



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

 Tel: +86-10-62304633-2079
 Fax: +86-10-62304633-2504

 E-mail: ettl@chinattl.com
 http://www.chinattl.en

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%.

Certificate No: Z19-60291

Page 2 of 8





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

Measurement Conditions

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

DASY Version	DASY52	V52.10.2
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	

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	41.6 ± 6 %	0.90 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.16 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.53 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.44 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.70 W/kg ± 18.7 % (k=2)

Body TSL parameters The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.9 ± 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	2.16 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	8.78 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.45 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	5.87 W/kg ±18.7 % (k=2)

Certificate No: Z19-60291





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

 Tel: +86-10-62304633-2079
 Fax: +86-10-62304633-2504

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

Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.5Ω- 4.53jΩ	
Return Loss	- 26.9dB	

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.5Ω- 3.38jΩ	
Return Loss	- 28.5dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	0.900 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
Mandiactored by	OF LAG

Certificate No: Z19-60291

Page 4 of 8





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

 Tel: +86-10-62304633-2079
 Fax: +86-10-62304633-2504

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

DASY5 Validation Report for Head TSL Test Laboratory: CTTL, Beijing, China

Date: 09.03.2019

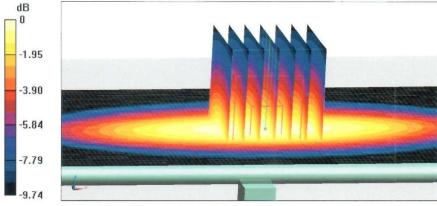
DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1163 Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1 Medium parameters used: f = 750 MHz; $\sigma = 0.904$ S/m; $\varepsilon_r = 41.62$; $\rho = 1000$ kg/m3 Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 SN3617; ConvF(10.03, 10.03, 10.03) @ 750 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; Calibrated: 8/22/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

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

```
Reference Value = 55.16 \text{ V/m}; Power Drift = -0.02 \text{ dB}
Peak SAR (extrapolated) = 3.11 \text{ W/kg}
SAR(1 g) = 2.16 \text{ W/kg}; SAR(10 g) = 1.44 \text{ W/kg}
Maximum value of SAR (measured) = 2.81 \text{ W/kg}
```



0 dB = 2.81 W/kg = 4.49 dBW/kg

Certificate No: Z19-60291

Page 5 of 8

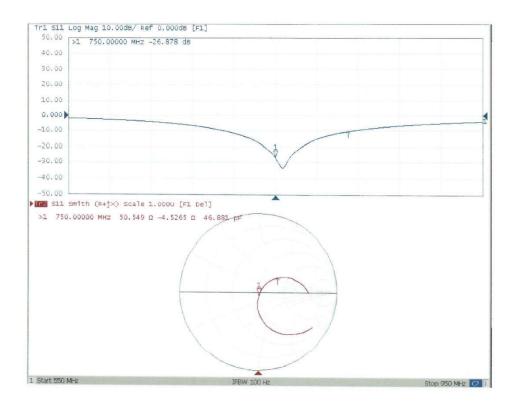






Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504 E-mail: cttl@chinattl.com http://www.chinattl.cn

Impedance Measurement Plot for Head TSL



Certificate No: Z19-60291

Page 6 of 8





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

 Tel: +86-10-62304633-2079
 Fax: +86-10-62304633-2504

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

DASY5 Validation Report for Body TSL Date: 09.03.2019 Test Laboratory: CTTL, Beijing, China DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1163 Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1

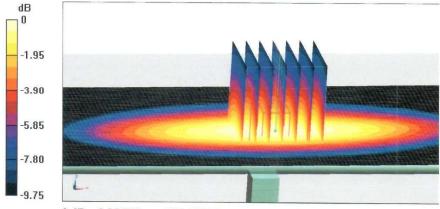
Medium parameters used: f = 750 MHz; $\sigma = 0.942 \text{ S/m}$; $\epsilon_r = 55.87$; $\rho = 1000 \text{ kg/m3}$ Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 SN3617; ConvF(9.85, 9.85, 9.85) @ 750 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; Calibrated: 8/22/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

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

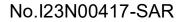
Reference Value = 52.88 V/m; Power Drift = 0.03 dBPeak SAR (extrapolated) = 3.20 W/kgSAR(1 g) = 2.16 W/kg; SAR(10 g) = 1.45 W/kgMaximum value of SAR (measured) = 2.85 W/kg



0 dB = 2.85 W/kg = 4.55 dBW/kg

Certificate No: Z19-60291

Page 7 of 8





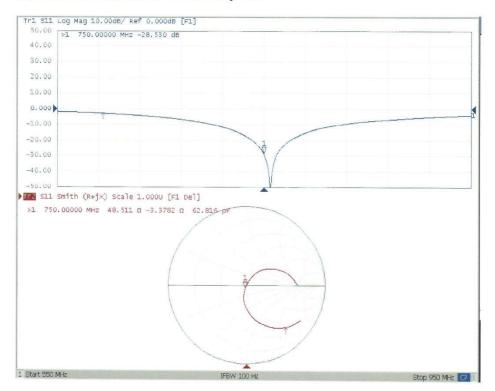


 Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China

 Tel: +86-10-62304633-2079
 Fax: +86-10-62304633-2504

 E-mail: ettl@chinattl.com
 http://www.chinattl.cn

Impedance Measurement Plot for Body TSL



Certificate No: Z19-60291

Page 8 of 8



750MHz Dipole (2022)

