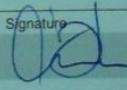
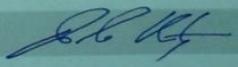


1.1. Probe Calibration Certificate

Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland		 	S Schweizerischer Kalibrierdienst C Service suisse d'étalonnage C Servizio svizzero di taratura S Swiss Calibration Service																																												
			Accreditation No.: SCS 108																																												
<small>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</small>																																															
Client	Certificate No: ES3-3292_Aug17																																														
CALIBRATION CERTIFICATE																																															
Object	ES3DV3 - SN:3292																																														
Calibration procedure(s)	QA CAL-01.v9, QA CAL-12.v9, QA CAL-23.v5, QA CAL-25.v6 Calibration procedure for dosimetric E-field probes																																														
Calibration date:	August 15, 2017																																														
<small>This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.</small>																																															
<small>All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.</small>																																															
<small>Calibration Equipment used (M&TE critical for calibration)</small>																																															
<table border="1"> <thead> <tr> <th>Primary Standards</th> <th>ID</th> <th>Cal Date (Certificate No.)</th> <th>Scheduled Calibration</th> </tr> </thead> <tbody> <tr> <td>Power meter E4419B</td> <td>GB41293874</td> <td>03-Apr-17 (No. 217-01911)</td> <td>Apr-18</td> </tr> <tr> <td>Power sensor E4412A</td> <td>MY41498087</td> <td>03-Apr-17 (No. 217-01911)</td> <td>Apr-18</td> </tr> <tr> <td>Reference 3 dB Attenuator</td> <td>SN: S5054 (3c)</td> <td>03-Apr-17 (No. 217-01915)</td> <td>Apr-18</td> </tr> <tr> <td>Reference 20 dB Attenuator</td> <td>SN: S5277 (20x)</td> <td>03-Apr-17 (No. 217-01919)</td> <td>Apr-18</td> </tr> <tr> <td>Reference 30 dB Attenuator</td> <td>SN: S5129 (30b)</td> <td>03-Apr-17 (No. 217-01920)</td> <td>Apr-18</td> </tr> <tr> <td>Reference Probe ES3DV2</td> <td>SN: 3013</td> <td>30-Dec-16 (No. ES3-3013_Dec16)</td> <td>Dec-17</td> </tr> <tr> <td>DAE4</td> <td>SN: 660</td> <td>13-Dec-16 (No. DAE4-660_Dec16)</td> <td>Dec-17</td> </tr> <tr> <td>Secondary Standards</td> <td>ID</td> <td>Check Date (in house)</td> <td>Scheduled Check</td> </tr> <tr> <td>RF generator HP 8648C</td> <td>US3642U01700</td> <td>4-Aug-99 (in house check Apr-16)</td> <td>In house check: Apr-17</td> </tr> <tr> <td>Network Analyzer HP 8753E</td> <td>US37390585</td> <td>18-Oct-01 (in house check Oct-16)</td> <td>In house check: Oct-17</td> </tr> </tbody> </table>				Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration	Power meter E4419B	GB41293874	03-Apr-17 (No. 217-01911)	Apr-18	Power sensor E4412A	MY41498087	03-Apr-17 (No. 217-01911)	Apr-18	Reference 3 dB Attenuator	SN: S5054 (3c)	03-Apr-17 (No. 217-01915)	Apr-18	Reference 20 dB Attenuator	SN: S5277 (20x)	03-Apr-17 (No. 217-01919)	Apr-18	Reference 30 dB Attenuator	SN: S5129 (30b)	03-Apr-17 (No. 217-01920)	Apr-18	Reference Probe ES3DV2	SN: 3013	30-Dec-16 (No. ES3-3013_Dec16)	Dec-17	DAE4	SN: 660	13-Dec-16 (No. DAE4-660_Dec16)	Dec-17	Secondary Standards	ID	Check Date (in house)	Scheduled Check	RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-16)	In house check: Apr-17	Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-16)	In house check: Oct-17
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Calibrated by:	Name Claudio Leubler	Function Laboratory Technician																																													
Approved by:	Katja Pokovic	Technical Manager																																													
Issued: August 15, 2017																																															
<small>This calibration certificate shall not be reproduced except in full without written approval of the laboratory.</small>																																															

Appendix A: Calibration Certificate

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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	
NORM _{x,y,z}	sensitivity in free space	
ConvF	sensitivity in TSL / NORM _{x,y,z}	
DCP	diode compression point	
CF	crest factor (1/duty_cycle) of the RF signal	
A, B, C, D	modulation dependent linearization parameters	
Polarization φ	φ rotation around probe axis	
Polarization θ	θ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\theta = 0$ is normal to probe axis	
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system	
Calibration is Performed According to the Following Standards:		
a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013		
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005		
Methods Applied and Interpretation of Parameters:		
<ul style="list-style-type: none">• $NORM_{x,y,z}$: Assessed for E-field polarization $\theta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). $NORM_{x,y,z}$ are only intermediate values, i.e., the uncertainties of $NORM_{x,y,z}$ does not affect the E^2-field uncertainty inside TSL (see below ConvF).• $NORM(f)x,y,z = NORM_{x,y,z} * frequency_response$ (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.• $DCPx,y,z$: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.• PAR: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics• $Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z$: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.• <i>ConvF and Boundary Effect Parameters</i>: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to $NORM_{x,y,z} * ConvF$ whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.• <i>Spherical isotropy (3D deviation from isotropy)</i>: in a field of low gradients realized using a flat phantom exposed by a patch antenna.• <i>Sensor Offset</i>: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.• <i>Connector Angle</i>: The angle is assessed using the information gained by determining the $NORM_x$ (no uncertainty required).		
Certificate No: ES3-3292_Aug17		
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ES3DV3 – SN:3292

