

ANNEX E Equivalent Media Recipes

The liquid used for the frequency range of 700-6000 MHz consisted of water, sugar, salt, preventol, glycol monobutyl and Cellulose. The liquid has been previously proven to be suited for worst-case. The Table E.1 shows the detail solution. It's satisfying the latest tissue dielectric parameters requirements proposed by the IEEE 1528 and IEC 62209.

Table E.1: Composition of the Tissue Equivalent Matter

Frequency (MHz)	835 Head	835 Body	1900 Head	1900 Body	2450 Head	2450 Body	5800 Head	5800 Body
Ingredients (% by weight)								
Water	41.45	52.5	55.242	69.91	58.79	72.60	65.53	65.53
Sugar	56.0	45.0	\	\	\	\	\	\
Salt	1.45	1.4	0.306	0.13	0.06	0.18	\	\
Preventol	0.1	0.1	\	\	\	\	\	\
Cellulose	1.0	1.0	\	\	\	\	\	\
Glycol Monobutyl	\	\	44.452	29.96	41.15	27.22	\	\
Diethylenglycol monohexylether	\	\	\	\	\	\	17.24	17.24
Triton X-100	\	\	\	\	\	\	17.24	17.24
Dielectric Parameters Target Value	$\epsilon=41.5$ $\sigma=0.90$	$\epsilon=55.2$ $\sigma=0.97$	$\epsilon=40.0$ $\sigma=1.40$	$\epsilon=53.3$ $\sigma=1.52$	$\epsilon=39.2$ $\sigma=1.80$	$\epsilon=52.7$ $\sigma=1.95$	$\epsilon=35.3$ $\sigma=5.27$	$\epsilon=48.2$ $\sigma=6.00$

Note: There is a little adjustment respectively for 750, 1800, 2600, 5200, 5300, and 5600, based on the recipe of closest frequency in table E.1

ANNEX F System Validation

The SAR system must be validated against its performance specifications before it is deployed. When SAR probes, system components or software are changed, upgraded or recalibrated, these must be validated with the SAR system(s) that operates with such components.

Table F.1: System Validation

Probe SN.	Liquid name	Validation date	Frequency point	Status (OK or Not)
3633	Head 750MHz	2018-02-06	750 MHz	OK
3633	Head 835MHz	2018-02-06	835 MHz	OK
3633	Head 1800MHz	2018-02-06	1800 MHz	OK
3633	Head 1900MHz	2018-02-08	1900 MHz	OK
3633	Head 2450MHz	2018-02-08	2450 MHz	OK
3633	Head 2550MHz	2018-02-08	2550 MHz	OK
3633	Head 5200MHz	2018-02-07	5200 MHz	OK
3633	Head 5300MHz	2018-02-07	5300 MHz	OK
3633	Head 5600MHz	2018-02-07	5600 MHz	OK
3633	Head 5800MHz	2018-02-07	5800 MHz	OK
3633	Body 750MHz	2018-02-06	750 MHz	OK
3633	Body 835MHz	2018-02-06	835 MHz	OK
3633	Body 1800MHz	2018-02-06	1800 MHz	OK
3633	Body 1900MHz	2018-02-08	1900 MHz	OK
3633	Body 2450MHz	2018-02-08	2450 MHz	OK
3633	Body 2550MHz	2018-02-08	5200 MHz	OK
3633	Body 5200MHz	2018-02-07	5200 MHz	OK
3633	Body 5300MHz	2018-02-07	5300 MHz	OK
3633	Body 5600MHz	2018-02-07	5600 MHz	OK
3633	Body 5800MHz	2018-02-07	5800 MHz	OK

ANNEX G DAE Calibration Certificate

DAE4 SN: 786 Calibration Certificate



Client : **CTTL(South Branch)**

Certificate No: **Z17-97239**

CALIBRATION CERTIFICATE

Object: **DAE4 - SN: 786**

Calibration Procedure(s): **FF-Z11-002-01
Calibration Procedure for the Data Acquisition Electronics (DAEx)**

Calibration date: **November 22, 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

