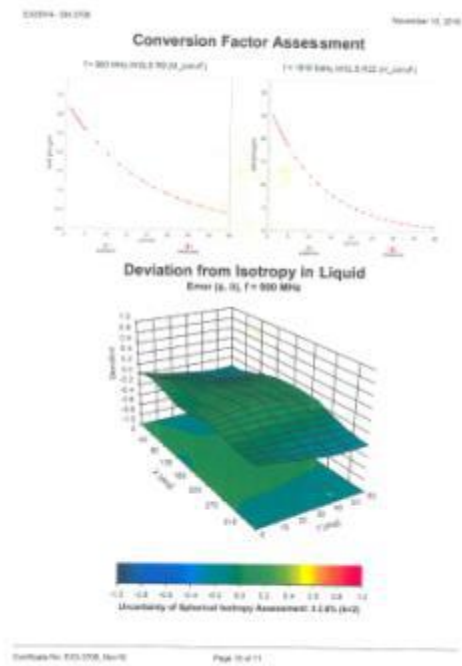
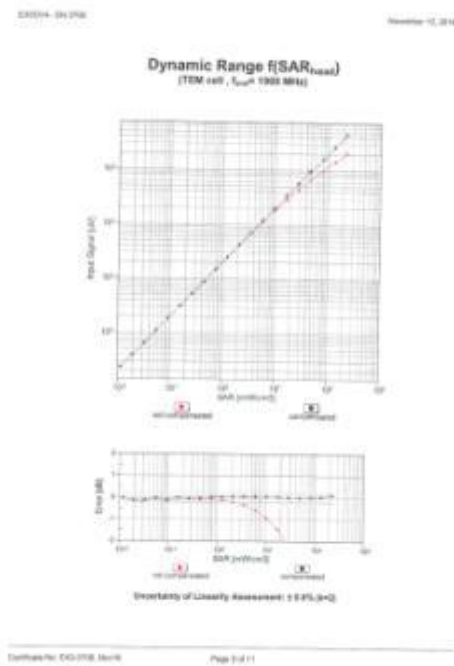


EX3DV4 Sn:3708



EX3DV4 - SN:3708 November 10, 2016

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3708

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-1.9
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

D835V2 Sn:4d023

Calibration Laboratory of Softest & Partner Engineering AG Zwinglistrasse 10, 8000 Zurich, Switzerland		 	Schweizerischer Bundesmetall Particular services of Switzerland for the calibration of Swiss Calibration Services
Accrediting 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: SPITEC (Hilti)		Certificate No.: DDIVS-8003Z Out	
CALIBRATION CERTIFICATE			
Item: DEGRIT - 500-A003			
Calibration product: QA-CAL-30-40 Calibration procedure for digital voltmeter kits above 700 M Ω			
Calibration date: October 24, 2016			
This calibration certificate documents the traceability to national standards, which ensure the global validity of measurements [1]. The measurement result and its comparison with conformity/compatibility are given in the following pages and are part of the certificate.			
All calibrations have been conducted in the client laboratory facility, ambient temperature 20 $\pm$ 0.5 $^{\circ}$ C and humidity $\pm$ 10%.			
Calibration Equipment used (MUT) ordered for calibration:			
Primary Standards	Lot n°	Exp. Date of Certificate (Yr.)	Expiry Date of Calibration
Phase meter 500-0	500-100749	06-Apr-16 to 06-12-2016 (annually)	Apr-17
Power source 500F-01	500-100844	06-Apr-16 to 06-12-2016 (annually)	Apr-17
Power source 500F-02	500-102343	06-Apr-16 to 06-12-2016 (annually)	Apr-17
Reference 50-0 Alternative	500-5009-0020	05-Apr-16 to 05-12-2016	Apr-17
Type of instrument calibration	104-20047-2 (300V)	05-Apr-16 to 05-12-2016	Apr-17
Reference Power 500V/0	500-11988	05-Apr-16 to 05-12-2016 (annually)	Apr-17
(100V)	500-9007	05-Dec-16 to 05-10-2017 (2x/yr)	Dec-17
Secondary Standards	Lot n°	Check Date of Calibration	Expiry Date of Calibration
Phase meter 500F-001	500-0001400101	01-Oct-15 to 01-Oct-2016 (check 1x/yr)	01-Oct-2016 (check 1x/yr)
Phase meter 500F-001-1	500-0001400102	01-Oct-15 to 01-Oct-2016 (check 1x/yr)	01-Oct-2016 (check 1x/yr)
500F-001-1001-001	500-0001400103	01-Oct-15 to 01-Oct-2016 (check 1x/yr)	01-Oct-2016 (check 1x/yr)
500F-001-1001-002	500-0001400104	01-Oct-15 to 01-Oct-2016 (check 1x/yr)	01-Oct-2016 (check 1x/yr)
500F-001-1001-003	500-0001400105	01-Oct-15 to 01-Oct-2016 (check 1x/yr)	01-Oct-2016 (check 1x/yr)
500F-001-1001-004	500-0001400106	01-Oct-15 to 01-Oct-2016 (check 1x/yr)	01-Oct-2016 (check 1x/yr)
500F-001-1001-005	500-0001400107	01-Oct-15 to 01-Oct-2016 (check 1x/yr)	01-Oct-2016 (check 1x/yr)
500F-001-1001-006	500-0001400108	01-Oct-15 to 01-Oct-2016 (check 1x/yr)	01-Oct-2016 (check 1x/yr)
500F-001-1001-007	500-0001400109	01-Oct-15 to 01-Oct-2016 (check 1x/yr)	01-Oct-2016 (check 1x/yr)
500F-001-1001-008	500-0001400110	01-Oct-15 to 01-Oct-2016 (check 1x/yr)	01-Oct-2016 (check 1x/yr)
500F-001-1001-009	500-0001400111	01-Oct-15 to 01-Oct-2016 (check 1x/yr)	01-Oct-2016 (check 1x/yr)
500F-001-1001-010	500-0001400112	01-Oct-15 to 01-Oct-2016 (check 1x/yr)	01-Oct-2016 (check 1x/yr)
500F-001-1001-011	500-0001400113	01-Oct-15 to 01-Oct-2016 (check 1x/yr)	01-Oct-2016 (check 1x/yr)
500F-001-1001-012	500-0001400114	01-Oct-15 to 01-Oct-2016 (check 1x/yr)	01-Oct-2016 (check 1x/yr)
500F-001-1001-013	500-0001400115	01-Oct-15 to 01-Oct-2016 (check 1x/yr)	01-Oct-2016 (check 1x/yr)
500F-001-1001-014	500-0001400116	01-Oct-15 to 01-Oct-2016 (check 1x/yr)	01-Oct-2016 (check 1x/yr)
500F-001-1001-015	500-0001400117	01-Oct-15 to 01-Oct-2016 (check 1x/yr)	01-Oct-2016 (check 1x/yr)
500F-001-1001-016	500-0001400118	01-Oct-15 to 01-Oct-2016 (check 1x/yr)	01-Oct-2016 (check 1x/yr)
500F-001-1001-017	500-0001400119	01-Oct-15 to 01-Oct-2016 (check 1x/yr)	01-Oct-2016 (check 1x/yr)
500F-001-1001-018	500-0001400120	01-Oct-15 to 01-Oct-2016 (check 1x/yr)	01-Oct-2016 (check 1x/yr)
500F-001-1001-019	500-0001400121	01-Oct-15 to 01-Oct-2016 (check 1x/yr)	01-Oct-2016 (check 1x/yr)
500F-001-1001-02			

Calibration Laboratory of Schmid & Partner Engineering AG Zöggenstrasse 45, 8054 Gütting, Switzerland			Calibration Laboratory of Schmid & Partner Engineering AG Zöggenstrasse 45, 8054 Gütting, Switzerland
According to the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is a one of the signatories to the EU Mutual Recognition Arrangement for the recognition of calibration certificates		Accreditation No.: SCS 0108	
Glossary:			
TSL	Issue circulating loop		
CovEff	sensitivity in TSL, %/C/Hz μ p		
N/A	not applicable or not measured		
Calibration is performed according to the following standards:			
a)	IEC 582 5029-2/3, "IEEE Recommended Practices for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices (Measurement Techniques)", July 2013		
b)	IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices 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 3 GHz)", March 2010		
d)	ICG 565564, "SAR Measurement Requirements for 100 MHz to 3 GHz"		
Additional Documentation:			
a)	DASY6 System handbook		
Methods Applied and Interpretation of Parameters:			
a)	Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures noted in the certificate are valid at the frequency indicated.		
b)	Antenna Parameters with TSL: The dipole is realized with the spacer in position to test post exactly below the center marking of the flat phantom section, with the arms oriented parallel to the torso axis.		
c)	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 reflections.		
d)	Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.		
e)	SAR measured: SAR measured at the stated antenna input power.		
f)	SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna terminals.		
g)	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		
DAF7 subject configuration as for the TSP-1000 (Table 1)		
DAF7 Version	DAF70	V53.4.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance (Spine Center - TSL)	10 mm	with spacer
Zone Scan Resolution	0x, 0y, 0z = 2 mm	
Frequency	200 MHz ± 1 MHz	

