

APPENDIX D: RELEVANT PAGES FROM DAE&

DIPOLE VALIDATION KIT REPORT(S)



深圳市计量质量检测研究院
Shenzhen Academy of Metrology & Quality Inspection

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Add: No.51 Xueyua Tel: +86-10-623046	m Road, Haidian Dist	rict, Beijing, 100191, China 86-10-62304633-2504	校准 CALIBRATIO CNAS L057
E-mail: cttl@chinat	2002204 million 2004030	www.ehimattl.en Certificate No: Z	17-97005
Client	North Second Second		17-57005
CALIBRATION CI	ERTIFICAT		
Object	D750V3	- SN: 1103	
Calibration Procedure(s)	FD-Z11- Calibrat	003-01 ion Procedures for dipole validation kits	
Calibration date:	January	10, 2017	
measurements(SI). The mean pages and are part of the ce	asurements and t artificate.	raceability to national standards, which re the uncertainties with confidence probability he closed laboratory facility: environmen	are given on the following
humidity<70%. Calibration Equipment used	(M&TE critical fo	r calibration)	
Calibration Equipment used	• • • • • • • • • • • • • • • • • • • •	2000-00-00-00-00-00-00-00-00-00-00-00-00	Scheduled Calibration
Calibration Equipment used	(M&TE critical fo	r calibration) Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04771)	Scheduled Calibration Jun-17
Calibration Equipment used Primary Standards	ID#	Cal Date(Calibrated by, Certificate No.)	
Calibration Equipment used Primary Standards Power Meter NRP2	ID# 101919 101547	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04771)	Jun-17 Jun-17
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-291	ID# 101919 101547	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04771) 27-Jun-16 (CTTL, No.J16X04771)	Jun-17 Jun-17
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-291 Reference Probe EX3DV4	ID# 101919 101547 SN 7307	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04771) 27-Jun-16 (CTTL, No.J16X04771) 19-Feb-16(SPEAG,No.EX3-7307_Feb16)	Jun-17 Jun-17 Feb-17
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-291 Reference Probe EX3DV4 DAE4	ID # 101919 101547 SN 7307 SN 771	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04771) 27-Jun-16 (CTTL, No.J16X04771) 19-Feb-16(SPEAG,No.EX3-7307_Feb16) 02-Feb-16(CTTL-SPEAG,No.Z16-97011)	Jun-17 Jun-17 Feb-17 Feb-17
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards	ID # 101919 101547 SN 7307 SN 771 ID #	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04771) 27-Jun-16 (CTTL, No.J16X04771) 19-Feb-16(SPEAG,No.EX3-7307_Feb16) 02-Feb-16(CTTL-SPEAG,No.Z16-97011) Cal Date(Calibrated by, Certificate No.)	Jun-17 Jun-17 Feb-17 Feb-17 Scheduled Calibration
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 7307 SN 771 ID # MY49071430	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04771) 27-Jun-16 (CTTL, No.J16X04771) 19-Feb-16(SPEAG,No.EX3-7307_Feb16) 02-Feb-16(CTTL-SPEAG,No.Z16-97011) Cal Date(Calibrated by, Certificate No.) 01-Feb-16 (CTTL, No.J16X00893)	Jun-17 Jun-17 Feb-17 Feb-17 Scheduled Calibration Jan-17
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C Network Analyzer E5071C	ID # 101919 101547 SN 7307 SN 771 ID # MY49071430 MY46110673	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04771) 27-Jun-16 (CTTL, No.J16X04771) 19-Feb-16(SPEAG,No.EX3-7307_Feb16) 02-Feb-16(CTTL-SPEAG,No.Z16-97011) Cal Date(Calibrated by, Certificate No.) 01-Feb-16 (CTTL, No.J16X00893) 26-Jan-16 (CTTL, No.J16X00894)	Jun-17 Jun-17 Feb-17 Feb-17 Scheduled Calibration Jan-17 Jan-17
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 7307 SN 771 ID # MY49071430 MY46110673 Name	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04771) 27-Jun-16 (CTTL, No.J16X04771) 19-Feb-16(SPEAG,No.EX3-7307_Feb16) 02-Feb-16(CTTL-SPEAG,No.Z16-97011) Cal Date(Calibrated by, Certificate No.) 01-Feb-16 (CTTL, No.J16X00893) 26-Jan-16 (CTTL, No.J16X00894) Function	Jun-17 Jun-17 Feb-17 Feb-17 Scheduled Calibration Jan-17 Jan-17
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-291 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C Network Analyzer E5071C Calibrated by:	ID # 101919 101547 SN 7307 SN 771 ID # MY49071430 MY46110673 Name Zhao Jing	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04771) 27-Jun-16 (CTTL, No.J16X04771) 19-Feb-16(SPEAG,No.EX3-7307_Feb16) 02-Feb-16(CTTL-SPEAG,No.Z16-97011) Cal Date(Calibrated by, Certificate No.) 01-Feb-16 (CTTL, No.J16X00893) 26-Jan-16 (CTTL, No.J16X00894) Function SAR Test Engineer	Jun-17 Jun-17 Feb-17 Feb-17 Scheduled Calibration Jan-17 Jan-17
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C Network Analyzer E5071C Calibrated by: Reviewed by:	ID # 101919 101547 SN 7307 SN 771 ID # MY49071430 MY46110673 Name Zhao Jing Qi Dianyuan	Cal Date(Calibrated by, Certificate No.) 27-Jun-16 (CTTL, No.J16X04771) 27-Jun-16 (CTTL, No.J16X04771) 19-Feb-16 (SPEAG,No.EX3-7307_Feb16) 02-Feb-16 (CTTL-SPEAG,No.Z16-97011) Cal Date(Calibrated by, Certificate No.) 01-Feb-16 (CTTL, No.J16X00893) 26-Jan-16 (CTTL, No.J16X00894) Function SAR Test Engineer SAR Project Leader Deputy Director of the laboratory	Jun-17 Jun-17 Feb-17 Feb-17 Scheduled Calibration Jan-17 Jan-17

Certificate No: Z17-97005

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'重质重粒测体 Shenzhen Academy of Metrology & Quality Inspection

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GI	os	s	a	n	y:
TS				1	

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) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions; Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole ٠ positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

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

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Measurement Conditions

DASY Version	DASY52	52.8.8.1258
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	750 MHz ± 1 MHz	

g

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 %	0.87 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	2.05 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	8.29 mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.37 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	5.53 mW /g ± 20.4 % (k=2)

Body TSL parameters

	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	55.6 ± 6 %	0.94 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	2.18 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	8.89 mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.47 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	5.97 mW /g ± 20.4 % (k=2)