August 15, 2017

Probe ES3DV3

SN:3292

Manufactured: July 6, 2010
Calibrated: August 15, 2017

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

Certificate No: ES3-3292_Aug17

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ES3DV3– SN:3292

August 15, 2017

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3292**Basic Calibration Parameters**

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	0.89	0.95	1.46	$\pm 10.1 \%$
DCP (mV) ^B	107.1	106.1	103.9	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB/ μV	C	D dB	VR mV	Unc ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	209.7	$\pm 3.8 \%$
		Y	0.0	0.0	1.0		218.8	
		Z	0.0	0.0	1.0		198.5	

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%.

^A The uncertainties of NormX,Y,Z do not affect the E²-field uncertainty inside TSL (see Pages 5 and 6).

^B Numerical linearization parameter: uncertainty not required.

^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

Appendix A: Calibration Certificate

ES3DV3– SN:3292

August 15, 2017

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3292

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unct. (k=2)
450	43.5	0.87	6.71	6.71	6.71	0.18	1.80	± 13.3 %
835	41.5	0.90	6.23	6.23	6.23	0.80	1.11	± 12.0 %
900	41.5	0.97	6.71	6.71	6.10	6.71	1.17	± 12.0 %
1810	40.0	1.40	5.07	5.07	5.07	0.61	1.36	± 12.0 %
1900	40.0	1.40	5.03	5.03	5.03	0.45	1.55	± 12.0 %
2100	39.8	1.49	5.04	5.04	5.04	0.77	1.17	± 12.0 %
2450	39.2	1.80	4.43	4.43	4.43	0.73	1.23	± 12.0 %

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

^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

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

Appendix A: Calibration Certificate

ES3DV3- SN:3292

August 15, 2017

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3292

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unct. (k=2)
450	56.7	0.94	7.10	7.10	7.10	0.13	1.00	± 13.3 %
835	55.2	0.97	6.11	6.11	6.11	0.36	1.78	± 12.0 %
900	55.0	1.05	5.97	5.97	5.97	0.73	1.22	± 12.0 %
1810	53.3	1.52	4.79	4.79	4.79	0.59	1.45	± 12.0 %
1900	53.3	1.52	4.66	4.66	4.66	0.41	1.79	± 12.0 %
2100	53.2	1.62	4.77	4.77	4.77	0.63	1.42	± 12.0 %
2450	52.7	1.95	4.23	4.23	4.23	0.66	0.98	± 12.0 %