Head TSL parameters			
The following parameters and calculations were applied:			
	Temperature	Permeability	Conductivity
Measured Head TSL parameters	30.0 ± 1 °C	41.5	0.00 mW/m
Measured Head TSL parameters	30.0 ± 0.5 °C	40.0 ± 0.5	0.00 mW/m ± 0 %
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	200 mW input power	0.07 W/kg
SAR for nominal Head TSL parameters	normalised to 1W	0.40 W/kg ± 17.0 % (Std)

SAR result with Head TSL		
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	200 mW input power	1.00 W/kg
SAR for nominal Head TSL parameters	normalised to 1W	0.14 W/kg ± 16.5 % (Std)

Body TSL parameters			
The following parameters and calculations were applied:			
	Temperature	Permeability	Conductivity
Measured Body TSL parameters	30.5 ± 1 °C	55.5	0.07 mW/m
Measured Body TSL parameters	30.0 ± 0.5 °C	53.5 ± 0.5	0.00 mW/m ± 0 %
Body TSL temperature change during test	± 0.2 °C		

SAR result with Body TSL		
SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	200 mW input power	0.36 W/kg
SAR for nominal Body TSL parameters	normalised to 1W	0.62 W/kg ± 17.0 % (Std)

SAR result with Body TSL		
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	200 mW input power	1.00 W/kg
SAR for nominal Body TSL parameters	normalised to 1W	0.33 W/kg ± 16.5 % (Std)

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Appendix (Additional assessments outside the scope of SCS 0106)	
Antenna Parameters with Head TSL	
Impedance, transformed to feed point	53.4 Ω - 1.9 j Ω
Return Loss	- 26.4 dB
Antenna Parameters with Body TSL	
Impedance, transformed to feed point	49.3 Ω - 5.1 j Ω
Return Loss	- 25.8 dB
General Antenna Parameters and Design	
Electrical Delay (one direction)	1.369 ns
After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured. The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.	
Additional EUT Data	
Manufactured by	SPEAIG
Manufactured on	December 17, 2004

Certificate No: D630V2-40231_Ort16

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D835V2 Sn:4d023

DASY5 Validation Report for Head TSL

Date: 24.10.2016

Test Laboratory: SPAG, Zurich, Switzerland

DUT: Dipole 835 MHz, Type: D835V2, Serial: D835V2 - SN:4d023

Communication System: UED 0 - CW, Frequency: 835 MHz

Medium parameters used: $f = 835 \text{ MHz}$, $n = 0.99$, $S_{\text{ref}} = 40 \text{ dB}$, $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Surface

Measurement Standard: DASY5 (IEEE/IEC/ANSI C37.19-2011)

DASY5 Configuration:

- Probe: EXCDV4 - 507546, Case: F0X.75, 0.72, 0.72; Calibration: 13.06.2016
- Sensor Surface: 1 Area (Mechanical Surface Detection)
- Electronics: DA64 50601, Calibration: 30.12.2015
- Phantom: Flat Phantom 4.0L, Type: QD000P00AA, Serial: 1001
- DASY5: 52.8.8(129); SEMCAD X 14.6.10(372)

Dipole Calibration for Head Tissue/ $P_{\text{iso}}=250 \text{ mW}$, $d=15\text{mm}$ /Zoom Scan (7x7x7)/Cube 0:

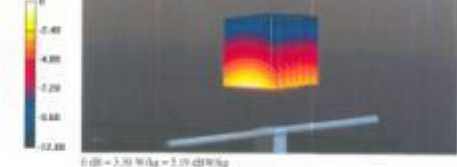
Measurement grid: $d_x=5\text{mm}$, $d_y=5\text{mm}$, $d_z=5\text{mm}$

Reference Value: $\approx 61.72 \text{ dB}$ VSWR, Power Dens: $\approx 0.01 \text{ dB}$

Peak SAR (extrapolated): $\approx 3.72 \text{ W/kg}$

SAR(10 g): 2.47 W/kg ; SAR(10 g): 1.89 W/kg

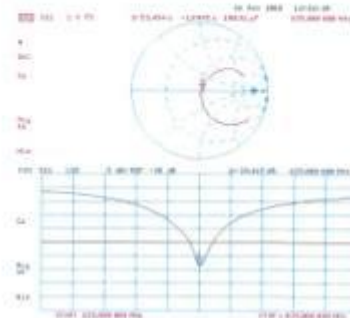
Maximum value of SAR (measured): $\approx 3.10 \text{ W/kg}$



Certificate No.: 080303-40001_00116

Page: 6 of 6

Impedance Measurement Plot for Head TSL



Certificate No.: 080303-40001_00116

Page: 6 of 6

DASY5 Validation Report for Body TSL

Date: 24.10.2016

Test Laboratory: SPAG, Zurich, Switzerland

DUT: Dipole 835 MHz, Type: D835V2, Serial: D835V2 - SN:4d023

Communication System: UED 0 - CW, Frequency: 835 MHz

Medium parameters used: $f = 835 \text{ MHz}$, $n = 0.99$, $S_{\text{ref}} = 40 \text{ dB}$, $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Surface

Measurement Standard: DASY5 (IEEE/IEC/ANSI C37.19-2011)

DASY5 Configuration:

- Probe: EXCDV4 - 507546, Case: F0X.75, 0.72, 0.72; Calibration: 13.06.2016
- Sensor Surface: 1 Area (Mechanical Surface Detection)
- Electronics: DA64 50601, Calibration: 30.12.2015
- Phantom: Flat Phantom 4.0L, Type: QD000P00AA, Serial: 1001
- DASY5: 52.8.8(129); SEMCAD X 14.6.10(372)

Dipole Calibration for Body Tissue/ $P_{\text{iso}}=250 \text{ mW}$, $d=15\text{mm}$ /Zoom Scan (7x7x7)/Cube 0:

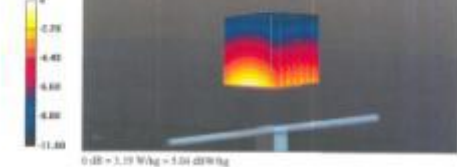
Measurement grid: $d_x=5\text{mm}$, $d_y=5\text{mm}$, $d_z=5\text{mm}$

Reference Value: $\approx 59.97 \text{ dB}$ VSWR, Power Dens: $\approx 0.01 \text{ dB}$

Peak SAR (extrapolated): $\approx 3.70 \text{ W/kg}$

SAR(10 g): 2.44 W/kg ; SAR(10 g): 1.8 W/kg

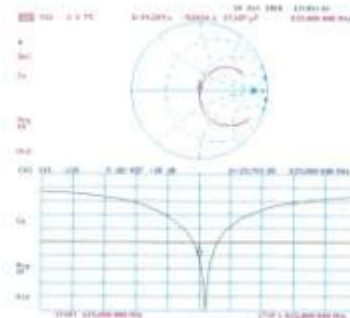
Maximum value of SAR (measured): $\approx 3.19 \text{ W/kg}$



Certificate No.: 080303-40001_00116

Page: 7 of 8

Impedance Measurement Plot for Body TSL



Certificate No.: 080303-40001_00116

Page: 8 of 8

D1900V2 Sn:5d113

Calibration Laboratory of
Schnitz & Partner
Engineering AG
Bismarckstrasse 10, 8033 Zurich, Switzerland

Accreditation No.: SCS 0108

Conformity to the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the IAF
Multilateral Agreement for the recognition of calibration certificates

Client: SRTC (THH) Certificate No.: D1900V2-Sn:5d113_Oct18

CALIBRATION CERTIFICATE

Object: D1900V2 - Sn:5d113

Calibration procedure: ICA CAL-05-v6
Calibration procedure for dipole calibration kits above 100 MHz

Calibration date: October 31, 2018

This calibration certificate documents the conformity to national standards, which include the physical units of measurements (SI).
The measurement and the calibration with uncertainty (coverage) are given in the following pages which are part of the certificate.

All calibrations have been conducted in the clean laboratory facility, environment temperature (20 ± 0.5) °C, humidity < 70%.