	Name	Function	Signature
Calibrated by:	Yu Zongying	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: November 25, 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 μ 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	404.138 \pm 0.15% (k=2)	404.330 \pm 0.15% (k=2)	404.714 \pm 0.15% (k=2)
Low Range	3.97217 \pm 0.7% (k=2)	3.97384 \pm 0.7% (k=2)	3.95842 \pm 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	229.5 $^{\circ}$ \pm 1 $^{\circ}$
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ANNEX H Probe Calibration Certificate

Probe EX3DV4-SN: 3633 Calibration Certificate


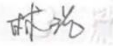





In Collaboration with
TTL **SPEAG**
CALIBRATION LABORATORY

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中国认可
国际互认
校准
CALIBRATION
CNAS L0570

Client **CTTL(South Branch)** Certificate No: **Z18-97014**

CALIBRATION CERTIFICATE			
Object	EX3DV4 - SN:3633		
Calibration Procedure(s)	FF-Z11-004-01 Calibration Procedures for Dosimetric E-field Probes		
Calibration date:	February 01, 2018		
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
Power Meter NRP2	101919	27-Jun-17 (CTTL, No.J17X05857)	Jun-18
Power sensor NRP-Z91	101547	27-Jun-17 (CTTL, No.J17X05857)	Jun-18
Power sensor NRP-Z91	101548	27-Jun-17 (CTTL, No.J17X05857)	Jun-18
Reference10dBAttenuator	18N50W-10dB	13-Mar-16(CTTL, No.J16X01547)	Mar-18
Reference20dBAttenuator	18N50W-20dB	13-Mar-16(CTTL, No.J16X01548)	Mar-18
Reference Probe EX3DV4	SN 7464	12-Sep-17(SPEAG, No.EX3-7464_Sep17)	Sep-18
DAE4	SN 1524	13-Sep-17(SPEAG, No.DAE4-1524_Sep17)	Sep -18
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
SignalGeneratorMG3700A	6201052605	27-Jun-17 (CTTL, No.J17X05858)	Jun-18
Network Analyzer E5071C	MY46110673	14-Jan-18 (CTTL, No.J18X00561)	Jan -19
Calibrated by:	Name	Function	Signature
	Yu Zongying	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	
Issued: February 02, 2018			
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			



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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), $\theta=0$ 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, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}: Assessed for E-field polarization $\theta=0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not effect 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.
- DCP_{x,y,z}: DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- PAR: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics.
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; VR_{x,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 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 $f \leq 800$ 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 valued 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.
- Spherical isotropy (3D deviation from isotropy): in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle: The angle is assessed using the information gained by determining the NORM_x (no uncertainty required).



Probe EX3DV4

SN: 3633

Calibrated: February 01, 2018

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)



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DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3633

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	0.39	0.37	0.38	±10.0%
DCP(mV) ^B	96.8	99.5	98.2	

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	145.8	±2.4%
		Y	0.0	0.0	1.0		145.4	
		Z	0.0	0.0	1.0		145.7	

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%.

^A The uncertainties of Norm X, Y, Z do not affect the E²-field uncertainty inside TSL (see Page 5 and Page 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.



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DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3633

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)
750	41.9	0.89	9.33	9.33	9.33	0.25	0.80	±12.1%
900	41.5	0.97	9.25	9.25	9.25	0.14	1.27	±12.1%
1450	40.5	1.20	8.43	8.43	8.43	0.12	1.32	±12.1%
1750	40.1	1.37	8.12	8.12	8.12	0.22	1.08	±12.1%
1900	40.0	1.40	7.81	7.81	7.81	0.25	0.98	±12.1%
2000	40.0	1.40	7.82	7.82	7.82	0.23	1.01	±12.1%
2300	39.5	1.67	7.87	7.87	7.87	0.48	0.76	±12.1%
2450	39.2	1.80	7.42	7.42	7.42	0.49	0.77	±12.1%
2600	39.0	1.96	7.28	7.28	7.28	0.61	0.70	±12.1%
3500	37.9	2.91	6.82	6.82	6.82	0.57	0.87	±13.3%
5250	35.9	4.71	5.61	5.61	5.61	0.40	1.40	±13.3%
5600	35.5	5.07	4.86	4.86	4.86	0.40	1.35	±13.3%
5750	35.4	5.22	4.81	4.81	4.81	0.45	1.60	±13.3%

^C Frequency validity above 300 MHz of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of 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 frequency 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 the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.