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

^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

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

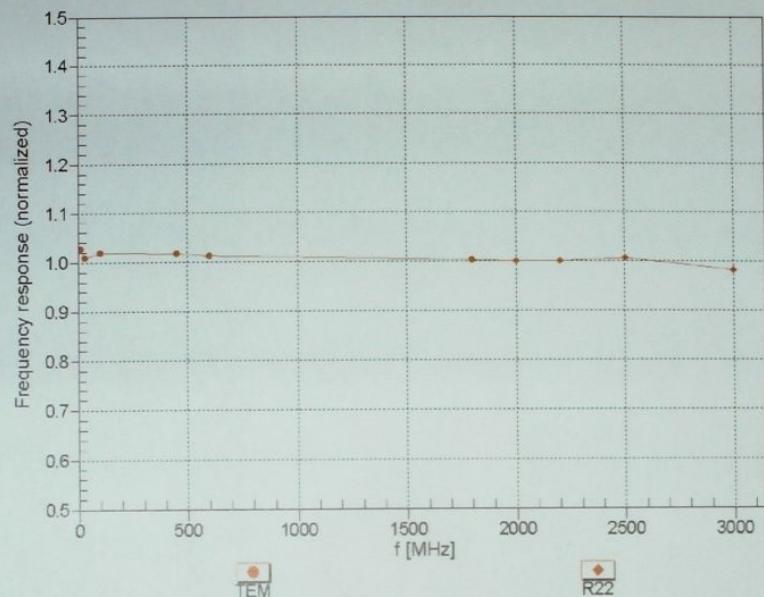
Certificate No: ES3-3292_Aug17

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ES3DV3- SN:3292

August 15, 2017

Frequency Response of E-Field

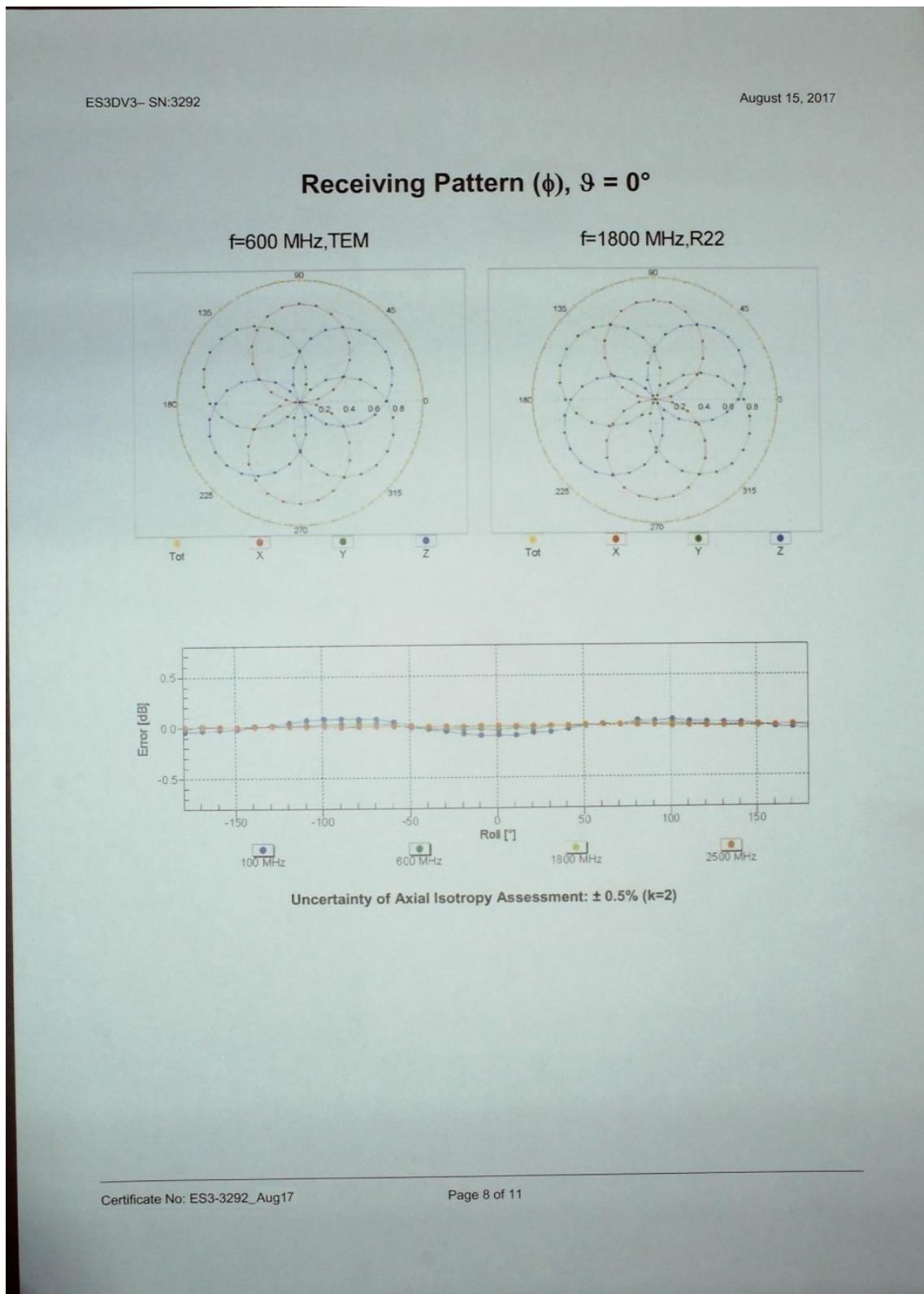


Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

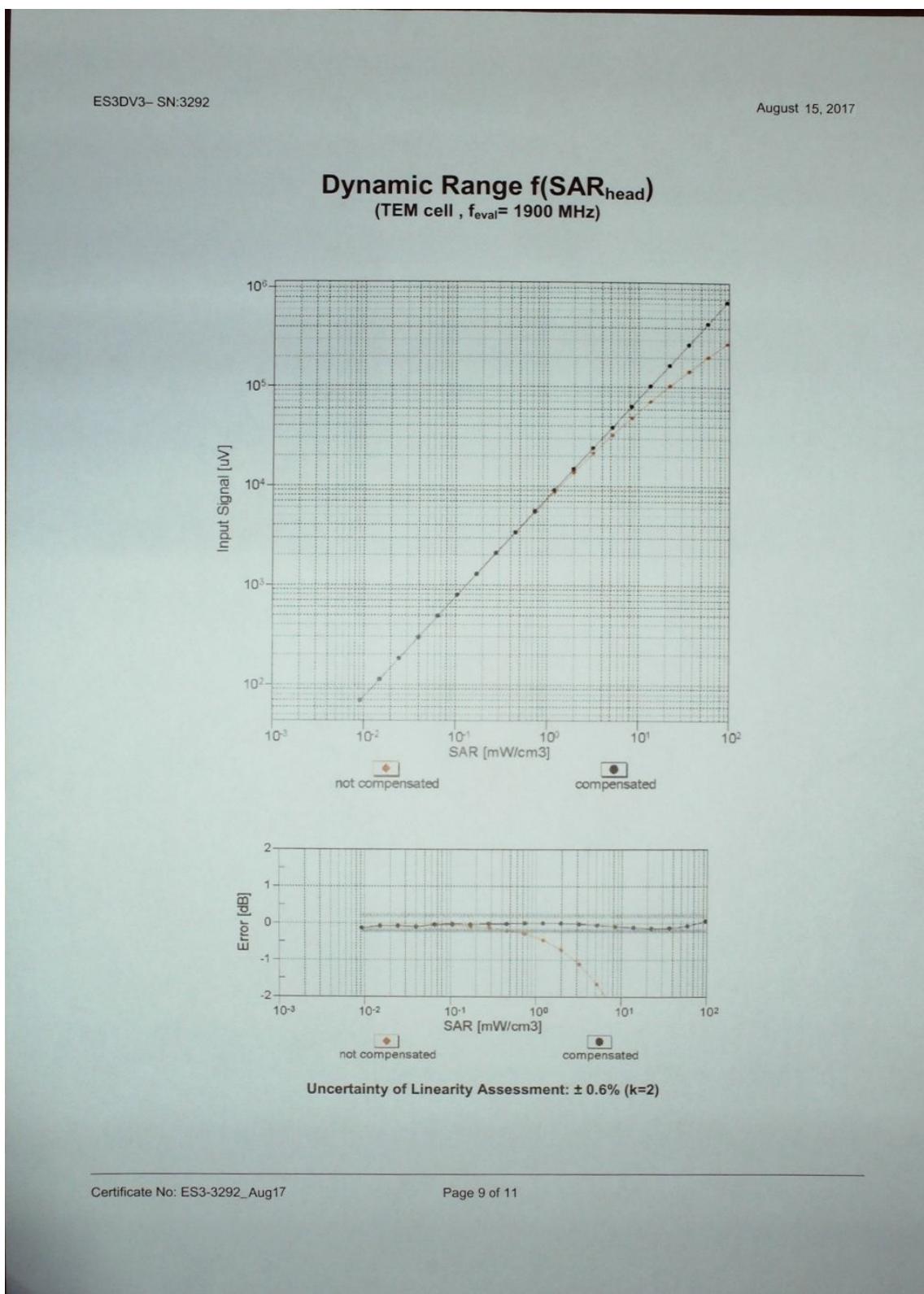