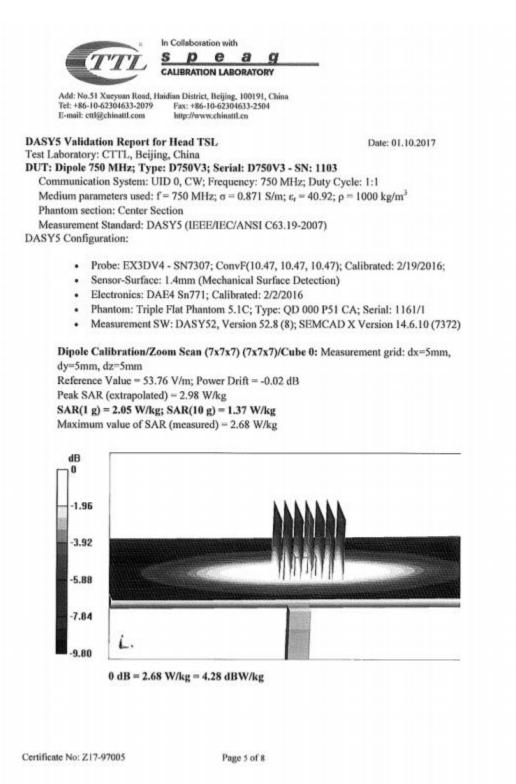
Certificate No: Z17-97005

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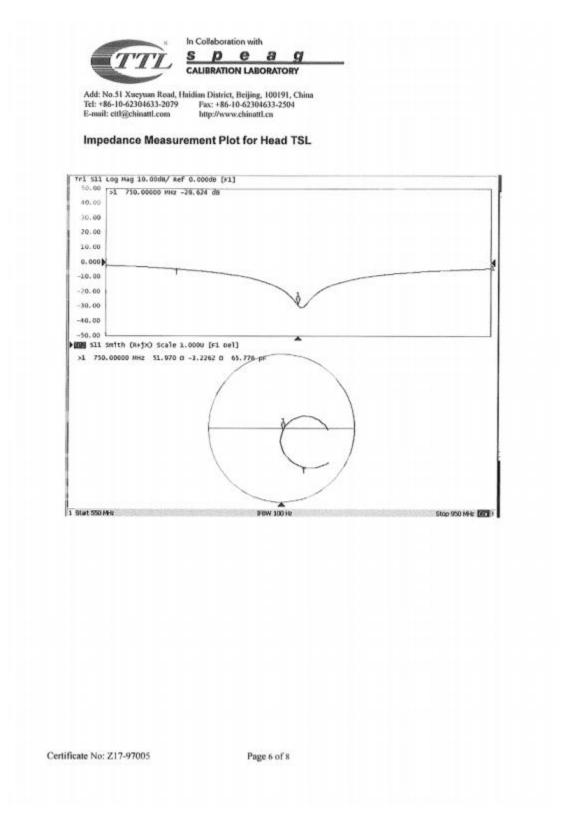


Appendix		
- pponuix		
Antenna P	Parameters with Head TSL	
Impedant	ce, transformed to feed point	52.0Ω- 3.23jΩ
Return Lo	065	- 28.6dB
Antenna P	Parameters with Body TSL	-
Impedance	ce, transformed to feed point	49.1Ω- 3.34jΩ
Return Lo		- 29.1dB
General A	ntenna Parameters and Design	
	Delay (one direction)	1.139 ns
1		
be measured The dipole is	d. s made of standard semirigid coaxial cal	a slight warming of the dipole near the feedpo ple. The center conductor of the feeding line is
be measured connected to of the dipole according to affected by ti No excessive connections	d. s made of standard semirigid coaxial cal o the second arm of the dipole. The ante s, small end caps are added to the dipo the position as explained in the "Measu his change. The overall dipole length is	ble. The center conductor of the feeding line is inna is therefore short-circuited for DC-signals le arms in order to improve matching when los rement Conditions" paragraph. The SAR data
be measured connected to of the dipole according to affected by ti No excessive connections	d. s made of standard semirigid coaxial cal to the second arm of the dipole. The anter s, small end caps are added to the dipol the position as explained in the "Measu his change. The overall dipole length is e force must be applied to the dipole arm near the feedpoint may be damaged. EUT Data	ble. The center conductor of the feeding line is nna is therefore short-circuited for DC-signals le arms in order to improve matching when los rement Conditions" paragraph. The SAR data still according to the Standard.
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be measured The dipole is connected to of the dipole: according to affected by th No excessive connections	d. s made of standard semirigid coaxial cal to the second arm of the dipole. The anter s, small end caps are added to the dipol the position as explained in the "Measu his change. The overall dipole length is e force must be applied to the dipole arm near the feedpoint may be damaged. EUT Data	ble. The center conductor of the feeding line is inna is therefore short-circuited for DC-signals le arms in order to improve matching when loa irement Conditions" paragraph. The SAR data still according to the Standard. ns, because they might bend or the soldered
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he dipole is onnected to f the dipole ccording to ffected by ti lo excessive	d. s made of standard semirigid coaxial cal o the second arm of the dipole. The ante s, small end caps are added to the dipol the position as explained in the "Measu his change. The overall dipole length is e force must be applied to the dipole arr	ble. The center conductor of the feeding lin nna is therefore short-circuited for DC-sig le arms in order to improve matching when rement Conditions" paragraph. The SAR still according to the Standard.







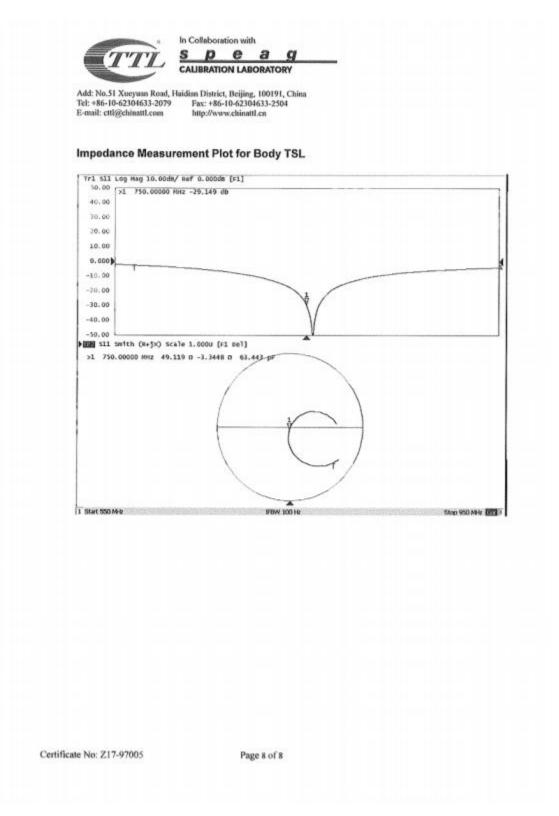




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ASY5 Validation Report f est Laboratory: CTTL, Beij	
Communication System: U Medium parameters used:	UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1 f = 750 MHz; $\sigma = 0.936$ S/m; $\epsilon_r = 55.59$; $\rho = 1000$ kg/m ³
Phantom section: Left Sec Measurement Standard: D ASY5 Configuration:	tion ASY5 (IEEE/IEC/ANSI C63.19-2007)
	V4 - SN7307; ConvF(9.93, 9.93, 9.93); Calibrated: 2/19/2016; e: I.4mm (Mechanical Surface Detection)
	AE4 Sn771; Calibrated: 2/2/2016
0552 005	ble Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial; 1161/1 SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)
- measurement	5 W. DAS 132, VERIOUS2.8 (8), SEMICAD A VERIOU PLO. 10 (1372
	Loom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm,
dy=5mm, dz=5mm	.96 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolat	
	sg; SAR(10 g) = 1.47 W/kg
Maximum value of SA	AR (measured) = 2.84 W/kg
dB	
	444444
-1.91	
-1.91	
-1.91	
-1.91 -3.82 -5.73	
-1.91	
-1.91 -3.82 -5.73 -7.64	
-1.91 -3.82 -5.73 -7.64 -9.55	
-1.91 -3.82 -5.73 -7.64 -9.55	64 W/kg = 4.53 dBW/kg
-1.91 -3.82 -5.73 -7.64 -9.55	84 W/kg = 4.53 dBW/kg