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DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3633

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)
750	55.5	0.96	9.69	9.69	9.69	0.40	0.80	±12.1%
900	55.0	1.05	9.33	9.33	9.33	0.24	1.14	±12.1%
1450	54.0	1.30	8.47	8.47	8.47	0.13	1.30	±12.1%
1750	53.4	1.49	8.05	8.05	8.05	0.20	1.14	±12.1%
1900	53.3	1.52	7.75	7.75	7.75	0.12	1.90	±12.1%
2000	53.3	1.52	7.73	7.73	7.73	0.18	1.24	±12.1%
2300	52.9	1.81	7.71	7.71	7.71	0.55	0.81	±12.1%
2450	52.7	1.95	7.47	7.47	7.47	0.32	1.24	±12.1%
2600	52.5	2.16	7.31	7.31	7.31	0.38	1.01	±12.1%
3500	51.3	3.31	6.43	6.43	6.43	0.60	0.94	±13.3%
5250	48.9	5.36	5.15	5.15	5.15	0.45	1.60	±13.3%
5600	48.5	5.77	4.33	4.33	4.33	0.50	1.70	±13.3%
5750	48.3	5.94	4.48	4.48	4.48	0.50	1.70	±13.3%

^C Frequency validity above 300 MHz of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of 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.

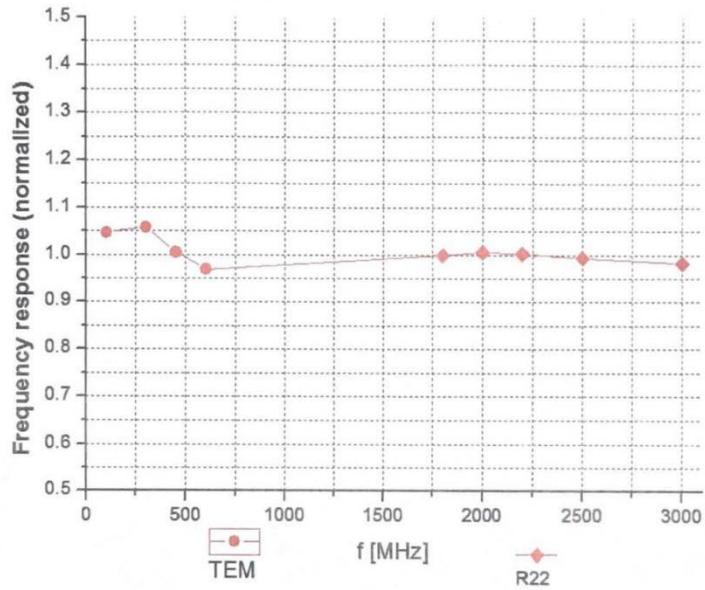
^F At frequency below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty 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 the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.



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



Uncertainty of Frequency Response of E-field: $\pm 7.4\%$ (k=2)

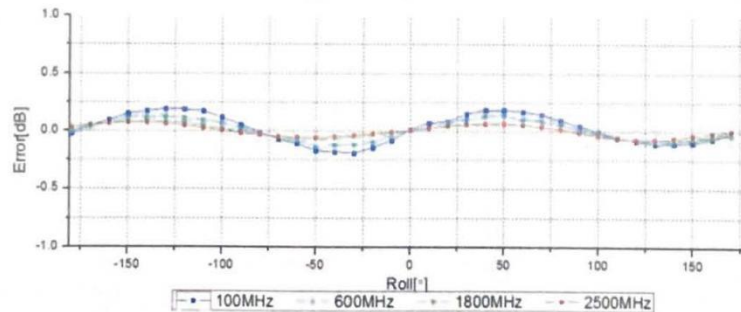
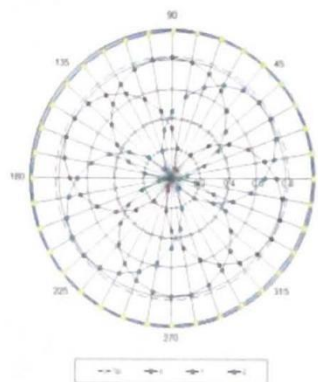
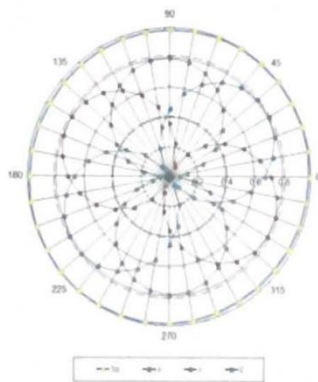