Certificate No: ES3-3292_Aug17

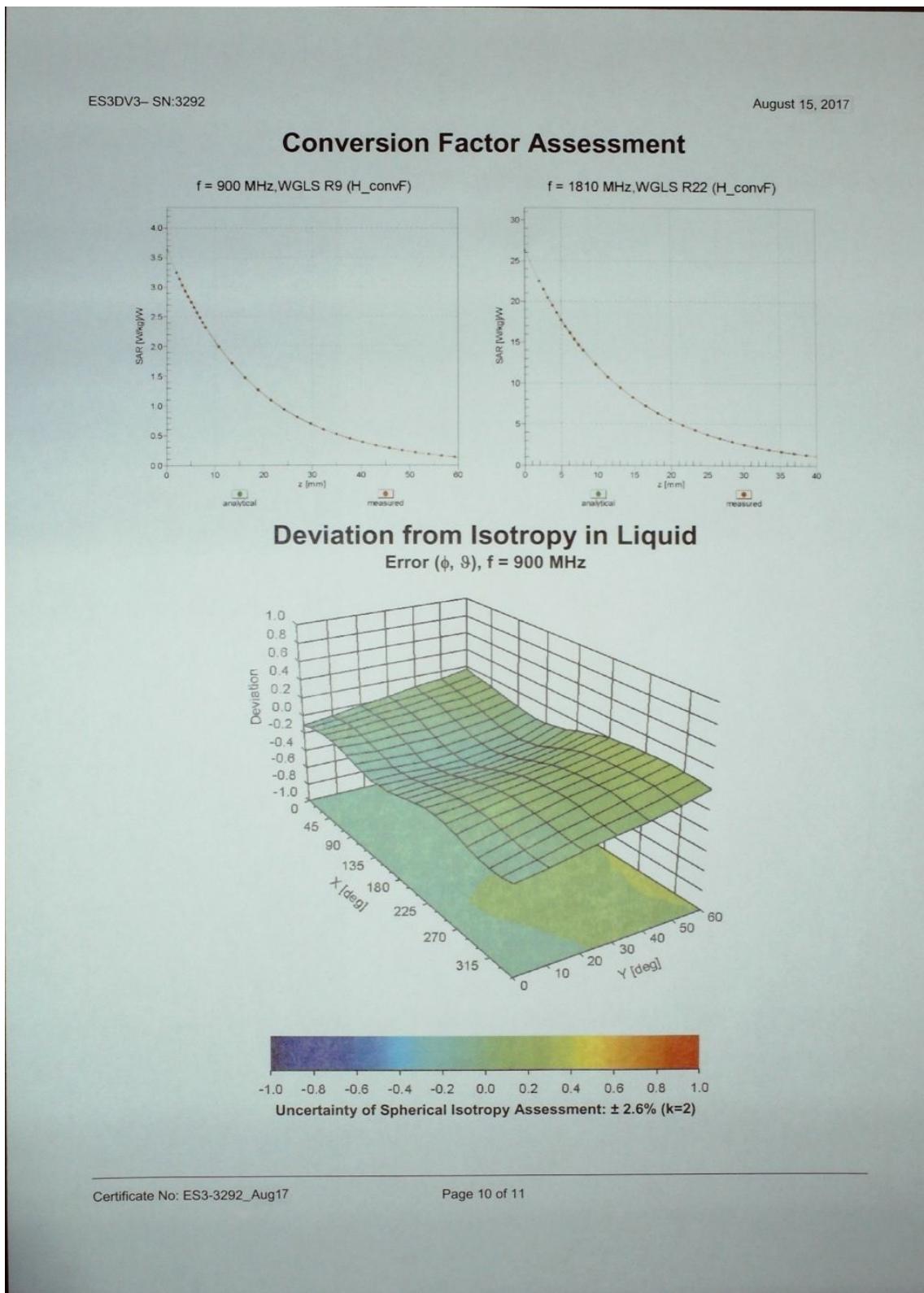
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Appendix A: Calibration Certificate



Appendix A: Calibration Certificate





ES3DV3- SN:3292

August 15, 2017

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3292

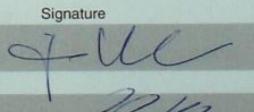
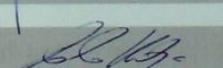
Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-8.9
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