Add: No.52 HuaYuanBei Ros Tel: +86-10-62304633-2117		bugues, too to t	AS L0570
E-mail: emf@caict.ac.cn Client SAIC	http://www.caict		2-60333
CALIBRATION CE	ERTIFICAT	E	
Object	D750V3	3 - SN: 1163	
Calibration Procedure(s)	FF-Z11 Calibra	-003-01 tion Procedures for dipole validation kits	
Calibration date:	August	22, 2022	
measurements (SI). The me	asurements and	traceability to national standards, which rea the uncertainties with confidence probability	
pages and are part of the ce	rtificate.		
All calibrations have been humidity<70%.	conducted in t	he closed laboratory facility: environment t or calibration)	temperature (22±3)°C and
All calibrations have been humidity<70%. Calibration Equipment used	conducted in t	or calibration)	
All calibrations have been humidity<70%. Calibration Equipment used	conducted in t		
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4	Conducted in t (M&TE critical for ID # 106277 104291 SN 7464	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 26-Jan-22(SPEAG,No.EX3-7464_Jan22)	Scheduled Calibration Sep-22 Sep-22 Jan-23
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4	conducted in t (M&TE critical fo ID # 106277 104291 SN 7464 SN 1556	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 26-Jan-22(SPEAG,No.EX3-7464_Jan22) 12-Jan-22(CTTL-SPEAG,No.Z22-60007)	Scheduled Calibration Sep-22 Sep-22 Jan-23 Jan-23
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	conducted in t (M&TE critical fo ID # 106277 104291 SN 7464 SN 1556 ID # MY49071430	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 26-Jan-22(SPEAG,No.EX3-7464_Jan22) 12-Jan-22(CTTL-SPEAG,No.Z22-60007) Cal Date (Calibrated by, Certificate No.) 13-Jan-22 (CTTL, No.J22X00409)	Scheduled Calibration Sep-22 Sep-22 Jan-23 Jan-23 Scheduled Calibration Jan-23
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C Network Analyzer E5071C	conducted in t (M&TE critical for 10 # 106277 104291 SN 7464 SN 1556 ID # MY49071430 MY46110673	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 26-Jan-22(SPEAG,No.EX3-7464_Jan22) 12-Jan-22(CTTL-SPEAG,No.Z22-60007) Cal Date (Calibrated by, Certificate No.) 13-Jan-22 (CTTL, No.J22X00409) 14-Jan-22 (CTTL, No.J22X00406)	Scheduled Calibration Sep-22 Jan-23 Jan-23 Scheduled Calibration Jan-23 Jan-23
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	conducted in t (M&TE critical fo ID # 106277 104291 SN 7464 SN 1556 ID # MY49071430 MY46110673 Name	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 26-Jan-22(SPEAG,No.EX3-7464_Jan22) 12-Jan-22(CTTL-SPEAG,No.Z22-60007) Cal Date (Calibrated by, Certificate No.) 13-Jan-22 (CTTL, No.J22X00409) 14-Jan-22 (CTTL, No.J22X00406) Function	Scheduled Calibration Sep-22 Jan-23 Jan-23 Scheduled Calibration Jan-23 Jan-23

Certificate No: Z22-60333

Page 1 of 6







a





Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2117 http://www.caiet.ac.cn E-mail: emf@caict.ac.cn

Glossary:

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

Calibration is Performed According to the Following Standards:

- a) IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020
- b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

c) 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: Z22-60333

Page 2 of 6









Add: No.52 HuaYuanBei Road, Haidian District, Beljing, 100191, China Tel: +86-10-62304633-2117 E-mail: emf@caict.ac.cn http://www.caict.ac.cn

Measurement Conditions

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

DASY Version	DASY52	V52.10.4
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	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	42.0	0.90 mho/m
Measured Head TSL parameters	(22.0 ±0.2) °C	41.3 ±6 %	0.90 mho/m ±6 %
Head TSL temperature change during test	<1.0 °C		13-51C

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.15 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.48 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.42 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.62 W/kg ±18.7 % (k=2)

Certificate No: Z22-60333

Page 3 of 6







Add: No.52 HuaYuanBei Road, Haldian District, Beijing, 100191, China Tel: +86-10-62304633-2117 E-mail: emf@caict.ac.cn http://www.caict.ac.cn

Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.0Ω- 4.06jΩ
Return Loss	- 27.8dB

General Antenna Parameters and Design

Electrical Delay (one direction)	0.941 ns	
----------------------------------	----------	--

After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point 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 feed-point may be damaged.

fanufactured by	SPEAG

Certificate No: Z22-60333

Page 4 of 6







Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2117 E-mail: emf@caict.ac.en http://www.caict.ac.en

DASY5 Validation Report for Head TSL

Date: 2022-08-22

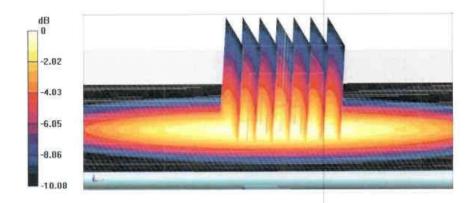
Test Laboratory: CTTL, Beijing, China **DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1163** Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1 Medium parameters used: f = 750 MHz; $\sigma = 0.902$ S/m; $\varepsilon_r = 41.26$; $\rho = 1000$ kg/m³ Phantom section: Right Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 SN7464; ConvF(10.26, 10.26, 10.26) @ 750 MHz; Calibrated: 2022-01-26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2022-01-12
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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

Reference Value = 55.49 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 3.17 W/kg SAR(1 g) = 2.15 W/kg; SAR(10 g) = 1.42 W/kg Smallest distance from peaks to all points 3 dB below = 21.2 mm Ratio of SAR at M2 to SAR at M1 = 67.5% Maximum value of SAR (measured) = 2.84 W/kg



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

Certificate No: Z22-60333

Page 5 of 6



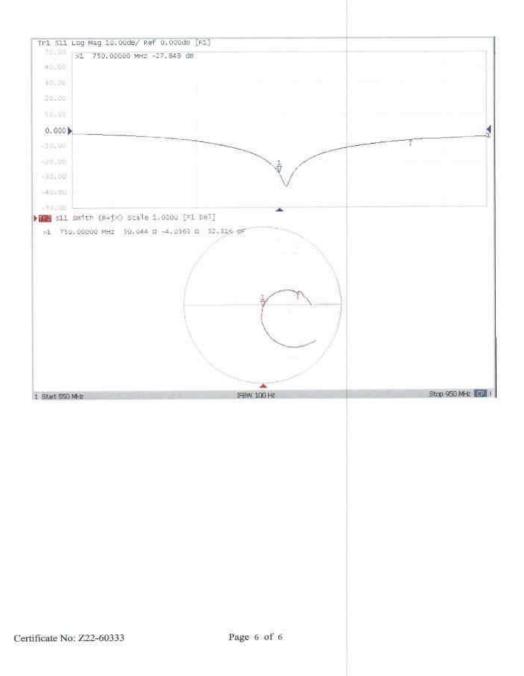




CAICT

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2117 E-mail: emf@caict.ac.cn http://www.caict.ac.cn

Impedance Measurement Plot for Head TSL





835MHz Dipole (2021)