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TI		C A G	CNAS
Add: No.51 Xueyu Tel: +86-10-62304 E-mail: ettl@china Client SM	633-2079 Fax: 4 ttLcom <u>Http://</u>	triet, Beijing, 100191, China 86-10-62304633-2504 www.chinattl.en Certificate No: 2	CALIBRATION No. L0570
CALIBRATION C	ERTIFICAT	E	
Object	D835V	2 - SN: 4d141	
Calibration Procedure(s)		-2-003-01 tion Procedures for dipole validation kits	
Calibration date:	Septer	iber 24, 2015	
All calibrations have been humidity<70%. Calibration Equipment used		the closed laboratory facility; environment or calibration)	nt temperature(22±3)℃ and
Primary Standards	ID#	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4	101919 101547 SN 3846 SN 910	01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 24-Sep-14(SPEAG,No.EX3-3846_Sep14 16-Jun-15(SPEAG,No.DAE4-910_Jun15	
Secondary Standards	ID#	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C Network Analyzer E5071C	MY49071430 MY46110673	02-Feb-15 (CTTL, No.J15X00729) 03-Feb-15 (CTTL, No.J15X00728)	Feb-16 Feb-16
	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	22
ter de la constante de la const	Qi Dianyuan	SAR Project Leader	22 -
keviewed by:			and
Reviewed by: Approved by:	Lu Bingsong	Deputy Director of the laboratory	horn

Certificate No: Z15-97116

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Glossary:

0100001.31	
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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Measurement Conditions

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

DASY Version	DASY52	52.8.8.1222
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

applied.		
Temperature	Permittivity	Conductivity
22.0 *C	41.5	0.90 mho/m
(22.0 ± 0.2) °C	42.0 ± 6 %	0.89 mho/m ± 6 %
<1.0 °C		
	Temperature 22.0 °C (22.0 ± 0.2) °C	Temperature Permittivity 22.0 *C 41.5 (22.0 ± 0.2) *C 42.0 ± 6 %

SAR result with Head TSL

SAR averaged over 1 cm ³ (1g) of Head TSL	Condition	
SAR measured	250 mW input power	2.33 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	9.45 mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm ³ (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	6.11 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	56.0 ± 6 %	0.98 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		
D requilt with Dedu TO			

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.39 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	9.51 mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.57 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	6.25 mW /g ± 20.4 % (k=2)

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Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.2Ω- 4.66jΩ
Return Loss	- 25.9dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.7Ω- 5.94jΩ
Return Loss	- 22.3dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.441 ns

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

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

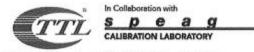
Additional EUT Data

Manufactured by	SPEAG

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DASY5 Validation Report for Head TSL Test Laboratory: CTTL, Beijing, China DUT: Director 255 MHz; Turner DS2EV2; Se Date: 09.18.2015

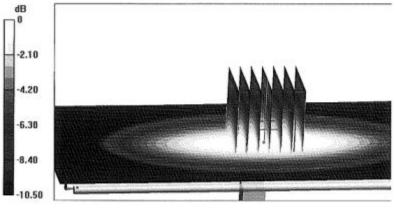
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d141 Communication System: UID 0, CW; Frequency: 835 MHz;Duty Cycle: 1:1 Medium parameters used: f = 835 MHz; $\sigma = 0.886$ S/m; $\varepsilon_r = 41.95$; $\rho = 1000$ kg/m³ Phantom section: Left Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007) DASY5 Configuration:

- · Probe: EX3DV4 SN3846; ConvF(9.18, 9.18, 9.18); Calibrated: 9/24/2014;
- · Sensor-Surface: 2mm (Mechanical Surface Detection)
- · Electronics: DAE4 Sn910; Calibrated: 6/16/2015
- 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 = 59.07 V/m; Power Drift = -0.06 dB

Reference Value = 59.07 V/m; Power Drift = -0.06 dB Peak SAR (extrapolated) = 3.48 W/kg SAR(1 g) = 2.33 W/kg; SAR(10 g) = 1.51 W/kg Maximum value of SAR (measured) = 2.95 W/kg



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

Certificate No: Z15-97116

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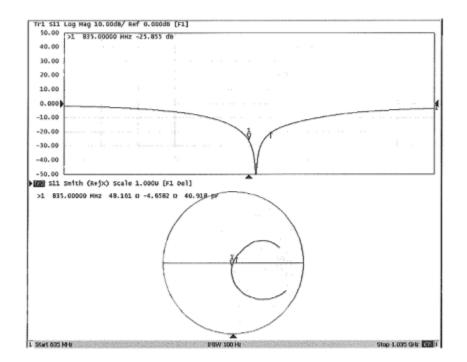






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Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL

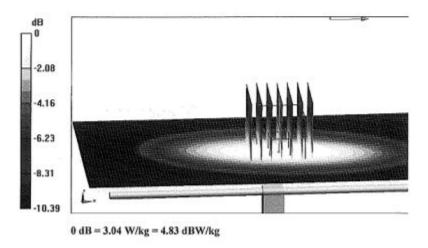
Date: 09.18.2015

Test Laboratory: CTTL, Beijing, China **DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d141** Communication System: UID 0, CW; Frequency: 835 MHz;Duty Cycle: 1:1 Medium parameters used: f = 835 MHz; $\sigma = 0.981$ S/m; $\epsilon_r = 55.99$; $\rho = 1000$ kg/m³ Phantom section: Right Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007) DASY5 Configuration:

- Probe: EX3DV4 SN3846; ConvF(9.09,9.09, 9.09); Calibrated: 9/24/2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn910; Calibrated: 6/16/2015
- · 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

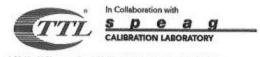
Reference Value = 56.07 V/m; Power Drift = 0.02 dB Peak SAR (extrapolated) = 3.58 W/kg SAR(1 g) = 2.39 W/kg; SAR(10 g) = 1.57 W/kg Maximum value of SAR (measured) = 3.04 W/kg



Certificate No: Z15-97116

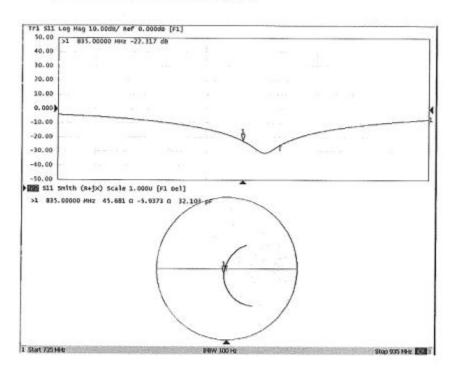
Page 7 of 8





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Impedance Measurement Plot for Body TSL



