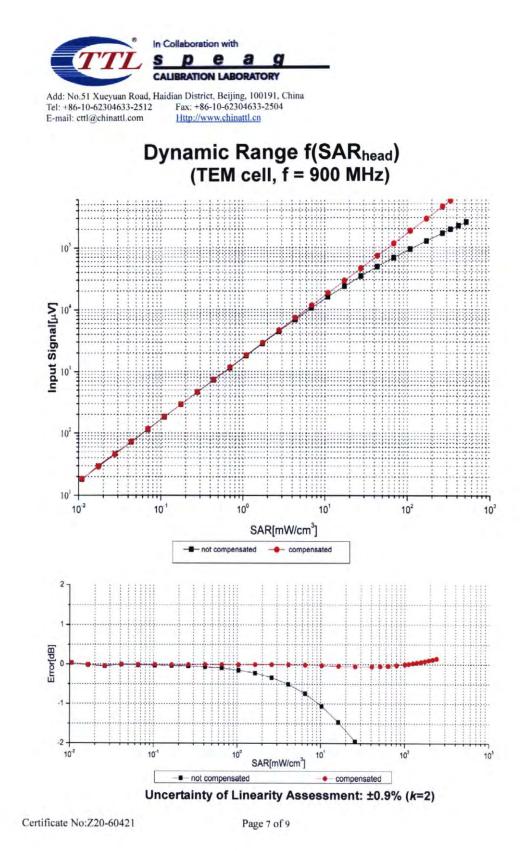




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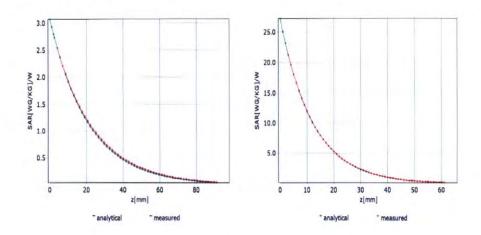
1



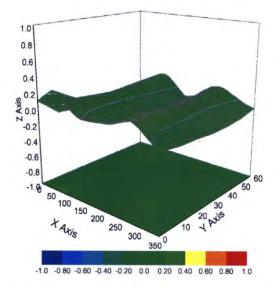
Conversion Factor Assessment

f=750 MHz,WGLS R9(H_convF)

f=1750 MHz,WGLS R22(H_convF)



Deviation from Isotropy in Liquid



Uncertainty of Spherical Isotropy Assessment: ±3.2% (k=2)

Certificate No:Z20-60421

Page 8 of 9







DASY/EASY – Parameters of Probe: EX3DV4 – SN:7600

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	40.7
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	10mm
Tip Diameter	2.5mm
Probe Tip to Sensor X Calibration Point	1mm
Probe Tip to Sensor Y Calibration Point	1mm
Probe Tip to Sensor Z Calibration Point	1mm
Recommended Measurement Distance from Surface	1.4mm

Certificate No:Z20-60421

Page 9 of 9





ANNEX H Dipole Calibration Certificate

750 MHz Dipole Calibration Certificate

Add: No.51 Xueyu	an Road, Haidian Di-	strict, Beijing, 100191, China	CNAS 校准 CALIBRATIO
Tel: +86-10-62304 E-mail: cttl@china	633-2079 Fax:	+86-10-62304633-2504	CNAS L0570
	DEN	Certificate No:	Z20-60484
CALIBRATION C	ERTIFICAT	TE .	
Object	D750V	/3 - SN: 1132	
Calibration Procedure(s)			
		I-003-01 ation Procedures for dipole validation kits	
Calibration date:			
salisfation date.	Decem	iber 23, 2020	
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Certificate No: Z20-60484

Page 1 of 6







Glossary:

TSL ConvF N/A tissue simulating liquid sensitivity in TSL / NORMx,y,z 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: Z20-60484

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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	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.5 ± 6 %	0.89 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	2.15 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.59 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	5.76 W/kg ± 18.7 % (k=2)

Certificate No: Z20-60484

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 http://www.chinattl.cn

Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.1Ω- 1.24jΩ	
Return Loss	- 27.7dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	0.996 ns	
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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	S	PEAG
ficate No: Z20-60484	Page 4 of 6	
	. 450 1 01 0	







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

Date: 12.23.2020

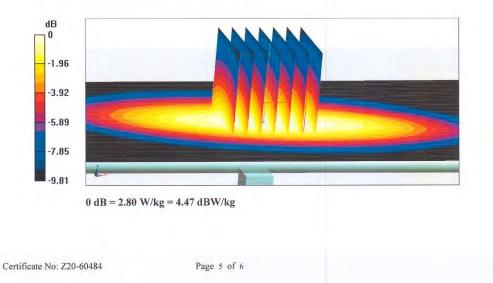
Test Laboratory: CTTL, Beijing, China **DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1132** Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1 Medium parameters used: f = 750 MHz; σ = 0.888 S/m; ε _r = 41.46; ρ = 1000 kg/m3 Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 SN3617; ConvF(10.07, 10.07, 10.07) @ 750 MHz; Calibrated: 2020-01-30
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2020-02-10
- 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 (7483)

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

Reference Value = 56.54 V/m; Power Drift = -0.02 dB Peak SAR (extrapolated) = 3.10 W/kg SAR(1 g) = 2.15 W/kg; SAR(10 g) = 1.44 W/kg Smallest distance from peaks to all points 3 dB below = 17.5 mm Ratio of SAR at M2 to SAR at M1 = 69.3% Maximum value of SAR (measured) = 2.80 W/kg







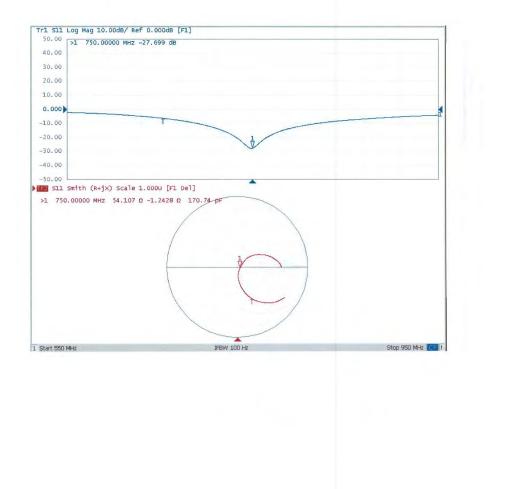


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 E-mail: cttl@chinattl.com
 http://www.chinattl.cn