Add: No.52 HuaYua Tel: +86-10-623046 E-mail: ettl a chinati	33-2079 Pax: +	86-10-62304633-2504	CNAS L0570
Client SAICT	in the second	www.chinattl.en Certificate No: Z2	1-60355
CALIBRATION CE	ERTIFICAT	E	
Dbject	D835V	2 - SN: 4d057	and the
alibration Procedure(s)	FF-Z11	-003-01	
	Calibra	tion Procedures for dipole validation kits	
alibration date:	Octobe	r 18, 2021	
Il calibrations have been	conducted in t	he closed laboratory facility: environment t	emperature (22±3)°C and
umidity<70%. alibration Equipment used rimary Standards Power Meter NRP2	(M&TE critical fo ID # 106277 104291	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326)	Scheduled Calibration Sep-22 Sep-22
umidity<70%. alibration Equipment used rimary Standards Power Meter NRP2 Power sensor NRP8S	ID # 106277	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326)	Sep-22
umidity<70%. alibration Equipment used rimary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4	ID # 106277 104291	Cal Date (Calibrated by Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326)	Sep-22 Sep-22
umidity<70%. alibration Equipment used rimary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4	ID # 106277 104291 SN 7517	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21(CTTL-SPEAG,No.Z21-60001) 15-Jan-21(SPEAG,No.DAE4-1556_Jan21)	Sep-22 Sep-22 Feb-22
umidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards	ID # 106277 104291 SN 7517 SN 1556	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21(CTTL-SPEAG,No.Z21-60001)	Sep-22 Sep-22 Feb-22 Jan-22
umidity<70%. calibration Equipment used rimary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ID # 106277 104291 SN 7517 SN 1556 ID #	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21(CTTL-SPEAG,No.Z21-60001) 15-Jan-21(SPEAG,No.DAE4-1556_Jan21) Cal Date (Calibrated by, Certificate No.)	Sep-22 Sep-22 Feb-22 Jan-22 Scheduled Calibration
umidity<70%. alibration Equipment used rimary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ID # 106277 104291 SN 7517 SN 1556 ID # MY49071430	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21(CTTL-SPEAG,No.Z21-60001) 15-Jan-21(SPEAG,No.DAE4-1556_Jan21) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593)	Sep-22 Sep-22 Feb-22 Jan-22 Scheduled Calibration Jan-22
umidity<70%. alibration Equipment used rimary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	ID # 106277 104291 SN 7517 SN 1556 ID # MY49071430 MY46110673	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21(CTTL-SPEAG,No.Z21-60001) 15-Jan-21(SPEAG,No.DAE4-1556_Jan21) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593) 14-Jan-21 (CTTL, No.J21X00232)	Sep-22 Sep-22 Feb-22 Jan-22 Scheduled Calibration Jan-22 Jan-22
umidity<70%. alibration Equipment used rimary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	ID # 106277 104291 SN 7517 SN 1556 ID # MY49071430 MY46110673 Name	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21(CTTL-SPEAG No.Z21-60001) 15-Jan-21(SPEAG,No.DAE4-1556_Jan21) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593) 14-Jan-21 (CTTL, No.J21X00232) Function	Sep-22 Sep-22 Feb-22 Jan-22 Scheduled Calibration Jan-22 Jan-22 Signature
umidity<70%. alibration Equipment used rimary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	ID # 106277 104291 SN 7517 SN 1556 ID # MY49071430 MY46110673 Name Zhao Jing	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21(CTTL-SPEAG,No.Z21-60001) 15-Jan-21(SPEAG,No.DAE4-1556_Jan21) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593) 14-Jan-21 (CTTL, No.J21X00232) Function SAR Test Engineer	Sep-22 Sep-22 Feb-22 Jan-22 Scheduled Calibration Jan-22 Jan-22 Signature
umidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C Calibrated by: Reviewed by:	ID # 106277 104291 SN 7517 SN 1556 ID # MY49071430 MY46110673 Name Zhao Jing Lin Hao	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21(CTTL-SPEAG,No.Z21-60001) 15-Jan-21(SPEAG,No.DAE4-1556_Jan21) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593) 14-Jan-21 (CTTL, No.J21X00232) Function SAR Test Engineer SAR Test Engineer	Sep-22 Feb-22 Jan-22 Scheduled Calibration Jan-22 Jan-22 Signature





 Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China

 Tel: +86-10-62304633-2079
 Fax: +86-10-62304633-2504

 E-mail: ettl@chinattl.com
 http://www.chinattl.cn

Glossary:

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

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- d) 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: Z21-60355

Page 2 of 6





Add: No.52 Hua YuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504 E-mail: ettl@chinattl.com http://www.chinattl.en

Measurement Conditions

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

DASY Version	DASY52	V52.10.4
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	40.9 ± 6 %	0.89 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	Serie .	

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.39 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.64 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.56 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.29 W/kg ± 18.7 % (k=2)

Certificate No: Z21-60355

Page 3 of 6







E-mail: ettl a chinattl.com http://www.chinattl.en

Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49,8Ω- 4.19jΩ
Return Loss	- 27.5dB

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 onnected 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 concerned to the dipole arms, because they might bend or the soldered concerned to the dipole arms. connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
manadaroa by	of End

Certificate No: Z21-60355

Page 4 of 6





 Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China

 Tel: =86-10-62304633-2079
 Fax: =86-10-62304633-2504

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

DASY5 Validation Report for Head TSL Test Laboratory: CTTL, Beijing, China

Date: 10.18.2021

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d057 Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1

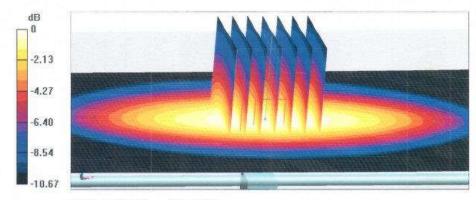
Medium parameters used: f = 835 MHz; σ = 0.886 S/m; ϵ_r = 40.9; ρ = 1000 kg/m³ Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 SN7517; ConvF(9.81, 9.81, 9.81) @ 835 MHz; Calibrated: 2021-02-03
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2021-01-15
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4): SEMCAD X Version 14.6.14 (7501)