Certificate No: Z15-97116

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Add: No.51 Xueyu Tel: +86-10-62304 E-mail: cttl@china Client SM	an Road, Haidian Dis 533-2079 Fax: 4 ttl.com <u>Http:</u>	TION LABORATORY Arict, Beijing, 100191, China 186-10-62304633-2504 2www.chinattl.cn Certificate No:	Z15-97117
CALIBRATION C	ERTIFICAT	E	
Object	D1900	V2 - SN: 5d162	
Calibration Procedure(s)		-2-003-01 tion Procedures for dipole validation kits	
Calibration date:	Septen	nber 16, 2015	
Air calibrations have been humidity<70%.		the closed laboratory facility: environr	nent temperature(22±3)°C and
Primary Standards	ID #	Cal Date(Calibrated by, Certificate No	.) Scheduled Calibration
Power Meter NRP2 Power sensor NRP-Z91 Reference Probe EX3DV4 DAE4	101919 101547 SN 3846 SN 910	01-Jul-15 (CTTL, No.J15X04256) 01-Jul-15 (CTTL, No.J15X04256) 24-Sep-14(SPEAG,No.EX3-3846_Sep 16-Jun-15(SPEAG,No.DAE4-910_Jun	
Secondary Standards	ID#	Cal Date(Calibrated by, Certificate No.)) Scheduled Calibration
Signal Generator E4438C Network Analyzer E5071C	MY49071430 MY46110673	02-Feb-15 (CTTL, No.J15X00729)	Feb-16 Feb-16
	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	111
Reviewed by:	Qi Dianyuan	SAR Project Leader	aron
Approved by:	Lu Bingsong	Deputy Director of the laboratory	mappin
This calibration certificate sh	all not be reproc	Issued: S Juced except in full without written appro	September 23, 2015 val of the laboratory.

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Glossary:

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

Calibration is Performed According to the Following Standards:

- 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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 Http://www.chinattl.cn

Measurement Conditions

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

DASY Version	DASY52	52.8.8.1222
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. oraturo Т

	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	40.9 ± 6 %	1.38 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	9.96 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	40.4 mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.20 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	21.0 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	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.6±6%	1.51 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		
Design Handler Design Tol			

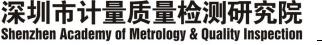
SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.2 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	41.2 mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.37 mW/g
SAR for nominal Body TSL parameters	normalized to 1W	21.6 mW /g ± 20.4 % (k=2)

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Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.0Ω+2.72jΩ
Return Loss	- 30.9dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.4Ω+ 3.95jΩ
Return Loss	- 27.3dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.301 ns

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

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

Additional EUT Data

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DASY5 Validation Report for Head TSL

Date: 09.16.2015

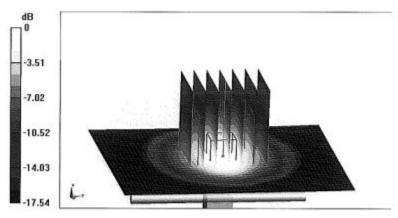
Test Laboratory: CTTL, Beijing, China DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d162 Communication System: UID 0, CW; Frequency: 1900 MHz;Duty Cycle: 1:1 Medium parameters used: f = 1900 MHz; σ = 1.378 S/m; εr = 40.94; ρ = 1000 kg/m3 Phantom section: Right Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 SN3846; ConvF(7.26, 7.26, 7.26); Calibrated: 9/24/2014;
- · Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn910; Calibrated: 6/16/2015
- 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)

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 104.1 V/m; Power Drift = -0.02 dB Peak SAR (extrapolated) = 18.0W/kg SAR(1 g) = 9.96 W/kg; SAR(10 g) = 5.2 W/kg Maximum value of SAR (measured) = 14.2 W/kg



0 dB = 14.2 W/kg = 11.52 dBW/kg

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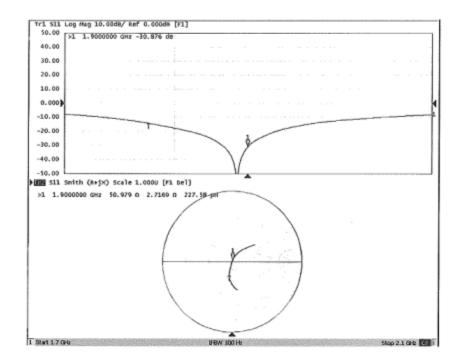


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Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL

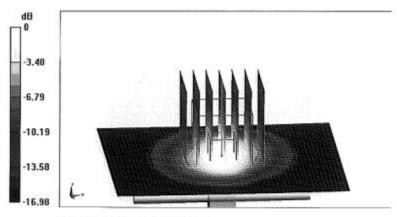
Date: 09.16.2015

Test Laboratory: CTTL, Beijing, China **DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d162** Communication System: UID 0, CW; Frequency: 1900 MHz;Duty Cycle: 1:1 Medium parameters used: f = 1900 MHz; $\sigma = 1.507$ S/m; $\varepsilon_r = 54.56$; p = 1000 kg/m³ Phantom section: Left Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007) DASY5 Configuration:

- Probe: EX3DV4 SN3846; ConvF(7.15, 7.15, 7.15); Calibrated: 9/24/2014;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn910; Calibrated: 6/16/2015
- · 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)

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 100.5 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 18.4 W/kg SAR(1 g) = 10.2 W/kg; SAR(10 g) = 5.37 W/kg Maximum value of SAR (measured) = 14.7 W/kg

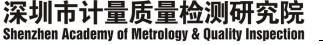


0 dB = 14.7 W/kg = 11.67 dBW/kg

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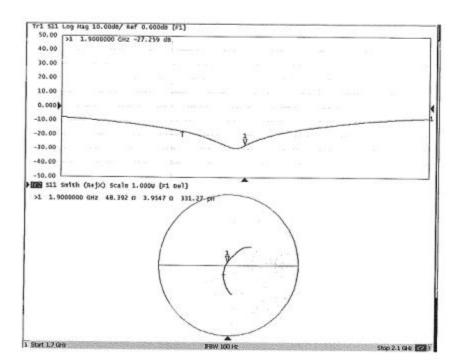






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Impedance Measurement Plot for Body TSL



