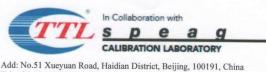


-1.0 -0.80 -0.60 -0.40 -0.20 0 0.20 0.40 0.60 0.80 1 Uncertainty of Spherical Isotropy Assessment: ±2.8% (K=2)

Certificate No: Z16-97087

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 Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China

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 Fax: +86-10-62304633-2209

 E-mail: cttl@chinattl.com
 Http://www.chinattl.cn

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

# Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	172.7
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: Z16-97087

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# ANNEX IDIPOLE CALIBRATION CERTIFICATE

# 750 MHz Dipole Calibration Certificate

Calibration Laborator Schmid & Partner Engineering AG <sup>Zeughausstrasse 43, 8004</sup> Zurich		S C C C C C C C C C C C C C C C C C C C	Schweizerischer Kalibrierdienst Service suisse d'étalonnage Servizio svizzero di taratura Swiss Calibration Service
Accredited by the Swiss Accredita The Swiss Accreditation Service	e is one of the signatorie	es to the EA	ccreditation No.: SCS 0108
Multilateral Agreement for the re Client CTTL-BJ (Aude			: D750V3-1017 Jul16
			: D750V5-1017_50110
CALIBRATION	ERIFICATE		
Object	D750V3 - SN:10	17	
Calibration procedure(s)	QA CAL-05.v9 Calibration proce	edure for dipole validation kits abo	ove 700 MHz
Calibration date:	July 20, 2016		
Calibration Equipment used (M&T Primary Standards	TE critical for calibration)		
Power meter NRP	SN: 104778	Cal Date (Certificate No.)	Scheduled Calibration
Power sensor NRP-Z91		Cal Date (Certificate No.) 06-Apr-16 (No. 217-02288/02289)	Scheduled Calibration
	SN: 103244	Cal Date (Certificate No.) 06-Apr-16 (No. 217-02288/02289) 06-Apr-16 (No. 217-02288)	Scheduled Calibration Apr-17 Apr-17
Power sensor NRP-Z91	second their statistics of elements	06-Apr-16 (No. 217-02288/02289)	Apr-17
	SN: 103244	06-Apr-16 (No. 217-02288/02289) 06-Apr-16 (No. 217-02288)	Apr-17 Apr-17
Reference 20 dB Attenuator	SN: 103244 SN: 103245	06-Apr-16 (No. 217-02288/02289) 06-Apr-16 (No. 217-02288) 06-Apr-16 (No. 217-02289)	Apr-17 Apr-17 Apr-17
Reference 20 dB Attenuator Type-N mismatch combination	SN: 103244 SN: 103245 SN: 5058 (20k)	06-Apr-16 (No. 217-02288/02289) 06-Apr-16 (No. 217-02288) 06-Apr-16 (No. 217-02289) 05-Apr-16 (No. 217-02292)	Apr-17 Apr-17 Apr-17 Apr-17
Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4	SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327	06-Apr-16 (No. 217-02288/02289) 06-Apr-16 (No. 217-02288) 06-Apr-16 (No. 217-02289) 05-Apr-16 (No. 217-02292) 05-Apr-16 (No. 217-02295)	Apr-17 Apr-17 Apr-17 Apr-17 Apr-17
Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards	SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 7349 SN: 601	06-Apr-16 (No. 217-02288/02289) 06-Apr-16 (No. 217-02288) 06-Apr-16 (No. 217-02289) 05-Apr-16 (No. 217-02292) 05-Apr-16 (No. 217-02295) 15-Jun-16 (No. EX3-7349_Jun16) 30-Dec-15 (No. DAE4-601_Dec15) Check Date (in house)	Apr-17 Apr-17 Apr-17 Apr-17 Apr-17 Jun-17 Dec-16 Scheduled Check
Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter EPM-442A	SN: 103244           SN: 103245           SN: 5058 (20k)           SN: 5058 (20k)           SN: 6047.2 / 06327           SN: 7349           SN: 601           ID #           SN: GB37480704	06-Apr-16 (No. 217-02288/02289) 06-Apr-16 (No. 217-02288) 06-Apr-16 (No. 217-02289) 05-Apr-16 (No. 217-02292) 05-Apr-16 (No. 217-02295) 15-Jun-16 (No. 217-02295) 15-Jun-16 (No. EX3-7349_Jun16) 30-Dec-15 (No. DAE4-601_Dec15) Check Date (in house) 07-Oct-15 (No. 217-02222)	Apr-17 Apr-17 Apr-17 Apr-17 Apr-17 Jun-17 Dec-16 Scheduled Check In house check: Oct-16
Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A	SN: 103244           SN: 103245           SN: 5058 (20k)           SN: 6047.2 / 06327           SN: 7349           SN: 601           ID #           SN: GB37480704           SN: US37292783	06-Apr-16 (No. 217-02288/02289) 06-Apr-16 (No. 217-02288) 06-Apr-16 (No. 217-02289) 05-Apr-16 (No. 217-02292) 05-Apr-16 (No. 217-02295) 15-Jun-16 (No. EX3-7349_Jun16) 30-Dec-15 (No. DAE4-601_Dec15) Check Date (in house) 07-Oct-15 (No. 217-02222) 07-Oct-15 (No. 217-02222)	Apr-17 Apr-17 Apr-17 Apr-17 Apr-17 Jun-17 Dec-16 Scheduled Check In house check: Oct-16 In house check: Oct-16
Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A	SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5058 (20k) SN: 7349 SN: 601 ID # SN: GB37480704 SN: US37292783 SN: MY41092317	06-Apr-16 (No. 217-02288/02289) 06-Apr-16 (No. 217-02288) 06-Apr-16 (No. 217-02289) 05-Apr-16 (No. 217-02292) 05-Apr-16 (No. 217-02295) 15-Jun-16 (No. EX3-7349_Jun16) 30-Dec-15 (No. DAE4-601_Dec15) Check Date (in house) 07-Oct-15 (No. 217-02222) 07-Oct-15 (No. 217-02222) 07-Oct-15 (No. 217-02223)	Apr-17 Apr-17 Apr-17 Apr-17 Apr-17 Jun-17 Dec-16 Scheduled Check In house check: Oct-16 In house check: Oct-16 In house check: Oct-16
Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 7349 SN: 601 ID # SN: GB37480704 SN: US37292783 SN: MY41092317 SN: 100972	06-Apr-16 (No. 217-02288/02289) 06-Apr-16 (No. 217-02288) 06-Apr-16 (No. 217-02289) 05-Apr-16 (No. 217-02292) 05-Apr-16 (No. 217-02295) 15-Jun-16 (No. EX3-7349_Jun16) 30-Dec-15 (No. DAE4-601_Dec15) Check Date (in house) 07-Oct-15 (No. 217-02222) 07-Oct-15 (No. 217-02222) 07-Oct-15 (No. 217-02223) 15-Jun-15 (in house check Jun-15)	Apr-17 Apr-17 Apr-17 Apr-17 Apr-17 Jun-17 Dec-16 Scheduled Check In house check: Oct-16 In house check: Oct-16 In house check: Oct-16 In house check: Oct-16
Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5058 (20k) SN: 7349 SN: 601 ID # SN: GB37480704 SN: US37292783 SN: MY41092317	06-Apr-16 (No. 217-02288/02289) 06-Apr-16 (No. 217-02288) 06-Apr-16 (No. 217-02289) 05-Apr-16 (No. 217-02292) 05-Apr-16 (No. 217-02295) 15-Jun-16 (No. EX3-7349_Jun16) 30-Dec-15 (No. DAE4-601_Dec15) Check Date (in house) 07-Oct-15 (No. 217-02222) 07-Oct-15 (No. 217-02222) 07-Oct-15 (No. 217-02223)	Apr-17 Apr-17 Apr-17 Apr-17 Apr-17 Jun-17 Dec-16 Scheduled Check In house check: Oct-16 In house check: Oct-16 In house check: Oct-16
Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer HP 8753E	SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 7349 SN: 601 ID # SN: GB37480704 SN: US37292783 SN: MY41092317 SN: 100972	06-Apr-16 (No. 217-02288/02289) 06-Apr-16 (No. 217-02288) 06-Apr-16 (No. 217-02289) 05-Apr-16 (No. 217-02292) 05-Apr-16 (No. 217-02295) 15-Jun-16 (No. EX3-7349_Jun16) 30-Dec-15 (No. DAE4-601_Dec15) Check Date (in house) 07-Oct-15 (No. 217-02222) 07-Oct-15 (No. 217-02222) 07-Oct-15 (No. 217-02223) 15-Jun-15 (in house check Jun-15)	Apr-17 Apr-17 Apr-17 Apr-17 Apr-17 Jun-17 Dec-16 Scheduled Check In house check: Oct-16 In house check: Oct-16 In house check: Oct-16 In house check: Oct-16
Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer HP 8753E	SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 7349 SN: 601 ID # SN: GB37480704 SN: US37292783 SN: MY41092317 SN: 100972 SN: US37390585	06-Apr-16 (No. 217-02288/02289) 06-Apr-16 (No. 217-02288) 06-Apr-16 (No. 217-02289) 05-Apr-16 (No. 217-02292) 05-Apr-16 (No. 217-02295) 15-Jun-16 (No. EX3-7349_Jun16) 30-Dec-15 (No. DAE4-601_Dec15) Check Date (in house) 07-Oct-15 (No. 217-02222) 07-Oct-15 (No. 217-02222) 07-Oct-15 (No. 217-02222) 07-Oct-15 (No. 217-02223) 15-Jun-15 (in house check Jun-15) 18-Oct-01 (in house check Oct-15)	Apr-17 Apr-17 Apr-17 Apr-17 Jun-17 Dec-16 Scheduled Check In house check: Oct-16 In house check: Oct-16
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer HP 8753E Calibrated by:	SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 7349 SN: 601 ID # SN: GB37480704 SN: US37292783 SN: MY41092317 SN: 100972 SN: US37390585 Name	06-Apr-16 (No. 217-02288/02289) 06-Apr-16 (No. 217-02288) 06-Apr-16 (No. 217-02289) 05-Apr-16 (No. 217-02292) 05-Apr-16 (No. 217-02295) 15-Jun-16 (No. EX3-7349_Jun16) 30-Dec-15 (No. DAE4-601_Dec15) Check Date (in house) 07-Oct-15 (No. 217-02222) 07-Oct-15 (No. 217-02222) 07-Oct-15 (No. 217-02223) 15-Jun-15 (in house check Jun-15) 18-Oct-01 (in house check Oct-15) Function	Apr-17 Apr-17 Apr-17 Apr-17 Jun-17 Dec-16 Scheduled Check In house check: Oct-16 In house check: Oct-16

