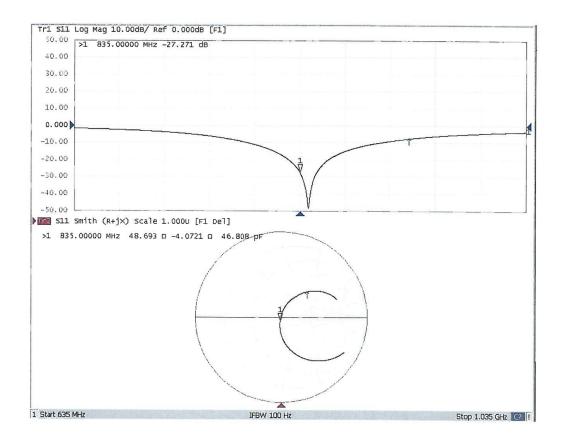




Impedance Measurement Plot for Head TSL



Certificate No: 23J02Z80182

Page 6 of 6

1.3. D1750V2 Dipole Calibration Certificate

In Collaboration	ion with C A <u>G</u> N LABORATORY		中国认可 国际互认 校准 CALIBRATION
Add: No.52 HuaYuanBei Roa Tel: +86-10-62304633-2117 E-mail: emf@caict.ac.cn	ad, Haidian District, T		CNAS L0570
Client HTW		Certificate No:	23J02Z80183
CALIBRATION CE	RTIFICAT	Έ	
Object	D1750\	/2 - SN: 1164	
Calibration Procedure(s)	FF-Z11	-003-01	
		tion Procedures for dipole validation kits	
Calibration date:	Decem	ber 8, 2023	
measurements (SI). The mea pages and are part of the cer All calibrations have been	asurements and rtificate.	traceability to national standards, which the uncertainties with confidence probabi he closed laboratory facility: environment	lity are given on the following
humidity<70%. Calibration Equipment used	(M&TE critical fo	or calibration)	
Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.) Scheduled Calibration
Power Meter NRP2	106276	15-May-23 (CTTL, No.J23X04183)	May-24
Power sensor NRP6A	101369	15-May-23 (CTTL, No.J23X04183)	May-24
Reference Probe EX3DV4	SN 3617	31-Mar-23(CTTL-SPEAG,No.Z23-60161	1
DAE4	SN 1556	11-Jan-23(CTTL-SPEAG,No.Z23-60034) Jan-24
Secondary Standards	ID#	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	05-Jan-23 (CTTL, No. J23X00107)	Jan-24
Network Analyzer E5071C	MY46110673	10-Jan-23 (CTTL, No. J23X00104)	Jan-24
	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	義意
Reviewed by:	Lin Hao	SAR Test Engineer	林林
Approved by:	Qi Dianyuan	SAR Project Leader	त्वेत
		Issued: De	ecember 12, 2023
This calibration certificate sh	all not be reproc	duced except in full without written approv	

Certificate No: 23J02Z80183

Page 1 of 6





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%.

Page 2 of 6





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	40.4 ± 6 %	1.40 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	9.22 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	36.5 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	4.89 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	19.4 W/kg ± 18.7 % (k=2)

Certificate No: 23J02Z80183

Page 3 of 6





Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	47.1Ω- 3.27jΩ	
Return Loss	- 27.0dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.124 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.

Additional EUT Data

Manufactured by	SPEAG

Page 4 of 6





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

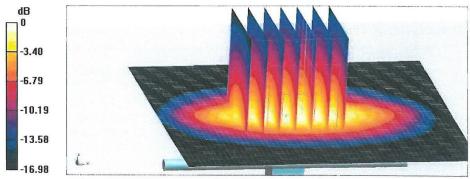
Date: 2023-12-08

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1164 Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1750 MHz; $\sigma = 1.399 \text{ S/m}$; $\varepsilon_r = 40.4$; $\rho = 1000 \text{ kg/m}^3$ Phantom section: Right Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007) **DASY5** Configuration:

- Probe: EX3DV4 SN3617; ConvF(8.4, 8.4, 8.4) @ 1750 MHz; Calibrated: 2023-03-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2023-01-11
- 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 = 96.58 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 17.0 W/kg

SAR(1 g) = 9.22 W/kg; SAR(10 g) = 4.89 W/kg Smallest distance from peaks to all points 3 dB below = 10 mm Ratio of SAR at M2 to SAR at M1 = 55.1%Maximum value of SAR (measured) = 14.1 W/kg



