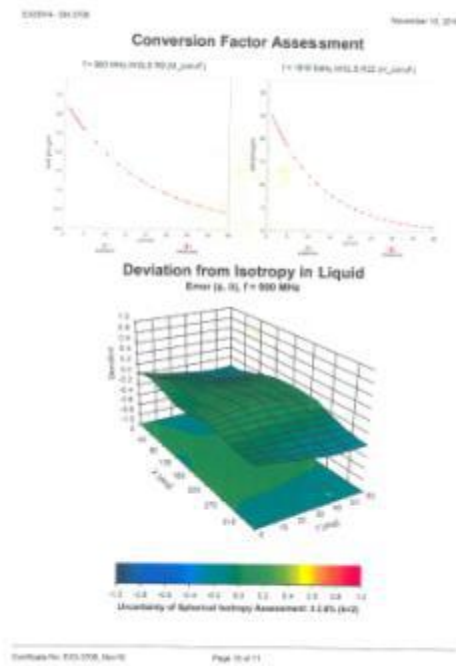
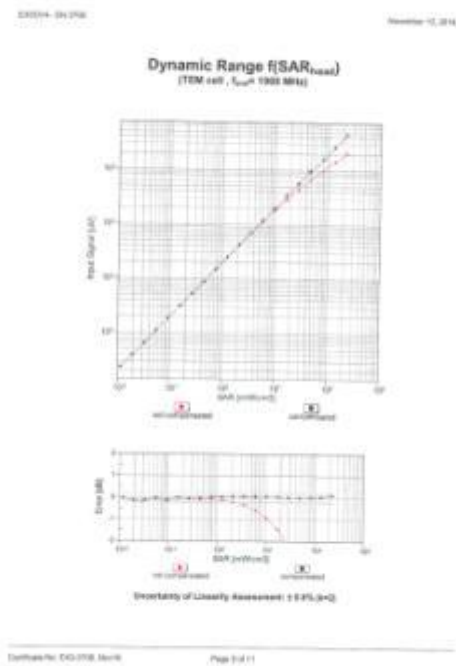


EX3DV4 Sn:3708



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 Schmalz & Partner Engineering AG
Accredited by the Swiss Accreditation Service (SAS) to the Swiss Accreditation Service in accordance with the Swiss Accreditation Agreement for the recognition of calibration certificates.

Accreditation No.: SCS 0108

Client: SRTC (Wien) Certificate No.: D835V2-40023_Oct16

CALIBRATION CERTIFICATE

Name: D835V2 - SN:4d023

Calibration procedure: QA-CAL-03-v0
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: October 24, 2016

This calibration certificate documents the feasibility to realize the data, which define the scope of the measurements (2). The measurement and the uncertainty with calibration uncertainty are given on the following pages and are part of the certificate.

All calibrations have been conducted in the federal laboratory facility, environmental conditions: 20 ± 0.5 °C and humidity < 60%.

Calibration Equipment used (MUT) unless otherwise stated:

Primary Standard	Lot #	Due Date (validity till)	Expiration date
Power Meter 3700-10	140-1007-10	04-Sep-16 (to 04-Sep-17)	Apr-17
Power sensor HP 3319	140-1008-10	04-Sep-16 (to 04-Sep-17)	Apr-17
Power sensor HP 3319	140-1008-10	04-Sep-16 (to 04-Sep-17)	Apr-17
Reference 10 dB Attenuator	140-1009-10	04-Sep-16 (to 04-Sep-17)	Apr-17
Super frequency generator	140-1010-10	04-Sep-16 (to 04-Sep-17)	Apr-17
Reference Plane E57174 (100)	140-1011-10	04-Sep-16 (to 04-Sep-17)	Apr-17
Reference Plane E57174 (100)	140-1012-10	04-Sep-16 (to 04-Sep-17)	Apr-17

Secondary Standards

Lot #	Check Date (to next)	Expiration Date
Power Meter 3700-10	04-Sep-16 (to 04-Sep-17)	04-Sep-17 (to 04-Sep-18)
Power sensor HP 3319	04-Sep-16 (to 04-Sep-17)	04-Sep-17 (to 04-Sep-18)
Power sensor HP 3319	04-Sep-16 (to 04-Sep-17)	04-Sep-17 (to 04-Sep-18)
10 dB Attenuator	04-Sep-16 (to 04-Sep-17)	04-Sep-17 (to 04-Sep-18)
Super frequency generator	04-Sep-16 (to 04-Sep-17)	04-Sep-17 (to 04-Sep-18)
Reference Plane E57174 (100)	04-Sep-16 (to 04-Sep-17)	04-Sep-17 (to 04-Sep-18)
Reference Plane E57174 (100)	04-Sep-16 (to 04-Sep-17)	04-Sep-17 (to 04-Sep-18)

Calibrator: SGP/Partner
Approved by: AdB./Partner

This calibration certificate shall not be reproduced except in full without written approval of the issuing laboratory.

Certificate No.: D835V2-40023_Oct16 Page 1 of 8

Calibration Laboratory of Schmalz & Partner Engineering AG
Accredited by the Swiss Accreditation Service (SAS) to the Swiss Accreditation Service in accordance with the Swiss Accreditation Agreement for the recognition of calibration certificates.

Accreditation No.: SCS 0108

Client: SRTC (Wien) Certificate No.: D835V2-40023_Oct16

CALIBRATION CERTIFICATE

Name: D835V2 - SN:4d023

Calibration procedure: QA-CAL-03-v0
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: October 24, 2016

This calibration certificate documents the feasibility to realize the data, which define the scope of the measurements (2). The measurement and the uncertainty with calibration uncertainty are given on the following pages and are part of the certificate.

All calibrations have been conducted in the federal laboratory facility, environmental conditions: 20 ± 0.5 °C and humidity < 60%.

Calibration Equipment used (MUT) unless otherwise stated:

Primary Standard	Lot #	Due Date (validity till)	Expiration date
Power Meter 3700-10	140-1007-10	04-Sep-16 (to 04-Sep-17)	Apr-17
Power sensor HP 3319	140-1008-10	04-Sep-16 (to 04-Sep-17)	Apr-17
Power sensor HP 3319	140-1008-10	04-Sep-16 (to 04-Sep-17)	Apr-17
Reference 10 dB Attenuator	140-1009-10	04-Sep-16 (to 04-Sep-17)	Apr-17
Super frequency generator	140-1010-10	04-Sep-16 (to 04-Sep-17)	Apr-17
Reference Plane E57174 (100)	140-1011-10	04-Sep-16 (to 04-Sep-17)	Apr-17
Reference Plane E57174 (100)	140-1012-10	04-Sep-16 (to 04-Sep-17)	Apr-17

Secondary Standards

Lot #	Check Date (to next)	Expiration Date
Power Meter 3700-10	04-Sep-16 (to 04-Sep-17)	04-Sep-17 (to 04-Sep-18)
Power sensor HP 3319	04-Sep-16 (to 04-Sep-17)	04-Sep-17 (to 04-Sep-18)
Power sensor HP 3319	04-Sep-16 (to 04-Sep-17)	04-Sep-17 (to 04-Sep-18)
10 dB Attenuator	04-Sep-16 (to 04-Sep-17)	04-Sep-17 (to 04-Sep-18)
Super frequency generator	04-Sep-16 (to 04-Sep-17)	04-Sep-17 (to 04-Sep-18)
Reference Plane E57174 (100)	04-Sep-16 (to 04-Sep-17)	04-Sep-17 (to 04-Sep-18)
Reference Plane E57174 (100)	04-Sep-16 (to 04-Sep-17)	04-Sep-17 (to 04-Sep-18)

Calibrator: SGP/Partner
Approved by: AdB./Partner

This calibration certificate shall not be reproduced except in full without written approval of the issuing laboratory.