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Client SMQ		Certificate No: Z	18-60333
CALIBRATION C	ERTIFICAT	re	
Object	D835V	2 - SN: 4d141	
Calibration Procedure(s)		-003-01 tion Procedures for dipole validation kits	
Calibration date:	Septen	nber 6, 2018	
		the uncertainties with confidence probability	are given on the following
All calibrations have been		the closed laboratory facility: environmen	t temperature(22±3)℃ ar
All calibrations have been humidity<70%. Calibration Equipment used	conducted in	or calibration)	- · ·
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards	M&TE critical f	or calibration) Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRVD	ID # 102083	or calibration) Cal Date(Calibrated by, Certificate No.) 01-Nov-17 (CTTL, No.J17X08756)	Scheduled Calibration Oct-18
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-Z5	ID # 100542	Cal Date(Calibrated by, Certificate No.) 01-Nov-17 (CTTL, No.J17X08756) 01-Nov-17 (CTTL, No.J17X08756)	Scheduled Calibration Oct-18 Oct-18
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-Z5 Reference Probe EX3DV4	ID # 102083 100542 SN 7464	Cal Date(Calibrated by, Certificate No.) 01-Nov-17 (CTTL, No.J17X08756) 01-Nov-17 (CTTL, No.J17X08756) 12-Sep-17(SPEAG,No.EX3-7464_Sep17)	Scheduled Calibration Oct-18 Oct-18 Sep-18
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-Z5	ID # 100542	Cal Date(Calibrated by, Certificate No.) 01-Nov-17 (CTTL, No.J17X08756) 01-Nov-17 (CTTL, No.J17X08756)	Scheduled Calibration Oct-18 Oct-18 Sep-18
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-Z5 Reference Probe EX3DV4	ID # 102083 100542 SN 7464	Cal Date(Calibrated by, Certificate No.) 01-Nov-17 (CTTL, No.J17X08756) 01-Nov-17 (CTTL, No.J17X08756) 12-Sep-17(SPEAG,No.EX3-7464_Sep17) 13-Sep-17(SPEAG,No.DAE4-1524_Sep17)	Scheduled Calibration Oct-18 Oct-18 Sep-18) Sep-18
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-25 Reference Probe EX3DV4 DAE4	Conducted in (M&TE critical for ID # 102083 100542 SN 7464 SN 1524	Cal Date(Calibrated by, Certificate No.) 01-Nov-17 (CTTL, No.J17X08756) 01-Nov-17 (CTTL, No.J17X08756) 12-Sep-17(SPEAG,No.EX3-7464_Sep17)	Scheduled Calibration Oct-18 Oct-18 Sep-18) Sep-18
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-25 Reference Probe EX3DV4 DAE4 Secondary Standards	Conducted in (M&TE critical for 10 # 102083 100542 SN 7464 SN 1524 ID #	or calibration) Cal Date(Calibrated by, Certificate No.) 01-Nov-17 (CTTL, No.J17X08756) 01-Nov-17 (CTTL, No.J17X08756) 12-Sep-17(SPEAG,No.EX3-7464_Sep17) 13-Sep-17(SPEAG,No.DAE4-1524_Sep17 Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration Oct-18 Oct-18 Sep-18) Sep-18 Scheduled Calibration
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-Z5 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	Conducted in (M&TE critical for 10 # 102083 100542 SN 7464 SN 1524 ID # MY49071430	or calibration) Cal Date(Calibrated by, Certificate No.) 01-Nov-17 (CTTL, No.J17X08756) 01-Nov-17 (CTTL, No.J17X08756) 12-Sep-17(SPEAG,No.EX3-7464_Sep17) 13-Sep-17(SPEAG,No.DAE4-1524_Sep17) Cal Date(Calibrated by, Certificate No.) 23-Jan-18 (CTTL, No.J18X00560)	Scheduled Calibration Oct-18 Oct-18 Sep-18) Sep-18 Scheduled Calibration Jan-19 Jan-19
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-Z5 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	Conducted in (M&TE critical f 102083 100542 SN 7464 SN 1524 ID # MY49071430 MY46110673	Cal Date(Calibrated by, Certificate No.) 01-Nov-17 (CTTL, No.J17X08756) 01-Nov-17 (CTTL, No.J17X08756) 12-Sep-17(SPEAG,No.EX3-7464_Sep17) 13-Sep-17(SPEAG,No.DAE4-1524_Sep17) Cal Date(Calibrated by, Certificate No.) 23-Jan-18 (CTTL, No.J18X00560) 24-Jan-18 (CTTL, No.J18X00561)	Scheduled Calibration Oct-18 Oct-18 Sep-18) Sep-18 Scheduled Calibration Jan-19
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRVD Power sensor NRV-Z5 Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	Conducted in (M&TE critical for 10 # 102083 100542 SN 7464 SN 1524 ID # MY49071430 MY46110673 Name	Cal Date(Calibrated by, Certificate No.) 01-Nov-17 (CTTL, No.J17X08756) 01-Nov-17 (CTTL, No.J17X08756) 12-Sep-17(SPEAG,No.EX3-7464_Sep17) 13-Sep-17(SPEAG,No.DAE4-1524_Sep17) Cal Date(Calibrated by, Certificate No.) 23-Jan-18 (CTTL, No.J18X00560) 24-Jan-18 (CTTL, No.J18X00561) Function	Scheduled Calibration Oct-18 Oct-18 Sep-18) Sep-18 Scheduled Calibration Jan-19 Jan-19

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Glossary:

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

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

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Measurement Conditions

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

DASY Version	DASY52	52.10.1.1476
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	42.7 ± 6 %	0.90 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		
	· · · · · · · · · · · · · · · · · · ·	Contraction of the second s	

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.32 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	9.31 mW /g ± 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.53 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	6.13 mW /g ± 18.7 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

Temperature	Permittivity	Conductivity
22.0 °C	55.2	0.97 mho/m
(22.0 ± 0.2) °C	56.0 ± 6 %	1.00 mho/m ± 6 %
<1.0 °C		
	22.0 °C (22.0 ± 0.2) °C	22.0 °C 55.2 (22.0 ± 0.2) °C 56.0 ± 6 %

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.48 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	9.74 mW /g ± 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.66 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	6.54 mW /g ± 18.7 % (k=2)

Certificate No: Z18-60333

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 http://www.chinattl.en

Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.3Ω- 5.68jΩ	
Return Loss	- 24.9dB	

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.8Ω- 7.52jΩ	
Return Loss	- 21.5dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.255 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

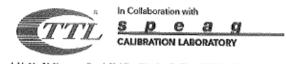
Manufactured by	SPEAG

Certificate No: Z18-60333

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DASY5 Validation Report for Head TSL

http://www.chinattl.en

Date: 09.04.2018

Test Laboratory: CTTL, Beijing, China DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d141 Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1

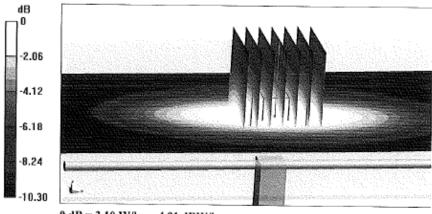
Medium parameters used: f = 835 MHz; $\sigma = 0.904$ S/m; $\varepsilon_r = 42.71$; $\rho = 1000$ kg/m3 Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 SN7464; ConvF(10.28, 10.28, 10.28) @ 835 MHz; Calibrated: • 9/12/2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1524; Calibrated: 9/13/2017
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 • (7439)

Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 57.01 V/m; Power Drift = -0.08 dB Peak SAR (extrapolated) = 3.49 W/kg SAR(1 g) = 2.32 W/kg; SAR(10 g) = 1.53 W/kg Maximum value of SAR (measured) = 3.10 W/kg