Certificate No: ES3-3292_Aug17

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1.2. D450V3 Dipole Calibration Certificate

Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland		 	S Schweizerischer Kalibrierdienst C Service suisse d'étalonnage S Servizio svizzero di taratura S Swiss Calibration Service
			Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates
Client	Accreditation No.: SCS 108		
Client	Certificate No: D450V3-1079_Feb16		
CALIBRATION CERTIFICATE			
Object	D450V3 - SN: 1079		
Calibration procedure(s)	QA CAL-15.v6 Calibration procedure for dipole validation kits below 700 MHz		
Calibration date:	February 28, 2016		
This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate. All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.			
Calibration Equipment used (M&TE critical for calibration)			
Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	31-Mar-15 (No. 217-01372)	Apr-16
Power sensor E4412A	MY41498087	31-Mar-15 (No. 217-01372)	Apr-16
Reference 3 dB Attenuator	SN: S5054 (3c)	29-Mar-15 (No. 217-01369)	Apr-16
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-15 (No. 217-01367)	Apr-16
Type-N mismatch combination	SN: 5047.3 / 06327	29-Mar-15 (No. 217-01168)	Apr-16
Reference Probe ET3DV6	SN: 1507	30-Dec-15 (No. ET3-1507_Dec11)	Dec-16
DAE4	SN: 654	03-May-15 (No. DAE4-654_May11)	May-16
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-15)	In house check: Oct-16
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-15)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-15)	In house check: Oct-16
Calibrated by:	Name Jeton Kastrati	Function Laboratory Technician	Signature 
Approved by:	Katja Pokovic	Technical Manager	
Issued: February 28, 2016			
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			
Certificate No: D450V3-1079_Feb16		Page 1 of 8	

Appendix A: Calibration Certificate

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Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates			Accreditation No.: SCS 108
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: <ul style="list-style-type: none">• <i>Measurement Conditions:</i> 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.• <i>Antenna Parameters with TSL:</i> 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.• <i>Feed Point Impedance and Return Loss:</i> 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.• <i>Electrical Delay:</i> One-way delay between the SMA connector and the antenna feed point. No uncertainty required.• <i>SAR measured:</i> SAR measured at the stated antenna input power.• <i>SAR normalized:</i> SAR as measured, normalized to an input power of 1 W at the antenna connector.• <i>SAR for nominal TSL parameters:</i> The measured TSL parameters are used to calculate the nominal SAR result.			
Certificate No: D450V3-1079_Feb16		Page 2 of 8	

Appendix A: Calibration Certificate

Measurement Conditions

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

DASY Version	DASY5	V52.8.0
Extrapolation	Advanced Extrapolation	
Phantom	ELI4 Flat Phantom	Shell thickness: 2 ± 0.2 mm
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	43.5	0.87 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	43.6 ± 6 %	0.85 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	398 mW input power	1.81 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	4.63 mW /g ± 18.1 % (k=2)
SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	398 mW input power	1.21 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	3.09 mW /g ± 17.6 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	56.7	0.94 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.0 ± 6 %	0.91 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	398 mW input power	1.74 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	4.45 mW / g ± 18.1 % (k=2)
SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	398 mW input power	1.16 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	2.97 mW / g ± 17.6 % (k=2)

Appendix A: Calibration Certificate

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	59.8 Ω - 0.5 $j\Omega$
Return Loss	- 21.0 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	56.4 Ω - 5.9 $j\Omega$
Return Loss	- 21.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.350 ns
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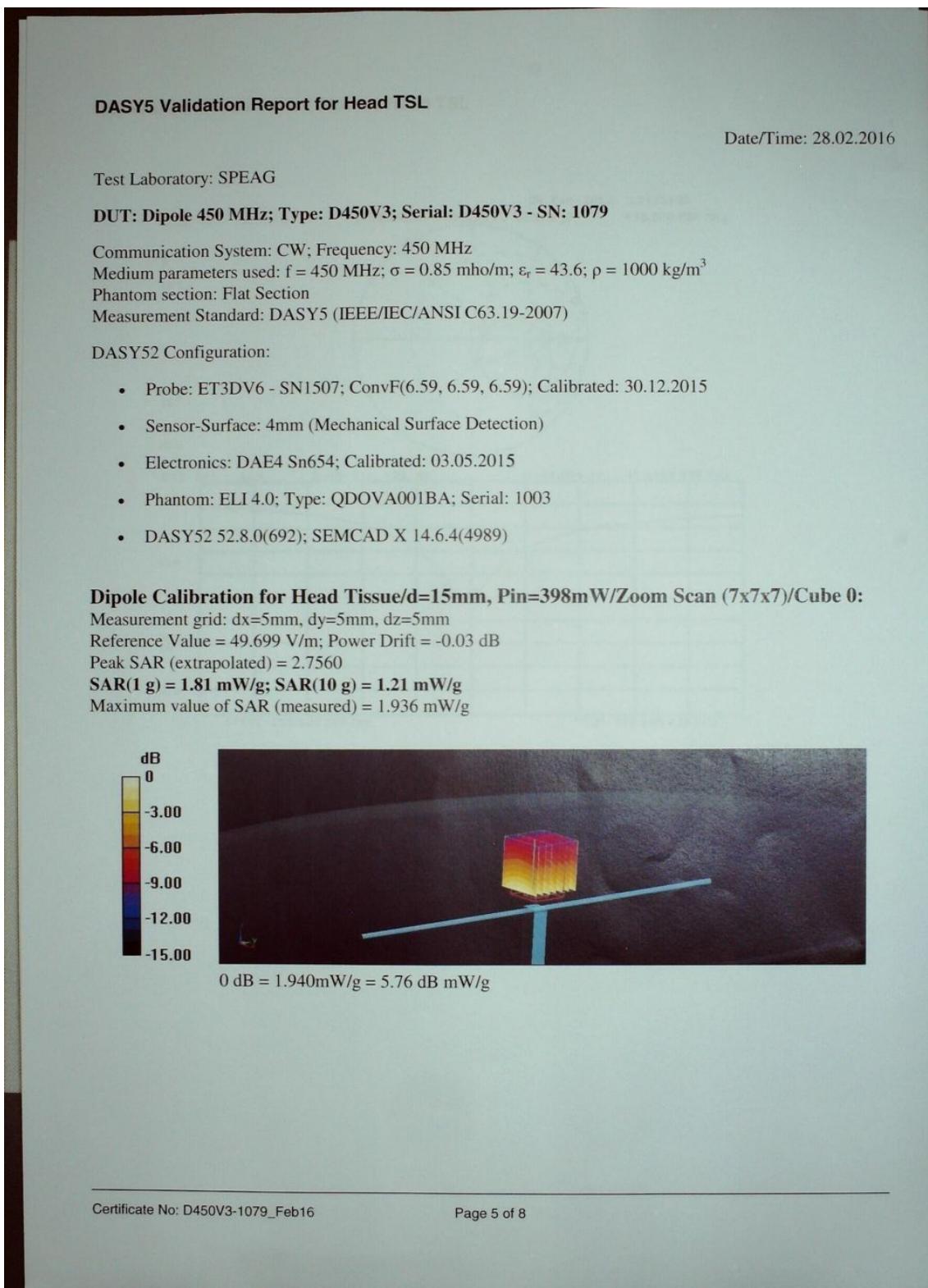
After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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