Calibration equipment used (MPE) (scope for calibration)

Antenna Parameters	ET	Test Date (Calibrators No.)	Subsequent Calibration
Power meter NIST	99-10078	08-Apr-18 (No. 211-000600000)	Apr-17
Power sensor SPM-200	99-10084	08-Apr-18 (No. 211-000600000)	Apr-17
Power sensor SPM-200	99-10085	08-Apr-18 (No. 211-000600000)	Apr-17
Reference 10 dB attenuator	99-10086	08-Apr-18 (No. 211-000600000)	Apr-17
Type A measurement comparison	99-10087	08-Apr-18 (No. 211-000600000)	Apr-17
Calibration Probe L2000A	99-10088	15-Jun-17 (No. 610-100000000)	Jun-17
Load	99-10089	08-Apr-18 (No. 211-000600000)	Apr-17

Secondary Standards	ET	Test Date (Calibrators No.)	Subsequent Calibration
Power meter NIST	99-10078	08-Apr-18 (No. 211-000600000)	Apr-17
Power sensor SPM-200	99-10084	08-Apr-18 (No. 211-000600000)	Apr-17
Power sensor SPM-200	99-10085	08-Apr-18 (No. 211-000600000)	Apr-17
Reference 10 dB attenuator	99-10086	08-Apr-18 (No. 211-000600000)	Apr-17
Type A measurement comparison	99-10087	08-Apr-18 (No. 211-000600000)	Apr-17
Calibration Probe L2000A	99-10088	15-Jun-17 (No. 610-100000000)	Jun-17
Load	99-10089	08-Apr-18 (No. 211-000600000)	Apr-17

Calibrated by: Hans-Joachim Schnitz
Approved by: Hans-Joachim Schnitz

The calibration certificate shall not be reproduced in part or full without written approval of the laboratory.

Certificate No.: D1900V2-Sn:5d113_Oct18 Page 1 of 8

Calibration Laboratory of
Schnitz & Partner
Engineering AG
Bismarckstrasse 10, 8033 Zurich, Switzerland

Accreditation No.: SCS 0108

Conformity to the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the IAF
Multilateral Agreement for the recognition of calibration certificates

Client: SRTC (THH) Certificate No.: D1900V2-Sn:5d113_Oct18

CALIBRATION CERTIFICATE

Object: D1900V2 - Sn:5d113

Calibration procedure: ICA CAL-05-v6
Calibration procedure for dipole calibration kits above 100 MHz

Calibration date: October 31, 2018

This calibration certificate documents the conformity to national standards, which include the physical units of measurements (SI).
The measurement and the calibration with uncertainty (coverage) are given in the following pages which are part of the certificate.

All calibrations have been conducted in the clean laboratory facility, environment temperature (20 ± 0.5) °C, humidity < 70%.

Calibration equipment used (MPE) (scope for calibration)

Antenna Parameters	ET	Test Date (Calibrators No.)	Subsequent Calibration
Power meter NIST	99-10078	08-Apr-18 (No. 211-000600000)	Apr-17
Power sensor SPM-200	99-10084	08-Apr-18 (No. 211-000600000)	Apr-17
Power sensor SPM-200	99-10085	08-Apr-18 (No. 211-000600000)	Apr-17
Reference 10 dB attenuator	99-10086	08-Apr-18 (No. 211-000600000)	Apr-17
Type A measurement comparison	99-10087	08-Apr-18 (No. 211-000600000)	Apr-17
Calibration Probe L2000A	99-10088	15-Jun-17 (No. 610-100000000)	Jun-17
Load	99-10089	08-Apr-18 (No. 211-000600000)	Apr-17

Secondary Standards	ET	Test Date (Calibrators No.)	Subsequent Calibration
Power meter NIST	99-10078	08-Apr-18 (No. 211-000600000)	Apr-17
Power sensor SPM-200	99-10084	08-Apr-18 (No. 211-000600000)	Apr-17
Power sensor SPM-200	99-10085	08-Apr-18 (No. 211-000600000)	Apr-17
Reference 10 dB attenuator	99-10086	08-Apr-18 (No. 211-000600000)	Apr-17
Type A measurement comparison	99-10087	08-Apr-18 (No. 211-000600000)	Apr-17
Calibration Probe L2000A	99-10088	15-Jun-17 (No. 610-100000000)	Jun-17
Load	99-10089	08-Apr-18 (No. 211-000600000)	Apr-17

Calibrated by: Hans-Joachim Schnitz
Approved by: Hans-Joachim Schnitz

The calibration certificate shall not be reproduced in part or full without written approval of the laboratory.

Certificate No.: D1900V2-Sn:5d113_Oct18 Page 1 of 8

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	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	40.6 ± 6 %	1.39 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	10.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	40.7 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.30 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	21.3 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	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.2 ± 6 %	1.48 mho/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	250 mW input power	9.80 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	39.8 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.23 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.1 W/kg ± 16.5 % (k=2)

Certificate No.: D1900V2-Sn:5d113_Oct18 Page 3 of 8

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	71.1 Ω ± 5.5 Ω
Return Loss	13.8 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	67.0 Ω ± 7.7 Ω
Return Loss	11.8 dB

General Antenna Parameters and Design

Electrical (dipole) length	1.22 m
----------------------------	--------

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

The dipole is made of standard weight coated cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited by DC signals. On some of the dipole, small and large air-filled gaps are added to the dipole arms in order to improve matching when heated according to the procedure explained under "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the standard.

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

Additional EUT Data

Manufactured by	SFEAG
Manufactured on	July 24, 2008

Certificate No.: D1900V2-Sn:5d113_Oct18 Page 4 of 8

D1900V2 Sn:5d113

DASY5 Validation Report for Head TSL

Date: 31.10.2016

Test Laboratory: SPAG, Zurich, Switzerland

Device: Dipole 1900 MHz; Type: D1900V2; Serial: SN:5d113

Communication System: UED 0 - CW; Frequency: 1900 MHz

Mechanic parameters used: $f = 1900 \text{ MHz}$; $a = 1.39 \text{ Sec}$; $\epsilon_r = 40.6$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: EXD14 - SN7149; Core: P7-85; T-89; T-89; Calibration: 15.06.2016;
- Sensor Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAH 1a011; Calibration: 30.12.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 0001
- DASY52 52.8-R(12M); SEMCAD X 14.6.0(7372)

Dipole Calibration for Head Thoms/Pier250 mW, 4-10mm/Zoom Scan (7x7x7)/Cube fit

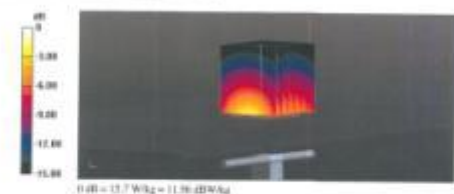
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 104.4 Vm; Power DdB = -0.02 dB

Peak SAR (extrapolated) = 19.0 W/kg

SAR(10 g) = 16.1 W/kg; SAR(10 g) = 8.3 W/kg

Minimum value of SAR (measured) = 13.7 W/kg

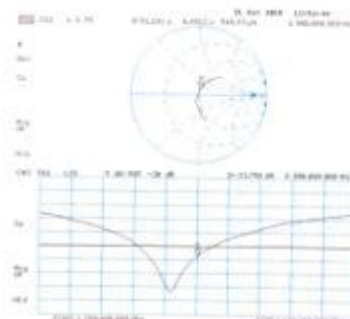


0 dB = 13.7 W/kg = 11.36 dBW/kg

Certificate No: 0100000-04713_C0102

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Impedance Measurement Plot for Head TSL



Certificate No: 0100000-04713_C0102

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DASY5 Validation Report for Body TSL

Date: 31.10.2016

Test Laboratory: SPAG, Zurich, Switzerland

Device: Dipole 1900 MHz; Type: D1900V2; Serial: SN:5d113

Communication System: UED 0 - CW; Frequency: 1900 MHz

Mechanic parameters used: $f = 1900 \text{ MHz}$; $a = 1.44 \text{ Sec}$; $\epsilon_r = 52.2$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: EXD14 - SN7149; Core: P7-03; 8.03; 8.03; Calibration: 15.06.2016;
- Sensor Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAH 1a011; Calibration: 30.12.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 0002
- DASY52 52.8-R(12M); SEMCAD X 14.6.0(7372)

Dipole Calibration for Body Thoms/Pier250 mW, 4-10mm/Zoom Scan (7x7x7)/Cube fit

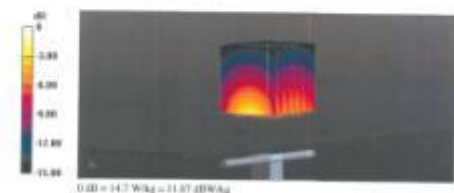
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 104.5 Vm; Power DdB = -0.06 dB

Peak SAR (extrapolated) = 17.2 W/kg

SAR(10 g) = 9.8 W/kg; SAR(10 g) = 5.25 W/kg

Minimum value of SAR (measured) = 14.7 W/kg

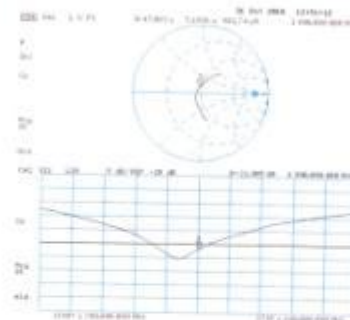


0 dB = 14.7 W/kg = 11.67 dBW/kg

Certificate No: 0100000-04713_C0102

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Impedance Measurement Plot for Body TSL



Certificate No: 0100000-04713_C0102

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D2450V2 S_n:738[illegible]