Certificate No.: D835V2-40023_Oct16 Page 1 of 8

Measurement Conditions

SRTC system configuration, see the SRTC (Wien) page 1

Parameter	Value	Unit
SAR Vector	SARV	W/kg
Exposure	Average	W/kg
Phantom	Medical Eye Phantom	
Distance Dipole Center - TSL	10 cm	cm
Zero Scan Resolution	0.5 dB	dB
Frequency	200 MHz ± 1 MHz	MHz

Head TSL parameters

The following parameters and conditions were applied:

Parameter	Value	Unit
Nominal Head TSL parameters	10.0 °C	°C
Measured Head TSL parameters	10.0 ± 0.2 °C	°C
Head TSL temperature change during test	+0.2 °C	°C

SAR result with Head TSL

Parameter	Value	Unit
SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.07 W/kg
SAR for nominal Head TSL parameters	nominal to 1W	6.40 W/kg ± 17.0 % (Std)

Body TSL parameters

The following parameters and conditions were applied:

Parameter	Value	Unit
Nominal Body TSL parameters	10.0 °C	°C
Measured Body TSL parameters	10.0 ± 0.2 °C	°C
Body TSL temperature change during test	+0.2 °C	°C

SAR result with Body TSL

Parameter	Value	Unit
SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.07 W/kg
SAR for nominal Body TSL parameters	nominal to 1W	6.40 W/kg ± 17.0 % (Std)

Certificate No.: D835V2-40023_Oct16 Page 2 of 8

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Parameter	Value
Impedance, transformed to feed point	53.0 Ω - 1.9 jΩ
Return Loss	-28.4 dB

Antenna Parameters with Body TSL

Parameter	Value
Impedance, transformed to feed point	49.3 Ω - 5.1 jΩ
Return Loss	-25.8 dB

General Antenna Parameters and Design

Parameter	Value
Electrical Delay (one direction)	1.389 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

Parameter	Value
Manufactured by	SPEAG
Manufactured on	December 17, 2004

Certificate No.: D835V2-40023_Oct16 Page 4 of 8

D835V2 Sn:4d023

DASY5 Validation Report for Head TSL

Date: 24.10.2016

The Laboratory: SPAG, Zurich, Switzerland

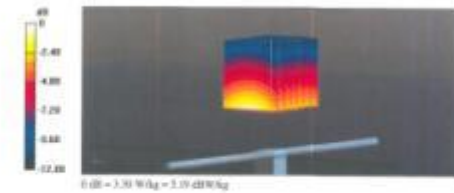
EUT: Dipole 835 MHz, Type: D835V2, Serial: D835V2 - 8N44823

Communication System: UED 0 - CW, Frequency: 835 MHz
Medium parameters used: $f = 835 \text{ MHz}$, $n = 0.99$ (air), $\epsilon_r = 40.8$, $\rho = 1000 \text{ kg/m}^3$
Phantom section: Flat Surface
Measurement Standard: DASY5 (IEEE/IEC/ANSI CS3.19-2011)

DASY5 Configuration:

- Probe: EXDVA - 8N746, Case(FX,T), 9.73, 9.73; Calibration: 13.06.2016
- Sensor Surface: 1 Area (Mechanical Surface Detection)
- Electronics: DAE4 8nH1, Calibration: 30.12.2015
- Phantom: Flat Phantom 4.0L, Type: QD00P40A, Serial: 1001
- DASY5: 32.8.R1(29); SEMCAD X 14.6.10(372)

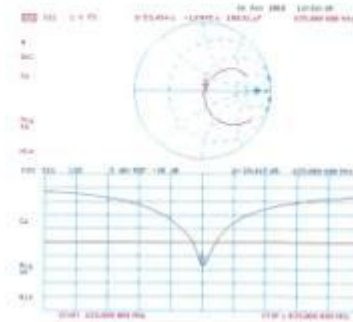
Dipole Calibration for Head Tissue($\rho = 200 \text{ mW}$, $d = 15 \text{ mm}$ /Zoom Scan (Tx/Ty)/Cube 8):
Measurement grid: $d_x = 15 \text{ mm}$, $d_y = 15 \text{ mm}$, $d_z = 15 \text{ mm}$
Reference Value = 81.73 V/m, Power Dens = 0.031 dB
Peak SAR (averaged) = 3.72 W/kg
SAR(10 g) = 2.47 W/kg; SAR(010 g) = 1.09 W/kg
Maximum value of SAR (measured) = 3.30 W/kg



Certificate No.: 200903-4002_0216

Page 4 of 6

Impedance Measurement Plot for Head TSL



Certificate No.: 200903-4002_0216

Page 5 of 6

DASY5 Validation Report for Body TSL

Date: 24.10.2016

The Laboratory: SPAG, Zurich, Switzerland

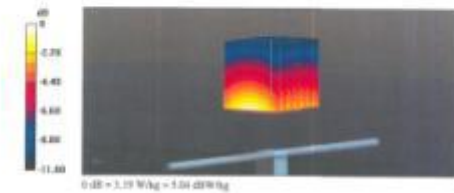
EUT: Dipole 835 MHz, Type: D835V2, Serial: D835V2 - 8N44823

Communication System: UED 0 - CW, Frequency: 835 MHz
Medium parameters used: $f = 835 \text{ MHz}$, $n = 0.99$ (air), $\epsilon_r = 25.8$, $\rho = 1000 \text{ kg/m}^3$
Phantom section: Flat Surface
Measurement Standard: DASY5 (IEEE/IEC/ANSI CS3.19-2011)

DASY5 Configuration:

- Probe: EXDVA - 8N746, Case(FX,T), 9.73, 9.73; Calibration: 13.06.2016
- Sensor Surface: 1 Area (Mechanical Surface Detection)
- Electronics: DAE4 8nH1, Calibration: 30.12.2015
- Phantom: Flat Phantom 4.0L, Type: QD00P40A, Serial: 1001
- DASY5: 32.8.R1(29); SEMCAD X 14.6.10(372)

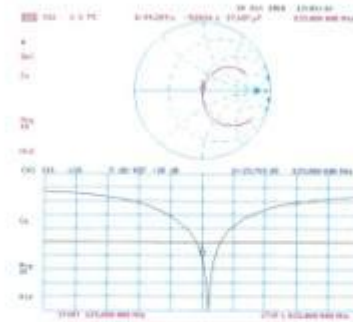
Dipole Calibration for Body Tissue($\rho = 200 \text{ mW}$, $d = 15 \text{ mm}$ /Zoom Scan (Tx/Ty)/Cube 8):
Measurement grid: $d_x = 15 \text{ mm}$, $d_y = 15 \text{ mm}$, $d_z = 15 \text{ mm}$
Reference Value = 39.07 V/m, Power Dens = 0.01 dB
Peak SAR (averaged) = 3.70 W/kg
SAR(10 g) = 2.44 W/kg; SAR(010 g) = 1.8 W/kg
Maximum value of SAR (measured) = 3.19 W/kg



Certificate No.: 200903-4002_0216

Page 7 of 8

Impedance Measurement Plot for Body TSL



Certificate No.: 200903-4002_0216

Page 8 of 8

D1900V2 Sn:5d113

Calibration Laboratory of Schmid & Partner Engineering AG
Ingenieurstrasse 16, 8048 Zurich, Switzerland

Accredited by 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

Authorisation No.: SCS 0108

Client: SRTC (THH) Certificate No.: D1900V2-Sn113_Oct18

CALIBRATION CERTIFICATE

Name: D1900V2-Sn113

Calibration procedure: IQA CAL-02-03
Calibration procedure for dipole calibration kits above 735 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/or calibration with certificate validity is given in the following table and on the certificate.

All calibrations have been conducted in the client laboratory facility, environmental temperature (20 ± 0.2) °C and humidity < 10%.