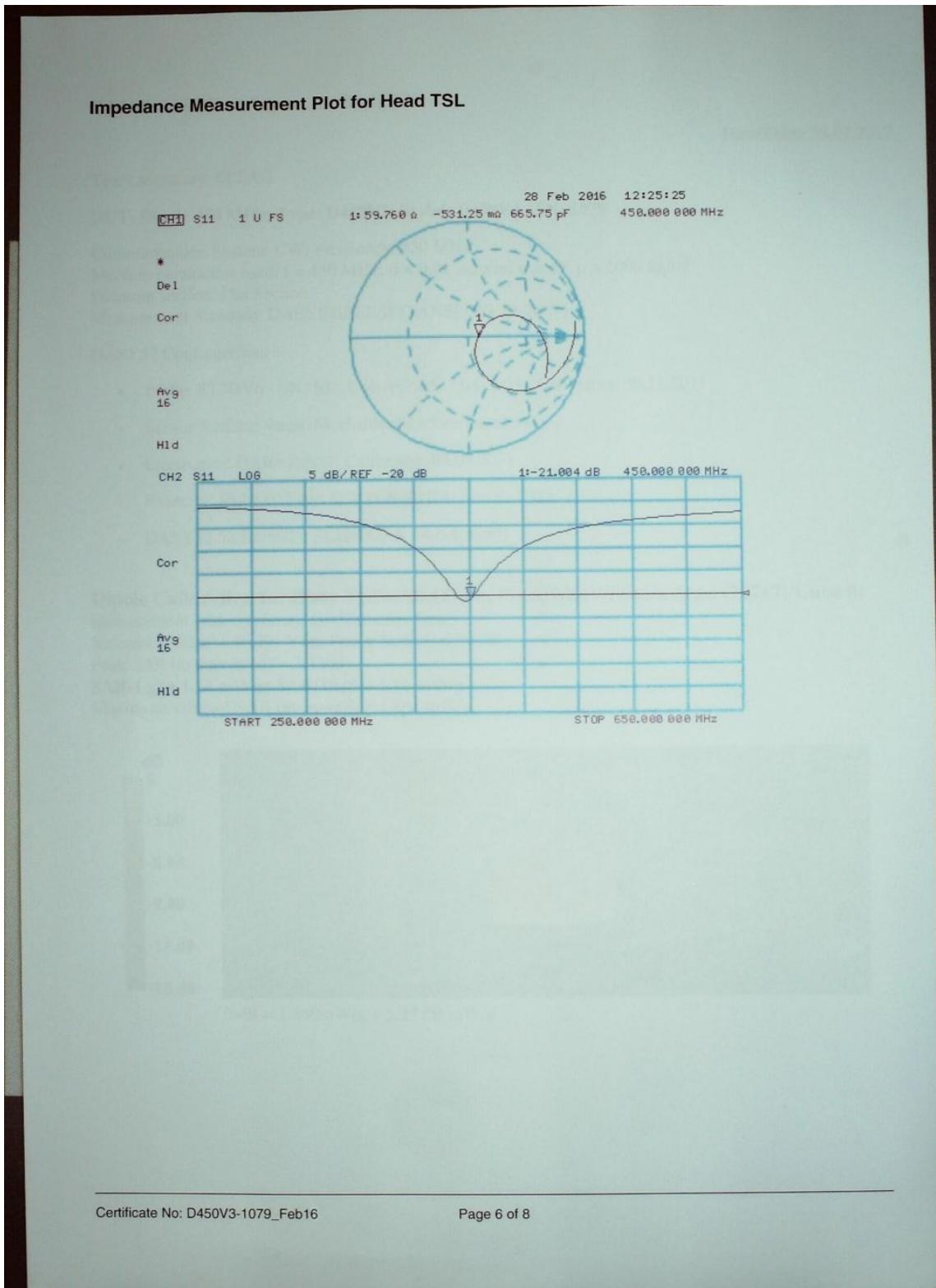
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