Calibration Laboratory of Schmid & Partner Engineering AG Hauptstrasse 18, 8904 Schaff, Switzerland			Schweizerische Eidgenossenschaft Confédération suisse Confederaziun Svizra Confederaziun Svizra
Accredited by the Swiss Accreditation Body (SAB) The Swiss Accreditation Body is a member of the organization for the EU Multilateral Agreement for the recognition of calibration laboratories			Accreditation No.: SGS 0158
Object: TSL CoreC N/A			
Issue: calibration load sensitivity in TSL, $\pm 0.01\%$ y.r. not applicable or not measured			
Calibration is Performed According to the Following Standards:			
(1) 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 (2) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency ranges of 300 MHz to 3 GHz)", February 2005 (3) 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 3 GHz)", March 2010 (4) RCB 065656, "SAR Measurement Requirements for 100 MHz to 6 GHz"			
Additional Documentation:			
a) DASY4 System Handbook			
Methods Applied and Interpretation of Parameters:			
• Measurement Conditions: Further details are available from the Calibration Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated. • Antenna Impedance with TSL: The dipole is mounted with the spacer to position its feed point exactly before the center marking of the flat pattern 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 SAR 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 normal 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	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz $\pm$ 1 MHz	

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.2 ± 6 %	1.87 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	13.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	51.2 W/kg ± 17.0 % (ku2)

SAR averaged over 10 cm ³ (10 g) of Head TSL		
	condition	
SAR measured	250 mW input power	6.07 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.9 W/kg ± 16.5 % (ku2)

Body TSL parameters			
The following parameters and calculations were applied.			
	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	51.3 $\pm$ 6 %	2.02 mho/m $\pm$ 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	250 mW input power normalized to 1W	13.0 W/kg
SAR for nominal Body TSL parameters		50.8 W/kg ± 17.0 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL		
	condition	
SAR measured	250 mW input power normalized to 1W	6.08 W/kg
SAR for nominal Body TSL parameters		24.0 W/kg ± 16.5 % (k=2)

Impedance, transformed to load point	$75.5 \pm 0.1 \text{ }\Omega$
Return loss (dB)	$> 27.3 \text{ dB}$

Antenna Parameters with Body TSL	
Impedance, Impedance to feedpoint	$45.7 \pm 5.8 \Omega$
Return Loss	-39.5 dB

Electrical Delay (one direction)	1.167 ns
----------------------------------	----------

The study is made of standard average length models. The center on either of the leading line is directly connected to the second arm of the dipole. The antenna is basically also constructed for 50 Ω signals. On one side of the dipoles, small enclosures are attached to the dipole arms in order to improve matching when loaded according to the position as expressed in the "Measurement Conditions" paragraph. The SAR data are not affected by the size of the antenna. The overall dipole length is adjusted according to the frequency of the signal.

No resonance fence must be applied to the dipole arms, because they might lead to the additional excitation near the feedpoint area be disrupted.

Manufactured by	SPENCER
Manufactured on	August 05, 2003

D2450V2 Sn:738

DASY5 Validation Report for Head TSL

Date: 25.10.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz, Type: D2450V2, Serial: D2450V2-SN:738

Communication System: UED 0 - CW, Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz, $n = 1.875$ m, $\epsilon_r = 36.2$, $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ARNT C39.39.3011)

DASY5 Configuration:

- Probe: EXCD14 - BNT500, CaseP(7.72, 7.72, 7.72), Calibrated: 15.08.2008,
- Sensor Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DNE9 Sub01, Calibrated: 30.12.2012
- Phantom: Flat Phantom 5.0 (Inch), Type: QD00P50AA, Serial: 1001
- DASY5: 52.8.0(258), SEMCAD X 14.6.0K(372)

Dipole Calibration for Head Tissue/Pho=230 mW, d=10mm/Zoom Scan (7x7x7)/Cube B:

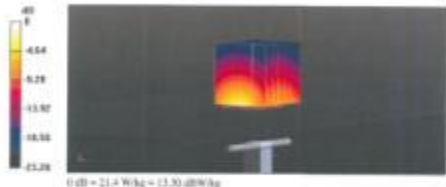
Measurement grid: d0=5mm, d1=5mm, d2=5mm

Reference Value = 111.7 V/m, Power Dens = 0.014 dB

Peak SAR (interpolated) = 26.4 W/kg

SAR(1 g) = 13.1 W/kg; SAR(10 g) = 6.87 W/kg

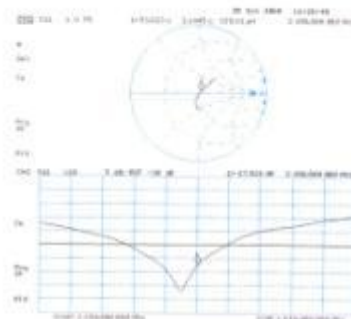
Minimum value of SAR (measured) = 2.14 W/kg



Certificate No. 20160403-F28, Cert 9

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Impedance Measurement Plot for Head TSL



Certificate No. 20160403-F28, Cert 10

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DASY5 Validation Report for Body TSL

Date: 25.10.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz, Type: D2450V2, Serial: D2450V2-SN:738

Communication System: UED 0 - CW, Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz, $n = 1.875$ m, $\epsilon_r = 51.3$, $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ARNT C39.39.3011)

DASY5 Configuration:

- Probe: EXCD14 - BNT500, CaseP(7.76, 7.76, 7.76), Calibrated: 15.08.2008,
- Sensor Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DNE9 Sub01, Calibrated: 30.12.2012
- Phantom: Flat Phantom 5.0 (Inch), Type: QD00P50AA, Serial: 1001
- DASY5: 52.8.0(258), SEMCAD X 14.6.0K(372)

Dipole Calibration for Body Tissue/Pho=230 mW, d=10mm/Zoom Scan (7x7x7)/Cube B:

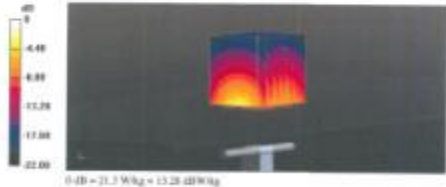
Measurement grid: d0=5mm, d1=5mm, d2=5mm

Reference Value = 107.3 V/m, Power Dens = 0.014 dB

Peak SAR (interpolated) = 26.0 W/kg

SAR(1 g) = 13.0 W/kg; SAR(10 g) = 6.88 W/kg

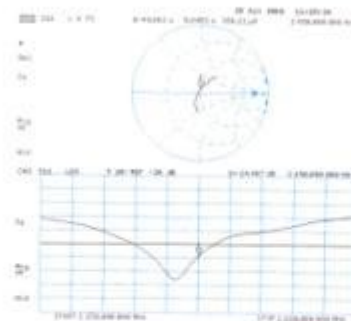
Minimum value of SAR (measured) = 2.13 W/kg



Certificate No. 20160403-F28, Cert 9

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Impedance Measurement Plot for Body TSL



Certificate No. 20160403-F28, Cert 10

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New calibrate documents

DAE4 Sn:546

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CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62504633-2218 Fax: +86-10-62504633-2209
E-mail: cti@chinaati.com Http://www.chinaati.cn

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国际互认
校准
CALIBRATION
CNAS L020

Client: **SRTC** Certificate No: **Z17-97141**

CALIBRATION CERTIFICATE

Object: **DAE4 - SN: 546**

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

Calibration date: **September 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: **Yu Zongying** SAR Test Engineer **Signature**

Reviewed by: **Lin Hao** SAR Test Engineer **Signature**

Approved by: **Qi Dianyuan** SAR Project Leader **Signature**

Issued: September 18, 2017

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Certificate No: Z17-97141

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E-mail: cti@chinaati.com Http://www.chinaati.cn

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.

Certificate No: Z17-97141

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DC Voltage Measurement

A/D - Converter Resolution nominal
High Range: 1LSB = 6.1μV / 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	405.337 ± 0.15% (k=2)	404.085 ± 0.15% (k=2)	404.215 ± 0.15% (k=2)
Low Range	3.98726 ± 0.7% (k=2)	3.95731 ± 0.7% (k=2)	3.97839 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	
	236.5° ± 1°

Certificate No: Z17-97141

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ES3DV3 Sn:3127

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国际互认
校准
CNAS
CALIBRATION
CNAS L6579

Client: **SRTC** Certificate No: **Z17-97142**

CALIBRATION CERTIFICATE

Object: **ES3DV3 - SN:3127**

Calibration Procedure(s): **FF-Z11-004-01**
Calibration Procedures for Dosimetric E-field Probes

Calibration date: **October 11, 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(23±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 7433	26-Sep-16(SPEAG No DX3-7433_Sep16)	Sep-17
DAE4	SN 549	13-Dec-16(SPEAG No DAE4-549_Dec16)	Dec-17

Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
SignalGeneratorMG3700A	6201052605	27-Jun-17 (CTTL No J17X05858)	Jun-18
Network Analyzer ES071C	MY46110673	13-Jan-17 (CTTL No J17X00285)	Jan-18

Calibrated by: **Yu Zongying** SAR Test Engineer

Reviewed by: **Lin Hao** SAR Test Engineer

Approved by: **Qi Dianyuan** SAR Project Leader

Issued: October 12, 2017

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Tel: +86-10-62304633-2218 Fax: +86-10-62304633-2209
E-mail: cti@chinaetl.com Http://www.chinaetl.cn

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: rotation around probe axis
Polarization θ: rotation around an axis that is in the plane normal to probe axis (at measurement center), i
θ=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) KOB 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 θ=0 (fs900MHz in TEM-cell; f>1800MHz; waveguide). NORM_{x,y,z} are only intermediate values, i.e. the uncertainties of NORM_{x,y,z} does not effect the E²-field uncertainty inside TSL (see below ConvF).
- NORM_{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 fs800MHz) and inside waveguide using analytical field distributions based on power measurements for f>800MHz. 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 50MHz to 100MHz.
- 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).