Certificate No: D750V3-1017\_Jul16

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



Schweizerischer Kalibrierdienst S Service suisse d'étalonnage C Servizio svizzero di taratura

S

Accredited by the Swiss Accreditation Service (SAS)

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

#### Glossary:

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

#### Calibration is Performed According to the Following Standards:

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

#### Additional Documentation:

e) DASY4/5 System Handbook

## Methods Applied and Interpretation of Parameters:

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

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

Certificate No: D750V3-1017\_Jul16

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Swiss Calibration Service Accreditation No.: SCS 0108

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### **Measurement Conditions**

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

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

### **Head TSL parameters**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.9 ± 6 %	0.91 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

# SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.13 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.33 W/kg ± 17.0 % (k=2)
	1 1	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.39 W/kg

#### Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.1 ± 6 %	0.99 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

# SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.25 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	8.78 W/kg ± 17.0 % (k=2)
		· · · · · · · · · · · · · · · · · · ·
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL SAR measured	condition 250 mW input power	1.47 W/kg

Certificate No: D750V3-1017\_Jul16



### Appendix (Additional assessments outside the scope of SCS 0108)

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.8 Ω - 0.2 jΩ
Return Loss	- 28.6 dB

#### Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.2 Ω - 2.3 jΩ
Return Loss	- 32.3 dB