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Receiving Pattern (Φ), $\theta=0^\circ$

f=600 MHz, TEM

f=1800 MHz, R22

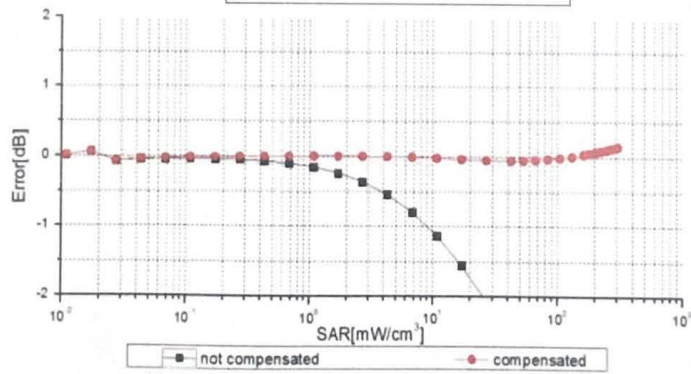
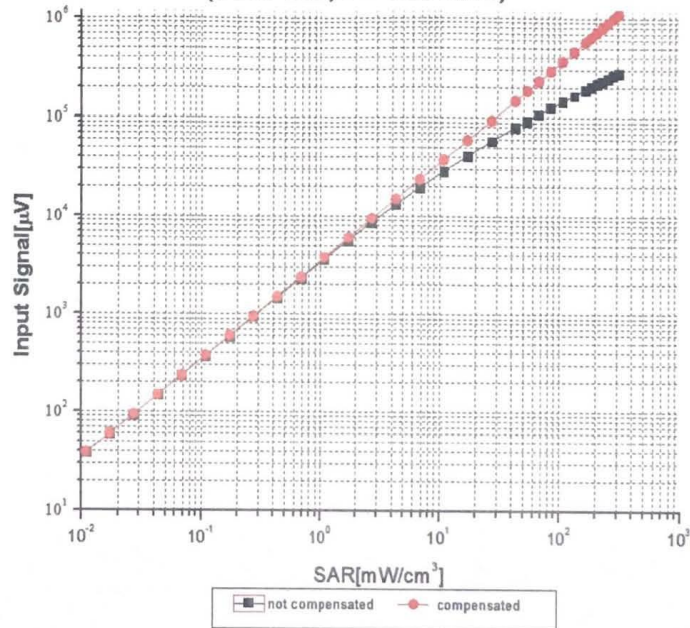


Uncertainty of Axial Isotropy Assessment: $\pm 1.2\%$ (k=2)



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Dynamic Range f(SAR_{head})
(TEM cell, f = 900 MHz)



Uncertainty of Linearity Assessment: ±0.9% (k=2)

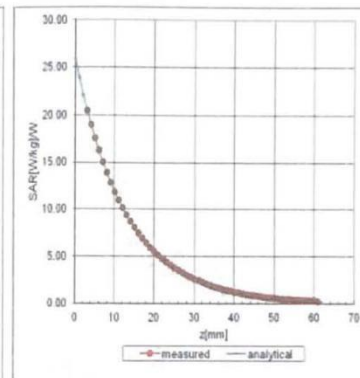
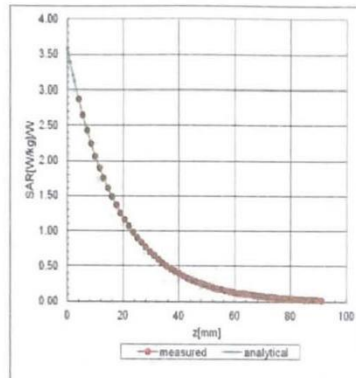