Certificate No: Z17-97142

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Probe ES3DV3

SN: 3127

Calibrated: October 11, 2017

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

Certificate No: Z17-97142

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DASY/EASY - Parameters of Probe: ES3DV3 - SN: 3127

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm(μV/(V/m) ^{1/2}) ^A	1.28	1.22	1.22	±10.0%
DCP(mV) ^B	103.2	105.3	105.1	

Modulation Calibration Parameters

UID	Communication System Name	A dB	B dB·μV	C	D dB	VR mV	Unc ^C (k=2)
0	CW	X 0.0	0.0	1.0	0.00	282.3	±2.5%
		Y 0.0	0.0	1.0		280.9	
		Z 0.0	0.0	1.0		275.1	

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

Certificate No: Z17-97142

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ES3DV3 Sn:3127



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Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2218 Fax: +86-10-62304633-2209
E-mail: cti@china.ttl.com http://www.china.ttl.com

DASY/EASY – Parameters of Probe: ES3DV3 - SN: 3127

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	6.28	6.28	6.28	0.60	1.20	±12.1%
900	41.5	0.97	6.15	6.15	6.15	0.37	1.62	±12.1%
1810	40.0	1.40	5.06	5.06	5.06	0.67	1.23	±12.1%
2000	40.0	1.40	4.88	4.88	4.88	0.67	1.23	±12.1%
2300	39.5	1.67	4.71	4.71	4.71	0.90	1.06	±12.1%
2450	39.2	1.80	4.58	4.58	4.58	0.90	1.10	±12.1%
2600	39.0	1.96	4.32	4.32	4.32	0.90	1.09	±12.1%

^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.

Certificate No: Z17-97142

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Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2218 Fax: +86-10-62304633-2209
E-mail: cti@china.ttl.com http://www.china.ttl.com

DASY/EASY – Parameters of Probe: ES3DV3 - SN: 3127

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	6.18	6.18	6.18	0.45	1.45	±12.1%
900	55.0	1.05	6.06	6.06	6.06	0.46	1.48	±12.1%
1810	53.3	1.52	4.83	4.83	4.83	0.65	1.29	±12.1%
2000	53.3	1.52	4.69	4.69	4.69	0.44	1.69	±12.1%
2300	52.9	1.81	4.43	4.43	4.43	0.90	1.15	±12.1%
2450	52.7	1.95	4.28	4.28	4.28	0.72	1.34	±12.1%
2600	52.5	2.16	4.07	4.07	4.07	0.90	1.16	±12.1%

^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.

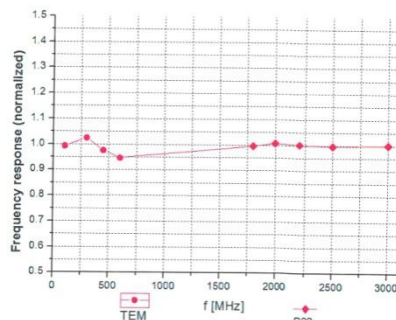
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Frequency Response of E-Field (TEM-Cell: ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field: ±7.4% (k=2)

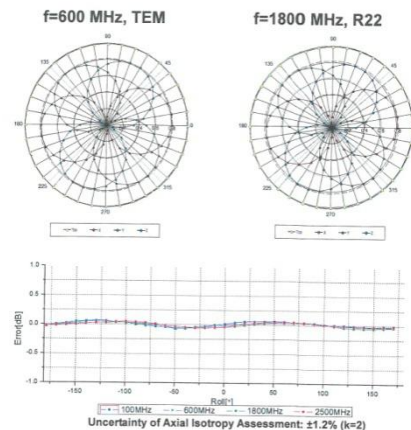
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Receiving Pattern (Φ, θ=0°

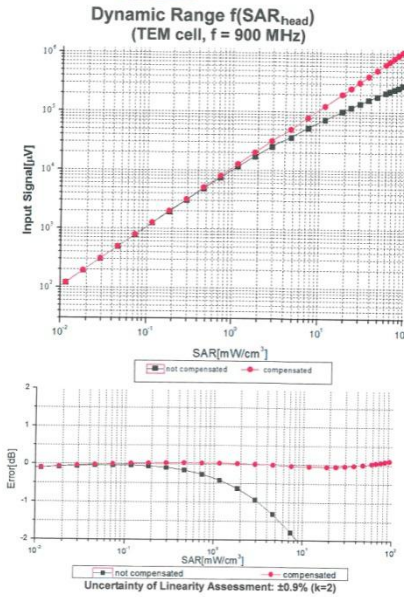


Uncertainty of Axial Isotropy Assessment: ±1.2% (k=2)

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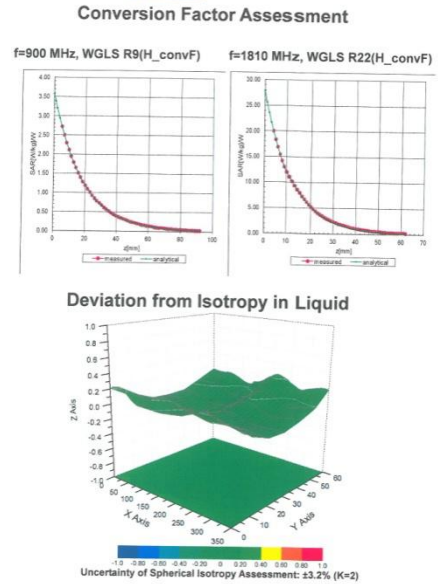
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ES3DV3 Sn:3127



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Certificate No: Z17-97142

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DASY/EASY – Parameters of Probe: ES3DV3 - SN: 3127

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	165.1
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	10mm
Tip Diameter	4mm
Probe Tip to Sensor X Calibration Point	2mm
Probe Tip to Sensor Y Calibration Point	2mm
Probe Tip to Sensor Z Calibration Point	2mm
Recommended Measurement Distance from Surface	3mm

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Appendix: Modulation Calibration Parameters

UID	Communication System Name	PAR	A dB	B dB μV	C	VR mV	Unc ^k (k=2)
0	CW	0.00	X 0.0	0.0	1.0	282.3	±2.5%
			Y 0.0	0.0	1.0	280.9	
			Z 0.0	0.0	1.0	275.1	
10012	IEEE 802.11b WIFI 2.4 GHz (DSSS, 1 Mbps)	1.87	X 2.77	68.02	18.46	143.0	±1.8%
			Y 2.75	68.05	18.52	145.0	
			Z 2.71	67.79	18.25	142.3	
10100	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	5.67	X 6.13	66.4	18.97	141.9	±1.9%
			Y 6.15	66.49	19.06	144.2	
			Z 6.09	66.32	18.90	140.9	
10108	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	5.80	X 6.09	66.24	19.07	139.5	±1.9%
			Y 6.10	66.33	19.15	141.5	
			Z 6.05	66.19	19.05	138.0	
10154	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	5.75	X 5.81	65.85	18.93	136.1	±1.9%
			Y 5.82	65.92	19.01	137.8	
			Z 5.79	65.89	18.97	134.7	
10169	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	5.73	X 4.84	65.92	19.20	130.8	±1.9%
			Y 4.82	65.98	19.27	131.3	
			Z 4.80	66.00	19.29	129.1	
10175	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	5.72	X 4.88	66.14	19.40	131.6	±1.9%
			Y 4.83	66.08	19.33	130.9	
			Z 4.79	66.02	19.29	129.3	
10287	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	5.81	X 6.19	66.61	19.42	141.9	±1.9%
			Y 6.13	66.43	19.26	140.7	
			Z 6.14	66.52	19.33	139.6	

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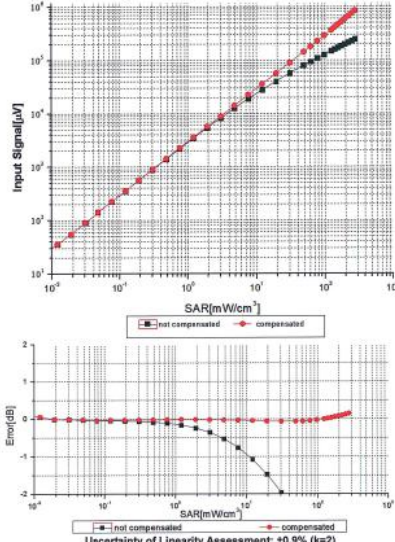
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EX3DV4 Sn:3708