Impedance Measurement Plot for Head TSL



Certificate No: Z20-60484 Page 6 of 6





835 MHz Dipole Calibration Certificate

l.com http://	-86-10-62304633-2504	CNAS L0570
N		21-60237
RTIFICAT	E	Mar
D835V	2 - SN: 4d120	
1		
FF-Z11	-003-01	
Calibra	tion Procedures for dipole validation kits	
June 2	3, 2021	
	1012000	
rtificate.		
(M&TE critical fo	or calibration) Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
106277	23-Sep-20 (CTTL, No.J20X08336)	Sep-21
104291	23-Sep-20 (CTTL, No.J20X08336)	Sep-21
		Apr-22
5N 549	08-Jan-21(CTTL-SPEAG,No.221-60002)	Jan-22
ID#	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
MY49071430	01-Feb-21 (CTTL, No.J21X00593)	Jan-22
MY46110673	14-Jan-21 (CTTL, No.J21X00232)	Jan-22
Nome		Signature
Name	Function	
Name Zhao Jing	Function SAR Test Engineer	A DELON
		~ 林光
Zhao Jing	SAR Test Engineer	A HAS
	Conducted in t (M&TE critical for ID # 106277 104291 SN 3846 SN 549 ID # MY49071430	RTIFICATE D835V2 - SN: 4d120 FF-Z11-003-01 Calibration Procedures for dipole validation kits June 23, 2021 Mocuments the traceability to national standards, which reasurements and the uncertainties with confidence probability trificate. conducted in the closed laboratory facility: environment (M&TE critical for calibration) ID # Cal Date (Calibrated by, Certificate No.) 106277 23-Sep-20 (CTTL, No.J20X08336) 104291 23-Sep-20 (CTTL, No.J20X08336) SN 3846 26-Apr-21(CTTL-SPEAG,No.Z21-60084) SN 549 08-Jan-21(CTTL-SPEAG,No.Z21-60002) ID # Cal Date (Calibrated by, Certificate No.) MY49071430 01-Feb-21 (CTTL, No.J21X00593)







Glossary:

tissue simulating liquid
sensitivity in TSL / NORMx,y,z
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: Z21-60237

Page 2 of 6







Measurement Conditions

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	41.0 ± 6 %	0.89 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	2.36 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.49 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.52 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.11 W/kg ± 18.7 % (k=2)

Certificate No: Z21-60237

Page 3 of 6







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 http://www.chinattl.cn

Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.8Ω- 0.87jΩ	
Return Loss	- 28.5dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.307 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	FUT	Data
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Manufactured by		SPEAG
tificate No: Z21-60237	Page 4 of 6	







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

DASY5 Validation Report for Head TSL

Fax: +86-10-62304633-2504 http://www.chinattl.cn

Date: 06.23.2021

Test Laboratory: CTTL, Beijing, China DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d120

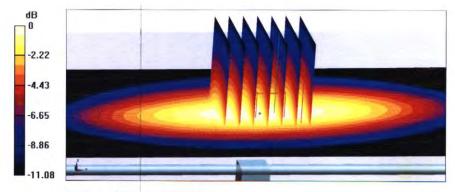
Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1 Medium parameters used: f = 835 MHz; $\sigma = 0.89$ S/m; $\epsilon_r = 40.96$; $\rho = 1000$ kg/m³ Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 SN3846; ConvF(10, 10, 10) @ 835 MHz; Calibrated: 2021-04-26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection) .
- Electronics: DAE4 Sn549; Calibrated: 2021-01-08
- 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 (7483)

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

Reference Value = 58.80 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 3.78 W/kg SAR(1 g) = 2.36 W/kg; SAR(10 g) = 1.52 W/kg Smallest distance from peaks to all points 3 dB below = 16.8 mm Ratio of SAR at M2 to SAR at M1 = 62.3% Maximum value of SAR (measured) = 3.26 W/kg



0 dB = 3.26 W/kg = 5.13 dBW/kg

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Certificate No: Z21-60237
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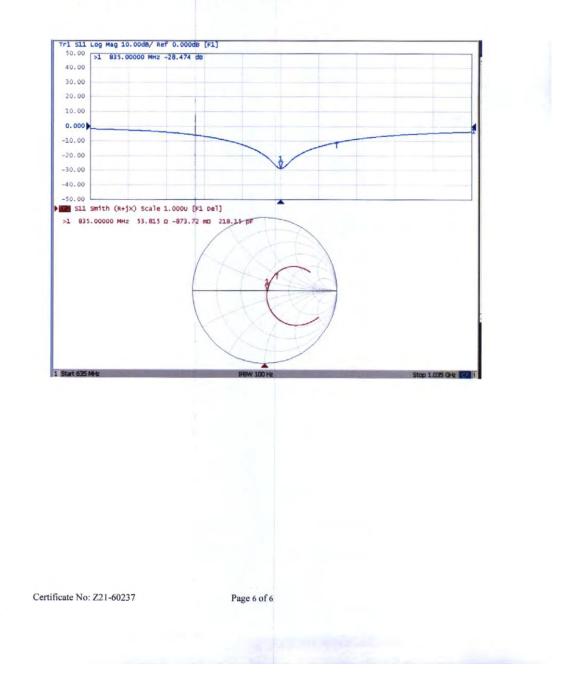
Page 5 of 6