#### General Antenna Parameters and Design

Electrical Delay (one direction)	1.034 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
Manufactured on	March 22, 2010

Certificate No: D750V3-1017\_Jul16



## **DASY5 Validation Report for Head TSL**

Date: 20.07.2016

Test Laboratory: SPEAG, Zurich, Switzerland

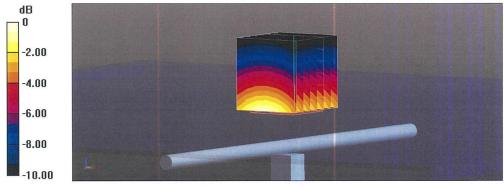
#### DUT: Dipole 750 MHz D750V3; Type: D750V3; Serial: D750V3 - SN:1017

 $\begin{array}{l} \mbox{Communication System: UID 0 - CW; Frequency: 750 MHz } \\ \mbox{Medium parameters used: } f = 750 MHz; \mbox{$\sigma$} = 0.91 \mbox{ S/m}; \mbox{$\epsilon$}_r = 40.9; \mbox{$\rho$} = 1000 \mbox{ kg/m}^3 \\ \mbox{Phantom section: Flat Section} \\ \mbox{Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)} \\ \end{array}$ 

DASY52 Configuration:

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

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 58.54 V/m; Power Drift = 0.03 dB Peak SAR (extrapolated) = 3.21 W/kg SAR(1 g) = 2.13 W/kg; SAR(10 g) = 1.39 W/kg Maximum value of SAR (measured) = 2.84 W/kg



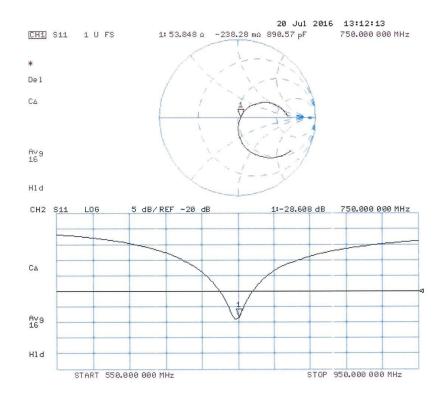
0 dB = 2.84 W/kg = 4.53 dBW/kg

Certificate No: D750V3-1017\_Jul16

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## Impedance Measurement Plot for Head TSL



Certificate No: D750V3-1017\_Jul16

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## **DASY5 Validation Report for Body TSL**

Date: 20.07.2016

Test Laboratory: SPEAG, Zurich, Switzerland

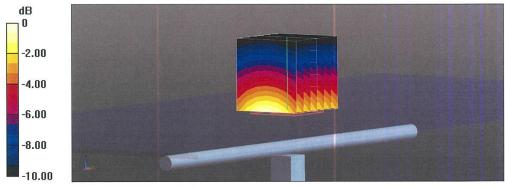
### DUT: Dipole 750 MHz D750V3; Type: D750V3; Serial: D750V3 - SN: 1017

Communication System: UID 0 - CW; Frequency: 750 MHz Medium parameters used: f = 750 MHz;  $\sigma$  = 0.99 S/m;  $\epsilon_r$  = 55.1;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(9.99, 9.99, 9.99); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 57.82 V/m; Power Drift = -0.03 dB Peak SAR (extrapolated) = 3.37 W/kg SAR(1 g) = 2.25 W/kg; SAR(10 g) = 1.47 W/kg Maximum value of SAR (measured) = 3.00 W/kg



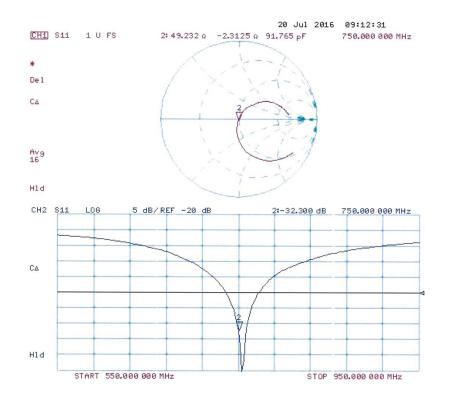
0 dB = 3.00 W/kg = 4.77 dBW/kg

Certificate No: D750V3-1017\_Jul16





## Impedance Measurement Plot for Body TSL



Certificate No: D750V3-1017\_Jul16

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# 835 MHz Dipole Calibration Certificate