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



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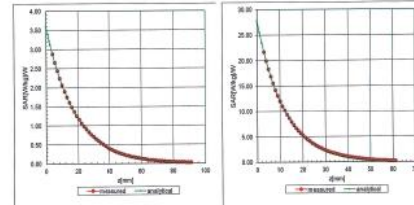
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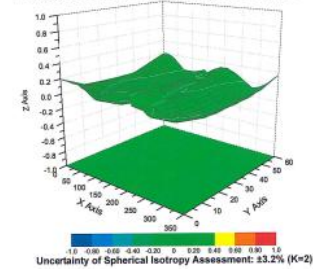
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Conversion Factor Assessment

f=900 MHz, WGLS R9(H_convF) f=1810 MHz, WGLS R22(H_convF)



Deviation from Isotropy in Liquid



Uncertainty of Spherical Isotropy Assessment: ±3.2% (K=2)

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DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3708

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	177.2
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

Certificate No: Z17-97214

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Appendix (Additional assessments outside the scope of FCC approved dual-logo scope)

Modulation Calibration Parameters

UID	Communication System Name	PAR	A dB	B dB-μV	C	VR mV	Unc [±] (k=2)
0	CW	0.00	X 0.0 0.0	0.0 1.0	95.9		±3.1%
			Y 0.0 0.0	0.0 1.0	149.0		
			Z 0.0 0.0	0.0 1.0	169.4		
10011	UMTS-FDD (WCDMA)	2.91	X 2.97 64.29	16.82 147.4			±1.8%
			Y 3.15 66.44	17.98 144.1			
			Z 3.21 67.23	18.44 141.7			
10021	GSM-FDD (TDMA GMSK)	9.39	X 0.95 57.62	9.60 48.2			±2.4%
			Y 1.22 59.57	9.93 44.1			
			Z 1.13 59.66	9.94 43.4			
10062	IEEE 802.11a/h WiFi 5 GHz (OFDM 8 Mbps)	8.68	X 9.01 65.22	19.38 92.1			±2.1%
			Y 8.26 63.95	18.73 71.9			
			Z 8.53 64.77	19.13 85.3			

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D835V2 Sn:4d023

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Client: **SRTC** Certificate No.: **Z17-97135**

CALIBRATION CERTIFICATE

Object: D835V2 - SN: 4d023

Calibration Procedure(s): FF-Z11-003-01
Calibration Procedures for dipole validation kits

Calibration date: September 13, 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
Power Meter NRVO	102196	02-Mar-17 (CTTL, No J17X01254)	Mar-18
Power sensor NR-VZ5	100596	02-Mar-17 (CTTL, No J17X01254)	Mar-18
Reference Probe EX3DV4	SN 7433	26-Sep-16(SPEAG, No EX3-7433_Sep16)	Sep-17
DAE4	SN 1331	19-Jan-17(CTTL-SPEAG, No Z17-97015)	Jan-18

Secondary Standards	ID #	Cal Date/Calibrated by, Certificate No.	Scheduled Calibration
Signal Generator E4438C	MY49071430	13-Jan-17 (CTTL, No J17X00285)	Jan-18
Network Analyzer E5071C	MY46110673	13-Jan-17 (CTTL, No J17X00285)	Jan-18

Calibrated by: Name: Zhao Jing, Function: SAR Test Engineer, Signature: [Signature]

Reviewed by: Yu Zongying, SAR Test Engineer, [Signature]

Approved by: Qi Dianyuan, SAR Project Leader, [Signature]

Issued: September 16, 2017

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Glossary:

TSL: tissue simulating liquid
ConvF: sensitivity in TSL / NORMx,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, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016

c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010

d) KDB865664, 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%.

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Measurement Conditions

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

DASY Version	DASY52	52.10.0.1448
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.3 ± 6 %	0.90 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	---	---

SAR result with Head TSL

SAR averaged over 1 cm ² (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.35 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	9.37 mW (g ± 18.8 % (k=2))
SAR averaged over 10 cm ² (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.52 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	6.06 mW (g ± 18.7 % (k=2))

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.7 ± 6 %	0.96 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	---	---

SAR result with Body TSL

SAR averaged over 1 cm ² (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.34 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	9.47 mW (g ± 18.8 % (k=2))
SAR averaged over 10 cm ² (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.53 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	6.17 mW (g ± 18.7 % (k=2))

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.00-2.79jΩ
Return Loss	- 30.7dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.6j-3.61jΩ
Return Loss	- 25.8dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.495 ns
----------------------------------	----------

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

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

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

Additional EUT Data

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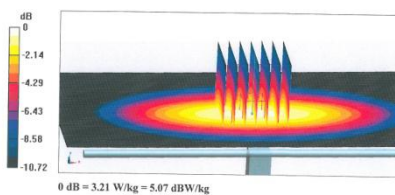
D835V2 Sn:4d023



DASY5 Validation Report for Head TSL
Test Laboratory: CTTL, Beijing, China
Date: 09.13.2017
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d023
Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 835$ MHz; $\alpha = 0.903$ S/m; $\epsilon_r = 41.34$; $\rho = 1000$ kg/m³
Phantom section: Left Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration:

- Probe: EX3DV4 - SN7433; ConvF(9.82, 9.82, 9.82); Calibrated: 9/26/2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 1/19/2017
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.28V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 3.66 W/kg
SAR(1 g) = 2.35 W/kg; SAR(10 g) = 1.52 W/kg
Maximum value of SAR (measured) = 3.21 W/kg

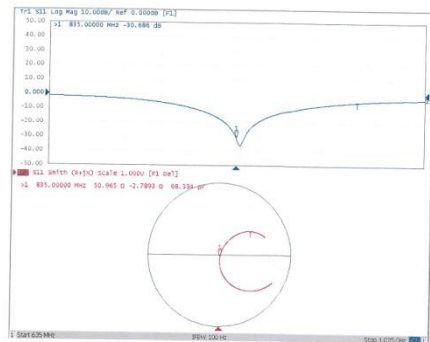


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Impedance Measurement Plot for Head TSL



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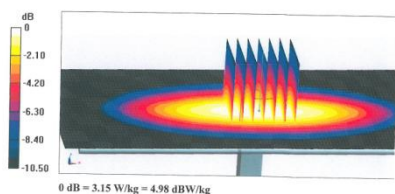
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DASY5 Validation Report for Body TSL
Test Laboratory: CTTL, Beijing, China
Date: 09.13.2017
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d023
Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 835$ MHz; $\alpha = 0.958$ S/m; $\epsilon_r = 55.68$; $\rho = 1000$ kg/m³
Phantom section: Center Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration:

- Probe: EX3DV4 - SN7433; ConvF(9.5, 9.5, 9.5); Calibrated: 9/26/2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 1/19/2017
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.17 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 3.57 W/kg
SAR(1 g) = 2.34 W/kg; SAR(10 g) = 1.53 W/kg
Maximum value of SAR (measured) = 3.15 W/kg

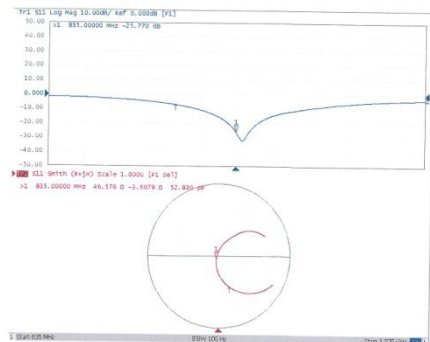


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Impedance Measurement Plot for Body TSL



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D1900V2 Sn:5d113

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CNAS L0570

Client: **SRTC** Certificate No: **Z17-97139**

CALIBRATION CERTIFICATE

Object: D1900V2 - SN: 5d113

Calibration Procedure(s): FF-Z11-003-01
Calibration Procedures for dipole validation kits

Calibration date: September 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
Power Meter NRVD	102196	02-Mar-17 (CTTL, No.J17X01254)	Mar-18
Power sensor NR-V25	100596	02-Mar-17 (CTTL, No.J17X01254)	Mar-18
Reference Probe EX3D/4	SN 7433	26-Sep-16(SPEAG, No EX3-3617, Sep16)	Sep-17
DAE4	SN 1331	19-Jan-17(CTTL-SPEAG, No Z17-97015)	Jan-18

Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	13-Jan-17 (CTTL, No.J17X02086)	Jan-18
Network Analyzer E5071C	MY46110673	13-Jan-17 (CTTL, No.J17X02085)	Jan-18

Calibrated by: Name: Zhao Jing Function: SAR Test Engineer Signature: [Signature]

