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D-PL-12139-01-01

I M S T

The Testcenter facility 'Dosimetric Test Lab' within IMST GmbH is accredited by the German National 'Deutsche Akkreditierungsstelle GmbH (DAkkS)' for testing according to the scope as listed in the accreditation certificate: D-PL-12139-01-01.

Appendix for the Report

Dosimetric Assessment of the SDP660TU FM Analogue PMR and Digital DMR (TDMA) Two-Way Radio from Simoco (FCC ID: STZSDP600TU) (IC: 7068A-SDP600TU)

According to the FCC Requirements Calibration Data

May 24, 2013

IMST GmbH

Carl-Friedrich-Gauß-Str. 2

D-47475 Kamp-Lintfort

Customer

TRaC Global Ltd

Unit 1, Pendle Place, Skelmersdale,

West Lancs, WN8 9PN,

UK

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
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 108**

Client **IMST**

Certificate No: **ET3-1669_Feb13/2**

CALIBRATION CERTIFICATE (Replacement of No: ET3-1669_Feb13)

Object	ET3DV6R - SN:1669
Calibration procedure(s)	QA CAL-01.v8, QA CAL-12.v7, QA CAL-23.v4, QA CAL-25.v4 Calibration procedure for dosimetric E-field probes
Calibration date:	February 19, 2013

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 E4419B	GB41293874	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	31-Jan-13 (No. DAE4-660_Jan13)	Jan-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: March 5, 2013

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

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Glossary:

TSL	tissue simulating liquid
NORMx,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, 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., ϑ = 0 is normal to probe axis

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

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal 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.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Probe ET3DV6R

SN:1669

Manufactured: February 8, 2002
Calibrated: February 19, 2013

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

DASY/EASY - Parameters of Probe: ET3DV6R - SN:1669

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (µV/(V/m)^2)[A]	1.76	1.92	1.76	± 10.1 %
DCP (mV)[B]	99.3	100.2	99.6	

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	145.7	±3.5 %
		Y	0.0	0.0	1.0		150.7	
		Z	0.0	0.0	1.0		143.9	

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

[A] The uncertainties of NormX,Y,Z do not affect the E^2-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.

DASY/EASY - Parameters of Probe: ET3DV6R - SN:1669

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	Depth (mm)	Unct. (k=2)
450	43.5	0.87	7.35	7.35	7.35	0.25	2.41	± 13.4 %
750	41.9	0.89	6.77	6.77	6.77	0.27	3.00	± 12.0 %
900	41.5	0.97	6.32	6.32	6.32	0.29	3.00	± 12.0 %
1750	40.1	1.37	5.28	5.28	5.28	0.79	2.06	± 12.0 %
1900	40.0	1.40	5.05	5.05	5.05	0.78	2.02	± 12.0 %
1950	40.0	1.40	4.89	4.89	4.89	0.80	1.98	± 12.0 %

[C] Frequency validity 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.
[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.