	CALIBRA	TION LABORATORY	G-MRA
Add: No.51 Xueyu Tel: +86-10-62304 E-mail: cttl@china	633-2079 Fax: +	trict, Beijing, 100191, China 86-10-62304633-2504 /www.chinattl.cn	CALIBRATIO No. L0570
Client CTT	L(South Branc	h) Certificate No: Z1	5-97173
CALIBRATION C	ERTIFICAT	E	
Object	D835V	2 - SN: 4d057	
Calibration Procedure(s)			
		-2-003-01	
	Calibra	tion Procedures for dipole validation kits	
Calibration date:	Octobe	r 22, 2015	
pages and are part of the ca All calibrations have been humidity<70%.	ertificate.	the closed laboratory facility: environment	temperature(22±3) <sup>-</sup> C an
bages and are part of the ca All calibrations have been numidity<70%. Calibration Equipment used Primary Standards	ertificate.	the closed laboratory facility: environment	
Primary Standards Power Meter NRP2	ertificate.	the closed laboratory facility: environment	
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91	ertificate.         1       conducted in 1         4       (M&TE critical for         ID #         101919         101547	the closed laboratory facility: environment or calibration) Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4	ertificate. 1 conducted in 1 1 (M&TE critical for 1D # 101919 101547 SN 3617	the closed laboratory facility: environment or calibration) Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15)	Scheduled Calibration Jun-16 Jun-16 Aug -16
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91	ertificate.         1       conducted in 1         4       (M&TE critical for         ID #         101919         101547	the closed laboratory facility: environment or calibration) Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256)	Scheduled Calibration Jun-16 Jun-16
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4	ertificate. 1 conducted in 1 1 (M&TE critical for 1D # 101919 101547 SN 3617	the closed laboratory facility: environment or calibration) Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15) 26-Aug-15(SPEAG,No.DAE4-777_Aug15)	Scheduled Calibration Jun-16 Jun-16 Aug -16 Aug -16
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#### **Glossary:**

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

## Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) For hand-held devices used in close proximity to the ear (frequency range of 300MHz to 3GHz)", February 2005
- c) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

#### Additional Documentation:

d) DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

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

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

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In Collaboration with
SDE20

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#### **Measurement Conditions**

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

DASY52	52.8.8.1222
Advanced Extrapolation	
Triple Flat Phantom 5.1C	
15 mm	with Spacer
dx, dy, dz = 5 mm	
835 MHz ± 1 MHz	
	Advanced Extrapolation Triple Flat Phantom 5.1C 15 mm dx, dy, dz = 5 mm

#### **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	42.2 ± 6 %	0.91 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	2.31 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	9.22 mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.51 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	6.03 mW /g ± 20.4 % (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	55.1 ± 6 %	0.96 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		

### SAR result with Body TSL

SAR averaged over 1 $cm^3$ (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	9.44 mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.54 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	6.20 mW /g ± 20.4 % (k=2)

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#### Appendix

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.2Ω- 3.12jΩ	
Return Loss	- 29.8dB	

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.1Ω- 5.38jΩ	
Return Loss	- 24.7dB	

#### **General Antenna Parameters and Design**

Electrical Delay (one direction)	1.500 ns
h	

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

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

#### Additional EUT Data

Manufactured by SPEAG
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**DASY5 Validation Report for Head TSL** 