0 dB = 3.10 W/kg = 4.91 dBW/kg

Certificate No: Z18-60333

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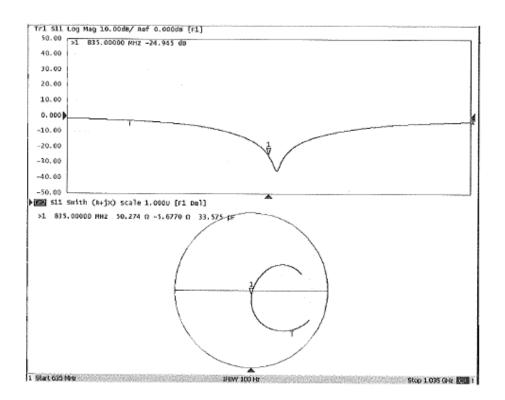


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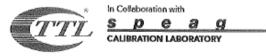
Impedance Measurement Plot for Head TSL



Certificate No: Z18-60333

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DASY5 Validation Report for Body TSL Test Laboratory: CTTL, Beijing, China DUT: Dinole 835 MHz: Type: D835V2: Serial: D83

Date: 09.06.2018

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d141

Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1 Medium parameters used: f = 835 MHz; σ = 0.998 S/m; ϵ_r = 56.04; p = 1000 kg/m3 Phantom section: Center Section

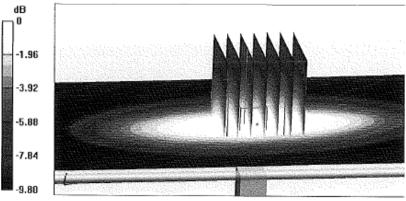
DASY5 Configuration:

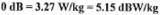
- Probe: EX3DV4 SN7464; ConvF(10.21, 10.21, 10.21) @ 835 MHz; Calibrated: 9/12/2017
- · Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1524; Calibrated: 9/13/2017
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 55.80 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 3.73 W/kg SAR(1 g) = 2.48 W/kg; SAR(10 g) = 1.66 W/kg

Maximum value of SAR (measured) = 3.27 W/kg





Certificate No: Z18-60333

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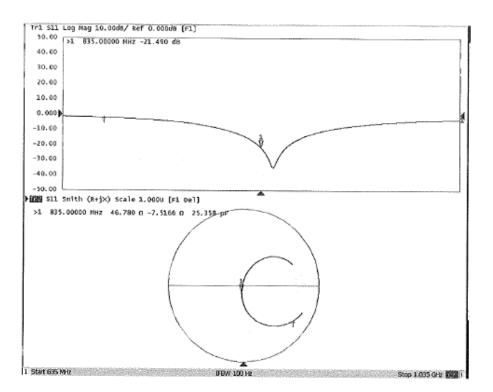


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Impedance Measurement Plot for Body TSL



Certificate No: Z18-60333

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深圳市计量质量检测研究院
Shenzhen Academy of Metrology & Quality Inspection

		pration with	中国认可
			NAS 肉脂 肉脂 肉脂 して し、
			校准 CALIBRATIO
Add: No.51 Xueyu Tel: +86-10-623046 E-mail: cttl@china	633-2079 Fax: 4	trict, Beijing, 100191, China 86-10-62304633-2504 www.chinattl.cn	CNAS L0570
Client SM0	Q	Certificate No: 2	218-60336
CALIBRATION C	ERTIFICAT	E	
Object	D1900	/2 - SN: 5d162	
Calibration Procedure(s)	EE.711	-003-01	
		tion Procedures for dipole validation kits	
Calibration date:	Calibration date: September 11, 2018		
		traceability to national standards, which r	
		the uncertainties with confidence probabilit	y are given on the following
pages and are part of the ce	ertificate.		
	conducted in	the closed laboratory facility: environment	nt temperature(22±3)°C and
humidity<70%.			
Calibration Equipment used	(M&TE critical fo	or calibration)	
Primary Standards	ID#	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRVD	102083	01-Nov-17 (CTTL, No.J17X08756)	Oct-18
Power sensor NRV-Z5	100542	01-Nov-17 (CTTL, No.J17X08756)	Oct-18
Reference Probe EX3DV4	SN 7464	12-Sep-17(SPEAG,No.EX3-7464 Sep17)	Sep-18
DAE4	SN 1524	13-Sep-17(SPEAG,No.DAE4-1524_Sep1	
			,
Secondary Standards	ID#	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	23-Jan-18 (CTTL, No.J18X00560)	Jan-19
NetworkAnalyzer E5071C	MY46110673	24-Jan-18 (CTTL, No.J18X00561)	Jan-19
NetworkAnalyzer E5071C			
	Name	Function	Jan-19 Signature
NetworkAnalyzer E5071C			
	Name	Function	
Calibrated by:	Name Zhao Jing	Function SAR Test Engineer	
Calibrated by: Reviewed by:	Name Zhao Jing Lin Jun	Function SAR Test Engineer SAR Test Engineer SAR Project Leader	

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

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Certificate No: Z18-60336

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Measurement Conditions

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

DASY Version	DASY52	52.10.1.1476
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	40.4 ± 6 %	1.44 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	2007	

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.1 mW/g
SAR for nominal Head TSL parameters	normalized to 1W	39.8 mW /g ± 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.33 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	21.1 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	53.3 ± 6 %	1.49 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	9.97 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	40.3 mW /g ± 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.38 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	21.7 mW /g ± 18.7 % (k=2)

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.0Ω+ 5.00jΩ		
Return Loss	- 24.2dB		

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.4Ω+ 5.03jΩ
Return Loss	- 25.4dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.061 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.

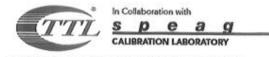
Additional EUT Data

Manufactured by	SPEAG
,	01 6110

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DASY5 Validation Report for Head TSL Test Laboratory: CTTL, Beijing, China DUT: Diracle 1000 MUre Trans. D1000022

Date: 09.10.2018

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d162 Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used: f = 1900 MHz; σ = 1.438 S/m; ϵ_r = 40.37; ρ = 1000 kg/m3

Phantom section: Center Section

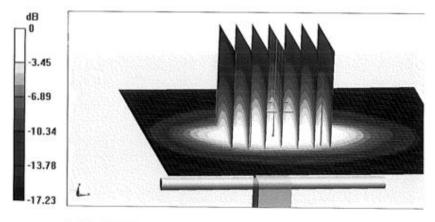
DASY5 Configuration:

- Probe: EX3DV4 SN7464; ConvF(8.39, 8.39, 8.39) @ 1900 MHz; Calibrated: 9/12/2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1524; Calibrated: 9/13/2017
- Phantom: MFP_V5.1C; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 97.60 V/m; Power Drift = -0.04 dB Peak SAR (extrapolated) = 19.0 W/kg SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.33 W/kg