DASY/EASY - Parameters of Probe: ET3DV6R - SN:1669

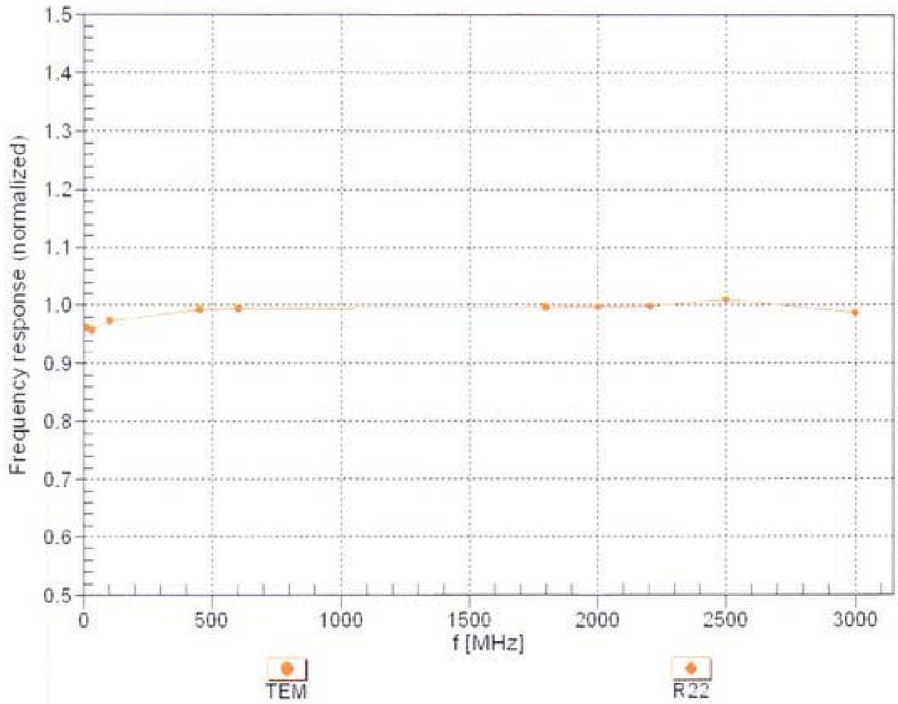
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
450	56.7	0.94	7.62	7.62	7.62	0.15	2.27	± 13.4 %
750	55.5	0.96	6.42	6.42	6.42	0.28	2.91	± 12.0 %
900	55.0	1.05	6.22	6.22	6.22	0.47	2.25	± 12.0 %
1750	53.4	1.49	4.79	4.79	4.79	0.80	2.39	± 12.0 %
1900	53.3	1.52	4.58	4.58	4.58	0.80	2.34	± 12.0 %
1950	53.3	1.52	4.68	4.68	4.68	0.80	2.30	± 12.0 %

[C] Frequency validity 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.
[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.

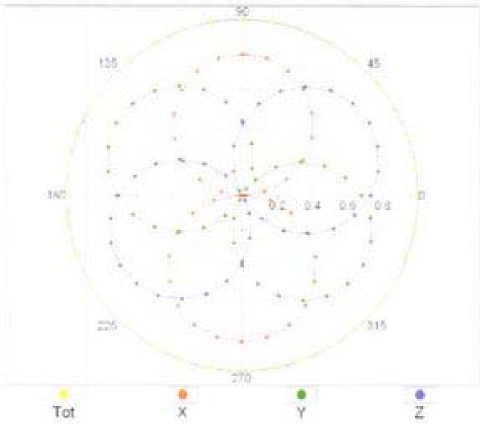
Frequency Response of E-Field

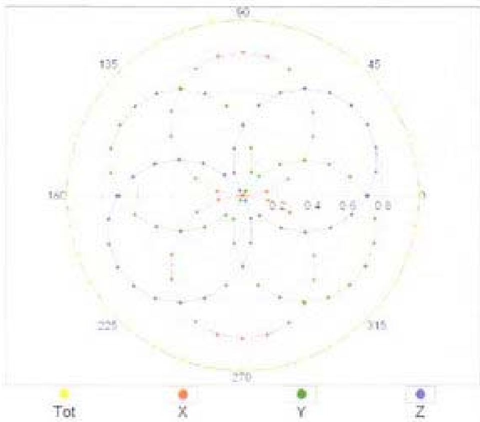
(TEM-Cell:ifi110 EXX, Waveguide: R22)