Calibration equipment used (MPE) (unless for calibration)

Process Standard	SI Unit	Top Order (Client's No.)	Subsequent Calibration
Power meter N197	dBm	06-Aer-13 (No. 211-00280000)	Apr 17
Power sensor SPM-230	dBm	06-100-04 (No. 211-00280000)	Apr 17
Power sensor SPM-230	dBm	06-100-05 (No. 211-00280000)	Apr 17
Reference 50 Ω Impedance	dBm	06-100-06 (No. 211-00280000)	Apr 17
Type B impedance comparison	dBm	06-100-07 (No. 211-00280000)	Apr 17
Calibration Probe L10234	dBm	15-Aer-07 (No. 150-1000-0-0-0)	Jan 17
Load	dBm	15-Aer-08 (No. 150-1000-0-0-0)	Jan 17

Subsequent Standards

SI Unit	Process (Top Order)	Subsequent Check
Power meter 076-0001	07-100-13 (SI Headset Check 000-00)	SI Headset Check 000-00
Power sensor 076-0002	07-100-14 (SI Headset Check 000-00)	SI Headset Check 000-00
Power sensor 076-0003	07-100-15 (SI Headset Check 000-00)	SI Headset Check 000-00
Reference 50 Ω Impedance	07-100-16 (SI Headset Check 000-00)	SI Headset Check 000-00
Reference 50 Ω Impedance	07-100-17 (SI Headset Check 000-00)	SI Headset Check 000-00

Calibrated by: [Signature]
Approved by: [Signature]

Certificate No.: D1900V2-Sn113_Oct18 Page 1 of 8

Calibration Laboratory of Schmid & Partner Engineering AG
Ingenieurstrasse 16, 8048 Zurich, Switzerland

Accredited by 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

Authorisation No.: SCS 0108

Client: SRTC (THH) Certificate No.: D1900V2-Sn113_Oct18

Glossary

TSL: Near-fielding head sensitivity in TSL / NCFM x,y,z
Conf: not applicable or not measured
NA: 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, "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
- 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
- KCB 016564, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DA545 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 this certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer in 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 assumed loss reflected power. No uncertainty required.
- Isotropic Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR as 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.: D1900V2-Sn113_Oct18 Page 2 of 8

Measurement Conditions

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

Parameter	Value
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.

Parameter	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

Parameter	Condition	Value
SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	10.1 W/kg
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)

Parameter	Condition	Value
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	5.30 W/kg
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.

Parameter	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

Parameter	Condition	Value
SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	9.80 W/kg
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)

Parameter	Condition	Value
SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	5.25 W/kg
SAR measured	250 mW input power	5.25 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.1 W/kg ± 16.5 % (k=2)

Certificate No.: D1900V2-Sn113_Oct18 Page 3 of 8

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Parameter	Value
Impedance, transformed to feed point	51.1 Ω ± 0.3 Ω
Return Loss	-23.8 dB

Antenna Parameters with Body TSL

Parameter	Value
Impedance, transformed to feed point	47.0 Ω ± 7.7 Ω
Return Loss	-17.6 dB

General Antenna Parameters and Design

Parameter	Value
Electrical Delay (one direction)	1.22 ns

After long term use with 1000W reflected power, only a slight warping of the dipole near the feedpoint can be measured. The dipole is made of standard weighted stainless steel. This center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore also suitable for DC ground. On some of the dipole, small stainless steel clips are added to the dipole wire in order to improve mounting when tested according to the procedure explained under "Measurement Conditions" paragraph. The SAR does not get 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 on the external connections near the feedpoint due to the design.

Additional EUT Data

Parameter	Value
Manufactured by	SFEAG
Manufactured on	July 24, 2018

Certificate No.: D1900V2-Sn113_Oct18 Page 4 of 8

D1900V2 Sn:5d113

DASY5 Validation Report for Head TSL

Date: 31.10.2016

Test Laboratory: SPAG, Zurich, Switzerland

DUT: Dipole (190 MHz) Type: D190V2, Serial: D190V2-SN:5d113

Communication System: UED 0 - CW, Frequency: 190 MHz

Mechanic parameters used: $f = 190 \text{ MHz}$, $v = 3.39 \text{ km/s}$, $\epsilon = 40.6$, $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (REITSCHNITT C3) (9.2011)

DASY5 Configuration:

- Probe: EXDVA-SN746; Case(P): 70, 700, 700; Calibration: 15.06.2016
- Sensor Surface: 1.4mm (Mechanical Surface Direction)
- Electronic: DA41-1401; Calibration: 30.12.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD00P90AA; Serial: 0302
- DASY5: 02.8.0(258); SEMCAD X 14.6.10(7372)

Dipole Calibration for Head ThomsPlan250 mW, d=10mm/Z-axis Scan (7x7x7)Cube It:

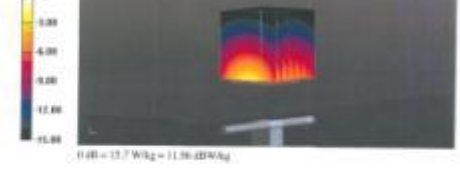
Measurement grid: d=10mm, d=10mm, d=10mm

Reference Value = 104.4 V/m, Power DUT = 0.10 dB

Peak SAR (interpolated) = 19.0 W/kg

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

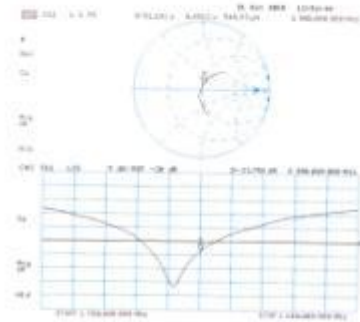
Minimum value of SAR (measured) = 13.7 W/kg



Certificate No. 019004-00113, 0010

Page 3 of 4

Impedance Measurement Plot for Head TSL



Certificate No. 019004-00113, 0010

Page 4 of 4

DASY5 Validation Report for Body TSL

Date: 31.10.2016

Test Laboratory: SPAG, Zurich, Switzerland

DUT: Dipole (190 MHz) Type: D190V2, Serial: D190V2-SN:5d113

Communication System: UED 0 - CW, Frequency: 190 MHz

Mechanic parameters used: $f = 190 \text{ MHz}$, $v = 3.44 \text{ km/s}$, $\epsilon = 55.2$, $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (REITSCHNITT C3) (9.2011)

DASY5 Configuration:

- Probe: EXDVA-SN746; Case(P): 03, 8.03, 8.03; Calibration: 15.06.2016
- Sensor Surface: 1.4mm (Mechanical Surface Direction)
- Electronic: DA41-1401; Calibration: 30.12.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD00P90AA; Serial: 0302
- DASY5: 02.8.0(258); SEMCAD X 14.6.10(7372)

Dipole Calibration for Body ThomsPlan250 mW, d=10mm/Z-axis Scan (7x7x7)Cube It:

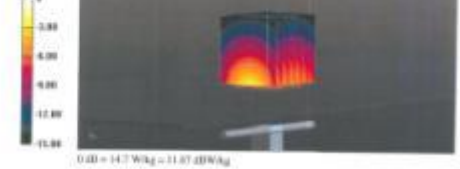
Measurement grid: d=10mm, d=10mm, d=10mm

Reference Value = 104.5 V/m, Power DUT = 0.10 dB

Peak SAR (interpolated) = 17.3 W/kg

SAR(10g) = 9.8 W/kg; SAR(10g) = 5.23 W/kg

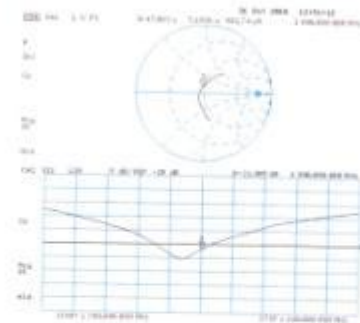
Minimum value of SAR (measured) = 14.7 W/kg



Certificate No. 019004-00113, 0010

Page 3 of 4

Impedance Measurement Plot for Body TSL



Certificate No. 019004-00113, 0010

Page 4 of 4

D2450V2 Sn:738

Calibration Laboratory of Schmid & Partner Engineering AG
 Accredited by the Swiss Accreditation Service (SAS)
 The Swiss Accreditation Service is one of the signatories to the EU Mutual Recognition Agreement for the recognition of calibration certificates.

Client: SRTC (HWA) Certificate No: D2450V2-738_0ct16

CALIBRATION CERTIFICATE

Name: D2450V2-738-16
 Calibration procedure: SAR CAL-05-16
 Calibration date: October 25, 2016

The calibration certificate documents the conformity to national standards, which reflect the special quality of measurement. The measurements and the corresponding self-calibration uncertainty are given in the following pages and are part of the certificate.

All calibrations have been conducted in the latest primary facility, environmental conditions (20 ± 0.5 °C) and humidity < 50%.