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

Reference Value – 58.86 V/m; Power Drift = 0.00 dB Peak SAR (extrapolated) = 3.68 W/kg SAR(1 g) = 2.39 W/kg; SAR(10 g) = 1.56 W/kg Smallest distance from peaks to all points 3 dB below = 18 mm Ratio of SAR at M2 to SAR at M1 = 64.9% Maximum value of SAR (measured) = 3.23 W/kg



0 dB = 3.23 W/kg = 5.09 dBW/kg

Certificate No: Z21-60355

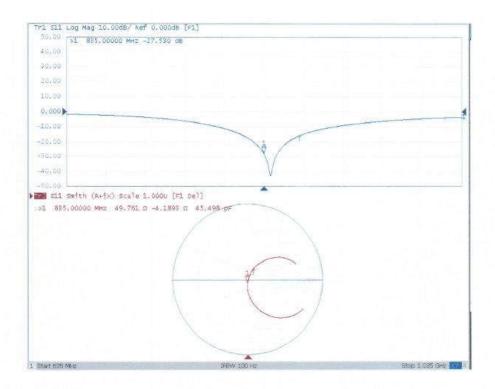
Page 5 of 6





Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504 E-mail: cttl@chinattl.com http://www.chinattl.en

Impedance Measurement Plot for Head TSL



Certificate No: Z21-60355

Page 6 of 6



1750MHz Dipole (2019)

		e a g	中国认可国际互认权
Add: No.51 Xueyuan Tel: +86-10-6230463 E-mail: ettl <i>a</i> chinattl.	Road, Haidian Distr 3-2079 Fax: +8	ict. Beijing, 100191, China 66-10-62304633-2504 www.chinattl.cn	CALIBRATION CNAS L0570
	South Branch	- HE - H	60292
CALIBRATION CE	and the second second		
Object	D1750\	/2 - SN: 1152	
Object	D1750V	2-5N. 1152	
Calibration Procedure(s)	FF-Z11-	003-01	
		ion Procedures for dipole validation kits	
Calibration date:	August	30, 2019	
measurements(SI). The mea pages and are part of the cer All calibrations have been humidity<70%.	asurements and rtificate. conducted in f	raceability to national standards, which rea the uncertainties with confidence probability a the closed laboratory facility: environment	are given on the following
Calibration Equipment used		or calibration)	
Primary Standards	ID #		
		Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106276	11-Apr-19 (CTTL, No.J19X02605)	Apr-20
Power sensor NRP6A	101369	11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605)	Apr-20 Apr-20
Power sensor NRP6A Reference Probe EX3DV4	101369 SN 3617	11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19(SPEAG,No.EX3-3617_Jan19)	Apr-20 Apr-20 Jan-20
Power sensor NRP6A	101369	11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605)	Apr-20 Apr-20
Power sensor NRP6A Reference Probe EX3DV4 DAE4	101369 SN 3617	11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19(SPEAG,No.EX3-3617_Jan19)	Apr-20 Apr-20 Jan-20
Power sensor NRP6A Reference Probe EX3DV4	101369 SN 3617 SN 1555	11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19(SPEAG,No.EX3-3617_Jan19) 22-Aug-19(CTTL-SPEAG,No.Z19-60295)	Apr-20 Apr-20 Jan-20 Aug-20
Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards	101369 SN 3617 SN 1555 ID #	11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19(SPEAG,No.EX3-3617_Jan19) 22-Aug-19(CTTL-SPEAG,No.Z19-60295) Cal Date(Calibrated by, Certificate No.)	Apr-20 Apr-20 Jan-20 Aug-20 Scheduled Calibration
Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	101369 SN 3617 SN 1555 ID # MY49071430	11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19 (SPEAG,No.EX3-3617_Jan19) 22-Aug-19 (CTTL-SPEAG,No.Z19-60295) Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336)	Apr-20 Apr-20 Jan-20 Aug-20 Scheduled Calibration Jan-20
Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	101369 SN 3617 SN 1555 ID # MY49071430 MY46110673 Name	11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19 (SPEAG,No.EX3-3617_Jan19) 22-Aug-19 (CTTL-SPEAG,No.Z19-60295) Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336) 24-Jan-19 (CTTL, No.J19X00547) Function	Apr-20 Apr-20 Jan-20 Aug-20 Scheduled Calibration Jan-20 Jan-20
Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	101369 SN 3617 SN 1555 ID # MY49071430 MY46110673	11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19(SPEAG,No.EX3-3617_Jan19) 22-Aug-19(CTTL-SPEAG,No.Z19-60295) Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336) 24-Jan-19 (CTTL, No.J19X00547)	Apr-20 Apr-20 Jan-20 Aug-20 Scheduled Calibration Jan-20 Jan-20
Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	101369 SN 3617 SN 1555 ID # MY49071430 MY46110673 Name	11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19 (SPEAG,No.EX3-3617_Jan19) 22-Aug-19 (CTTL-SPEAG,No.Z19-60295) Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336) 24-Jan-19 (CTTL, No.J19X00547) Function	Apr-20 Apr-20 Jan-20 Aug-20 Scheduled Calibration Jan-20 Jan-20
Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	101369 SN 3617 SN 1555 ID # MY49071430 MY46110673 Name Zhao Jing	11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19 (SPEAG,No.EX3-3617_Jan19) 22-Aug-19 (CTTL-SPEAG,No.Z19-60295) Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336) 24-Jan-19 (CTTL, No.J19X00547) Function SAR Test Engineer	Apr-20 Apr-20 Jan-20 Aug-20 Scheduled Calibration Jan-20 Jan-20
Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C Calibrated by: Reviewed by: Approved by:	101369 SN 3617 SN 1555 ID # MY49071430 MY46110673 Name Zhao Jing Lin Hao Qi Dianyuan	11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19 (SPEAG,No.EX3-3617_Jan19) 22-Aug-19 (CTTL-SPEAG,No.Z19-60295) Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336) 24-Jan-19 (CTTL, No.J19X00547) Function SAR Test Engineer SAR Test Engineer SAR Project Leader	Apr-20 Apr-20 Jan-20 Aug-20 Scheduled Calibration Jan-20 Jan-20 Signature

Certificate No: Z19-60292

Page 1 of 8





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

 Tel: +86-10-62304633-2079
 Fax: +86-10-62304633-2504

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

Glossary:

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

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- d) 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: Z19-60292

Page 2 of 8





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

Measurement Conditions

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

DASY Version	DASY52	V52.10.2
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	1750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.9±6%	1.36 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