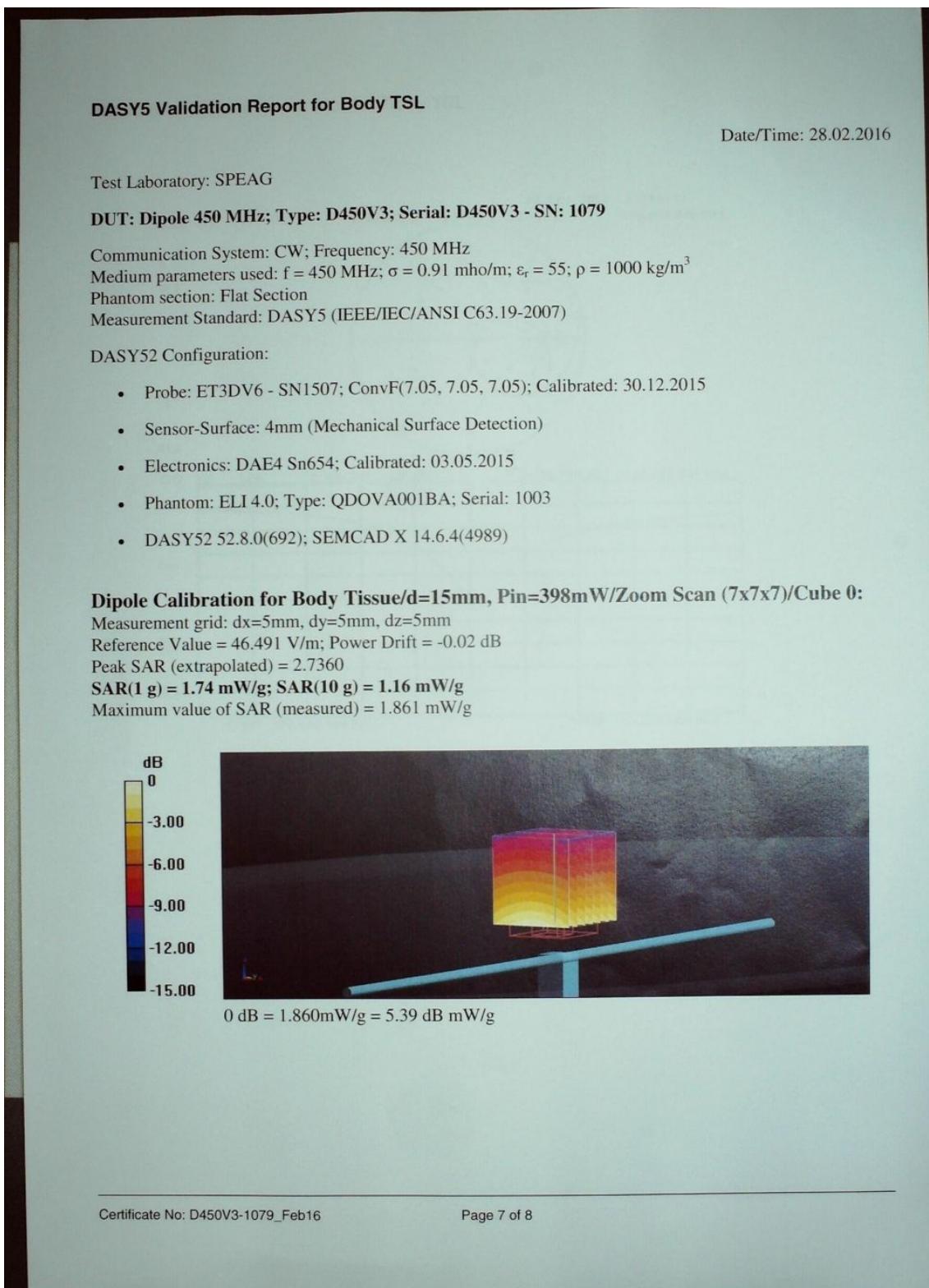
Manufactured by	SPEAG
Manufactured on	March 03, 2013