Date: 10.22.2015

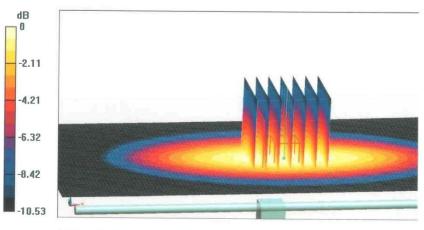
Test Laboratory: CTTL, Beijing, China **DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d05**7 Communication System: UID 0, CW; Frequency: 835 MHz;Duty Cycle: 1:1 Medium parameters used: f = 835 MHz;  $\sigma = 0.907$  S/m;  $\varepsilon_r = 42.15$ ;  $\rho = 1000$  kg/m<sup>3</sup> Phantom section: Center Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 SN3617; ConvF(9.56, 9.56, 9.56); Calibrated: 8/26/2015;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn777; Calibrated: 8/26/2015
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 57.74 V/m; Power Drift = 0.00 dB Peak SAR (extrapolated) = 3.47 W/kg

SAR(1 g) = 2.31 W/kg; SAR(10 g) = 1.51 W/kg Maximum value of SAR (measured) = 2.94 W/kg



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

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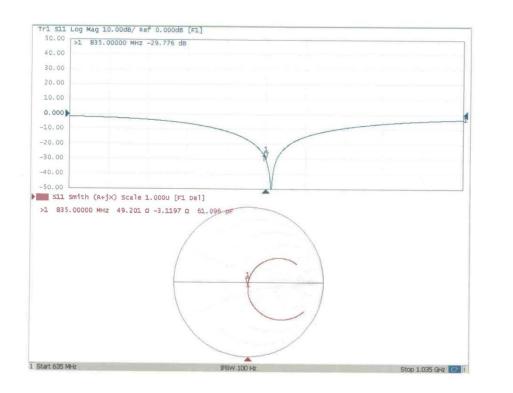


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# Impedance Measurement Plot for Head TSL



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# No.I16N01168-SAR Page 170 of 234



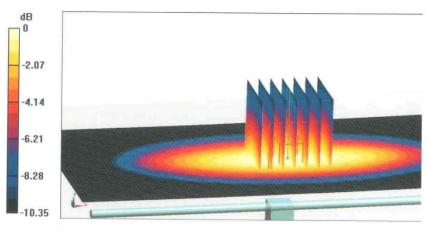
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China Fax: +86-10-62304633-2504 Http://www.chinattl.cn Tel: +86-10-62304633-2079 E-mail: cttl@chinattl.com

Date: 10.22.2015

**DASY5 Validation Report for Body TSL** Test Laboratory: CTTL, Beijing, China DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d057 Communication System: UID 0, CW; Frequency: 835 MHz;Duty Cycle: 1:1 Medium parameters used: f = 835 MHz;  $\sigma$  = 0.958 S/m;  $\epsilon_r$  = 55.11;  $\rho$  = 1000 kg/m^3 Phantom section: Right Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007) DASY5 Configuration:

- Probe: EX3DV4 SN3617; ConvF(9.71,9.71, 9.71); Calibrated: 8/26/2015;
- Sensor-Surface: 2mm (Mechanical Surface Detection) .
- . Electronics: DAE4 Sn777; Calibrated: 8/26/2015
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1 .
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331) .

Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 56.68 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 3.46 W/kg SAR(1 g) = 2.34 W/kg; SAR(10 g) = 1.54 W/kg Maximum value of SAR (measured) = 2.95 W/kg



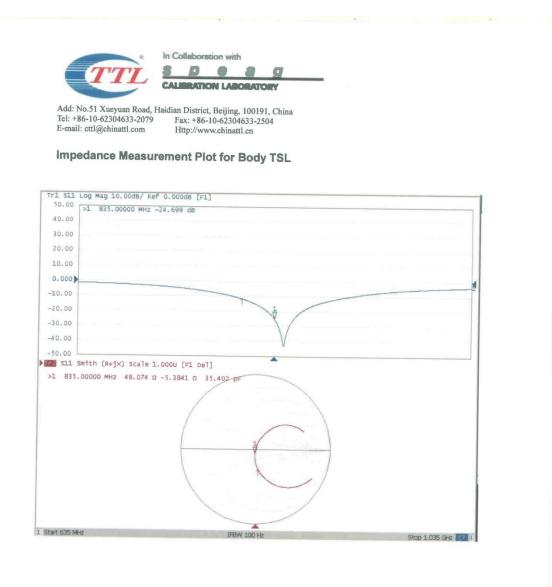
0 dB = 2.95 W/kg = 4.70 dBW/kg

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Certificate No: Z15-97173

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# 1800 MHz Dipole Calibration Certificate