SA

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.05 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	36.4 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	4.80 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	19.3 W/kg ± 18.7 % (k=2)

Body TSL parameters The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.1 ± 6 %	1.52 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	9.45 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	37.3 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.05 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.0 W/kg ± 18.7 % (k=2)

Certificate No: Z19-60292

Page 3 of 8





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

 Tel: +86-10-62304633-2079
 Fax: +86-10-62304633-2504

 E-mail: ettl@chinattl.com
 http://www.chinattl.cn

Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.1Ω- 0.84 jΩ
Return Loss	- 38.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.2Ω- 1.37 jΩ
Return Loss	- 25.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.084 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: Z19-60292

Page 4 of 8





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

DASY5 Validation Report for Head TSL

Date: 08.30.2019

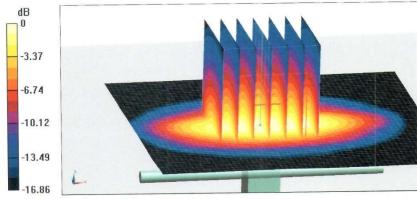
Test Laboratory: CTTL, Beijing, China **DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1152** Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1750 MHz; $\sigma = 1.358$ S/m; $\epsilon_r = 39.91$; $\rho = 1000$ kg/m3 Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 SN3617; ConvF(8.38, 8.38, 8.38) @ 1750 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; Calibrated: 8/22/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 97.38 V/m; Power Drift = -0.03 dB Peak SAR (extrapolated) = 16.8 W/kg

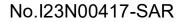
SAR(1 g) = 9.05 W/kg; SAR(10 g) = 4.8 W/kg Maximum value of SAR (measured) = 13.9 W/kg



0 dB = 13.9 W/kg = 11.43 dBW/kg

Certificate No: Z19-60292

Page 5 of 8





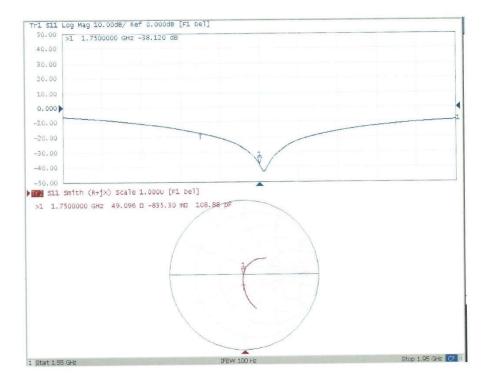


 Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China

 Tel: +86-10-62304633-2079
 Fax: +86-10-62304633-2504

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

Impedance Measurement Plot for Head TSL



Certificate No: Z19-60292

Page 6 of 8





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

 Tel: +86-10-62304633-2079
 Fax: +86-10-62304633-2504

 E-mail: ettl@chinattl.com
 http://www.chinattl.en

DASY5 Validation Report for Body TSL Test Laboratory: CTTL, Beijing, China

Date: 08.30.2019

Test Laboratory: CTTL, Beijing, China **DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1152** Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1750 MHz; $\sigma = 1.516$ S/m; $\varepsilon_r = 53.05$; $\rho = 1000$ kg/m3 Phantom section: Center Section

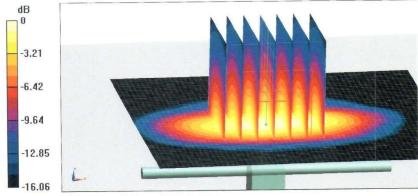
DASY5 Configuration:

- Probe: EX3DV4 SN3617; ConvF(8.03, 8.03, 8.03) @ 1750 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; Calibrated: 8/22/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

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

Reference Value = 87.16 V/m; Power Drift = 0.06 dB Peak SAR (extrapolated) = 17.0 W/kg SAR(1 g) = 9.45 W/kg; SAR(10 g) = 5.05 W/kg

Maximum value of SAR (measured) = 14.4 W/kg



0 dB = 14.4 W/kg = 11.58 dBW/kg

Certificate No: Z19-60292

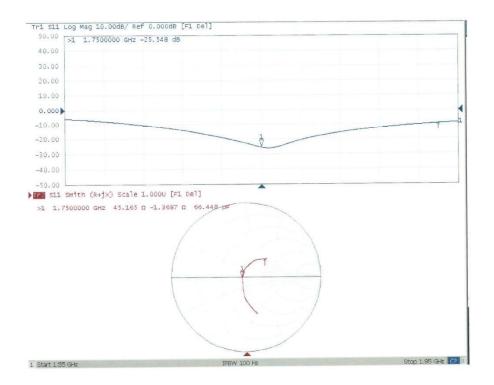
Page 7 of 8





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

Impedance Measurement Plot for Body TSL



Certificate No: Z19-60292

Page 8 of 8



1750MHz Dipole (2022)