Impedance Measurement Plot for Head TSL







1750 MHz Dipole Calibration Certificate

Add: No.52 Hua Yua Tel: +86-10-6230463 E-mail: ettl@chinatt	33-2079 Fax:	n District, Beijing, 100191, Ch +86-10-62304633-2504 //www.chinattl.cn	CALIBRATION CNAS L0570
Client AUDEN	4	Certificate No: Z21	-60254
CALIBRATION CE	RTIFICA	TE	
Dbject	D1750	0V2 - SN: 1023	
Calibration Procedure(s)	0.000		
		1-003-01	
	Calibr	ation Procedures for dipole validation kits	
Calibration date:	June 2	23, 2021	
		d the uncertainties with confidence probability	are given on the following
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bages and are part of the ce All calibrations have been humidity<70%. Calibration Equipment used	ertificate. conducted in	the closed laboratory facility: environment t for calibration) Cal Date (Calibrated by, Certificate No.)	
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All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4	ertificate. conducted in (M&TE critical ID # 106277 104291 SN 3846 SN 549	the closed laboratory facility: environment t for calibration) Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 26-Apr-21(CTTL-SPEAG,No.Z21-60084) 08-Jan-21(CTTL-SPEAG,No.Z21-60002)	temperature (22±3)℃ and Scheduled Calibration Sep-21 Sep-21 Apr-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	ertificate. conducted in (M&TE critical ID # 106277 104291 SN 3846 SN 549 ID #	the closed laboratory facility: environment t for calibration) Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 26-Apr-21(CTTL-SPEAG,No.Z21-60084) 08-Jan-21(CTTL-SPEAG,No.Z21-60002) Cal Date (Calibrated by, Certificate No.)	temperature (22±3)℃ and Scheduled Calibration Sep-21 Sep-21 Apr-22 Jan-22 Scheduled Calibration
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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	ertificate. conducted in (M&TE critical ID # 106277 104291 SN 3846 SN 549 ID # ID # ID #	the closed laboratory facility: environment t for calibration) Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 26-Apr-21(CTTL-SPEAG,No.Z21-60084) 08-Jan-21(CTTL-SPEAG,No.Z21-60002) Cal Date (Calibrated by, Certificate No.) 0 01-Feb-21 (CTTL, No.J21X00593)	temperature (22±3)°C and Scheduled Calibration Sep-21 Sep-21 Apr-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	ertificate. conducted in (M&TE critical 106277 104291 SN 3846 SN 549 ID # ID # MY49071430 MY46110673	the closed laboratory facility: environment t for calibration) Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 26-Apr-21(CTTL-SPEAG,No.Z21-60084) 08-Jan-21(CTTL-SPEAG,No.Z21-60002) Cal Date (Calibrated by, Certificate No.) 0 01-Feb-21 (CTTL, No.J21X00593) 3 14-Jan-21 (CTTL, No.J21X00232)	Scheduled Calibration Sep-21 Sep-21 Apr-22 Jan-22 Scheduled Calibration Jan-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 Signal Generator E4438C	ertificate. conducted in (M&TE critical ID# 106277 104291 SN 3846 SN 549 ID# MY49071430 MY46110673 Name	the closed laboratory facility: environment t for calibration) Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 26-Apr-21(CTTL-SPEAG,No.Z21-60084) 08-Jan-21(CTTL-SPEAG,No.Z21-60002) Cal Date (Calibrated by, Certificate No.) 0 01-Feb-21 (CTTL, No.J21X00593) 3 14-Jan-21 (CTTL, No.J21X00232) Function	Scheduled Calibration Sep-21 Sep-21 Apr-22 Jan-22 Scheduled Calibration Jan-22 Jan-22

Certificate No: Z21-60254

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Glossary: TSL

ConvF N/A tissue simulating liquid sensitivity in TSL / NORMx,y,z 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: Z21-60254

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Measurement Conditions

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

Head TSL parameters

Frequency

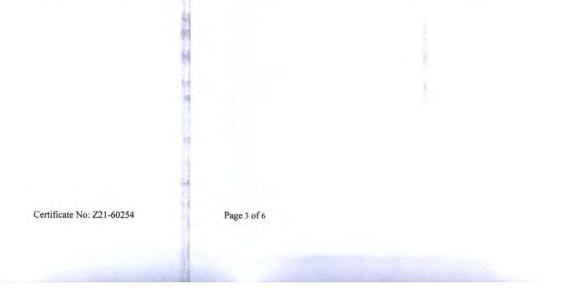
The following parameters and calculations were applied.

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

1750 MHz ± 1 MHz

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	l.
SAR measured	250 mW input power	9.16 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	4.75 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	18.9 W/kg ± 18.7 % (k=2)









Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.8Ω- 1.44jΩ	
Return Loss	- 32.9 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.122 ns
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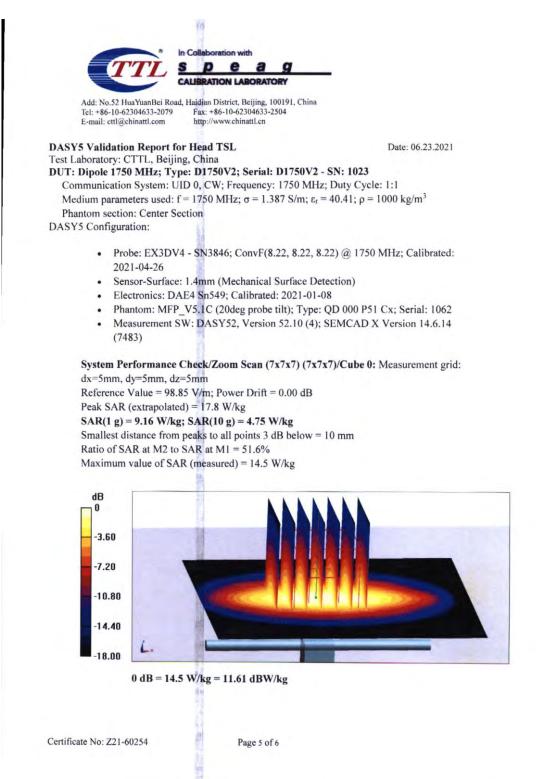
After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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.