Reviewed by: Yu Zongying SAR Test Engineer

Approved by: Qi Dianyuan SAR Project Leader

Issued: September 18, 2017

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Glossary:
TSL tissue simulating liquid
ConvF sensitivity in TSL / NORMx,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, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
d) KDB865664, 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.
• **SAR measured:** SAR measured at the stated antenna input power.
• **SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
• **SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

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

Certificate No: Z17-97139

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In Collaboration with
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E-mail: cti@chinaatl.com http://www.chinaatl.cn

Measurement Conditions
DASY system configuration, as far as not given on page 1

DASY Version	DASY52	52.10.0.1448
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	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	40.3 ± 6 %	1.42 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	---	---

SAR result with Head TSL

	Condition	
SAR averaged over 1 cm ³ (1 g) of Head TSL	250 mW input power	10.2 mW / g
SAR measured	normalized to 1W	40.6 mW / g ± 18.8 % (k=2)
SAR for nominal Head TSL parameters	Condition	
SAR averaged over 10 cm ³ (10 g) of Head TSL	250 mW input power	5.27 mW / g
SAR measured	normalized to 1W	21.0 mW / g ± 18.7 % (k=2)

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	53.1 ± 6 %	1.51 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	---	---

SAR result with Body TSL

	Condition	
SAR averaged over 1 cm ³ (1 g) of Body TSL	250 mW input power	10.0 mW / g
SAR measured	normalized to 1W	40.2 mW / g ± 18.8 % (k=2)
SAR for nominal Body TSL parameters	Condition	
SAR averaged over 10 cm ³ (10 g) of Body TSL	250 mW input power	5.21 mW / g
SAR measured	normalized to 1W	20.9 mW / g ± 18.7 % (k=2)

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.1 Ω ± 5.57 Ω
Return Loss	- 25.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.6 Ω ± 5.70 Ω
Return Loss	- 24.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.309 ns
----------------------------------	----------

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
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D1900V2 Sn:5d113

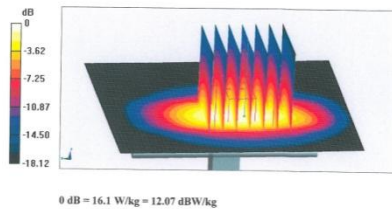
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Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2204
E-mail: cti@china.ttl.com http://www.china.ttl.cn

DASY5 Validation Report for Head TSL Date: 09.15.2017
Test Laboratory: CTTL, Beijing, China
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d113
Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 1900$ MHz; $\sigma = 1.419$ S/m; $\epsilon_r = 40.32$; $\rho = 1000$ kg/m³
Phantom section: Left Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration:

- Probe: EX3DV4 - SN7433; ConvF(7.98, 7.98, 7.98); Calibrated: 9/26/2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 1/19/2017
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:
dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.29 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 19.6 W/kg
SAR(1 g) = 10.2 W/kg; SAR(10 g) = 5.27 W/kg
Maximum value of SAR (measured) = 16.1 W/kg



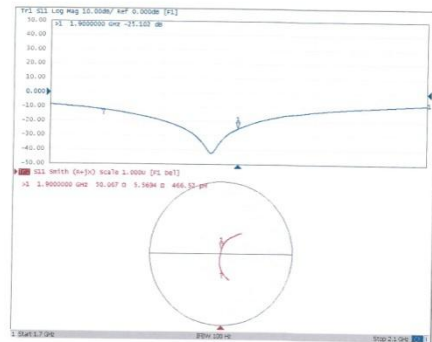
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Impedance Measurement Plot for Head TSL



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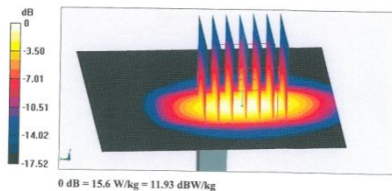
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DASY5 Validation Report for Body TSL Date: 09.15.2017
Test Laboratory: CTTL, Beijing, China
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d113
Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 1900$ MHz; $\sigma = 1.507$ S/m; $\epsilon_r = 53.06$; $\rho = 1000$ kg/m³
Phantom section: Center Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration:

- Probe: EX3DV4 - SN7433; ConvF(7.7, 7.7, 7.7); Calibrated: 9/26/2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 1/19/2017
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:
dx=5mm, dy=5mm, dz=5mm
Reference Value = 87.42 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 18.6 W/kg
SAR(1 g) = 10 W/kg; SAR(10 g) = 5.21 W/kg
Maximum value of SAR (measured) = 15.6 W/kg



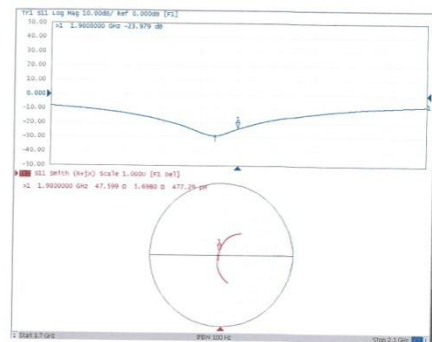
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Impedance Measurement Plot for Body TSL



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D2450V2 Sn:738

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E-mail: cti@chinaatl.com http://www.chinaatl.cn

Client: **SRTC** Certificate No: **Z17-97140**

CALIBRATION CERTIFICATE

Object: D2450V2 - SN: 738

Calibration Procedure(s): FF-Z11-003-01
Calibration Procedures for dipole validation kits

Calibration date: September 18, 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&E critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by Certificate No.)	Scheduled Calibration
Power Meter NRVD	102196	02-Mar-17 (CTTL No.J17X01254)	Mar-18
Power sensor NR-VZ5	100596	02-Mar-17 (CTTL No.J17X01254)	Mar-18
Reference Probe EX30V4	SN 7433	26-Sep-16(SPEAG No EX3-7433_Sep16)	Sep-17
DAE4	SN 1331	19-Jan-17(CTTL-SPEAG No Z17-97015)	Jan-18

Secondary Standards	ID #	Cal Date(Calibrated by Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	13-Jan-17 (CTTL No.J17X00286)	Jan-18
Network Analyzer E5071C	MY46110673	13-Jan-17 (CTTL No.J17X00285)	Jan-18

Calibrated by: Name: Zhao Jing Function: SAR Test Engineer Signature: [Signature]

Reviewed by: Yu Zongying SAR Test Engineer [Signature]

Approved by: Qi Dianyuan SAR Project Leader [Signature]

Issued: September 21, 2017

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
ConvF: sensitivity in TSL / NORMx,y,z
N/A: not applicable or not measured

Calibration is Performed According to the Following Standards:

- 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
- IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:
e) DAS14/5 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.
- 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%.

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Measurement Conditions
DASY system configuration, as far as not given on page 1

DASY Version	DASY52	52.10.0.1448
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters
The following parameters and calculations were applied

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.7 ± 6 %	1.79 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	---	---

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.1 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	52.4 mW (g ± 18.8 % (k=2))
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.10 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	24.4 mW (g ± 18.7 % (k=2))

Body TSL parameters
The following parameters and calculations were applied

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.5 ± 6 %	1.96 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	---	---

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.2 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	52.3 mW (g ± 18.8 % (k=2))
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	6.10 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	24.3 mW (g ± 18.7 % (k=2))

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.30+ 5.92jΩ
Return Loss	- 24.5dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.6Ω+ 6.38jΩ
Return Loss	- 23.1dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.268 ns
----------------------------------	----------

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

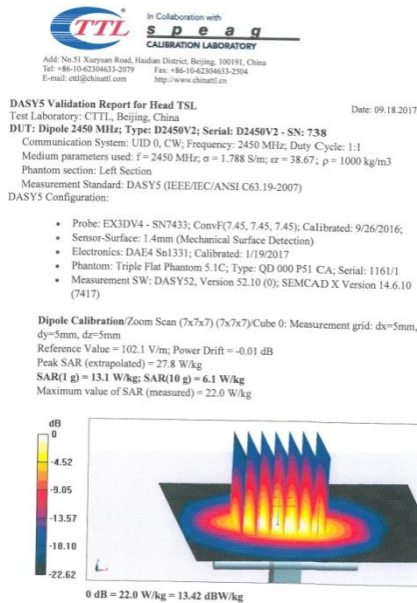
Additional EUT Data

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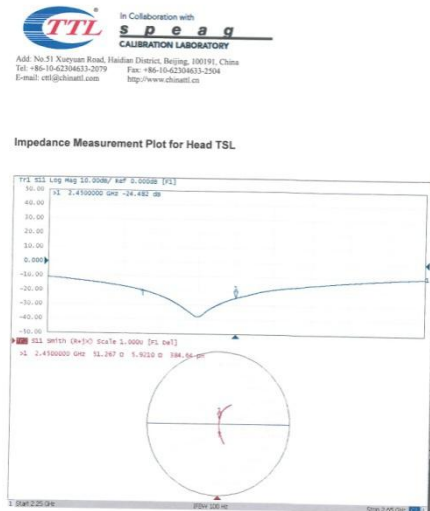
Page 4 of 8