Calibration facilities used: SAR-05-16 (Head)

Change / Products	Cal. #	Cal. Date (Certificate No.)	Expiration / Calibration
Power meter NRP	104	10-Apr-16 (No. 2111020000000)	Apr-17
Power sensor NRP-D1	104	10-Apr-16 (No. 2111020000000)	Apr-17
Power sensor NRP-D2	104	10-Apr-16 (No. 2111020000000)	Apr-17
Reference for SAR-05-16	104	10-Apr-16 (No. 2111020000000)	Apr-17
Test equipment maintenance	104	10-Apr-16 (No. 2111020000000)	Apr-17
Reference Point (EUT) SA	104	10-Apr-16 (No. 2111020000000)	Apr-17
SA	104	10-Apr-16 (No. 2111020000000)	Apr-17

Secondary standards:

Cal. #	Cal. Date (Certificate No.)	Expiration / Calibration
104	10-Apr-16 (No. 2111020000000)	Apr-17
104	10-Apr-16 (No. 2111020000000)	Apr-17
104	10-Apr-16 (No. 2111020000000)	Apr-17
104	10-Apr-16 (No. 2111020000000)	Apr-17
104	10-Apr-16 (No. 2111020000000)	Apr-17

Calibrated by: [Signature]
 Approved by: [Signature]

Certificate No: D2450V2-738_0ct16 Page 1 of 8

Calibration Laboratory of Schmid & Partner Engineering AG
 Accredited by the Swiss Accreditation Service (SAS)
 The Swiss Accreditation Service is one of the signatories to the EU Mutual Recognition Agreement for the recognition of calibration certificates.

Client: SRTC (HWA) Certificate No: D2450V2-738_0ct16

CALIBRATION CERTIFICATE

Name: D2450V2-738-16
 Calibration procedure: SAR CAL-05-16
 Calibration date: October 25, 2016

The calibration certificate documents the conformity to national standards, which reflect the special quality of measurement. The measurements and the corresponding self-calibration uncertainty are given in the following pages and are part of the certificate.

All calibrations have been conducted in the latest primary facility, environmental conditions (20 ± 0.5 °C) and humidity < 50%.

Calibration facilities used: SAR-05-16 (Head)

Change / Products	Cal. #	Cal. Date (Certificate No.)	Expiration / Calibration
Power meter NRP	104	10-Apr-16 (No. 2111020000000)	Apr-17
Power sensor NRP-D1	104	10-Apr-16 (No. 2111020000000)	Apr-17
Power sensor NRP-D2	104	10-Apr-16 (No. 2111020000000)	Apr-17
Reference for SAR-05-16	104	10-Apr-16 (No. 2111020000000)	Apr-17
Test equipment maintenance	104	10-Apr-16 (No. 2111020000000)	Apr-17
Reference Point (EUT) SA	104	10-Apr-16 (No. 2111020000000)	Apr-17
SA	104	10-Apr-16 (No. 2111020000000)	Apr-17

Secondary standards:

Cal. #	Cal. Date (Certificate No.)	Expiration / Calibration
104	10-Apr-16 (No. 2111020000000)	Apr-17
104	10-Apr-16 (No. 2111020000000)	Apr-17
104	10-Apr-16 (No. 2111020000000)	Apr-17
104	10-Apr-16 (No. 2111020000000)	Apr-17
104	10-Apr-16 (No. 2111020000000)	Apr-17

Calibrated by: [Signature]
 Approved by: [Signature]

Certificate No: D2450V2-738_0ct16 Page 2 of 8

Measurement Conditions

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

Parameter	Value
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 ± 1 MHz

Head TSL parameters

The following parameters and calculations were applied.

Parameter	Value
Nominal Head TSL parameters	22.0 °C
Measured Head TSL parameters	(22.0 ± 0.2) °C
Head TSL temperature change during test	< 0.5 °C

SAR result with Head TSL

Parameter	Value
SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition
SAR measured	250 mW input power
SAR for nominal Head TSL parameters	51.2 W/kg ± 17.0 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

Parameter	Value
Nominal Body TSL parameters	22.0 °C
Measured Body TSL parameters	(22.0 ± 0.2) °C
Body TSL temperature change during test	< 0.5 °C

SAR result with Body TSL

Parameter	Value
SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition
SAR measured	250 mW input power
SAR for nominal Body TSL parameters	50.8 W/kg ± 17.0 % (k=2)

Certificate No: D2450V2-738_0ct16 Page 3 of 8

Appendix (Additional assessments outside the scope of SAS 0108)

Antenna Parameters with Head TSL

Parameter	Value
Impedance, transformed to feed point	75.8 Ω ± 1.0 Ω
Return Loss	> 21.0 dB

Antenna Parameters with Body TSL

Parameter	Value
Impedance, transformed to feed point	46.7 Ω ± 5.8 Ω
Return Loss	> 9.0 dB

General Antenna Parameters and Design

Parameter	Value
Electrical Delay (one direction)	1.187 ns

After long term use with 100W substitution, one a slight warping of the dipole (see the footprint) can be measured. The dipole is made of standard weight metal cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore also suitable for DC signals. On some of the dipole, small wrinkles are added to the dipole arms in order to improve matching when tested according to the procedure expressed in the "Measurement Conditions" paragraph. The SAR test was not affected by this change. The overall dipole length is 100% according to the Standard. No silicone force must be applied to the dipole arms, because they might bend on the additional connections near the footprint area be damaged.

Additional EUT Data

Parameter	Value
Manufactured by	SPEAS
Manufactured on	August 05, 2005

Certificate No: D2450V2-738_0ct16 Page 4 of 8

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, $n = 1.47$ (Skin), $\epsilon = 30.2$, $\rho = 1000$ kg/m³

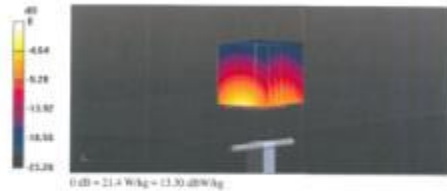
Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C93.19-2011)

DASY5 Configuration:

- Probe: EXCIP04 - SNT500, Class(F) 7.70, 7.70, 7.70, Calibrated: 15.08.2016,
- Sensor-Surface: 1-4mm (Mechanical Surface Detection)
- Electronics: DMS Sub01, Calibrated: 30.12.2012
- Phantom: Flat Phantom 5.0 (Innc), Type: QD000P50AA, Serial: 1001
- DASY5: S2.8.0(128), SEMCAD X 14.4.10(1312)

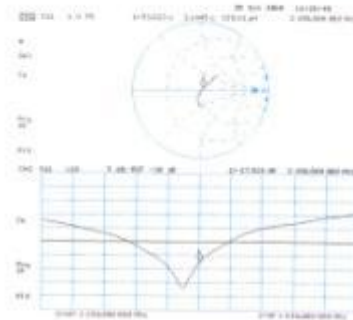
Dipole Calibration for Head Tissue/Flat=230 mW, d=10mm/Z-axis Scan (7x7x7)/Cube 0:
Measurement grid: d0=5mm, d1=5mm, d2=5mm
Reference Value = 111.7 V/m, Power Dens = 0.010 dB
Peak SAR (interpolated) = 20.4 W/kg
SAR(1 g) = 13.1 W/kg; SAR(10 g) = 6.87 W/kg
Maximum value of SAR (measured) = 21.4 W/kg



Graphical No. 20160407-FM_Dat04

Page 5 of 6

Impedance Measurement Plot for Head TSL



Graphical No. 20160407-FM_Dat05

Page 6 of 6

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, $n = 2.02$ (Skin), $\epsilon = 51.3$, $\rho = 1000$ kg/m³

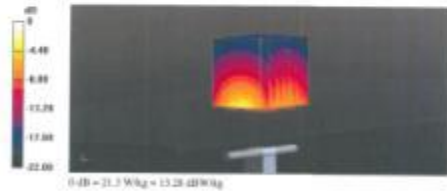
Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C93.19-2011)

DASY5 Configuration:

- Probe: EXCIP04 - SNT500, Class(F) 7.70, 7.70, 7.70, Calibrated: 15.08.2016,
- Sensor-Surface: 1-4mm (Mechanical Surface Detection)
- Electronics: DMS Sub01, Calibrated: 30.12.2012
- Phantom: Flat Phantom 5.0 (Innc), Type: QD000P50AA, Serial: 1001
- DASY5: S2.8.0(128), SEMCAD X 14.4.10(1312)