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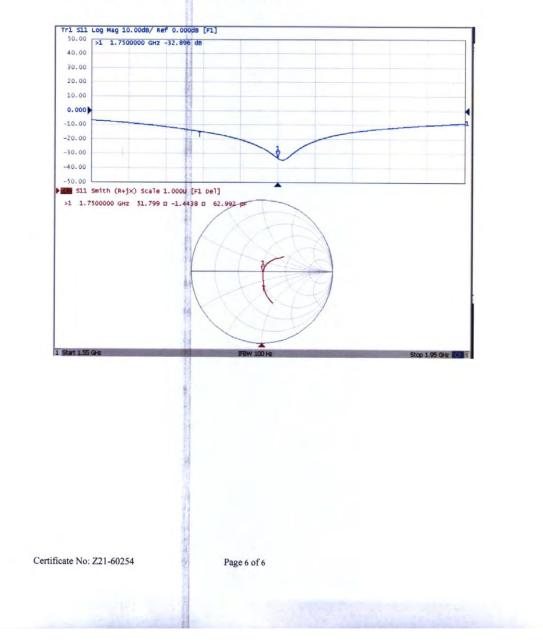


 Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China

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

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

Impedance Measurement Plot for Head TSL







1900 MHz Dipole Calibration Certificate

Tel: +86-10-623040 E-mail: ettl@chinat Client AUI	633-2079 Fax: + ttl.com http://v	District, Beijing, 100191, Chi 86-10-62304633-2504 www.chinattl.cn	CALIBRATION CNAS L0570
Client AUI			
CALIBRATION C	DEN	Certificate No: Z2	21-60238
OALIDITATION O	Contraction of the local division of the loc	E	10 1
Dbject	D1900\	/2 - SN: 5d142	
Calibration Procedure(s)	FF-Z11	-003-01	
		tion Procedures for dipole validation kits	
Calibration date:	hurse Al	2024	
Jailbration date.	June 28	5, 2021	
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numidity<70%.		he closed laboratory facility: environment or calibration)	temperature (22±3)°C and
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numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4	ID # 106277 104291 4 SN 3846 SN 549	Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 26-Apr-21(CTTL-SPEAG,No.Z21-60084) 08-Jan-21(CTTL-SPEAG,No.Z21-60002)	Scheduled Calibration Sep-21 Sep-21 Apr-22 Jan-22
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards	ID # 106277 104291 4 SN 3846 SN 549 ID #	Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 26-Apr-21(CTTL-SPEAG,No.Z21-60084) 08-Jan-21(CTTL-SPEAG,No.Z21-60002) Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration Sep-21 Sep-21 Apr-22 Jan-22 Scheduled Calibration
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4	ID # 106277 104291 4 SN 3846 SN 549 ID # MY49071430	Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 26-Apr-21(CTTL-SPEAG,No.Z21-60084) 08-Jan-21(CTTL-SPEAG,No.Z21-60002)	Scheduled Calibration Sep-21 Sep-21 Apr-22 Jan-22
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ID # 106277 104291 4 SN 3846 SN 549 ID # MY49071430	Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 26-Apr-21(CTTL-SPEAG,No.Z21-60084) 08-Jan-21(CTTL-SPEAG,No.Z21-60002) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593)	Scheduled Calibration Sep-21 Sep-21 Apr-22 Jan-22 Scheduled Calibration Jan-22
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	ID # 106277 104291 SN 3846 SN 549 ID # MY49071430 MY46110673	Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 26-Apr-21(CTTL-SPEAG,No.Z21-60084) 08-Jan-21(CTTL-SPEAG,No.Z21-60002) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593) 14-Jan-21 (CTTL, No.J21X00232)	Scheduled Calibration Sep-21 Sep-21 Apr-22 Jan-22 Scheduled Calibration Jan-22 Jan-22
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	D # 106277 104291 4 SN 3846 SN 549 1D # MY49071430 MY46110673 Name	Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 26-Apr-21(CTTL-SPEAG,No.Z21-60084) 08-Jan-21(CTTL-SPEAG,No.Z21-60002) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593) 14-Jan-21 (CTTL, No.J21X00232) Function	Scheduled Calibration Sep-21 Sep-21 Apr-22 Jan-22 Scheduled Calibration Jan-22 Jan-22

Certificate No: Z21-60238

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 Iossary:

 TSL
 tissue simulating liquid

 ConvF
 sensitivity in TSL / NORMx,y,z

 N/A
 not applicable or not measured

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

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Measurement Conditions

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

DASY Version	DASY52	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	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	39.8 ± 6 %	1.39 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	10.0 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	40.1 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.06 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	20.3 W/kg ± 18.7 % (k=2)

Certificate No: Z21-60238

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.9Ω+ 4.05jΩ
Return Loss	- 25.3dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.103 ns
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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	
rtificate No: Z21-60238	Page 4 of 6		







DASY5 Validation Report for Head TSL

Date: 06.25.2021

Test Laboratory: CTTL, Beijing, China DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d142

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1900 MHz; $\sigma = 1.392 \text{ S/m}$; $\varepsilon_r = 39.81$; $\rho = 1000 \text{ kg/m}^3$

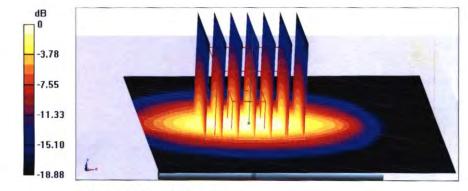
Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 SN3846; ConvF(7.96, 7.96, 7.96) @ 1900 MHz; Calibrated: 2021-04-26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn549; Calibrated: 2021-01-08
- 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 (7483)

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

Reference Value = 98.83 V/m; Power Drift = 0.04 dB Peak SAR (extrapolated) = 19.9 W/kg SAR(1 g) = 10 W/kg; SAR(10 g) = 5.06 W/kg Smallest distance from peaks to all points 3 dB below = 10 mm Ratio of SAR at M2 to SAR at M1 = 50.2% Maximum value of SAR (measured) = 16.2 W/kg