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Client CT	TL(South Bran	nch) Certificate No: 2	Z15-97178
CALIBRATION C	ERTIFICAT	ſE	
Object	D1900	V2 CN: 24147	Charles and the second
	D 1800	V2 - SN: 2d147	
Calibration Procedure(s)	ED-711	1-2-003-01	
		tion Procedures for dipole validation kits	
Colibustian data:			
Calibration date:	Novem	ber 3, 2015	
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All calibrations have been humidity<70%.	I (M&TE critical fo	or calibration) Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards	n conducted in I (M&TE critical fo	or calibration)	
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2	ID # 101919 101547	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256)	Scheduled Calibration Jun-16 Jun-16
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91	ID # 101919 101547	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256)	Scheduled Calibration Jun-16 Jun-16 ) Aug -16
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4	ID# 101919 101547 SN 3617	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15)	Scheduled Calibration Jun-16 Jun-16 ) Aug -16
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4	ID # 101919 101547 SN 3617 SN 777 ID #	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15) 26-Aug-15(SPEAG,No.DAE4-777_Aug15)	Scheduled Calibration Jun-16 Jun-16 ) Aug -16 ) Aug -16
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards	ID # 101919 101547 SN 3617 SN 777 ID # MY49071430	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15) 26-Aug-15(SPEAG,No.DAE4-777_Aug15 Cal Date(Calibrated by, Certificate No.) 02-Feb-15 (CTTL, No.J15X00729)	Scheduled Calibration Jun-16 Jun-16 ) Aug -16 ) Aug -16 Scheduled Calibration
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ID # 101919 101547 SN 3617 SN 777 ID # MY49071430	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15) 26-Aug-15(SPEAG,No.DAE4-777_Aug15 Cal Date(Calibrated by, Certificate No.) 02-Feb-15 (CTTL, No.J15X00729)	Scheduled Calibration Jun-16 Jun-16 ) Aug -16 ) Aug -16 Scheduled Calibration Feb-16
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	n conducted in I (M&TE critical fo ID # 101919 101547 SN 3617 SN 777 ID # MY49071430 MY46110673	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15) 26-Aug-15(SPEAG,No.DAE4-777_Aug15 Cal Date(Calibrated by, Certificate No.) 02-Feb-15 (CTTL, No.J15X00729) 03-Feb-15 (CTTL, No.J15X00728)	Scheduled Calibration Jun-16 Jun-16 ) Aug -16 ) Aug -16 Scheduled Calibration Feb-16 Feb-16
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C Network Analyzer E5071C	a conducted in a (M&TE critical for ID # 101919 101547 SN 3617 SN 777 ID # MY49071430 MY46110673 Name	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15) 26-Aug-15(SPEAG,No.DAE4-777_Aug15 Cal Date(Calibrated by, Certificate No.) 02-Feb-15 (CTTL, No.J15X00729) 03-Feb-15 (CTTL, No.J15X00728) Function	Scheduled Calibration Jun-16 Jun-16 ) Aug -16 ) Aug -16 Scheduled Calibration Feb-16 Feb-16 Signature
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C Network Analyzer E5071C	a conducted in (M&TE critical for ID # 101919 101547 SN 3617 SN 777 ID # MY49071430 MY46110673 Name Zhao Jing	Cal Date(Calibrated by, Certificate No.) 01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 26-Aug-15(SPEAG,No.EX3-3617_Aug15) 26-Aug-15(SPEAG,No.DAE4-777_Aug15) Cal Date(Calibrated by, Certificate No.) 02-Feb-15 (CTTL, No.J15X00729) 03-Feb-15 (CTTL, No.J15X00728) Function SAR Test Engineer	Scheduled Calibration Jun-16 Jun-16 ) Aug -16 ) Aug -16 Scheduled Calibration Feb-16 Feb-16 Signature

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