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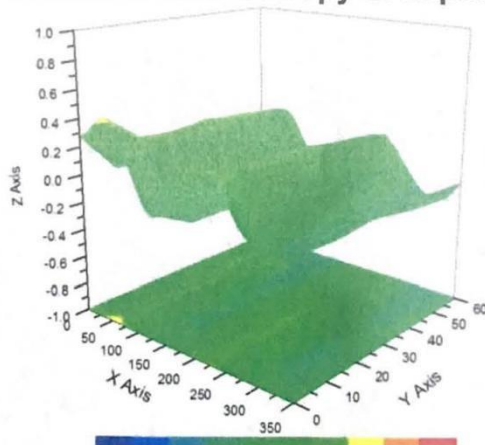
Conversion Factor Assessment

f=900 MHz, WGLS R9(H_convF)

f=1750 MHz, WGLS R22(H_convF)



Deviation from Isotropy in Liquid



Uncertainty of Spherical Isotropy Assessment: $\pm 3.2\%$ (K=2)



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DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3633

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	71.8
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	9mm
Tip Diameter	2.5mm
Probe Tip to Sensor X Calibration Point	1mm
Probe Tip to Sensor Y Calibration Point	1mm
Probe Tip to Sensor Z Calibration Point	1mm
Recommended Measurement Distance from Surface	1.4mm

ANNEX I Dipole Calibration Certificate

750 MHz 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

Accreditation No.: **SCS 0108**

Client **TMC-SZ (Auden)**

Certificate No: **D750V3-1163_Sep16**

CALIBRATION CERTIFICATE			
Object	D750V3 - SN:1163		
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz		
Calibration date:	September 19, 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 ± 3)°C and humidity < 70%.			
Calibration Equipment used (M&TE critical for calibration)			
Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: 5058 (20k)	05-Apr-16 (No. 217-02292)	Apr-17
Type-N mismatch combination	SN: 5047.2 / 06327	05-Apr-16 (No. 217-02295)	Apr-17
Reference Probe EX3DV4	SN: 7349	15-Jun-16 (No. EX3-7349_Jun16)	Jun-17
DAE4	SN: 601	30-Dec-15 (No. DAE4-601_Dec15)	Dec-16
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (No. 217-02223)	In house check: Oct-16
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Jun-15)	In house check: Oct-16
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16
Calibrated by:	Name Jeton Kastrati	Function Laboratory Technician	Signature
Approved by:	Name Katja Pokovic	Function Technical Manager	Signature
			Issued: September 19, 2016
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			

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

Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.0 ± 6 %	0.91 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	250 mW input power	2.11 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.26 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.43 W/kg ± 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.9 ± 6 %	0.99 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.20 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	8.58 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.44 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	5.64 W/kg ± 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.5 Ω - 1.8 j Ω
Return Loss	- 26.8 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.8 Ω - 3.5 j Ω
Return Loss	- 29.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.032 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	June 23, 2016

DASY5 Validation Report for Head TSL

Date: 19.09.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: D750V3 - SN1163; Type: D750V3; Serial: SN1163

Communication System: UID 0 - CW; Frequency: 750 MHz

Medium parameters used: $f = 750$ MHz; $\sigma = 0.91$ S/m; $\epsilon_r = 41$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10.07, 10.07, 10.07); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

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

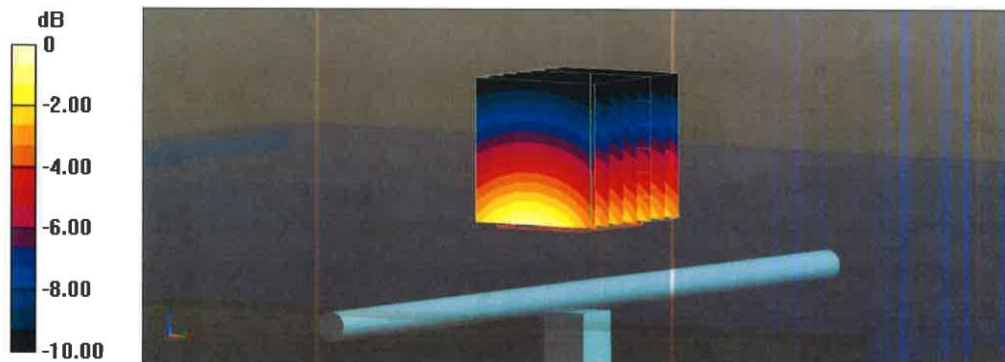
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 58.31 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.16 W/kg