0 dB = 16.2 W/kg = 12.10 dBW/kg

Certificate No: Z21-60238

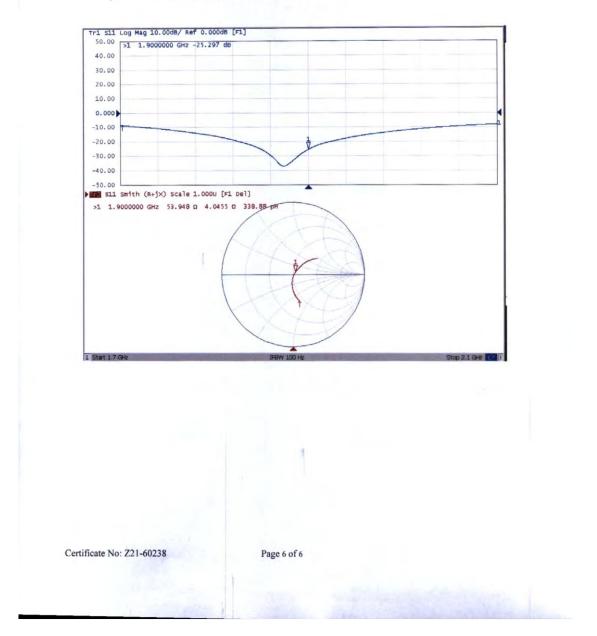
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Impedance Measurement Plot for Head TSL







2450 MHz Dipole Calibration Certificate

Dbject Calibration Procedure(s)	L.com http://view.com ERTIFICAT D2450V FF-Z11		1-60255
CALIBRATION CE	D2450	E	100233
Dbject Calibration Procedure(s)	D2450\ FF-Z11		
Calibration Procedure(s)	FF-Z11	/2 - SN: 869	
Calibration Procedure(s) Calibration date:			
Calibration date:		000.04	
Calibration date:		ion Procedures for dipole validation kits	
Calibration date.			
	June 22	2, 2021	
Calibration Equipment used	(M&TE critical fo	or calibration)	
Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
minary standards	106277	23-Sep-20 (CTTL, No.J20X08336)	
Power Meter NRP2			Sep-21
Power Meter NRP2 Power sensor NRP8S	104291	23-Sep-20 (CTTL, No.J20X08336)	Sep-21
Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4	104291 SN 3846	23-Sep-20 (CTTL, No.J20X08336) 26-Apr-21(CTTL-SPEAG,No.Z21-60084)	Sep-21 Apr-22
Power Meter NRP2 Power sensor NRP8S	104291	23-Sep-20 (CTTL, No.J20X08336)	Sep-21
Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4	104291 SN 3846	23-Sep-20 (CTTL, No.J20X08336) 26-Apr-21(CTTL-SPEAG,No.Z21-60084)	Sep-21 Apr-22
Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4	104291 SN 3846 SN 549	23-Sep-20 (CTTL, No.J20X08336) 26-Apr-21(CTTL-SPEAG,No.Z21-60084) 08-Jan-21(CTTL-SPEAG,No.Z21-60002) Cal Date (Calibrated by, Certificate No.)	Sep-21 Apr-22 Jan-22
Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards	104291 SN 3846 SN 549 ID #	23-Sep-20 (CTTL, No.J20X08336) 26-Apr-21(CTTL-SPEAG,No.Z21-60084) 08-Jan-21(CTTL-SPEAG,No.Z21-60002) Cal Date (Calibrated by, Certificate No.)	Sep-21 Apr-22 Jan-22 Scheduled Calibration
Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	104291 SN 3846 SN 549 ID # MY49071430 MY46110673	23-Sep-20 (CTTL, No.J20X08336) 26-Apr-21(CTTL-SPEAG,No.Z21-60084) 08-Jan-21(CTTL-SPEAG,No.Z21-60002) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593) 14-Jan-21 (CTTL, No.J21X00232)	Sep-21 Apr-22 Jan-22 Scheduled Calibration Jan-22 Jan-22
Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	104291 SN 3846 SN 549 ID # MY49071430 MY46110673 Name	23-Sep-20 (CTTL, No.J20X08336) 26-Apr-21(CTTL-SPEAG,No.Z21-60084) 08-Jan-21(CTTL-SPEAG,No.Z21-60002) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593) 14-Jan-21 (CTTL, No.J21X00232) Function	Sep-21 Apr-22 Jan-22 Scheduled Calibration Jan-22
Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	104291 SN 3846 SN 549 ID # MY49071430 MY46110673	23-Sep-20 (CTTL, No.J20X08336) 26-Apr-21(CTTL-SPEAG,No.Z21-60084) 08-Jan-21(CTTL-SPEAG,No.Z21-60002) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593) 14-Jan-21 (CTTL, No.J21X00232)	Sep-21 Apr-22 Jan-22 Scheduled Calibration Jan-22 Jan-22
Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	104291 SN 3846 SN 549 ID # MY49071430 MY46110673 Name	23-Sep-20 (CTTL, No.J20X08336) 26-Apr-21(CTTL-SPEAG,No.Z21-60084) 08-Jan-21(CTTL-SPEAG,No.Z21-60002) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593) 14-Jan-21 (CTTL, No.J21X00232) Function	Sep-21 Apr-22 Jan-22 Scheduled Calibration Jan-22 Jan-22
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Certificate No: Z21-60255

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Fax: +86-10-62304633-2504 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: Z21-60255

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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	

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	39.3 ± 6 %	1.78 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	13.2 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	53.1 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.99 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.0 W/kg ± 18.7 % (k=2)

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.1Ω+ 4.79jΩ	
Return Loss	- 24.4dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.068 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: Z21-60255	Page 4 of 6	







DASY5 Validation Report for Head TSL

Date: 06.22.2021

Test Laboratory: CTTL, Beijing, China DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 869

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1

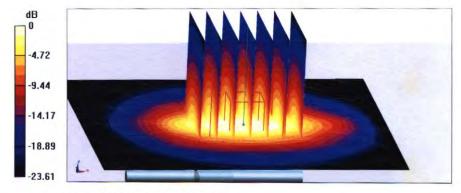
Medium parameters used: f = 2450 MHz; σ = 1.784 S/m; ϵ_r = 39.31; ρ = 1000 kg/m³ Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 SN3846; ConvF(7.45, 7.45, 7.45) @ 2450 MHz; Calibrated: 2021-04-26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn549; Calibrated: 2021-01-08
- 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 (7483)

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

Reference Value = 102.0 V/m; Power Drift = -0.06 dB Peak SAR (extrapolated) = 28.6 W/kg SAR(1 g) = 13.2 W/kg; SAR(10 g) = 5.99 W/kg Smallest distance from peaks to all points 3 dB below = 9 mm Ratio of SAR at M2 to SAR at M1 = 45.5% Maximum value of SAR (measured) = 22.7 W/kg