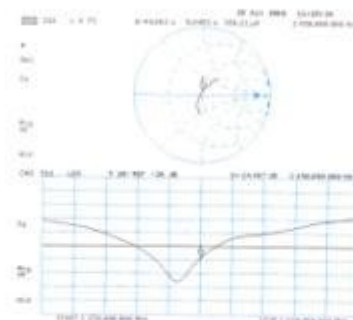
Dipole Calibration for Body Tissue/Flat=230 mW, d=10mm/Z-axis Scan (7x7x7)/Cube 0:
Measurement grid: d0=5mm, d1=5mm, d2=5mm
Reference Value = 107.3 V/m, Power Dens = 0.010 dB
Peak SAR (interpolated) = 20.0 W/kg
SAR(1 g) = 13 W/kg; SAR(10 g) = 6.88 W/kg
Maximum value of SAR (measured) = 21.3 W/kg



Graphical No. 20160407-FM_Dat04

Page 7 of 8

Impedance Measurement Plot for Body TSL



Graphical No. 20160407-FM_Dat05

Page 8 of 8

New calibrate documents

DAE4 Sn:546

In Collaboration with
TTL **s p e a g**
CALIBRATION LABORATORY

中国认可
国际互认
校准
CALIBRATION
CNAS L020

Address: No.51 Xuyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62394633-2218 Fax: +86-10-62394633-2209
E-mail: cti@chinatti.com Http://www.chinatti.cn

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

Issued: September 18, 2017
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: Z17-97141

Page 1 of 3

In Collaboration with
TTL **s p e a g**
CALIBRATION LABORATORY

Address: No.51 Xuyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62394633-2218 Fax: +86-10-62394633-2209
E-mail: cti@chinatti.com Http://www.chinatti.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

Page 2 of 3



DC Voltage Measurement

A/D - Converter Resolution nominal
High Range: 1LSB = 61µV, 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	3.98728 ± 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	236.8° ± 1°
---	-------------

Certificate No: Z17-97141

Page 3 of 3

ES3DV3 Sn:3127



In Collaboration with
TTT Calibration Laboratory
SPEAG
Address: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2218 Fax: +86-10-62304633-2209
E-mail: cti@china.ttt.com.cn http://www.china.ttt.com.cn



中国认可
国际互认
CALIBRATION
CNAS L6574

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:(22±3)°C and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	27-Jun-17 (CTTL No.J17X05857)	Jun-18
Power sensor NRP-Z91	101547	27-Jun-17 (CTTL No.J17X05857)	Jun-18
Power sensor NRP-Z91	101548	27-Jun-17 (CTTL No.J17X05857)	Jun-18
Reference 10dB Attenuator	18N50V-10dB	13-Mar-16(CTTL No.J16X01547)	Mar-18
Reference 20dB Attenuator	18N50V-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
Signal Generator MG3700A	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

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: Z17-97142 Page 1 of 12



In Collaboration with
TTT Calibration Laboratory
SPEAG
Address: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2218 Fax: +86-10-62304633-2209
E-mail: cti@china.ttt.com.cn http://www.china.ttt.com.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 : ϕ rotation around probe axis
Polarization θ : θ rotation around an axis that is in the plane normal to probe axis (at measurement center), $\theta = 0^\circ$ 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) KCB 865684, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z} Assessed for E-field polarization $\theta=0^\circ$ (fs800MHz in TEM-cell, $f > 1800$ MHz; waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not effect the E^2 field uncertainty inside TSL (see below ConvF).
- NORM_{(k,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 a B.C 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 $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha_depth) of which typical uncertainty value 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 Page 2 of 12



In Collaboration with
TTT Calibration Laboratory
SPEAG
Address: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2218 Fax: +86-10-62304633-2209
E-mail: cti@china.ttt.com.cn http://www.china.ttt.com.cn

Probe ES3DV3

SN: 3127

Calibrated: October 11, 2017
Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

Certificate No: Z17-97142 Page 3 of 12



In Collaboration with
TTT Calibration Laboratory
SPEAG
Address: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2218 Fax: +86-10-62304633-2209
E-mail: cti@china.ttt.com.cn http://www.china.ttt.com.cn

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

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm($\mu V/(V/m)^2$) ^A	1.28	1.22	1.22	$\pm 10.0\%$
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	$\pm 2.5\%$
		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 E^2 -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 Page 4 of 12

ES3DV3 Sn:3127



In Collaboration with
TTL Speaq
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2218 Fax: +86-10-62304633-2209
E-mail: ctf@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 ^h (mm)	Unct. (k=2)
750	41.9	0.89	6.26	6.26	6.26	0.60	1.20	±12.1%
900	41.5	0.97	6.15	6.15	6.15	0.37	1.82	±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 (s and o) 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 (s and o) 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

Page 5 of 12



In Collaboration with
TTL Speaq
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2218 Fax: +86-10-62304633-2209
E-mail: ctf@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 ^h (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 (s and o) 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 (s and o) 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.

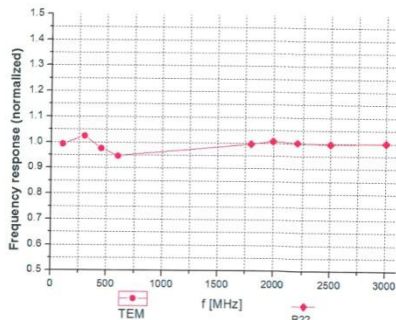
Certificate No: Z17-97142

Page 6 of 12



In Collaboration with
TTL Speaq
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2218 Fax: +86-10-62304633-2209
E-mail: ctf@china.ttl.com http://www.china.ttl.com

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



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

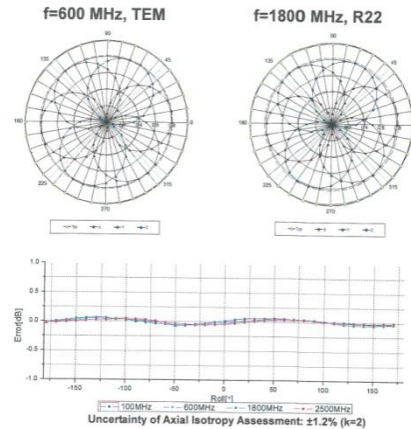
Certificate No: Z17-97142

Page 7 of 12



In Collaboration with
TTL Speaq
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2218 Fax: +86-10-62304633-2209
E-mail: ctf@china.ttl.com http://www.china.ttl.com

Receiving Pattern (Φ, θ=0°)



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

Certificate No: Z17-97142

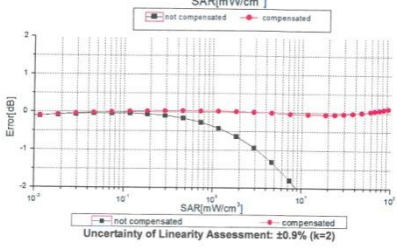
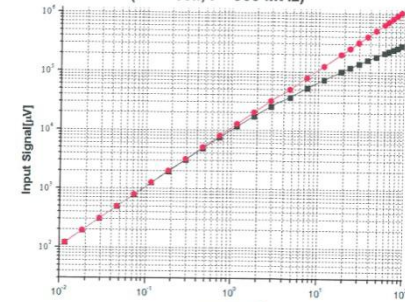
Page 8 of 12

ES3DV3 Sn:3127



In Collaboration with
TTL Calibration Laboratory
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-42304633-2218 Fax: +86-10-42304633-2209
E-mail: cti@chinaamti.com http://www.chinaamti.cn

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



Certificate No: Z17-97142

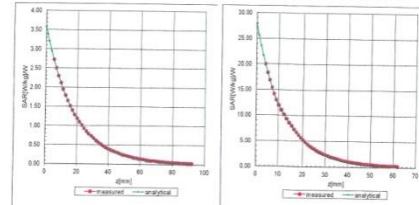
Page 9 of 12



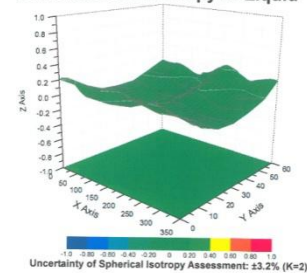
In Collaboration with
TTL Calibration Laboratory
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-42304633-2218 Fax: +86-10-42304633-2209
E-mail: cti@chinaamti.com http://www.chinaamti.cn