D2450V2 Sn:738



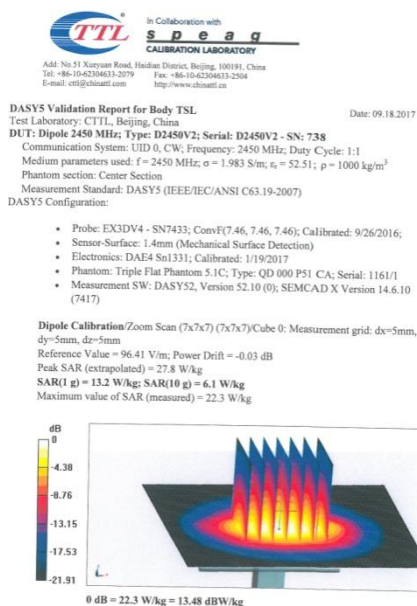
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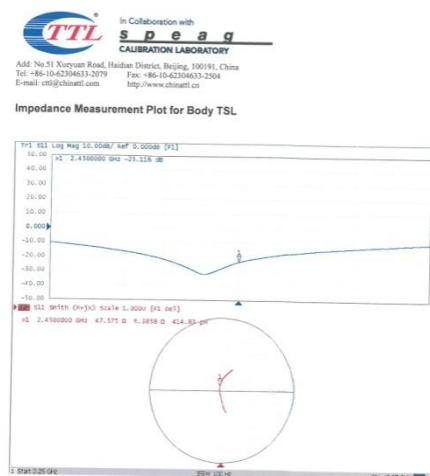
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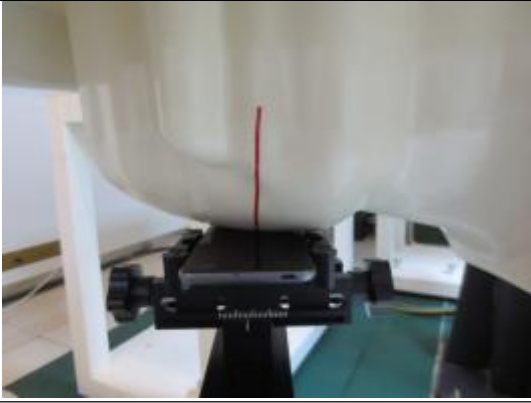
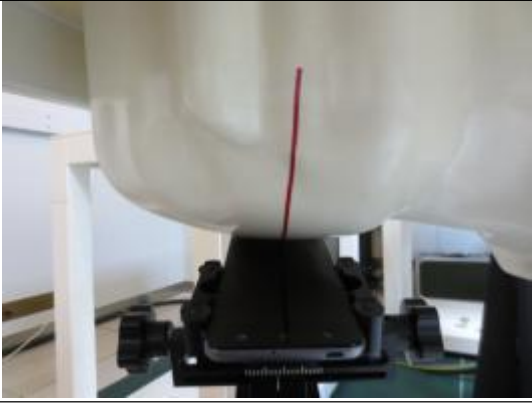
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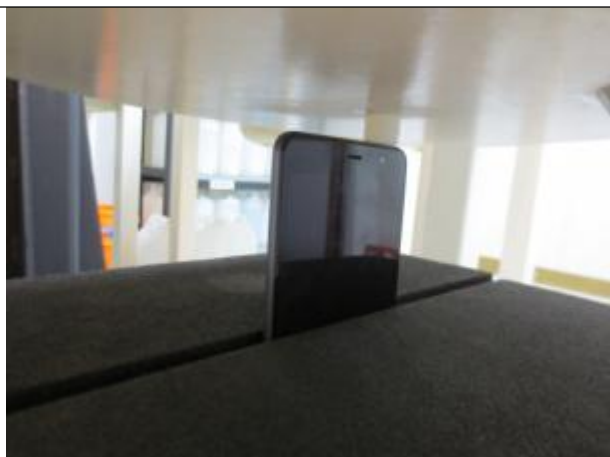


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ANNEX C – PHOTOGRAPH

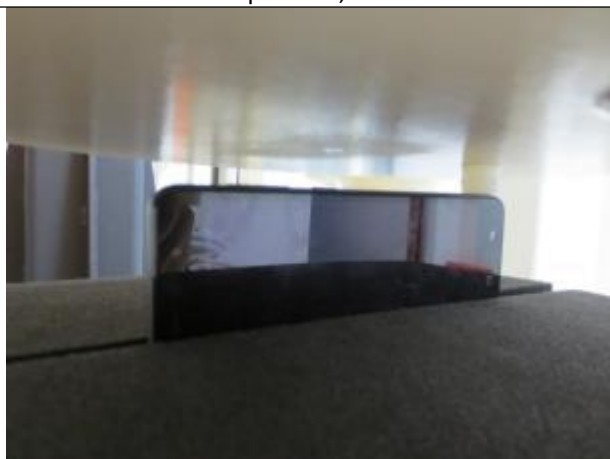
	
Cheek position, left side	Tilt position, left side
	
Cheek position, Right side	Tilt position, Right side
	
FLAT position, Towards phantom	FLAT position, Towards ground



FLAT position, EDGE1



FLAT position, EDGE2

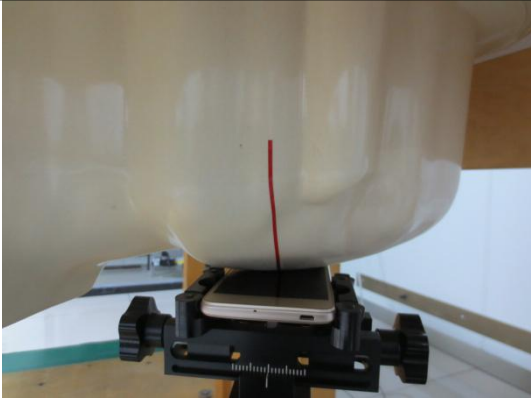
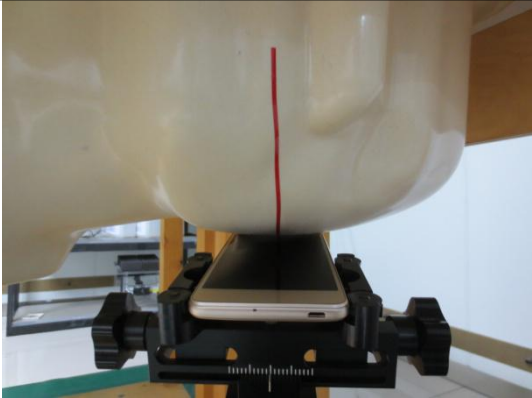
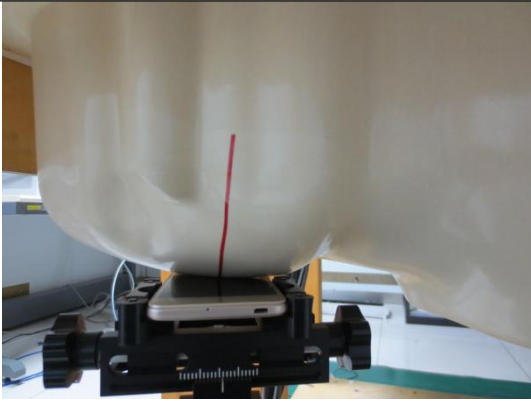
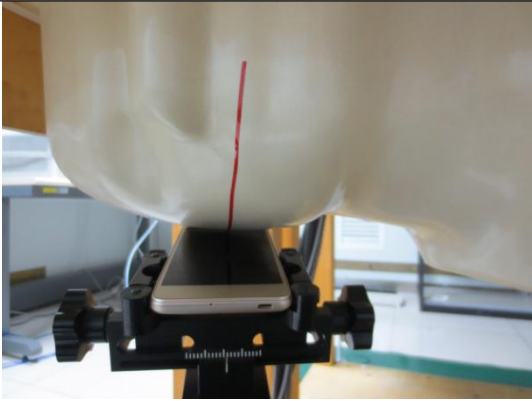
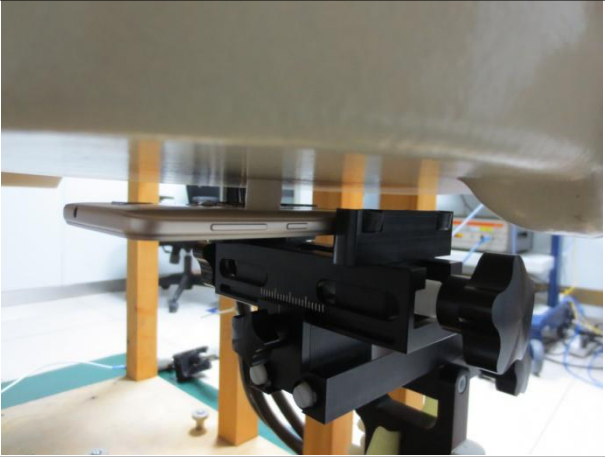


FLAT position, EDGE3



FLAT position, EDGE4

New test position

	
	
	
FLAT position, Towards ground	10mm Spacer

---End of Test Report---