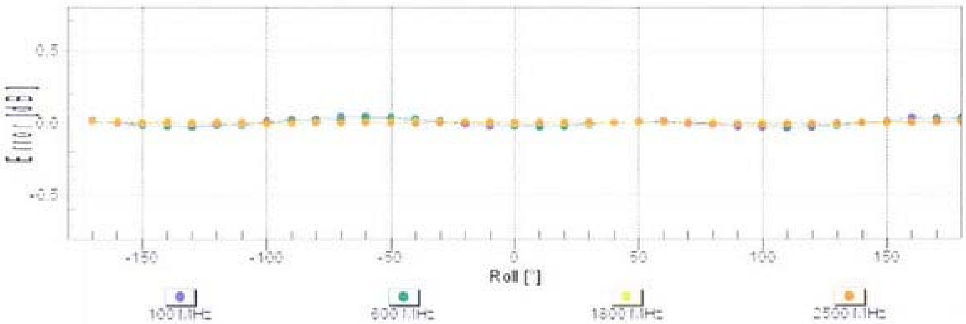


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), $\vartheta = 0°$

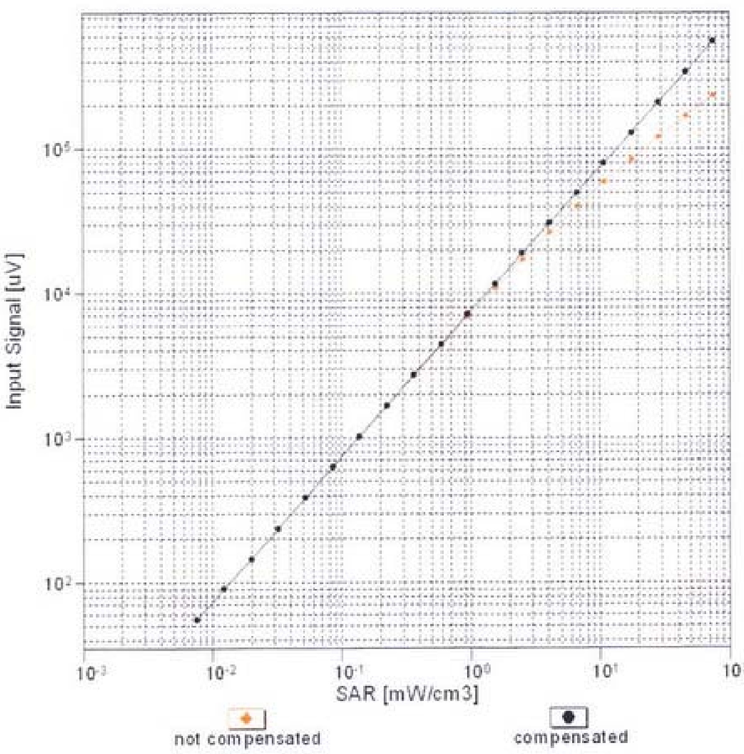


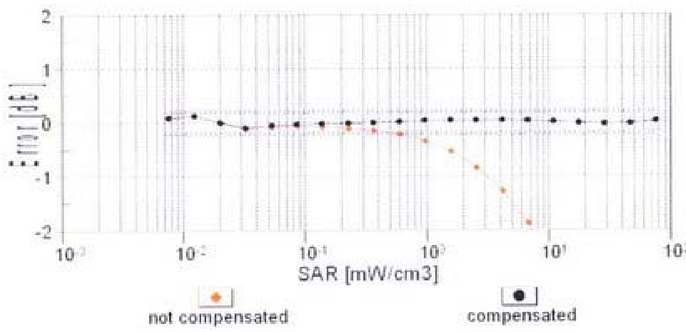




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

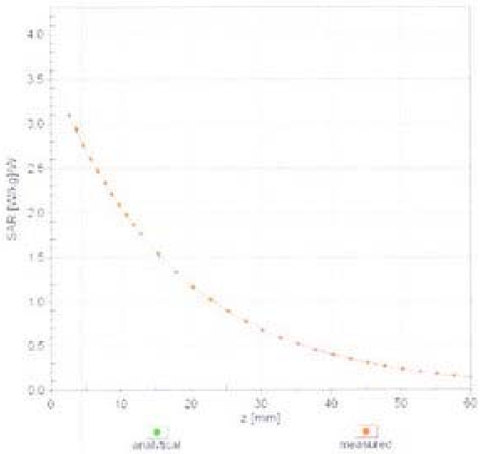




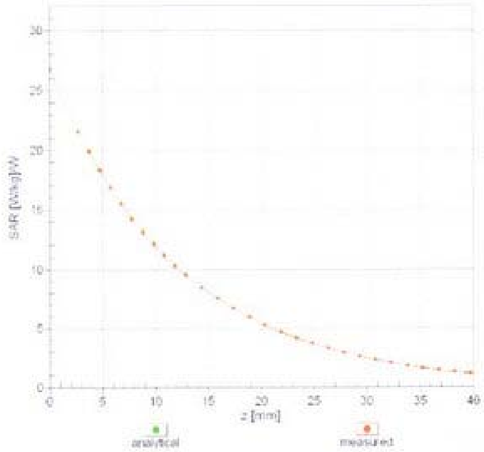
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 900 MHz,WGLS R9 (H_convF)

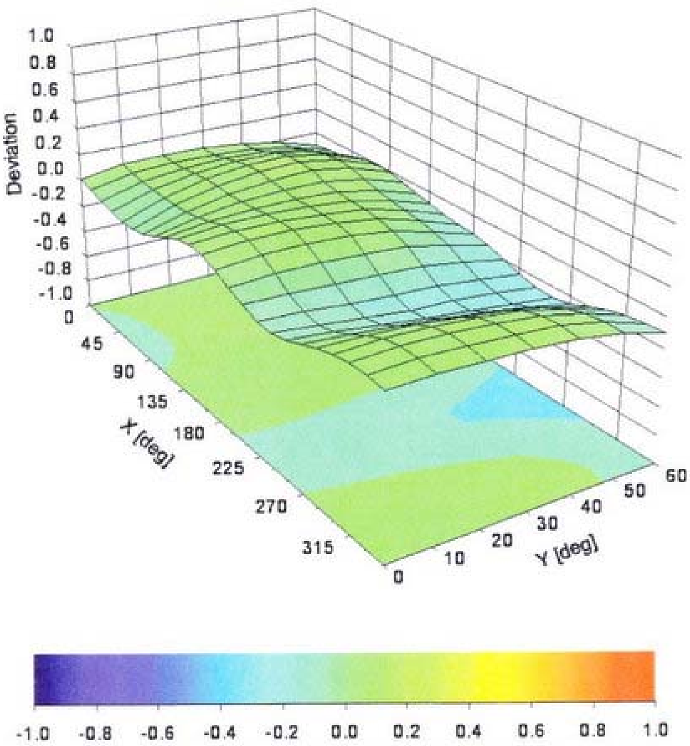


f = 1750 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

DASY/EASY - Parameters of Probe: ET3DV6R - SN:1669

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-0.1
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	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

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DAT-P-152/98-01

IMST

Calibration Certificate

Certificate No:	Cal_D450V2_SN1014_0212 0
Object:	D450V2 SN: 1014
Date of Calibration:	February 13, 2012
Next Calibration:	February 2014
Object Condition:	In Tolerance

Calibration Equipment used:

Test Equipment	**Serial Number**	**Last calibration**	**Calibrated by**	**Next calibration**
Powermeter E4416A	GB41050414	Dec 10	Agilent Techn. (ISO/IEC 17025, 1-1784162174-1)	Dec 12
Power Sensor E9301H	US40010212	Dec 10	Agilent Techn. (ISO/IEC 17025, 1-1784041195-1)	Dec 12
Powermeter E4417A	GB41050441	Dec 10	Agilent Techn. (ISO/IEC 17025, 1-1674038198-1)	Dec 12
Power Sensor E9301A	MY41495584	Dec 10	Agilent Techn. (ISO/IEC 17025, 1-1784041307-1)	Dec 12
Network Analyzer E5071C	MY46103220	Aug 11	Agilent (1-3503689015-1)	Aug 13
Reference Probe ET3DV6	SN 1579	Jan 12	SPEAG, No ET3-1579_Jan12	Jan 13
DAE3	SN 335	Feb 11	SPEAG, No DAE3-335_Feb11	Feb 12