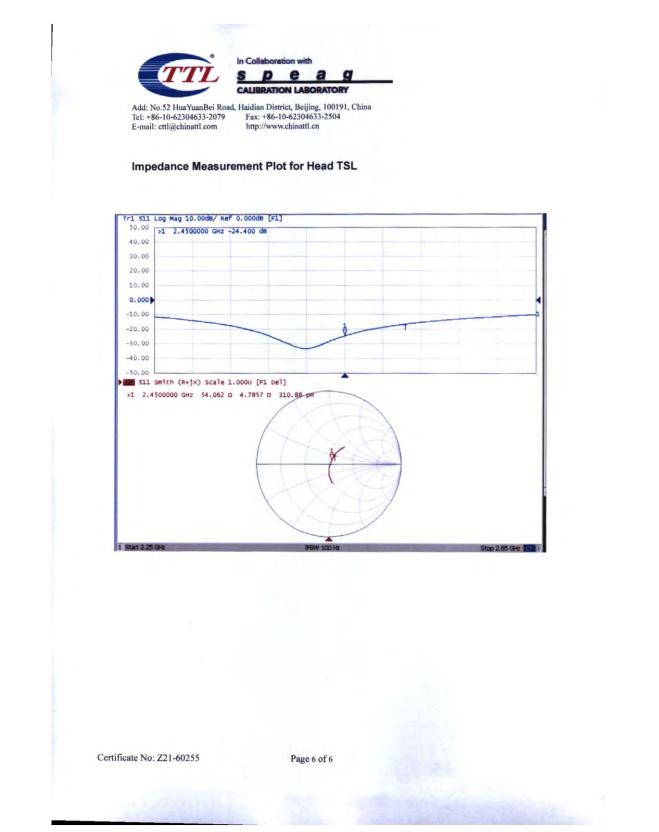
0 dB = 22.7 W/kg = 13.56 dBW/kg

Certificate No: Z21-60255

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5G Dipole Calibration Certificate

E-mail: cttl@chir	latti com http			
Client Au	iden	://www.chinattl.cn Certificate No: Z	20-60486	
CALIBRATION C	ERTIFICA		20 00400	
Object	D5GH	IzV2 - SN: 1203		
Calibration Procedure(s)	EE 74	1 002 04		
		FF-Z11-003-01 Calibration Procedures for dipole validation kits		
Calibration date:				
	Decer	nber 22, 2020		
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Pages and are part of the of All calibrations have bee humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzerE5071C	Dertificate. n conducted in d (M&TE critical) ID # 106276 101369 SN 3617 SN 771 ID # ID # MY49071430 MY46110673 MY46110673	the closed laboratory facility: environment for calibration) Cal Date(Calibrated by, Certificate No.) 12-May-20 (CTTL, No.J20X02965) 12-May-20 (CTTL, No.J20X02965) 30-Jan-20(SPEAG,No.EX3-3617_Jan20) 10-Feb-20(CTTL-SPEAG,No.Z20-60017) Cal Date(Calibrated by, Certificate No.) 25-Feb-20 (CTTL, No.J20X00516) 10-Feb-20 (CTTL, No.J20X00515)	Scheduled Calibration May-21 May-21 Jan-21 Feb-21 Scheduled Calibration Feb-21	
pages and are part of the of All calibrations have bee humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	xertificate. n conducted in d (M&TE critical) ID # 106276 101369 SN 3617 SN 771 ID # MY49071430 MY46110673 Name Name	the closed laboratory facility: environment for calibration) Cal Date(Calibrated by, Certificate No.) 12-May-20 (CTTL, No.J20X02965) 12-May-20 (CTTL, No.J20X02965) 30-Jan-20(SPEAG,No.EX3-3617_Jan20) 10-Feb-20(CTTL-SPEAG,No.Z20-60017) Cal Date(Calibrated by, Certificate No.) 25-Feb-20 (CTTL, No.J20X00516) 10-Feb-20 (CTTL, No.J20X00515) Function	temperature(22±3)℃ and Scheduled Calibration May-21 May-21 Jan-21 Feb-21 Scheduled Calibration Feb-21 Feb-21 Feb-21	

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Glossary:

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

Calibration is Performed According to the Following Standards:

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

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

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

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Measurement Conditions

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

DASY Version	DASY52	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 = 4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5250 MHz ± 1 MHz 5600 MHz ± 1 MHz 5750 MHz ± 1 MHz	(========,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,

Head TSL parameters at 5250 MHz The following parameters and calculations were applied.

Temperature	Permittivity	Conductivity
22.0 °C	35.9	4.71 mho/m
(22.0 ± 0.2) °C	35.1 ± 6 %	4.70 mho/m ± 6 %
<1.0 °C		
	22.0 °C (22.0 ± 0.2) °C	22.0 °C 35.9 (22.0 ± 0.2) °C 35.1 ± 6 %

SAR result with Head TSL at 5250 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.88 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	78.5 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.26 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.5 W/kg ± 24.2 % (k=2)

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Head TSL parameters at 5600 MHz The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.6 ± 6 %	5.08 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		0.00 millo/m ± 0 %

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.20 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	81.6 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	01.0 Wing 1 24.4 % (K=2)
SAR measured	100 mW input power	2.35 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.3 W/kg ± 24.2 % (k=2)

Head TSL parameters at 5750 MHz The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.4	5.22 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.4 ± 6 %	5.24 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		0.24 1110/11 ± 0 %

SAR result with Head TSL at 5750 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.71 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	76.7 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	100 100 g 2 24.4 70 (K-2)
SAR measured	100 mW input power	2.20 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	21.8 W/kg ± 24.2 % (k=2)

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Body TSL parameters at 5250 MHz The following parameters and calculations w

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.36 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.8 ± 6 %	5.37 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		0.07 1110/11 1 0 7

SAR result with Body TSL at 5250 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.20 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	72.0 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	(i - 2)
SAR measured	100 mW input power	2.06 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.6 W/kg ± 24.2 % (k=2)

Body TSL parameters at 5600 MHz The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.2 ± 6 %	5.85 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.69 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	76.8 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	100 mW input power	2.20 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	22.0 W/kg ± 24.2 % (k=2)