Add No 51 Has Mars Dol B	A TLAN DUAL		
Add: No.52 HuaYuanBei Re Tel: +86-10-62304633-2117 E-mail: emf@caiet.ac.cn	http://www.caic		CNAS L0570
Client SAIC	And the set of the set		Z22-60335
CALIBRATION CI	ERTIFICAT	E	
Object	D1750	V2 - SN: 1152	
Calibration Procedure(s)			
	1.0.0.000000	-003-01	
	Calibra	tion Procedures for dipole validation kits	
Calibration date:	August	22, 2022	
pages and are part of the ce	artificate.	the uncertainties with confidence probabil	
cages and are part of the ce All calibrations have been numidity<70%. Calibration Equipment used Primary Standards	conducted in t (M&TE critical fo	he closed laboratory facility: environmen or calibration) Cal Date (Calibrated by, Certificate No.)	nt temperature (22±3)°C and Scheduled Calibration
bages and are part of the ce All calibrations have been humidity<70%. Calibration Equipment used	ertificate. conducted in t (M&TE critical fo	he closed laboratory facility: environmer or calibration)	it temperature (22±3)°C and
Pages and are part of the ce All calibrations have been numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4	ID # 106277 104291 SN 7464	he closed laboratory facility: environment or calibration) Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 26-Jan-22(SPEAG,No.EX3-7464_Jan22)	It temperature (22±3)°C and Scheduled Calibration Sep-22 Sep-22 Jan-23
Pages and are part of the ce All calibrations have been numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S	ID # 106277 104291	he closed laboratory facility: environment or calibration) Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326)	It temperature (22±3)°C and Scheduled Calibration Sep-22 Sep-22 Jan-23
Calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4	ID # 106277 104291 SN 7464	he closed laboratory facility: environment or calibration) Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 26-Jan-22(SPEAG,No.EX3-7464_Jan22)	It temperature (22±3)°C and Scheduled Calibration Sep-22 Sep-22 Jan-23
pages and are part of the ce All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4	ID # 106277 104291 SN 7464 SN 1556	he closed laboratory facility: environment or calibration) Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 26-Jan-22(SPEAG,No.EX3-7464_Jan22) 12-Jan-22(CTTL-SPEAG,No.Z22-60007)	Scheduled Calibration Sep-22 Sep-22 Jan-23 Jan-23
bages and are part of the ce All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards	ertificate. conducted in t (M&TE critical fr ID # 106277 104291 SN 7464 SN 1556 ID # ID # MY49071430	he closed laboratory facility: environment or calibration) Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 26-Jan-22(SPEAG,No.EX3-7464_Jan22) 12-Jan-22(CTTL-SPEAG,No.Z22-60007) Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration Sep-22 Sep-22 Jan-23 Jan-23 Scheduled Calibration
bages and are part of the ce All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ertificate. conducted in t (M&TE critical fr ID # 106277 104291 SN 7464 SN 1556 ID # ID # MY49071430	he closed laboratory facility: environment or calibration) Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 26-Jan-22(SPEAG,No.EX3-7464_Jan22) 12-Jan-22(CTTL-SPEAG,No.Z22-60007) Cal Date (Calibrated by, Certificate No.) 13-Jan-22 (CTTL, No.J22X00409)	Scheduled Calibration Sep-22 Sep-22 Jan-23 Jan-23 Scheduled Calibration Jan-23
bages and are part of the ce All calibrations have been numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C Network Analyzer E5071C	ertificate. conducted in t (M&TE critical for ID # 106277 104291 SN 7464 SN 1556 ID # MY49071430 MY46110673	he closed laboratory facility: environment or calibration) Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 26-Jan-22(SPEAG,No.EX3-7464_Jan22) 12-Jan-22(CTTL-SPEAG,No.Z22-60007) Cal Date (Calibrated by, Certificate No.) 13-Jan-22 (CTTL, No.J22X00409) 14-Jan-22 (CTTL, No.J22X00406)	Scheduled Calibration Sep-22 Sep-22 Jan-23 Jan-23 Scheduled Calibration Jan-23 Jan-23 Jan-23
pages and are part of the ce All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ertificate. conducted in t (M&TE critical fo ID # 106277 104291 SN 7464 SN 1556 ID # MY49071430 MY46110673 Name	he closed laboratory facility: environment or calibration) Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 26-Jan-22(SPEAG,No.EX3-7464_Jan22) 12-Jan-22(CTTL-SPEAG,No.Z22-60007) Cal Date (Calibrated by, Certificate No.) 13-Jan-22 (CTTL, No.J22X00409) 14-Jan-22 (CTTL, No.J22X00406) Function	Scheduled Calibration Sep-22 Sep-22 Jan-23 Jan-23 Scheduled Calibration Jan-23 Jan-23 Jan-23

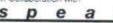
Certificate No: Z22-60335

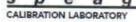
Page 1 of 6













Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2117 E-mail: emf@caict.ac.en http://www.caict.ac.cn

Glossary:

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

Calibration is Performed According to the Following Standards:

- a) IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020
- b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

c) 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: Z22-60335

Page 2 of 6













Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2117 E-mail: emf@caict.ac.cn http://www.caict.ac.en

Measurement Conditions

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

DASY Version	DASY52	52.10.4
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	1750 MHz ±1 MHz	

Head TSL parameters The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.3 ±6 %	1.41 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	9.18 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	36.3 W/kg ±18.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	4.94 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	19.6 W/kg ± 18.7 % (k=2)

Certificate No: Z22-60335

Page 3 of 6







Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2117 E-mail: emf@caict.ac.cn http://www.caict.ac.cn

Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	47.9Ω- 0.71jΩ
Return Loss	- 32.8dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.120 ns	
----------------------------------	----------	--

After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point 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 feed-point may be damaged.

Manufactured by		SPEAG
ficate No: Z22-60335	Page 4 of 6	







Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2117 E-mail: emf@caiet.ac.cn http://www.caiet.ac.cn

DASY5 Validation Report for Head TSL Test Laboratory: CTTL, Beijing, China

Date: 2022-08-22

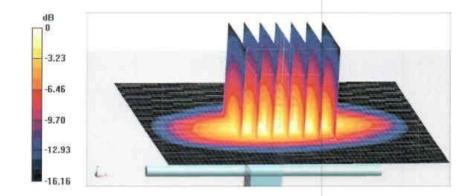
DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1152 Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1750 MHz; $\sigma = 1.408$ S/m; $\epsilon_r = 41.28$; $\rho = 1000$ kg/m³ Phantom section: Right Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 SN7464; ConvF(8.52, 8.52, 8.52) @ 1750 MHz; Calibrated: 2022-01-26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2022-01-12
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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

```
Reference Value = 91.44 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 16.5 W/kg
SAR(1 g) = 9.18 W/kg; SAR(10 g) = 4.94 W/kg
Smallest distance from peaks to all points 3 dB below = 10 mm
Ratio of SAR at M2 to SAR at M1 = 56.3%
Maximum value of SAR (measured) = 14.0 W/kg
```



0 dB = 14.0 W/kg = 11.46 dBW/kg

Certificate No: Z22-60335

Page 5 of 6









Add: No.52. HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2117 E-mail: emf@caict.ac.cn http://www.caict.ac.cn

Impedance Measurement Plot for Head TSL

40100		
20.00		
10.00		
0,000)		4
-10.00		1
- 810-000	\$	
40.00	0	
>1 1.7100000 GHz 47.869 (
⇒l. 1.7500000 GHz 47.869 ($\left(\begin{array}{c} \\ \end{array} \right)$	

Certificate No: Z22-60335

Page 6 of 6



1900MHz Dipole (2021)