0 dB = 14.1 W/kg = 11.49 dBW/kg

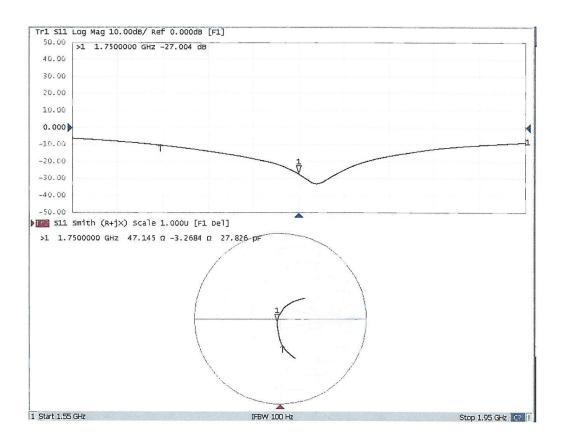
Certificate No: 23J02Z80183

Page 5 of 6





Impedance Measurement Plot for Head TSL



Certificate No: 23J02Z80183

Page 6 of 6

1.4. D1900V2 Dipole Calibration Certificate

Add: No.52 HuaYuanBei Roz Tel: +86-10-62304633-2117	ad, Haidian District, I	Beijing, 100191	CNAS L0570
E-mail: cttl@chinattl.com	http://www.caid		23J02Z80184
Client HTW	RTIFICAT		23302280184
Dbject	D1900\	/2 - SN: 5d226	
Calibration Procedure(s)	FF-Z11-	-003-01	
	Calibrat	tion Procedures for dipole validation kits	
Calibration date:	Decemi	ber 7, 2023	
	asurements and	traceability to national standards, which n the uncertainties with confidence probabili	
Il calibrations have been	conducted in th	he closed laboratory facility; environmon	t tomporature (22,2)% and
numidity<70%.		he closed laboratory facility: environmen or calibration)	t temperature (22±3)℃ and
umidity<70%. Calibration Equipment used		or calibration)	
umidity<70%. Calibration Equipment used	(M&TE critical fo		t temperature (22±3)℃ and Scheduled Calibration May-24
umidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2	(M&TE critical fo	or calibration) Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A	(M&TE critical fo ID # 106276 101369	or calibration) Cal Date (Calibrated by, Certificate No.) 15-May-23 (CTTL, No.J23X04183)	Scheduled Calibration May-24 May-24
umidity<70%. Calibration Equipment used Primary Standards	(M&TE critical fo ID # 106276 101369	Cal Date (Calibrated by, Certificate No.) 15-May-23 (CTTL, No.J23X04183) 15-May-23 (CTTL, No.J23X04183)	Scheduled Calibration May-24 May-24 Mar-24 Mar-24
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards	(M&TE critical fo ID # 106276 101369 SN 3617	Cal Date (Calibrated by, Certificate No.) 15-May-23 (CTTL, No.J23X04183) 15-May-23 (CTTL, No.J23X04183) 31-Mar-23(CTTL-SPEAG,No.Z23-60161) 11-Jan-23(CTTL-SPEAG,No.Z23-60034) Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration May-24 May-24 Mar-24
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards	(M&TE critical fo ID # 106276 101369 SN 3617 SN 1556	Cal Date (Calibrated by, Certificate No.) 15-May-23 (CTTL, No.J23X04183) 15-May-23 (CTTL, No.J23X04183) 31-Mar-23(CTTL-SPEAG,No.Z23-60161) 11-Jan-23(CTTL-SPEAG,No.Z23-60034)	Scheduled Calibration May-24 May-24 Mar-24 Jan-24
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	(M&TE critical fo ID # 106276 101369 SN 3617 SN 1556 ID #	Cal Date (Calibrated by, Certificate No.) 15-May-23 (CTTL, No.J23X04183) 15-May-23 (CTTL, No.J23X04183) 31-Mar-23(CTTL-SPEAG,No.Z23-60161) 11-Jan-23(CTTL-SPEAG,No.Z23-60034) Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration May-24 May-24 Mar-24 Jan-24 Scheduled Calibration
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4	(M&TE critical fo ID # 106276 101369 SN 3617 SN 1556 ID # MY49071430	Cal Date (Calibrated by, Certificate No.) 15-May-23 (CTTL, No.J23X04183) 15-May-23 (CTTL, No.J23X04183) 31-Mar-23(CTTL-SPEAG,No.Z23-60161) 11-Jan-23(CTTL-SPEAG,No.Z23-60034) Cal Date (Calibrated by, Certificate No.) 05-Jan-23 (CTTL, No. J23X00107)	Scheduled Calibration May-24 May-24 Mar-24 Jan-24 Scheduled Calibration Jan-24 Jan-24
Aumidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C Network Analyzer E5071C	(M&TE critical fo ID # 106276 101369 SN 3617 SN 1556 ID # MY49071430 MY46110673	Cal Date (Calibrated by, Certificate No.) 15-May-23 (CTTL, No.J23X04183) 15-May-23 (CTTL, No.J23X04183) 31-Mar-23(CTTL-SPEAG,No.Z23-60161) 11-Jan-23(CTTL-SPEAG,No.Z23-60034) Cal Date (Calibrated by, Certificate No.) 05-Jan-23 (CTTL, No. J23X00107) 10-Jan-23 (CTTL, No. J23X00104)	Scheduled Calibration May-24 May-24 Mar-24 Jan-24 Scheduled Calibration Jan-24
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C Network Analyzer E5071C	(M&TE critical fo ID # 106276 101369 SN 3617 SN 1556 ID # MY49071430 MY46110673 Name	Cal Date (Calibrated by, Certificate No.) 15-May-23 (CTTL, No.J23X04183) 15-May-23 (CTTL, No.J23X04183) 31-Mar-23 (CTTL-SPEAG,No.Z23-60161) 11-Jan-23 (CTTL-SPEAG,No.Z23-60034) Cal Date (Calibrated by, Certificate No.) 05-Jan-23 (CTTL, No. J23X00107) 10-Jan-23 (CTTL, No. J23X00104) Function	Scheduled Calibration May-24 May-24 Mar-24 Jan-24 Scheduled Calibration Jan-24 Jan-24
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	(M&TE critical fo ID # 106276 101369 SN 3617 SN 1556 ID # MY49071430 MY46110673 Name Zhao Jing	Cal Date (Calibrated by, Certificate No.) 15-May-23 (CTTL, No.J23X04183) 15-May-23 (CTTL, No.J23X04183) 31-Mar-23(CTTL-SPEAG,No.Z23-60161) 11-Jan-23(CTTL-SPEAG,No.Z23-60034) Cal Date (Calibrated by, Certificate No.) 05-Jan-23 (CTTL, No. J23X00107) 10-Jan-23 (CTTL, No. J23X00104) Function SAR Test Engineer	Scheduled Calibration May-24 May-24 Mar-24 Jan-24 Scheduled Calibration Jan-24 Jan-24