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Body TSL parameters at 5750 MHz The following parameters and calculations w

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.3	5.94 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.8 ± 6 %	6.08 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		0.00 1110/11 ± 0 %

SAR result with Body TSL at 5750 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.26 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	72.5 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	(n-2)
SAR measured	100 mW input power	2.06 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.6 W/kg ± 24.2 % (k=2)

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	48.8Ω - 2.87jΩ
Return Loss	- 30.1dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	52.3Ω + 2.41jΩ
Return Loss	- 29.7dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	51.0Ω + 5.47jΩ		
Return Loss	- 25.2dB		

Antenna Parameters with Body TSL at 5250 MHz

Impedance, transformed to feed point	48.0Ω - 1.77ϳΩ		
Return Loss	- 31.3dB		

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	52.8Ω + 4.00jΩ		
Return Loss	- 26.5dB		

Antenna Parameters with Body TSL at 5750 MHz

Impedance, transformed to feed point	51.6Ω + 6.91jΩ		
Return Loss	- 23.1dB		

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General Antenna Parameters and Design

Electrical Delay (one direction)	1.098 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	
Manufactured by	SPEAG

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

Date: 12.22.2020

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1203

Communication System: CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz,

Medium parameters used: f = 5250 MHz; σ = 4.7 S/m; ϵ_r = 35.12; ρ = 1000 kg/m³, Medium parameters used: f = 5600 MHz; σ = 5.079 S/m; ϵ_r = 34.55; ρ = 1000 kg/m³, Medium parameters used: f = 5750 MHz; σ = 5.243 S/m; ϵ_r = 34.39; ρ = 1000 kg/m³,

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 SN3617; ConvF(5.39, 5.39, 5.39) @ 5250 MHz; ConvF(4.99, 4.99, 4.99) @ 5600 MHz; ConvF(5.1, 5.1, 5.1) @ 5750 MHz; Calibrated: 2020-01-30
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2020-02-10
- 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 (7483)

Dipole Calibration /Pin=100mW, d=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 67.41 V/m; Power Drift = -0.09 dB Peak SAR (extrapolated) = 31.4 W/kg SAR(1 g) = 7.88 W/kg; SAR(10 g) = 2.26 W/kg Smallest distance from peaks to all points 3 dB below = 7.5 mm Ratio of SAR at M2 to SAR at M1 = 65.7% Maximum value of SAR (measured) = 18.4 W/kg

Dipole Calibration /Pin=100mW, d=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 66.63 V/m; Power Drift = -0.07 dB Peak SAR (extrapolated) = 35.8 W/kg SAR(1 g) = 8.2 W/kg; SAR(10 g) = 2.35 W/kg Smallest distance from peaks to all points 3 dB below = 7.4 mm Ratio of SAR at M2 to SAR at M1 = 62.3% Maximum value of SAR (measured) = 20.3 W/kg

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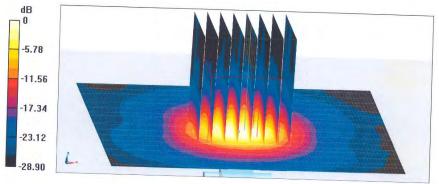






Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2512 E-mail: cttl@chinattl.com

Dipole Calibration /Pin=100mW, d=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 64.48 V/m; Power Drift = -0.07 dB Peak SAR (extrapolated) = 34.5 W/kg SAR(1 g) = 7.71 W/kg; SAR(10 g) = 2.2 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 61.5% Maximum value of SAR (measured) = 18.6 W/kg



0 dB = 18.6 W/kg = 12.70 dBW/kg

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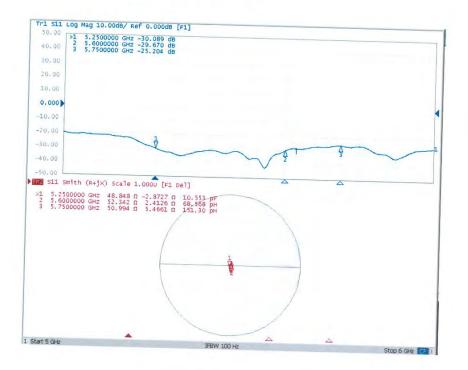






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Impedance Measurement Plot for Head TSL



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

Date: 12.21.2020

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1203

Communication System: CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz,

Medium parameters used: f = 5250 MHz; σ = 5.368 S/m; ϵ_r = 48.82; ρ = 1000 kg/m³, Medium parameters used: f = 5600 MHz; σ = 5.846 S/m; ϵ_r = 48.15; ρ = 1000 kg/m³, Medium parameters used: f = 5750 MHz; σ = 6.077 S/m; ϵ_r = 47.81; ρ $= 1000 \text{ kg/m}^3$

Phantom section: Left Section

DASY5 Configuration:

- Probe: EX3DV4 SN3617; ConvF(4.7, 4.7, 4.7) @ 5250 MHz; ConvF(4.23, . 4.23, 4.23) @ 5600 MHz; ConvF(4.36, 4.36, 4.36) @ 5750 MHz; Calibrated: 2020-01-30.
- Sensor-Surface: 1.4mm (Mechanical Surface Detection) .
- Electronics: DAE4 Sn771; Calibrated: 2020-02-10 .
- 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
- (7483)

Dipole Calibration /Pin=100mW, d=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 64.50 V/m; Power Drift = -0.09 dB Peak SAR (extrapolated) = 26.5 W/kg SAR(1 g) = 7.2 W/kg; SAR(10 g) = 2.06 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 67.7% Maximum value of SAR (measured) = 16.4 W/kg

Dipole Calibration /Pin=100mW, d=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 65.82 V/m; Power Drift = -0.08 dB Peak SAR (extrapolated) = 31.0 W/kg SAR(1 g) = 7.69 W/kg; SAR(10 g) = 2.2 W/kg Smallest distance from peaks to all points 3 dB below = 7.4 mm Ratio of SAR at M2 to SAR at M1 = 64.7% Maximum value of SAR (measured) = 18.8 W/kg