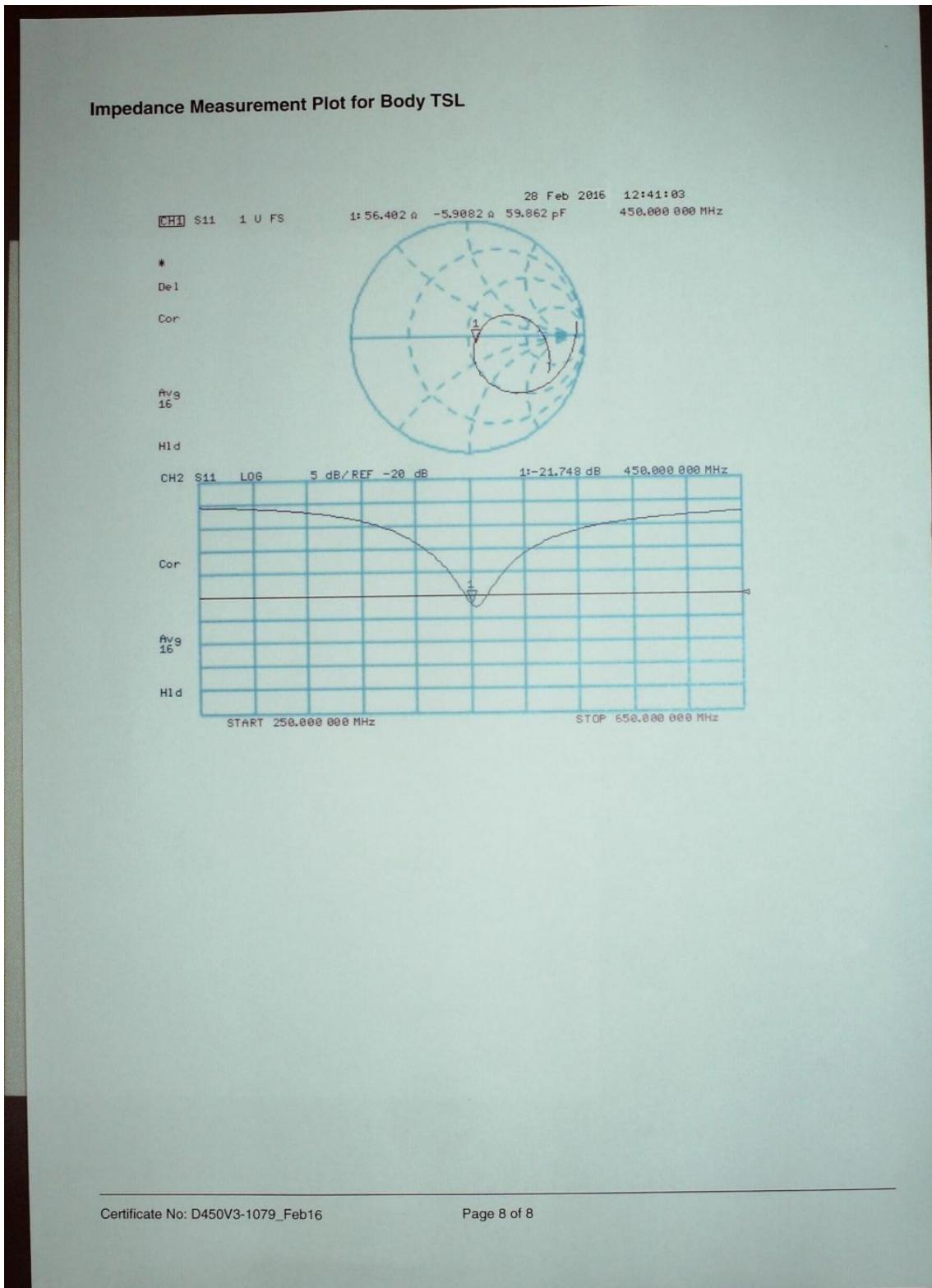
Appendix A: Calibration Certificate



Appendix A: Calibration Certificate



Appendix A: Calibration Certificate



Extended Dipole Calibrations

Referring to KDB865664 D01, if dipoles are verified in return loss (<-20dB, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

Head						
Date of measurement	Return-loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary impedance (ohm)	Delta (ohm)
2016-02-28	-21.0		59.8		0.5	
2017-02-27	-20.5	5.93	58.9	-0.9	0.8	0.3

Body						
Date of measurement	Return-loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary impedance (ohm)	Delta (ohm)
2016-02-28	-21.7		56.4		5.9	
2017-02-27	-22.6	-9.84	55.7	-0.7	5.2	-0.7

The return loss is <-20dB, within 20% of prior calibration; the impedance is within 5ohm of prior calibration. Therefore the verification result should support extended calibration.

1.2. DAE4 Calibration Certificate



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中国认可
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校准
CALIBRATION
CNAS L0570

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Client : CIQ(Shenzhen)

Certificate No: Z17-97109

CALIBRATION CERTIFICATE

Object	DAE4 - SN: 1315					
Calibration Procedure(s)	FF-Z11-002-01 Calibration Procedure for the Data Acquisition Electronics (DAEx)					
Calibration date:	August 15, 2017					
This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements(SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.						
All calibrations have been conducted in the closed laboratory facility: environment temperature(22 ± 3)°C and humidity<70%.						
Calibration Equipment used (M&TE critical for calibration)						
Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration			
Process Calibrator 753	1971018	27-Jun-17 (CTTL, No.J17X05859)	June-18			
Calibrated by:	Name	Function	Signature			
	Yu Zongying	SAR Test Engineer				
Reviewed by:	Name	Function				
	Lin Hao	SAR Test Engineer				
Approved by:	Name	Function				
	Qi Dianyuan	SAR Project Leader				
Issued: August 16, 2017						
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.						



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Glossary:

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

Methods Applied and Interpretation of Parameters:

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle:* The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The report provide only calibration results for DAE, it does not contain other performance test results.



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DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = $6.1\mu V$, full range = $-100...+300 mV$
Low Range: 1LSB = $61nV$, full range = $-1.....+3mV$

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

Calibration Factors	X	Y	Z
High Range	$405.175 \pm 0.15\% (k=2)$	$405.013 \pm 0.15\% (k=2)$	$404.971 \pm 0.15\% (k=2)$
Low Range	$3.99087 \pm 0.7\% (k=2)$	$3.98644 \pm 0.7\% (k=2)$	$3.98913 \pm 0.7\% (k=2)$

Connector Angle

Connector Angle to be used in DASY system	$20.5^\circ \pm 1^\circ$
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Certificate No: Z17-97109

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