Certificate No: 23J02Z80184

Page 1 of 6



In Collaboration with





Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2117 E-mail: cttl@chinattl.com 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%.

Page 2 of 6





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	1900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.3 ± 6 %	1.38 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	10.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	40.8 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.23 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	21.1 W/kg ± 18.7 % (k=2)

Page 3 of 6





Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.6Ω+ 7.29jΩ
Return Loss	- 22.8dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.103 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.

Additional EUT Data

Manufactured by	SPEAG
Manulactured by	SFEAG

Page 4 of 6





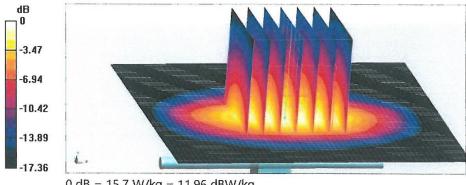
Date: 2023-12-07

Test Laboratory: CTTL, Beijing, China **DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d226** Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1900 MHz; $\sigma = 1.38$ S/m; $\varepsilon_r = 40.27$; $\rho = 1000$ kg/m³ Phantom section: Right Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007) DASY5 Configuration:

- Probe: EX3DV4 SN3617; ConvF(8.14, 8.14, 8.14) @ 1900 MHz; Calibrated: 2023-03-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2023-01-11
- 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 = 95.04 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 18.8 W/kgSAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.23 W/kgSmallest distance from peaks to all points 3 dB below = 10 mmRatio of SAR at M2 to SAR at M1 = 54.3%Maximum value of SAR (measured) = 15.7 W/kg