Conversion Factor Assessment

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



Deviation from Isotropy in Liquid



Certificate No: Z17-97142

Page 10 of 12



In Collaboration with
TTL Calibration Laboratory
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-42304633-2218 Fax: +86-10-42304633-2209
E-mail: cti@chinaamti.com http://www.chinaamti.cn

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

Certificate No: Z17-97142

Page 11 of 12



In Collaboration with
TTL Calibration Laboratory
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-42304633-2218 Fax: +86-10-42304633-2209
E-mail: cti@chinaamti.com http://www.chinaamti.cn

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
10297	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

Certificate No: Z17-97142

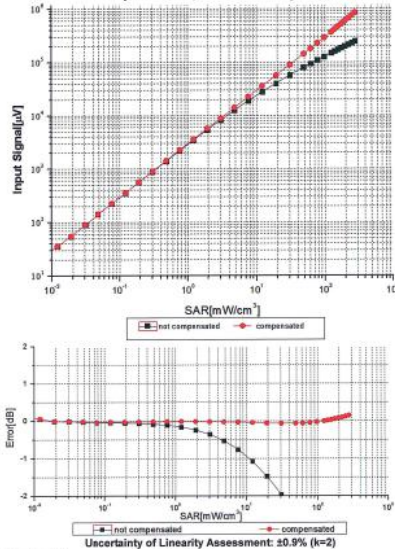
Page 12 of 12

EX3DV4 Sn:3708



In Collaboration with
TTL Speaq
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62594633-2218 Fax: +86-10-62594633-2209
E-mail: cti@china.ttl.com.cn http://www.china.ttl.com

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



Certificate No: Z17-97214

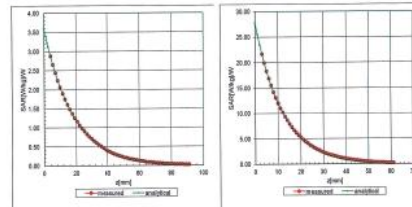
Page 9 of 12



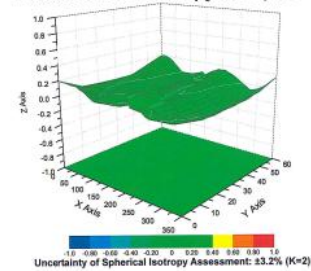
In Collaboration with
TTL Speaq
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62594633-2218 Fax: +86-10-62594633-2209
E-mail: cti@china.ttl.com.cn http://www.china.ttl.com

Conversion Factor Assessment

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



Deviation from Isotropy in Liquid



Certificate No: Z17-97214

Page 10 of 12



In Collaboration with
TTL Speaq
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62594633-2218 Fax: +86-10-62594633-2209
E-mail: cti@china.ttl.com.cn http://www.china.ttl.com

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

Page 11 of 12



In Collaboration with
TTL Speaq
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62594633-2218 Fax: +86-10-62594633-2209
E-mail: cti@china.ttl.com.cn http://www.china.ttl.com

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	1.0	95.9 ±3.1%
			Y	0.0	0.0	1.0	149.0
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

Certificate No: Z17-97214

Page 12 of 12

D835V2 Sn:4d023

In Collaboration with
TTL **SPEAG**
CALIBRATION LABORATORY

中国认可
国际互认
校准
CNAS
CALIBRATION
CNAS L1879

Address: No. 51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62394633-2079 Fax: +86-10-62394633-2504
E-mail: ctt@chinaatl.com http://www.chinaatl.cn

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&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 NRV-Z5	100596	02-Mar-17 (CTTL, No.J17X01254)	Mar-18
Reference Probe EX3DV4 DAE4	SN 7433	28-Sep-16(SPEAG, No. EX3-7433_Sep16)	Sep-17
	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: [Signature]

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

Issued: September 16, 2017

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: Z17-97135 Page 1 of 8

In Collaboration with
TTL **SPEAG**
CALIBRATION LABORATORY

Address: No. 51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62394633-2079 Fax: +86-10-62394633-2504
E-mail: ctt@chinaatl.com http://www.chinaatl.cn

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) KDB655684, 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%.

Certificate No: Z17-97135 Page 2 of 8

In Collaboration with
TTL **SPEAG**
CALIBRATION LABORATORY

Address: No. 51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62394633-2079 Fax: +86-10-62394633-2504
E-mail: ctt@chinaatl.com http://www.chinaatl.cn

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

DASy Version	DASy52	52.10.0.1446
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)

Certificate No: Z17-97135 Page 3 of 8

In Collaboration with
TTL **SPEAG**
CALIBRATION LABORATORY

Address: No. 51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62394633-2079 Fax: +86-10-62394633-2504
E-mail: ctt@chinaatl.com http://www.chinaatl.cn

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 semi-rigid 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
-----------------	-------

Certificate No: Z17-97135 Page 4 of 8

D835V2 Sn:4d023

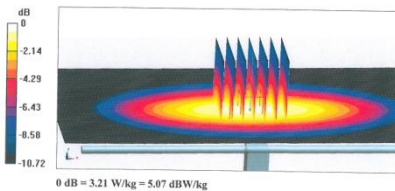


In Collaboration with
TTL Calibration Laboratory
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: ctt@chinattl.com http://www.chinattl.cn

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



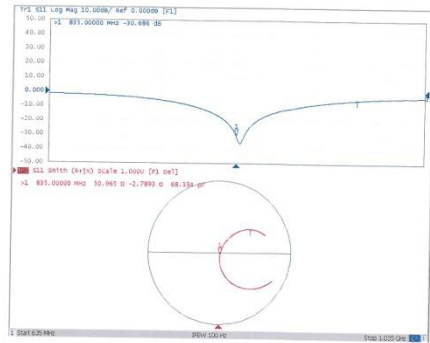
Certificate No: Z17-97135

Page 5 of 8



In Collaboration with
TTL Calibration Laboratory
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: ctt@chinattl.com http://www.chinattl.cn

Impedance Measurement Plot for Head TSL



Certificate No: Z17-97135

Page 6 of 8

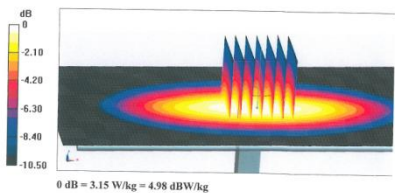


In Collaboration with
TTL Calibration Laboratory
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: ctt@chinattl.com http://www.chinattl.cn

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



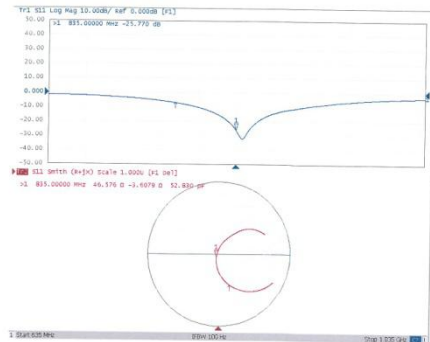
Certificate No: Z17-97135

Page 7 of 8



In Collaboration with
TTL Calibration Laboratory
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: ctt@chinattl.com http://www.chinattl.cn

Impedance Measurement Plot for Body TSL



Certificate No: Z17-97135

Page 8 of 8

D1900V2 Sn:5d113

In Collaboration with
TTL **s p e a g**
CALIBRATION LABORATORY

中国认可
国际互认
校准
CNAS
CALIBRATION
CNAS L0570

Address: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cti@chinaati.com http://www.chinaati.cn

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 EX3DV4	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.J17X02085)	Jan-18
Network Analyzer E5071C	MY46110673	13-Jan-17 (CTTL, No.J17X02085)	Jan-18

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

Issued: September 18, 2017

This calibration certificate shall not be reproduced except in full without written approval of the laboratory

Certificate No: Z17-97139

Page 1 of 8

In Collaboration with
TTL **s p e a g**
CALIBRATION LABORATORY

中国认可
国际互认
校准
CNAS
CALIBRATION
CNAS L0570

Address: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cti@chinaati.com http://www.chinaati.cn