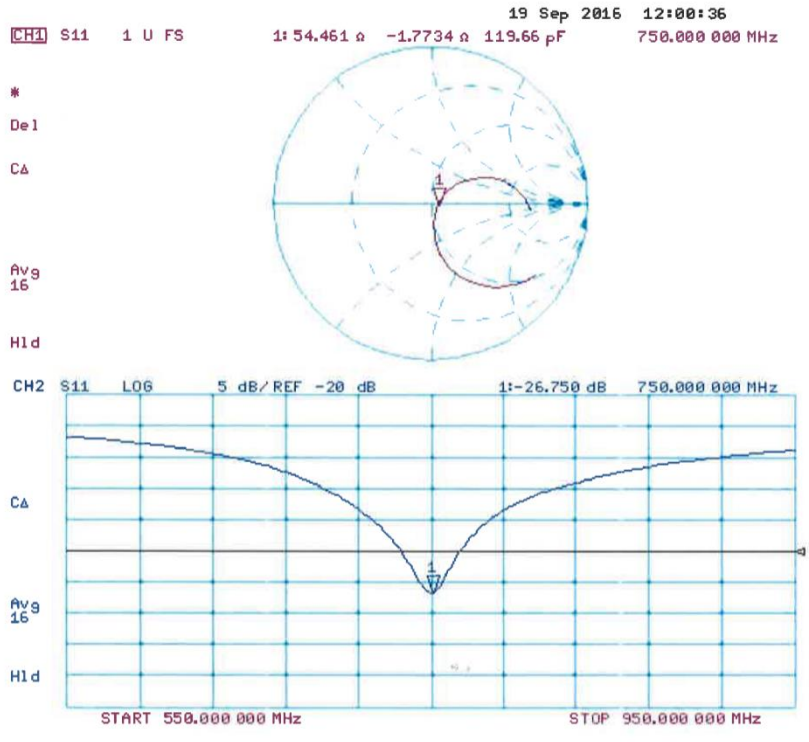
SAR(1 g) = 2.11 W/kg; SAR(10 g) = 1.38 W/kg

Maximum value of SAR (measured) = 2.79 W/kg



0 dB = 2.79 W/kg = 4.46 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 19.09.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: D750V3 - SN1163; Type: D750V3; Serial: SN1163

Communication System: UID 0 - CW; Frequency: 750 MHz

Medium parameters used: $f = 750 \text{ MHz}$; $\sigma = 0.99 \text{ S/m}$; $\epsilon_r = 54.9$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(9.99, 9.99, 9.99); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

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

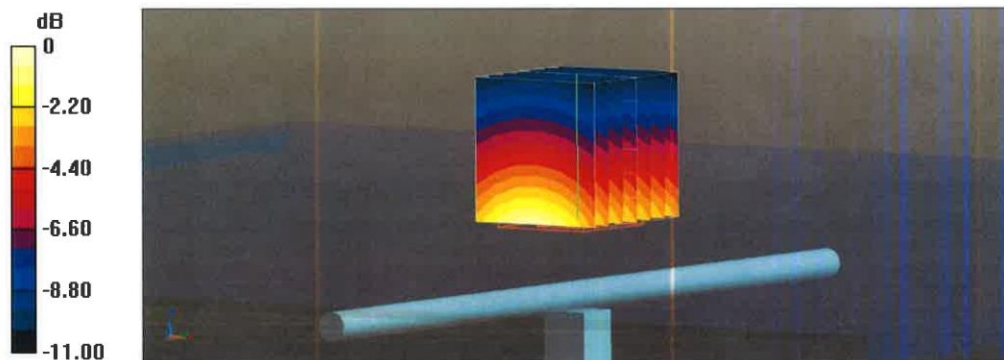
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 57.12 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 3.33 W/kg

SAR(1 g) = 2.2 W/kg; SAR(10 g) = 1.44 W/kg

Maximum value of SAR (measured) = 2.94 W/kg



0 dB = 2.94 W/kg = 4.68 dBW/kg

Impedance Measurement Plot for Body TSL