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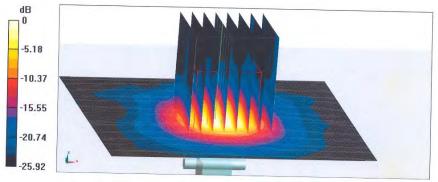






Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504 E-mail: ettl@chinattl.com http://www.chinattl.cn

Dipole Calibration /Pin=100mW, d=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 63.28 V/m; Power Drift = -0.08 dB Peak SAR (extrapolated) = 30.5 W/kg SAR(1 g) = 7.26 W/kg; SAR(10 g) = 2.06 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 63.4% Maximum value of SAR (measured) = 18.0 W/kg



0 dB = 18.0 W/kg = 12.55 dBW/kg

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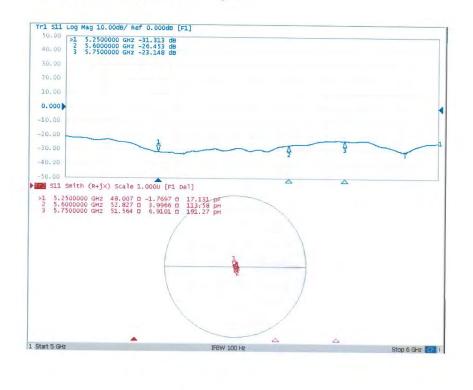


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 E-mail: cttl@chinattl.com
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Impedance Measurement Plot for Body TSL



Certificate No: Z20-60486

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2600 MHz Dipole Calibration Certificate

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



Schweizerischer Kalibrierdienst Service suisse d'étalonnage Servizio svizzero di taratura Swiss Calibration Service

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Client CTTL-BJ (Auden)

Certificate No: D2600V2-1012_Jul20

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Object	D2600V2 - SN:1	1012	
Calibration procedure(s)	QA CAL-05.v11 Calibration Proc	edure for SAR Validation Source	es between 0.7-3 GHz
Calibration date:	July 21, 2020		
and the uncertainty and the uncer	nambes with confidence p	tional standards, which realize the physical u probability are given on the following pages a bry facility: environment temperature (22 ± 3)	and are part of the certificate.
Calibration Equipment used (M&T			
Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	01-Apr-20 (No. 217-03100/03101)	Apr-21
ower sensor NRP-Z91	SN: 103244	01-Apr-20 (No. 217-03100)	Apr-21
ower sensor NRP-Z91	SN: 103245	01-Apr-20 (No. 217-03101)	Apr-21
eference 20 dB Attenuator	SN: BH9394 (20k)	31-Mar-20 (No. 217-03106)	Apr-21
ype-N mismatch combination	SN: 310982 / 06327	31-Mar-20 (No. 217-03104)	Apr-21
Reference Probe EX3DV4	SN: 7349	29-Jun-20 (No. EX3-7349_Jun20)	Jun-21
AE4	SN: 601	27-Dec-19 (No. DAE4-601_Dec19)	Dec-20
	1		
econdary Standards	ID #	Check Date (in house)	Schodulad Cheel
ower meter E4419B	ID # SN: GB39512475	Check Date (in house) 30-Oct-14 (in house check Feb-19)	Scheduled Check
ower meter E4419B ower sensor HP 8481A	1000 11	30-Oct-14 (in house check Feb-19)	In house check: Oct-20
ower meter E4419B ower sensor HP 8481A ower sensor HP 8481A	SN: GB39512475	30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18)	In house check: Oct-20 In house check: Oct-20
ower meter E4419B ower sensor HP 8481A ower sensor HP 8481A F generator R&S SMT-06	SN: GB39512475 SN: US37292783	30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18)	In house check: Oct-20 In house check: Oct-20 In house check: Oct-20
ower meter E4419B ower sensor HP 8481A ower sensor HP 8481A F generator R&S SMT-06	SN: GB39512475 SN: US37292783 SN: MY41092317	30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18)	In house check: Oct-20
Secondary Standards Power meter E44198 Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 letwork Analyzer Agilent E8358A	SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972	30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18) 31-Mar-14 (in house check Oct-19)	In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20
ower meter E4419B ower sensor HP 8481A ower sensor HP 8481A F generator R&S SMT-06 etwork Analyzer Agilent E8358A	SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477 Name	30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18) 31-Mar-14 (in house check Oct-19) Function	In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 Signature
ower meter E4419B ower sensor HP 8481A ower sensor HP 8481A F generator R&S SMT-06 etwork Analyzer Agilent E8358A	SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477	30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18) 31-Mar-14 (in house check Oct-19)	In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 Signature
Yower meter E4419B Yower sensor HP 8481A Yower sensor HP 8481A IF generator R&S SMT-06 letwork Analyzer Agilent E8358A alibrated by:	SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477 Name Jeffrey Katzman	30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18) 31-Mar-14 (in house check Oct-19) Function	In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 Signature
Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477 Name	30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18) 31-Mar-14 (in house check Oct-19) Function	In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 Signature
Yower meter E4419B Yower sensor HP 8481A Yower sensor HP 8481A IF generator R&S SMT-06 letwork Analyzer Agilent E8358A alibrated by:	SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477 Name Jeffrey Katzman	30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18) 31-Mar-14 (in house check Oct-19) Function Laboratory Technician	In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20





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



Schweizerischer Kalibrierdienst Service suisse d'étalonnage С Servizio svizzero di taratura S Swiss Calibration Service

Accreditation No.: SCS 0108

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Accredited by the Swiss Accreditation Service (SAS)

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

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured
	not applicable of 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 the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Certificate No: D2600V2-1012_Jul20

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Measurement Conditions

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

DASY Version	DASY5	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2600 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.9 ± 6 %	2.01 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition		
SAR measured	250 mW input power	14.5 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	57.0 W/kg ± 17.0 % (k=2)	
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition		
SAR averaged over 10 cm ³ (10 g) of Head TSL SAR measured	condition 250 mW input power	6.40 W/kg	

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.5	2.16 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.0 ± 6 %	2.20 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	14.0 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	55.1 W/kg ± 17.0 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR averaged over 10 cm ³ (10 g) of Body TSL SAR measured	condition 250 mW input power	6.20 W/kg

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