	CALIBRA		NAS 樹际互认
Add: No.52 HuaYu Tel: +86-10-62304c E-mail: ettl a chinat	33-2079 Fax: -	District, Beljing, 100191, Chi 86-10-62304633-2504 www.chinattl.en	CALIBRATION CNAS L0570
Client SAI	СТ	Certificate No: Z2	1-60357
CALIBRATION CI	ERTIFICAT	E	
Object	D1900	V2 - SN: 5d088	5.58
Calibration Procedure(s)	FE-711	-003-01	
		tion Procedures for dipole validation kits	
Calibration date:	Octobe	ir 18, 2021	
		traceability to national standards, which rea	
		La di stati	
All calibrations have been numidity<70%.	conducted in t	he closed laboratory facility: environment t or calibration)	temperature (22±3)℃ and
All calibrations have been numidity<70%. Calibration Equipment used	conducted in t		temperature (22±3)℃ and Scheduled Calibration
All calibrations have been numidity<70%. Calibration Equipment used	conducted in t	or calibration)	
All calibrations have been numidity<70%. Calibration Equipment used Primary Standards	conducted in t (M&TE critical fo	or calibration) Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
All calibrations have been iumidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4	Conducted in t (M&TE critical for ID # 106277	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21(CTTL-SPEAG.No.Z21-60001)	Scheduled Calibration Sep-22
All calibrations have been numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S	conducted in t (M&TE critical fe ID # 106277 104291	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326)	Scheduled Calibration Sep-22 Sep-22
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4	conducted in t (M&TE critical fe ID # 106277 104291 SN 7517	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21(CTTL-SPEAG.No.Z21-60001)	Scheduled Calibration Sep-22 Sep-22 Feb-22
All calibrations have been numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4	conducted in t (M&TE critical fo ID # 106277 104291 SN 7517 SN 1556	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21(CTTL-SPEAG,No.Z21-60001) 15-Jan-21(SPEAG,No.DAE4-1556_Jan21)	Scheduled Calibration Sep-22 Sep-22 Feb-22 Jan-22
All calibrations have been numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards	conducted in t (M&TE critical fe 106277 104291 SN 7517 SN 1556 ID #	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21(CTTL-SPEAG,No.Z21-60001) 15-Jan-21(SPEAG,No.DAE4-1556_Jan21) Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration Sep-22 Sep-22 Feb-22 Jan-22 Scheduled Calibration
All calibrations have been numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	conducted in t (M&TE critical fo ID # 106277 104291 SN 7517 SN 1556 ID # MY49071430	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21(CTTL-SPEAG,No.Z21-60001) 15-Jan-21(SPEAG,No.DAE4-1556_Jan21) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593)	Scheduled Calibration Sep-22 Sep-22 Feb-22 Jan-22 Scheduled Calibration Jan-22
All calibrations have been numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	conducted in t (M&TE critical fr 106277 104291 SN 7517 SN 1556 ID # MY49071430 MY46110673	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21(CTTL-SPEAG,No.Z21-60001) 15-Jan-21(SPEAG,No.DAE4-1556_Jan21) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593) 14-Jan-21 (CTTL, No.J21X00232)	Scheduled Calibration Sep-22 Sep-22 Feb-22 Jan-22 Scheduled Calibration Jan-22 Jan-22
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	conducted in t (M&TE critical fe 106277 104291 SN 7517 SN 1556 ID # MY49071430 MY46110673 Name	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21 (CTTL-SPEAG,No.Z21-60001) 15-Jan-21 (SPEAG,No.DAE4-1556_Jan21) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593) 14-Jan-21 (CTTL, No.J21X00232) Function	Scheduled Calibration Sep-22 Sep-22 Feb-22 Jan-22 Scheduled Calibration Jan-22 Jan-22 Sign:ature
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	conducted in t (M&TE critical fe 106277 104291 SN 7517 SN 1556 ID # MY49071430 MY46110673 Name Zhao Jing	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21 (CTTL-SPEAG No.Z21-60001) 15-Jan-21 (SPEAG No.DAE4-1556_Jan21) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593) 14-Jan-21 (CTTL, No.J21X00232) Function SAR Test Engineer	Scheduled Calibration Sep-22 Sep-22 Feb-22 Jan-22 Scheduled Calibration Jan-22 Jan-22 Sign:ature

Certificate No: Z21-60357

Page I of 6





Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504 E-mail: cttl@chinattl.com http://www.chinattl.en

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: Z21-60357

Page 2 of 6





 Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China

 Tel: +86-10-62304633-2079
 Fax: -86-10-62304633-2504

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

Measurement Conditions

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

 DASY Version
 DASY52

 V52.10.4

 Extrapolation

 Phantom
 Triple Flat Phantom 5.1C

 Distance Dipole Center - TSL
 10 mm
 with Spacer

 Zoom Scan Resolution
 dx, dy, dz = 5 mm
 Frequency

 Frequency
 1900 MHz ± 1 MHz
 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	39.9±6%	1.39 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	steen	

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.0 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	40.2 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.10 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	20.5 W/kg ± 18.7 % (k=2)

Certificate No: Z21-60357

Page 3 of 6





 Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China

 Tel: +86-10-62304633-2079
 Fax: +86-10-62304633-2504

 E-mail: ettl.achinattl.com
 http://www.chinattl.cn

Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.7Ω+ 6.80jΩ	
Return Loss	- 22.6dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.110 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: Z21-60357

Page 4 of 6





Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504 E-mail: ettl@chinattLcom http://www.ehinattLcn

DASY5 Validation Report for Head TSL Test Laboratory: CTTL, Beijing, China

Date: 10.18.2021

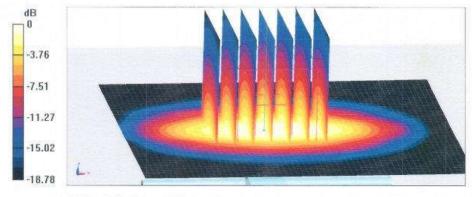
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN; 5d088 Communication System: UID 0, CW; Frequency: 1900 MHz: Duty Cycle: 1:1 Medium parameters used: f = 1900 MHz; $\sigma = 1.387$ S/m; $\varepsilon_t = 39.88$; $\rho = 1000$ kg/m³ Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 SN7517; ConvF(7.81, 7.81, 7.81) @ 1900 MHz; Calibrated: 2021-02-03
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2021-01-15
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4): SEMCAD X Version 14.6.14 (7501)