Calibration is performed according the following standards:

IEEE 1528-2003

"IEEE Recommended Practice for Determining the Peak Spatial - Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communication Devices: Measurement Technique", December 2003

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 3GHz)", February 2005

IEC 62209-2

"Evaluation of Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices in the Frequency Range of 30 MHz to 6 GHz: Human models, Instrumentation, and Procedures ", Part 2: “Procedure to determine the Specific Absorption Rate (SAR) for including accessories and multiple transmitters” Edition 1.0, 2010-01

Federal Communications Commission Office of Engineering & Technologies (FCCOET)

"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: DASY 4/5 System Handbook

prepared by: Alexander Rahn, test engineer

reviewed by: André van den Bosch, quality assurance engineer

Measurement Conditions		
DASY Version:	Dasy 4;	V4.7
Phantom:	ELI Phantom	1004 Shell thickness: 6 ± 2mm
Distance Dipole Center – TSL:	15mm	With spacer
Zoom Scan res.	dx, dy, dz = 5mm	
Frequency:	450 MHz ± 1MHz	

Head TSL Parameters			
	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL Parameters	22.0	43.50	0.87
Measured Head TSL Parameters	21.5	43.30 ± 6%	0.85 S/m ± 6%

SAR result with Head TSL			
Averaged over 1g	SAR measured	250mW input power	1.28 mW/g
	SAR normalized	normalized to 1W	5.12 mW/g
	SAR for nominal Head TSL parameters	normalized to 1W	**5.21 mW/g ± 16.5 % (k=2)**
Averaged over 10g	SAR measured	250mW input power	0.865 mW/g
	SAR normalized	normalized to 1W	3.46 mW/g
	SAR for nominal Head TSL parameters	normalized to 1W	**3.51 mW/g ± 16.5 % (k=2)**

Body TSL Parameters			
	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL Parameters	22.0	56.70	0.94
Measured Body TSL Parameters	22.1	56.00 ± 6%	0.95 S/m ± 6%

SAR result with Body TSL			
Averaged over 1g	SAR measured	250mW input power	1.31 mW/g
	SAR normalized	normalized to 1W	5.24 mW/g
	SAR for nominal Body TSL parameters	normalized to 1W	**5.18 mW/g ± 16.5 % (k=2)**
Averaged over 10g	SAR measured	250mW input power	0.890 mW/g
	SAR normalized	normalized to 1W	3.56 mW/g
	SAR for nominal Body TSL parameters	normalized to 1W	**3.53 mW/g ± 16.5 % (k=2)**

General Antenna Parmeters		
Antenna Parameter with Head TSL	Impedance, transformed to feed point	49.93 jΩ - 10.19 jΩ
	Return Loss	-19.87 dB
Antenna Parameter with Body TSL	Impedance, transformed to feed point	49.99 jΩ - 9.96 jΩ
	Return Loss	-20.07 dB
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 semigrid 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.		