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
- KDB85664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

- 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

Page 2 of 8

In Collaboration with
TTL **s p e a g**
CALIBRATION LABORATORY

中国认可
国际互认
校准
CNAS
CALIBRATION
CNAS L0570

Address: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cti@chinaati.com http://www.chinaati.cn

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

DASY Version	DASY52	52.10.0.1446
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

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

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

Certificate No: Z17-97139

Page 3 of 8

In Collaboration with
TTL **s p e a g**
CALIBRATION LABORATORY

中国认可
国际互认
校准
CNAS
CALIBRATION
CNAS L0570

Address: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cti@chinaati.com http://www.chinaati.cn

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	- 25.19 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
-----------------	-------

Certificate No: Z17-97139

Page 4 of 8

D1900V2 Sn:5d113

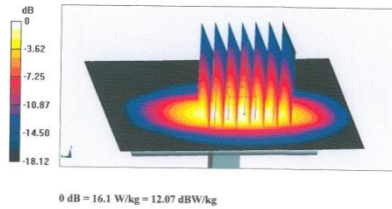


In Collaboration with
TTL Calibration Laboratory
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2004
E-mail: cttl@chinanet.com http://www.chinanet.cn

DASY5 Validation Report for Head TSL Date: 09.15.2017
Test Laboratory: CTTI, 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 @: 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



In Collaboration with
TTL Calibration Laboratory
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2004
E-mail: cttl@chinanet.com http://www.chinanet.cn

DASY5 Validation Report for Head TSL Date: 09.15.2017
Test Laboratory: CTTI, 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 @: 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

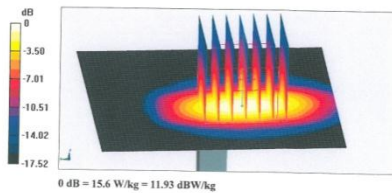


In Collaboration with
TTL Calibration Laboratory
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2004
E-mail: cttl@chinanet.com http://www.chinanet.cn

DASY5 Validation Report for Body TSL Date: 09.15.2017
Test Laboratory: CTTI, 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 @: 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



In Collaboration with
TTL Calibration Laboratory
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2004
E-mail: cttl@chinanet.com http://www.chinanet.cn

DASY5 Validation Report for Body TSL Date: 09.15.2017
Test Laboratory: CTTI, 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 @: 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



D2450V2 Sn:738

In Collaboration with
TTL S P E A G
CALIBRATION LABORATORY

中国认可
国际互认
校准
CALIBRATION
CNAS L6570

Address: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cti@chinaast.com http://www.chinaast.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&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 NRVDZ5	100596	02-Mar-17 (CTTL, No.J17X01254)	Mar-18
Reference Probe EX3DV4	SN 7433	28-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: Zhao Jing (SAR Test Engineer) Signature: [Signature]

Reviewed by: Yu Zongying (SAR Test Engineer) Signature: [Signature]

Approved by: Qi Dianyuan (SAR Project Leader) Signature: [Signature]

Issued: September 21, 2017

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: Z17-97140 Page 1 of 8

In Collaboration with
TTL S P E A G
CALIBRATION LABORATORY

Address: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cti@chinaast.com http://www.chinaast.cn

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
- KDB86564, 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. 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%.

Certificate No: Z17-97140 Page 2 of 8

In Collaboration with
TTL S P E A G
CALIBRATION LABORATORY

Address: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cti@chinaast.com http://www.chinaast.cn

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

DASY Version	DASY52	52.10.0.1446
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 ² (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 ² (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 ² (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 ² (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)

Certificate No: Z17-97140 Page 3 of 8

In Collaboration with
TTL S P E A G
CALIBRATION LABORATORY

Address: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cti@chinaast.com http://www.chinaast.cn

Appendix (Additional assessments outside the scope of CNAS L6570)

Antenna Parameters with Head TSL

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

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.8Ω+ j 6.39Ω
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

Manufactured by	SPEAG
-----------------	-------

Certificate No: Z17-97140 Page 4 of 8

D2450V2 Sn:738

In Collaboration with
TTL **S p e a g**
CALIBRATION LABORATORY

Address: No. 51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@china.ttl.com http://www.chinatitl.cn

DASY5 Validation Report for Head TSL Date: 09.18.2017
Test Laboratory: CTTL, Beijing, China
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 738
Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 2450$ MHz; $\sigma = 1.788$ S/m; $\epsilon_r = 38.67$; $\rho = 1000$ kg/m³
Phantom section: Left Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration:

- Probe: EX3DV4 - SN7433; ConvF(7.45, 7.45, 7.45); 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 = 102.1 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 27.8 W/kg
SAR(1 g) = 13.1 W/kg; SAR(10 g) = 6.1 W/kg
Maximum value of SAR (measured) = 22.0 W/kg

0 dB = 22.0 W/kg = 13.42 dBW/kg

Certificate No: Z17-97140 Page 5 of 8

In Collaboration with
TTL **S p e a g**
CALIBRATION LABORATORY

Address: No. 51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@china.ttl.com http://www.chinatitl.cn

Impedance Measurement Plot for Head TSL

Certificate No: Z17-97140 Page 6 of 8

In Collaboration with
TTL **S p e a g**
CALIBRATION LABORATORY

Address: No. 51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@china.ttl.com http://www.chinatitl.cn

DASY5 Validation Report for Body TSL Date: 09.18.2017
Test Laboratory: CTTL, Beijing, China
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 738
Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 2450$ MHz; $\sigma = 1.983$ S/m; $\epsilon_r = 52.51$; $\rho = 1000$ kg/m³
Phantom section: Center Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration:

- Probe: EX3DV4 - SN7433; ConvF(7.46, 7.46, 7.46); 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 = 96.41 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 27.8 W/kg
SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.1 W/kg
Maximum value of SAR (measured) = 22.3 W/kg

0 dB = 22.3 W/kg = 13.48 dBW/kg

Certificate No: Z17-97140 Page 7 of 8

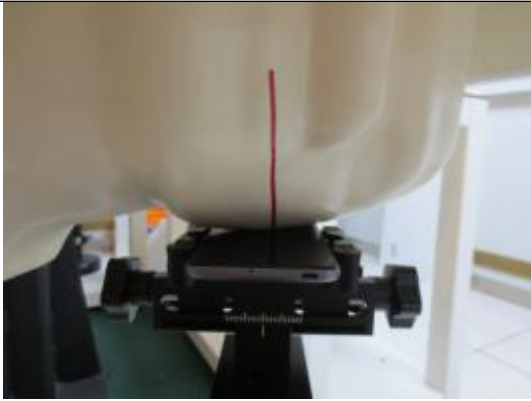
In Collaboration with
TTL **S p e a g**
CALIBRATION LABORATORY

Address: No. 51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@china.ttl.com http://www.chinatitl.cn