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 103.6 V/m; Power Drift = 0.00 dB Peak SAR (extrapolated) = 19.2 W/kg

SAR(1 g) = 10 W/kg; SAR(10 g) = 5.1 W/kg Smallest distance from peaks to all points 3 dB below = 10 mm Ratio of SAR at M2 to SAR at M1 = 52.1%Maximum value of SAR (measured) = 15.8 W/kg



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

Certificate No: Z21-60357

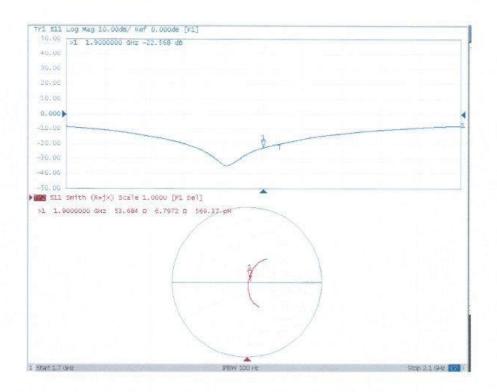
Page 5 of 6





Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504 E-mail: ettl@chinattl.com http://www.ehinattl.en

Impedance Measurement Plot for Head TSL



Certificate No: Z21-60357

Page 6 of 6



2450MHz Dipole (2021)

	CALIBRA	TION LABORATORY	NAS検准
Add: No.52 Hua¥u Tel: +86-10-623046 E-mail: ettl/å.chinat	633-2079 Fax: -	District, Beijing, 100191, Chi 86-10-62304633-2504 www.chinattl.cn	CALIBRATIO CNAS L0570
Client SAIC	Т	Certificate No: Z2	21-60358
CALIBRATION CI	ERTIFICAT	TE	
Object	D2450	V2 - SN: 873	
Calibration Procedure(s)	FF-Z11	-003-01	
	Calibra	tion Procedures for dipole validation kits	
Calibration date:	Octobe	er 21, 2021	
All sufficiency to a second			
All calibrations have been humidity<70%. Calibration Equipment used		the closed laboratory facility: environment or calibration)	temperature (22±3)°C and
humidity<70%.		or calibration)	
humidity<70%. Calibration Equipment used	I (M&TE critical f		
humidity<70%. Calibration Equipment used Primary Standards	I (M&TE critical fi	or calibration) Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4	I (M&TE critical fi ID # 106277 104291 SN 7517	or calibration) Cal Date (Calibrated by. Certificate No.) 24-Sep-21 (CTTL, No.J21X08326)	Scheduled Calibration Sep-22
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S	I (M&TE critical fi ID # 106277 104291	or calibration) Cal Date (Calibrated by. Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326)	Scheduled Calibration Sep-22 Sep-22 Feb-22
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4	I (M&TE critical fi ID # 106277 104291 SN 7517	or calibration) Cal Date (Calibrated by. Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21(CTTL-SPEAG.No.Z21-60001)	Scheduled Calibration Sep-22 Sep-22 Feb-22
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4	I (M&TE critical fi ID # 106277 104291 SN 7517 SN 1556	or calibration) Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21(CTTL-SPEAG,No.Z21-60001) 15-Jan-21(SPEAG,No.DAE4-1556_Jan21)	Scheduled Calibration Sep-22 Sep-22 Feb-22 Jan-22
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards	I (M&TE critical fi ID # 106277 104291 SN 7517 SN 1556 ID #	or calibration) Cal Date (Calibrated by. Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21(CTTL-SPEAG.No.Z21-60001) 15-Jan-21(SPEAG.No.DAE4-1556_Jan21) Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration Sep-22 Sep-22 Feb-22 Jan-22 Scheduled Calibration
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	I (M&TE critical fi ID # 106277 104291 SN 7517 SN 1556 ID # MY49071430	or calibration) Cal Date (Calibrated by Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21(CTTL-SPEAG,No.Z21-60001) 15-Jan-21(SPEAG,No.DAE4-1556_Jan21) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593)	Scheduled Calibration Sep-22 Sep-22 Feb-22 Jan-22 Scheduled Calibration Jan-22
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	I (M&TE critical fi ID # 106277 104291 SN 7517 SN 1556 ID # MY49071430 MY46110673	or calibration) Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21(CTTL-SPEAG,No.Z21-60001) 15-Jan-21(SPEAG,No.DAE4-1556_Jan21) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593) 14-Jan-21 (CTTL, No.J21X00232)	Scheduled Calibration Sep-22 Sep-22 Feb-22 Jan-22 Scheduled Calibration Jan-22 Jan-22
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	I (M&TE critical fi ID # 106277 104291 SN 7517 SN 1556 ID # MY49071430 MY46110673 Name	or calibration) Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21(CTTL-SPEAG,No.Z21-60001) 15-Jan-21(SPEAG,No.DAE4-1556_Jan21) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593) 14-Jan-21 (CTTL, No.J21X00232) Function	Scheduled Calibration Sep-22 Sep-22 Feb-22 Jan-22 Scheduled Calibration Jan-22 Jan-22
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	I (M&TE critical fi ID # 106277 104291 SN 7517 SN 1556 ID # MY49071430 MY46110673 Name Zhao Jing	or calibration) Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21(CTTL-SPEAG,No.Z21-60001) 15-Jan-21(SPEAG,No.DAE4-1556_Jan21) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593) 14-Jan-21 (CTTL, No.J21X00232) Function SAR Test Engineer	Scheduled Calibration Sep-22 Sep-22 Feb-22 Jan-22 Scheduled Calibration Jan-22 Jan-22

Certificate No: Z21-60358

Page 1 of 6





Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504 E-mail: ettl@chinattl.com http://www.chinattl.en

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%.

Certificate No: Z21-60358

Page 2 of 6





 Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China

 Tel: +86-10-62304633-2079
 Fax: +86-10-62304633-2504

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

Measurement Conditions

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

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

g

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.5±6%	1.81 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	53.2 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.05 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.2 W/kg ± 18.7 % (k=2)

Certificate No: Z21-60358

Page 3 of 6





 Add; No.52 HuaYuanBel Road, Haidian District, Beijing, 100191, China

 Tel: +86-10-62304633-2079
 Fax: +86-10-62304633-2504

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

Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.6Ω+ 1.26jΩ	
Return Loss	- 28.8dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.066 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

Certificate No: Z21-60358

Page 4 of 6