Maximum value of SAR (measured) = 15.8 W/kg



0 dB = 15.8 W/kg = 11.99 dBW/kg

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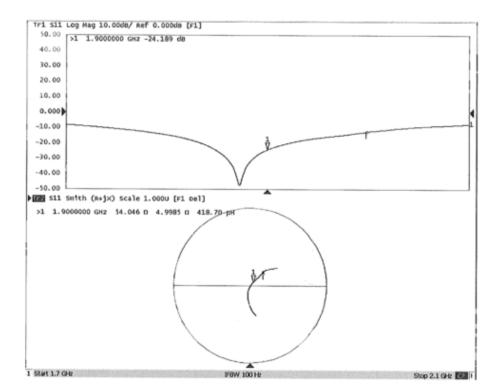


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Impedance Measurement Plot for Head TSL

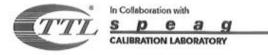


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 http://www.chinattl.cn

DASY5 Validation Report for Body TSL Test Laboratory: CTTL, Beijing, China DUT: Dinole 1900 MHz: Type: D1900V2: Serial: D1900V2

Date: 09.10.2018

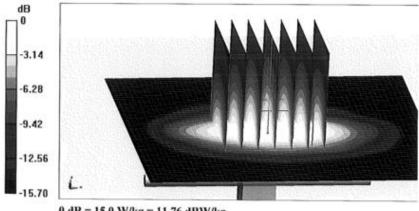
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d162 Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1900 MHz; $\sigma = 1.493$ S/m; $\varepsilon_r = 53.34$; $\rho = 1000$ kg/m3 Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 SN7464; ConvF(8.32, 8.32, 8.32) @ 1900 MHz; Calibrated: 9/12/2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1524; Calibrated: 9/13/2017
- Phantom: MFP_V5.1C; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439))

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

```
Reference Value = 94.26 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 17.5 W/kg
SAR(1 g) = 9.97 W/kg; SAR(10 g) = 5.38 W/kg
Maximum value of SAR (measured) = 15.0 W/kg
```

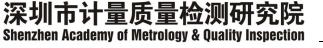


0 dB = 15.0 W/kg = 11.76 dBW/kg

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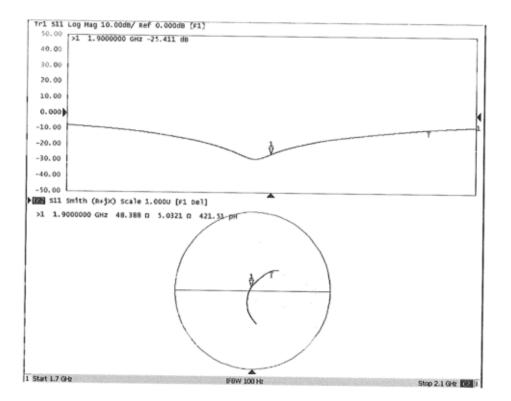


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Impedance Measurement Plot for Body TSL



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Client : SN	and the second se		ate No: Z18-97053
CALIBRATION	CERTIFICAT	E	
Object	DAE4 -	SN: 876	
Calibration Procedure(s	1		
ound upon through the	FF-Z11	-002-01	
	(DAEx)	tion Procedure for the Data Ac	equisition Electronics
Calibration date:	March 2	22, 2018	
measurements(SI). The pages and are part of th All calibrations have b humidity<70%.	measurements and e certificate. een conducted in t	the uncertainties with confidence the closed laboratory facility: er	which realize the physical units of probability are given on the following nvironment temperature(22±3)°C and
measurements(SI). The pages and are part of th All calibrations have b humidity<70%. Calibration Equipment u	measurements and e certificate. een conducted in t sed (M&TE critical fo	the uncertainties with confidence the closed laboratory facility: er	probability are given on the following nvironment temperature(22±3)℃ and
measurements(SI). The pages and are part of th	measurements and e certificate. een conducted in t sed (M&TE critical fo ID # Cal	the uncertainties with confidence the closed laboratory facility: er or calibration)	probability are given on the following nvironment temperature(22±3)°C and p.) Scheduled Calibration
measurements(SI). The pages and are part of th All calibrations have b humidity<70%. Calibration Equipment u Primary Standards	measurements and e certificate. een conducted in t sed (M&TE critical fo ID # Cal 1971018	the uncertainties with confidence the closed laboratory facility: er or calibration) Date(Calibrated by, Certificate No 27-Jun-17 (CTTL, No.J17X05859	probability are given on the following nvironment temperature(22±3)°C and b.) Scheduled Calibration) June-18
measurements(SI). The pages and are part of th All calibrations have b humidity<70%. Calibration Equipment u Primary Standards Process Calibrator 753	measurements and e certificate. een conducted in t sed (M&TE critical fo ID # Cal 1971018 : Name	the uncertainties with confidence the closed laboratory facility: er or calibration) Date(Calibrated by, Certificate No 27-Jun-17 (CTTL, No.J17X05859 Function	probability are given on the following nvironment temperature(22±3)°C and p.) Scheduled Calibration
measurements(SI). The pages and are part of th All calibrations have b humidity<70%. Calibration Equipment u Primary Standards	measurements and e certificate. een conducted in t sed (M&TE critical fo ID # Cal 1971018	the uncertainties with confidence the closed laboratory facility: er or calibration) Date(Calibrated by, Certificate No 27-Jun-17 (CTTL, No.J17X05859	probability are given on the following nvironment temperature(22±3)°C and b.) Scheduled Calibration) June-18

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Glossary: DAE

Connector angle

data acquisition electronics information used in DASY system to align probe sensor X to the robot coordinate system.

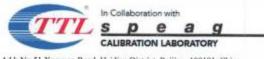
Methods Applied and Interpretation of Parameters:

- DC Voltage Measurement: Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- Connector angle: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The report provide only calibration results for DAE, it does not contain other performance test results.

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DC Voltage Measurement

A/D - Converter Re	solution nomin	nal		
High Range:	1LSB =	6.1µV.	full range =	-100+300 mV
Low Range:	1LSB =	61nV .	full range =	-1+3mV
DASY measuremen	t parameters:	Auto Zero	Time: 3 sec; Meas	uring time: 3 sec

Calibration Factors	х	Y	z	
High Range	405.525 ± 0.15% (k=2)	405.181 ± 0.15% (k=2)	405.395 ± 0.15% (k=2)	
Low Range	3.98865 ± 0.7% (k=2)	3.97176 ± 0.7% (k=2)	3.99799 ± 0.7% (k=2)	

Connector Angle

Connector Angle to be used in DASY system	181°±1°
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Certificate No: Z18-97053

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Note:

1) Per KDB865664D01 requirements for dipole calibration, the test laboratory has adopted three-year extended calibration interval. Each measured dipole is expected to evaluate with the following criteria at least on annual interval in Appendix D.

- a) There is no physical damage on the dipole;
- b) System check with specific dipole is within 10% of calibrated value;
- c) The most recent return-loss result, measured at least annually, deviates by no more than 20% from the previous measurement.
- d) The most recent measurement of the real or imaginary parts of the impedance, measured at least annually is within 5Ω from the previous measurement.