Additional EUT Data	
Manufactured by:	SPEAG
Manufactured on:	April 25, 2003

SAR Result with Head TSL

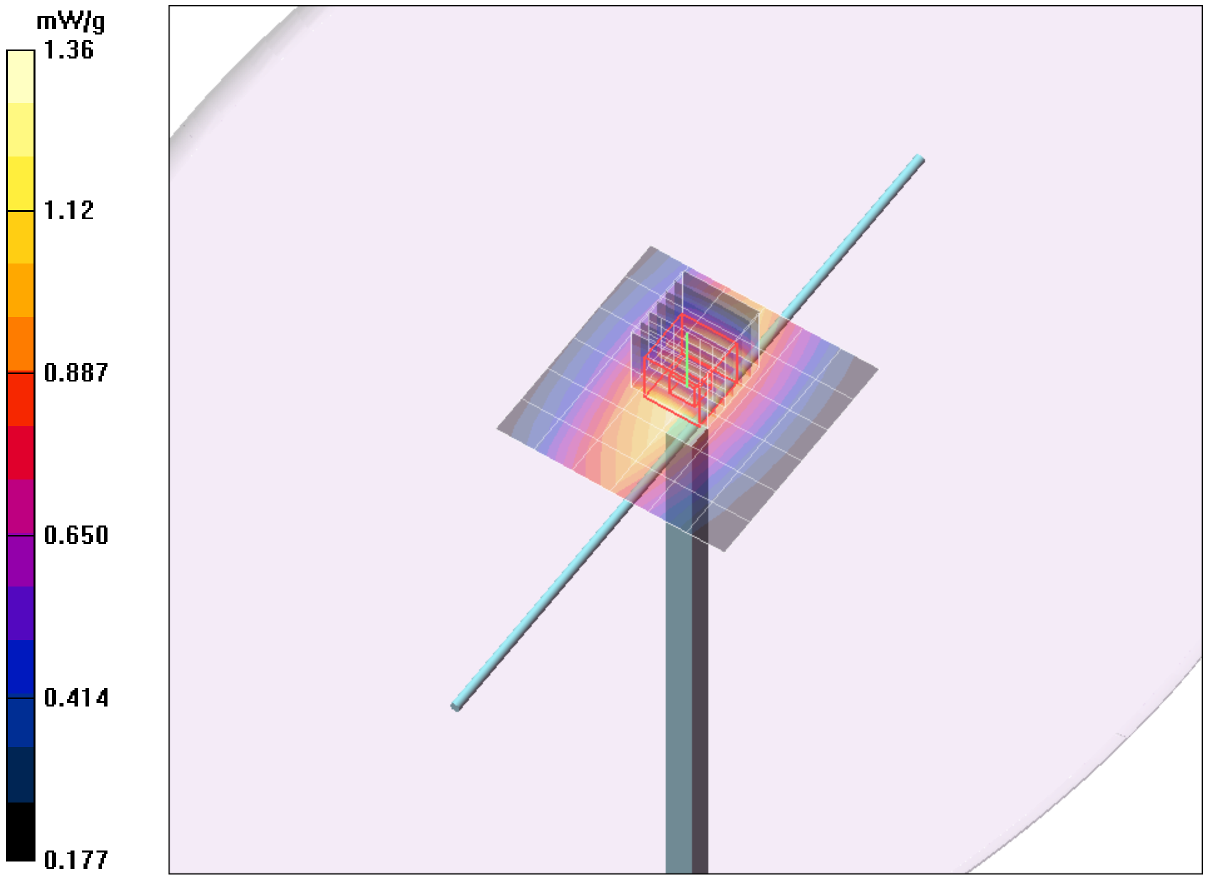
Test Laboratory: IMST GmbH, DASY Blue (I); File Name: 130212_b_1579.da4

DUT: Dipole 450 MHz SN1014; Type: D450V2; Serial: D450V2 - SN:1014
Program Name: System Performance Check at 450 MHz

Communication System: CW; Frequency: 450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 450 MHz; σ = 0.85 mho/m; ε_r = 43.3; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6R – SN1579; ConvF(7.45, 7.45, 7.45); Calibrated: 25.01.2012
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn335; Calibrated: 22.02.2011
- Phantom: Speag; Type: ELI 4; Serial: 1004
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d=10mm, Pin=250mW/Area Scan (7x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.31 mW/g
d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 39.9 V/m; Power Drift = -0.023 dB
Peak SAR (extrapolated) = 2.00 W/kg
SAR(1 g) = 1.28 mW/g; SAR(10 g) = 0.865 mW/g
Maximum value of SAR (measured) = 1.36 mW/g