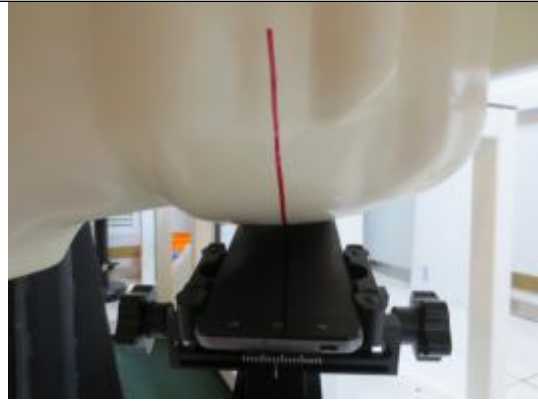
Impedance Measurement Plot for Body TSL

Certificate No: Z17-97140 Page 8 of 8

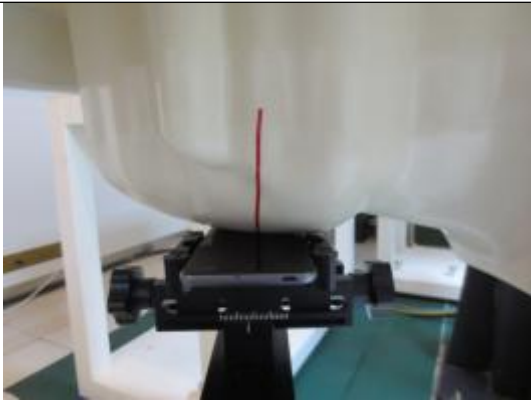
ANNEX C – PHOTOGRAPH



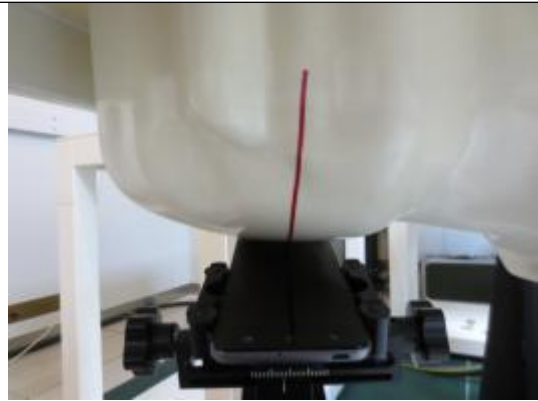
Cheek position, left side



Tilt position, left side



Cheek position, Right side



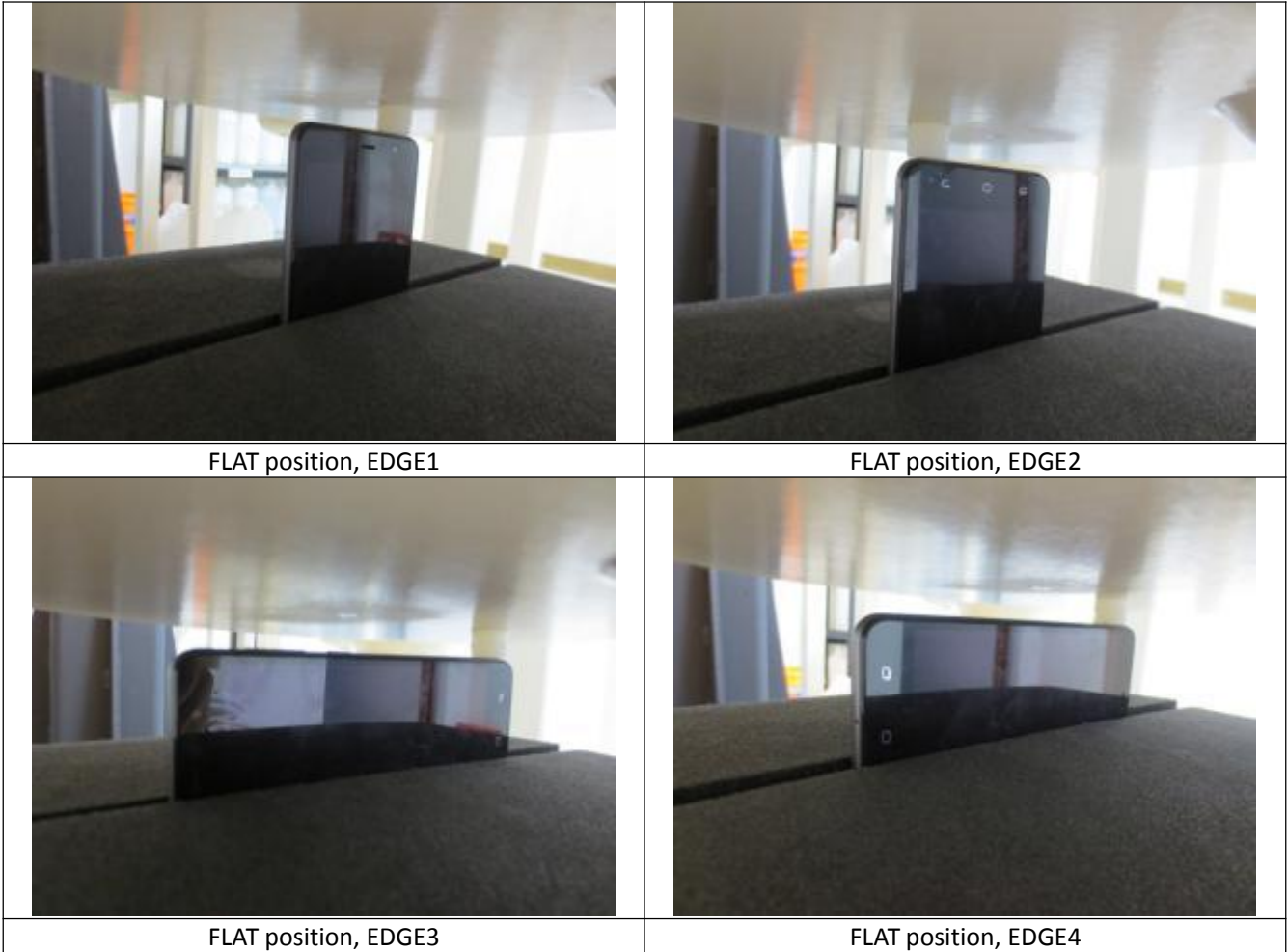
Tilt position, Right side



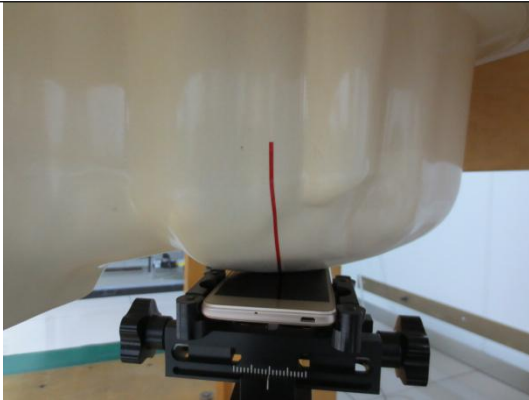
FLAT position, Towards phantom



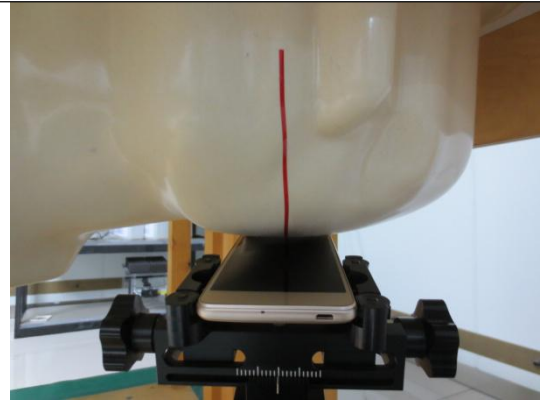
FLAT position, Towards ground



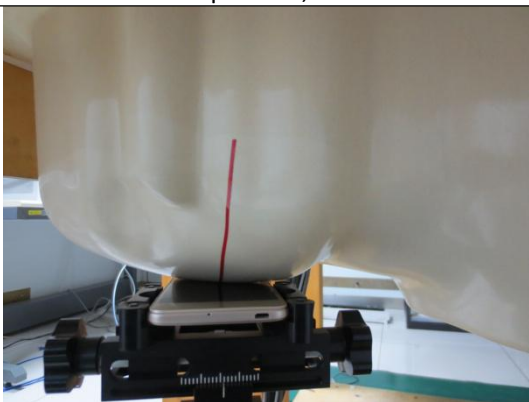
New test position



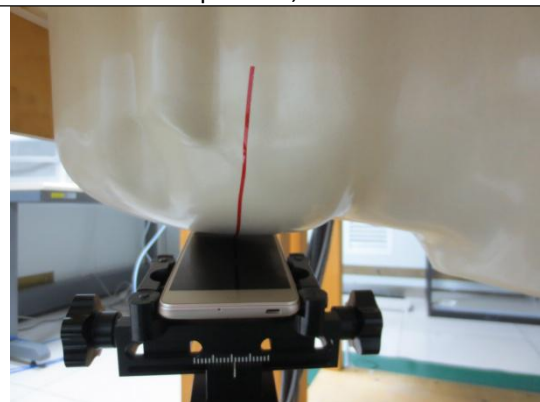
Cheek position, left side



Tilt position, left side



Cheek position, Right side



Tilt position, Right side



FLAT position, Towards ground



10mm Spacer

---End of Test Report---