Active Ch/Trace 2 Response 3 Stimulus 4 Mis		
fr1 511 Smith (R+jx) Scale 1.0		System
>1 750.00000 MHz 54.349 Ω	• 3.380 0 28.802-pH	Print
		Abort Printing
		Printer Setup
		Invert Image ON
		Dump Screen Image
		Multiport Test Se Setup
S11 Log Mag 5.000dB/ Ref -	20.0048 [61]	Misc Setup
		mite Sarup
5.000 >1 750.00000 MHz -28		Backlight ON
5.000 >1 750.00000 MHz -28 0.000 5.000		Backlight
5.000 >1 750.00000 MHz -28 0.000 5.000 20.00		Backlight ON Firmware
5.000 >1 750.00000 MHz -25 0.000 5.000 20.00 25.00 20.00		Backlight CN Firmware Revision
5.000 >1 750.00000 MHz -25 0.000 5.000 10.00 15.00 20.00 25.00		Baddight ON Firmware Revision Service Menu Help
5.000 >1. 750.00000 MHz -25 0.000 10.00 10.00 25.00 20.00 25.00 30.00		Baddight CN Firmware Revision Service Menu
		Backlight ON Firmware Revision Service Menu Help

D750V2, serial No. 1103 Extended Dipole Calibrations

	835MHz Head					
Date of	Return-Loss	Delta(%)	Real	Delta	Imaginary	Delta
Measurement	(dB)		Impedance(ohm)	(ohm)	Impedance(ohm)	(ohm)
2017-01-10	-28.624		51.970		-3.226	
2018-01-10	-28.632	-0.03	54.349	-4.38	-3.380	-4.56

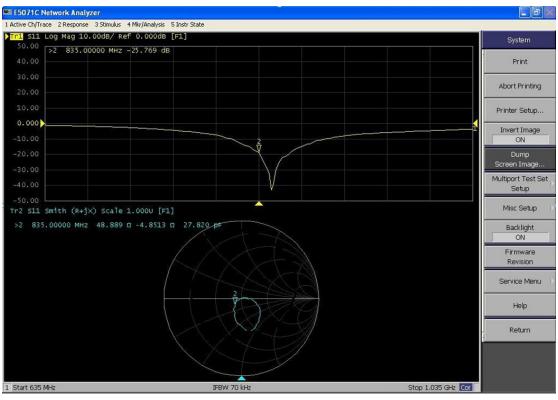


	Analysis 5 Instr State	
r1 s11 smith (R+j×) scale 1.00		System
>1 750.00000 MHz 48.888 Ω -:	3.3725 n 38.830 pF	Print Abort Printing
		Printer Setup Invert Image ON
		Dump Screen Image
		Multiport Test S Setup
2 S11 Log Mag 5.000dB/ Ref -2 5.000 >1 750.00000 MHz -29.		Misc Setup
0.000		Backlight
5.000		2 Firmware Revision
15.00		Service Menu
20.00	1	Help
25.00	W	
35.00		Return
40.00		

D750V2, serial No. 1103 Extended Dipole Calibrations

	750MHz Body					
Date of	Return-Loss	Delta(%)	Real	Delta	Imaginary	Delta
Measurement	(dB)		Impedance(ohm)	(ohm)	Impedance(ohm)	(ohm)
2017-01-10	-29.149		49.119		-3.345	
2018-01-10	-29.404	-0.87	48.888	0.48	-3.373	0.41

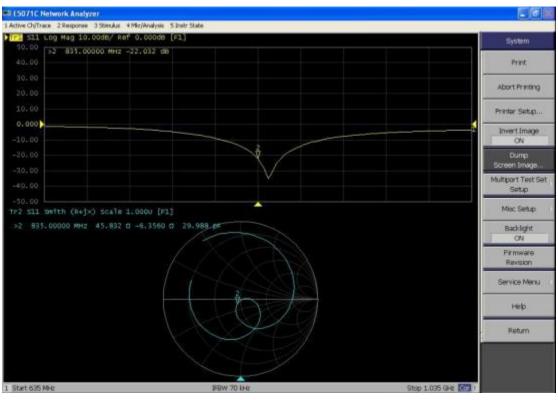




D835V2, serial No. 4d141 Extended Dipole Calibrations

	835MHz Head					
Date of	Return-Loss	Delta(%)	Real	Delta	Imaginary	Delta
Measurement	(dB)		Impedance(ohm)	(ohm)	Impedance(ohm)	(ohm)
2015-09-24	-25.885		48.161		-4.66	
2017-09-24	-25.769	0.46	48.889	-1.49	-4.85	-3.92

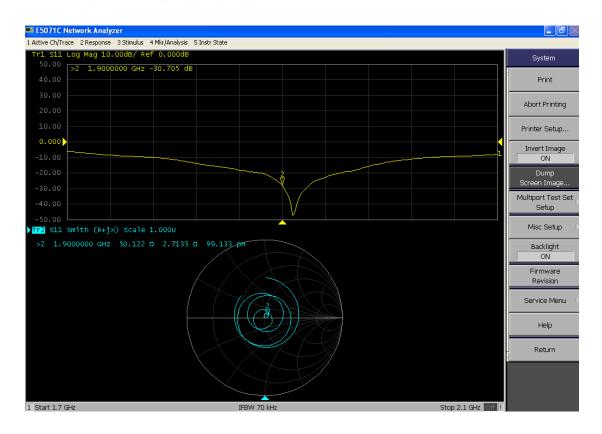




D835V2, serial No. 4d141 Extended Dipole Calibrations

	835MHz Body					
Date of	Return-Loss	Delta(%)	Real	Delta	Imaginary	Delta
Measurement	(dB)		Impedance(ohm)	(ohm)	Impedance(ohm)	(ohm)
2015-09-24	-22.3		45.681		-5.94	
2017-09-24	-22.0	1.36	45.832	-0.151	-6.35	0.41

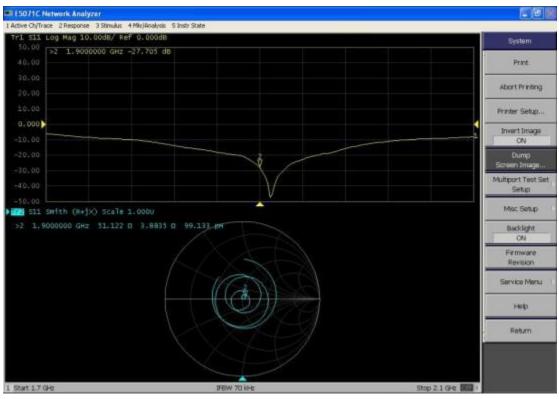




D1900V2, serial No. 5d162 Extended Dipole Calibrations

	1900MHz Head					
Date of	Return-Loss	Delta(%)	Real	Delta	Imaginary	Delta
Measurement	(dB)		Impedance(ohm)	(ohm)	Impedance(ohm)	(ohm)
2015-09-16	-30.876		50.979		2.720	
2017-09-16	-30.705	0.56	51.122	0.28	2.714	0.23





D1900V2, serial No. 5d162 Extended Dipole Calibrations

	1900MHz Body					
Date of	Return-Loss	Delta(%)	Real	Delta	Imaginary	Delta
Measurement	(dB)		Impedance(ohm)	(ohm)	Impedance(ohm)	(ohm)
2015-09-16	-27.259		48.392		3.955	
2017-09-16	-27.705	-1.6	51.122	-2.73	3.884	0.071