SAR Result with Body TSL

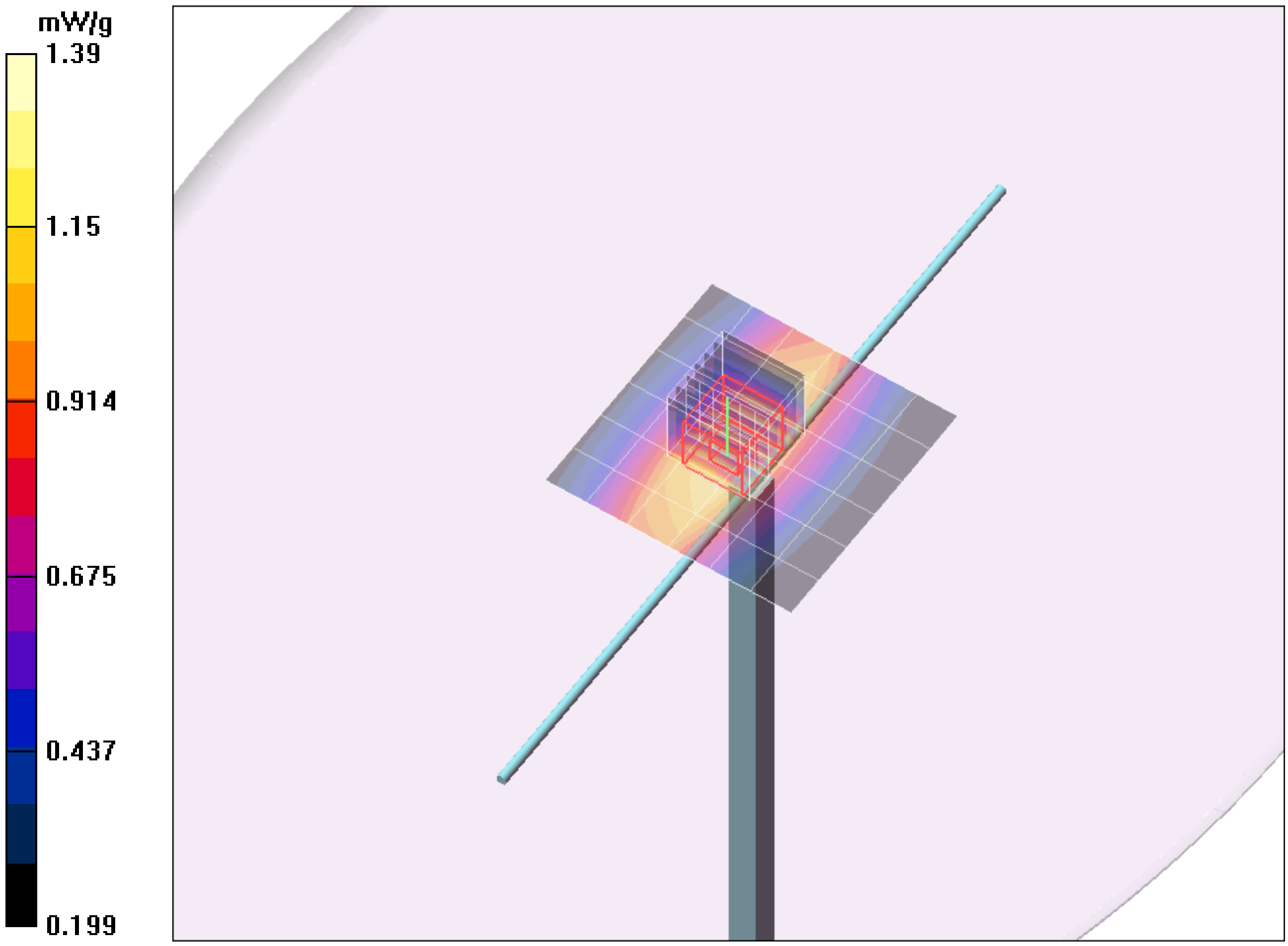
Test Laboratory: IMST GmbH, DASY Blue (I); File Name: 140212_b_1579.da4