0 dB = 15.7 W/kg = 11.96 dBW/kg

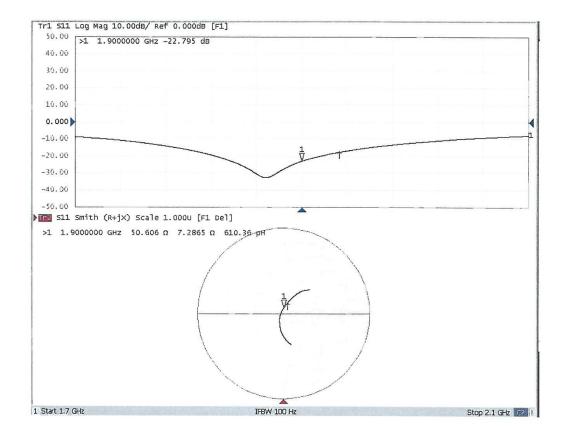
Certificate No: 23J02Z80184

Page 5 of 6





Impedance Measurement Plot for Head TSL



Certificate No: 23J02Z80184

Page 6 of 6

1.5. D2450V2 Dipole Calibration Certificate

CALIBRATIC	tion with C C C C CN LABORATORY	- CNAS	中国认可 国际互认 校准 CAICI
Add: No.52 HuaYuanBei Ro Tel: +86-10-62304633-2117 E-mail: cttl@chinattl.com			CNAS L0570
Client HTW	a she is a	Certificate No:	23J02Z80185
CALIBRATION CI	ERTIFICAT	Έ	
Object	D2450	√2 - SN: 1009	
Calibration Procedure(s)	FF-711	-003-01	
		tion Procedures for dipole validation kits	
Calibration date:	Decem	ber 6, 2023	
measurements (SI). The me pages and are part of the ce All calibrations have been humidity<70%.	easurements and ertificate. conducted in t	traceability to national standards, which r the uncertainties with confidence probabili he closed laboratory facility: environmen	ty are given on the following
Calibration Equipment used			
Primary Standards Power Meter NRP2	ID # 106276	Cal Date (Calibrated by, Certificate No.) 15-May-23 (CTTL, No.J23X04183)	Scheduled Calibration
Power sensor NRP6A	101369	15-May-23 (CTTL, No.J23X04183)	May-24 May-24
Reference Probe EX3DV4		10-111ay-20 (011L, 110.020X04100)	IVIAV-24
DAE4	SN 1556	31-Mar-23(CTTL-SPEAG No 723-60161)	
	SN 1550	31-Mar-23(CTTL-SPEAG,No.Z23-60161) 11-Jan-23(CTTL-SPEAG,No.Z23-60034)	Mar-24
Secondary Standards	ID #	A S 100 VE S a Con-decay Manufacture I a serie to condition of the	Mar-24
Secondary Standards Signal Generator E4438C		11-Jan-23(CTTL-SPEAG,No.Z23-60034)	Mar-24 Jan-24
the second secon	ID #	11-Jan-23(CTTL-SPEAG,No.Z23-60034) Cal Date (Calibrated by, Certificate No.)	Mar-24 Jan-24 Scheduled Calibration
Signal Generator E4438C	ID # MY49071430 MY46110673	11-Jan-23(CTTL-SPEAG,No.Z23-60034) Cal Date (Calibrated by, Certificate No.) 05-Jan-23 (CTTL, No. J23X00107) 10-Jan-23 (CTTL, No. J23X00104)	Mar-24 Jan-24 Scheduled Calibration Jan-24 Jan-24
Signal Generator E4438C	ID # MY49071430	11-Jan-23(CTTL-SPEAG,No.Z23-60034) Cal Date (Calibrated by, Certificate No.) 05-Jan-23 (CTTL, No. J23X00107)	Mar-24 Jan-24 Scheduled Calibration Jan-24
Signal Generator E4438C NetworkAnalyzer E5071C	ID # MY49071430 MY46110673 Name	11-Jan-23(CTTL-SPEAG,No.Z23-60034) Cal Date (Calibrated by, Certificate No.) 05-Jan-23 (CTTL, No. J23X00107) 10-Jan-23 (CTTL, No. J23X00104) Function	Mar-24 Jan-24 Scheduled Calibration Jan-24 Jan-24
Signal Generator E4438C NetworkAnalyzer E5071C Calibrated by:	ID # MY49071430 MY46110673 Name Zhao Jing	11-Jan-23(CTTL-SPEAG,No.Z23-60034) Cal Date (Calibrated by, Certificate No.) 05-Jan-23 (CTTL, No. J23X00107) 10-Jan-23 (CTTL, No. J23X00104) Function SAR Test Engineer	Mar-24 Jan-24 Scheduled Calibration Jan-24 Jan-24
Signal Generator E4438C NetworkAnalyzer E5071C Calibrated by: Reviewed by: Approved by:	ID # MY49071430 MY46110673 Name Zhao Jing Lin Hao Qi Dianyuan	11-Jan-23(CTTL-SPEAG,No.Z23-60034) Cal Date (Calibrated by, Certificate No.) 05-Jan-23 (CTTL, No. J23X00107) 10-Jan-23 (CTTL, No. J23X00104) Function SAR Test Engineer SAR Test Engineer SAR Project Leader	Mar-24 Jan-24 Scheduled Calibration Jan-24 Jan-24 Jan-24 Signature

Certificate No: 23J02Z80185

Page 1 of 6





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%.

Page 2 of 6





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	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.9 ± 6 %	1.80 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	53.4 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.7 W/kg ± 18.7 % (k=2)

Certificate No: 23J02Z80185

Page 3 of 6





Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.6Ω+ 4.03jΩ	
Return Loss	- 27.4dB	

General Antenna Parameters and Design

Electrical Delay (one direction) 1.	067 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.

Additional EUT Data

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

Page 4 of 6