DUT: Dipole 450 MHz SN1014; Type: D450V2; Serial: D450V2 - SN:1014
Program Name: System Performance Check at 450 MHz

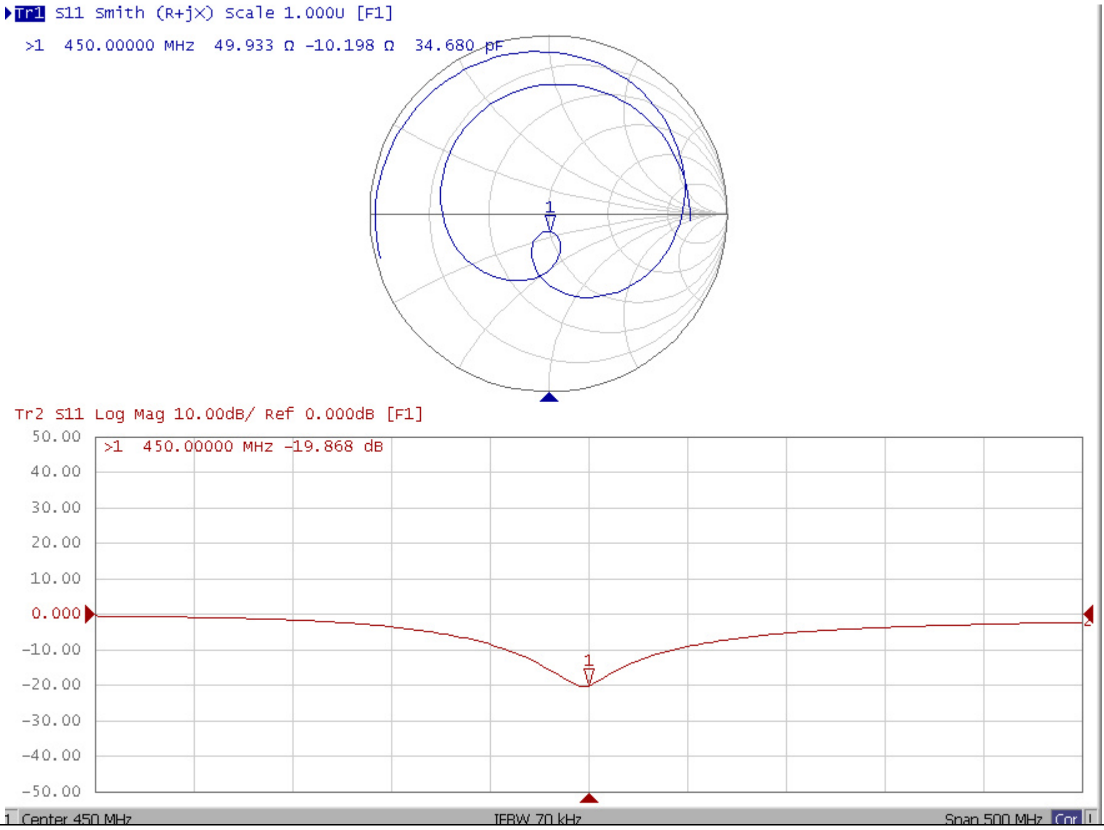
Communication System: CW; Frequency: 450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 450 MHz; σ = 0.95 mho/m; ε_r = 56; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6R - SN1579; ConvF(7.81, 7.81, 7.81); Calibrated: 25.01.2012
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn335; Calibrated: 22.02.2011
- Phantom: ELI 4; Type: ELI 4; Serial: 1004
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d=10mm, Pin=250mW/Area Scan (7x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.32 mW/g
d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 37.9 V/m; Power Drift = 0.070 dB
Peak SAR (extrapolated) = 2.03 W/kg
SAR(1 g) = 1.31 mW/g; SAR(10 g) = 0.890 mW/g
Maximum value of SAR (measured) = 1.39 mW/g



Impedance Measurements Plot for Head TSL



Impedance Measurements Plot for Body TSL