# APPENDIX D: RELEVANT PAGES FROM DAE&

## DIPOLE VALIDATION KIT REPORT(S)

11	<u>I</u> s p		中国认可国际互认
Add: No.52 HuaYu Tel: +86-10-623046 E-mail: ettl@chinat	533-2079 Fax:	n District, Beijing, 100191, Chi +86-10-62304633-2504 //www.chinattl.en	CALIBRATIO CNAS L0570
Client SMQ	0	Certificate No: Z	21-60302
CALIBRATION CI	ERTIFICAT	ſE	
Object	D835V	/2 - SN: 4d141	
Calibration Procedure(s)		1-003-01 ation Procedures for dipole validation kits	
Calibration date:	August	t 31, 2021	
All calibrations have been	conducted in t	the closed laboratory facility: environment	temperature (22±3)°C and
All calibrations have been humidity<70%. Calibration Equipment used			temperature (22±3)°C and
humidity<70%. Calibration Equipment used Primary Standards			temperature (22±3)*C and Scheduled Calibration
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2	(M&TE critical f ID # 106277	Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336)	
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S	(M&TE critical f ID # 106277 104291	Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336)	Scheduled Calibration Sep-21 Sep-21
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4	(M&TE critical f ID # 106277 104291 SN 7517	Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 03-Feb-21(CTTL-SPEAG,No.Z21-60001)	Scheduled Calibration Sep-21 Sep-21 Feb-22
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S	(M&TE critical f ID # 106277 104291	Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336)	Scheduled Calibration Sep-21 Sep-21
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4	(M&TE critical f ID # 106277 104291 SN 7517	Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 03-Feb-21(CTTL-SPEAG,No.Z21-60001)	Scheduled Calibration Sep-21 Sep-21 Feb-22
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE3 Secondary Standards Signal Generator E4438C	(M&TE critical f ID # 106277 104291 SN 7517 SN 536 ID # MY49071430	Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 03-Feb-21(CTTL-SPEAG,No.Z21-60001) 06-Nov-20(CTTL-SPEAG,No.Z20-60452) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593)	Scheduled Calibration Sep-21 Sep-21 Feb-22 Nov-21 Scheduled Calibration Jan-22
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE3 Secondary Standards	(M&TE critical f ID # 106277 104291 SN 7517 SN 536 ID # MY49071430 MY46110673	Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 03-Feb-21 (CTTL-SPEAG,No.Z21-60001) 06-Nov-20(CTTL-SPEAG,No.Z20-60452) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593) 14-Jan-21 (CTTL, No.J21X00232)	Scheduled Calibration Sep-21 Sep-21 Feb-22 Nov-21 Scheduled Calibration Jan-22 Jan-22
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE3 Secondary Standards Signal Generator E4438C	(M&TE critical f ID # 106277 104291 SN 7517 SN 536 ID # MY49071430	Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 03-Feb-21(CTTL-SPEAG,No.Z21-60001) 06-Nov-20(CTTL-SPEAG,No.Z20-60452) 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 Feb-22 Nov-21 Scheduled Calibration Jan-22
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE3 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	(M&TE critical f ID # 106277 104291 SN 7517 SN 536 ID # MY49071430 MY46110673 Name	Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 03-Feb-21 (CTTL-SPEAG,No.Z21-60001) 06-Nov-20(CTTL-SPEAG,No.Z20-60452) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593) 14-Jan-21 (CTTL, No.J21X00232)	Scheduled Calibration Sep-21 Sep-21 Feb-22 Nov-21 Scheduled Calibration Jan-22 Jan-22
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE3 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	(M&TE critical f ID # 106277 104291 SN 7517 SN 536 ID # MY49071430 MY49071430 MY46110673 Name Zhao Jing	Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 03-Feb-21(CTTL-SPEAG,No.Z21-60001) 06-Nov-20(CTTL-SPEAG,No.Z20-60452) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593) 14-Jan-21 (CTTL, No.J21X00232) Function SAR Test Engineer	Scheduled Calibration Sep-21 Sep-21 Feb-22 Nov-21 Scheduled Calibration Jan-22 Jan-22

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#### 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%.

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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
 835 MHz ± 1 MHz

#### Head TSL parameters

The following parameters and calculations were applied.

2996	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	41.7 ± 6 %	0.88 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

#### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.36 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.58 W/kg ± 18.8 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.53 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.19 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	50.6Ω- 6.50jΩ	
Return Loss	- 23.8dB	

#### General Antenna Parameters and Design

Electrical Delay (one direction)	1.299 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	
	2		

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#### **DASY5 Validation Report for Head TSL** Test Laboratory: CTTL, Beijing, China DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d141 Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1 Medium parameters used: f = 835 MHz; $\sigma = 0.884$ S/m; $\varepsilon_r = 41.66$ ; $\rho = 1000$ kg/m<sup>3</sup> Phantom section: Right Section

DASY5 Configuration:

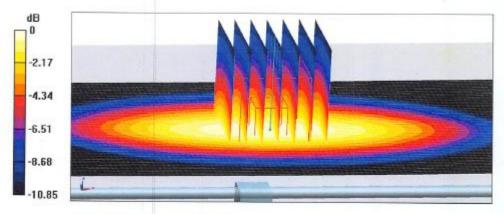
Probe: EX3DV4 - SN7517; ConvF(9.81, 9.81, 9.81) @ 835 MHz; Calibrated; . 2021-02-03

Date: 08.31.2021

- Sensor-Surface: 1.4mm (Mechanical Surface Detection) .
- Electronics: DAE3 Sn536; Calibrated: 2020-11-06
- 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 = 59.32 V/m; Power Drift = -0.07 dB Peak SAR (extrapolated) = 3.73 W/kg SAR(1 g) = 2.36 W/kg; SAR(10 g) = 1.53 W/kg Smallest distance from peaks to all points 3 dB below = 18 mm Ratio of SAR at M2 to SAR at M1 = 63,4% Maximum value of SAR (measured) = 3.25 W/kg



0 dB = 3.25 W/kg = 5.12 dBW/kg

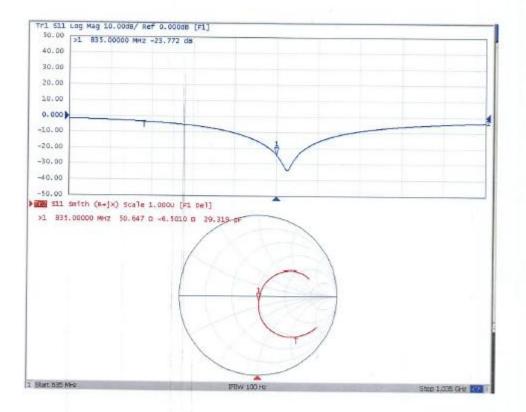
Certificate No: Z21-60302

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

Impedance Measurement Plot for Head TSL



Certificate No: Z21-60302

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	TL S A	e a g	中国认可国际互认
Add: No 52 HunVi		ATION LABORATORY	NAS 校准 CALIBRATIO
Tel: +86-10-62304 E-mail: ettl@china	633-2079 Fax:	+86-10-62304633-2504	CNAS L0570
Client SM	Q	Certificate No: Z	21-60303
CALIBRATION C	ERTIFICA	TE	
Object	D900\	/2 - SN:1d077	
Calibration Procedure(s)		1-003-01	
Calibration date:		ation Procedures for dipole validation kits	
This calibration Certificate measurements (SI). The me pages and are part of the c	easurements and	traceability to national standards, which re I the uncertainties with confidence probability	alize the physical units of are given on the following
All calibrations have been humidity<70%.	conducted in	the closed laboratory facility: environment	temperature (22±3)°C and
Calibration Equipment used	I (M&TE critical f	or calibration)	
Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106277	23-Sep-20 (CTTL, No.J20X08336)	Sep-21
Power sensor NRP8S Reference Probe EX3DV4	104291 SN 7517	23-Sep-20 (CTTL, No.J20X08336)	Sep-21
DAE3	SN 536	03-Feb-21(CTTL-SPEAG,No.Z21-60001) 06-Nov-20(CTTL-SPEAG,No.Z20-60452)	Feb-22 Nov-21
Secondary Standards	ID#	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	01-Feb-21 (CTTL, No.J21X00593)	Jan-22
NetworkAnalyzer E5071C	MY46110673	14-Jan-21 (CTTL, No.J21X00232)	Jan-22
	Name	Function	Signature
			1.4
Calibrated by:	Zhao Jing	SAR Test Engineer	201-
	Zhao Jing Lin Hao	SAR Test Engineer	林兆
Calibrated by: Reviewed by: Approved by:			1000 林治 えの
Reviewed by: Approved by:	Lin Hao Qi Dianyuan	SAR Test Engineer	数型 林子路 ま 31, 2021 of the laboratory.



#### 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", February 2013
- b) IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

#### Additional Documentation:

e) DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

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

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

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#### Measurement Conditions

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

DASY Version	DASY52	52.10.4
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	900 MHz ± 1 MHz	

Head TSL parameters The following parameters and calculations were applied.

Temperature	Permittivity	Conductivity
22.0 °C	41.5	0.97 mho/m
(22.0 ± 0.2) °C	41.2 ± 6 %	0.96 mho/m ± 6 %
<1.0 °C		
	22.0 °C (22.0 ± 0.2) °C	22.0 °C 41.5 (22.0 ± 0.2) °C 41.2 ± 6 %

#### SAR result with Head TSL

Condition	
250 mW input power	2.72 W/kg
normalized to 1W	10.9 W/kg ± 18.8 % (k=2)
Condition	
250 mW input power	1.74 W/kg
normalized to 1W	7.00 W/kg ± 18.7 % (k=2)
	250 mW input power normalized to 1W Condition 250 mW input power

Certificate No: Z21-60303

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## Appendix (Additional assessments outside the scope of CNAS L0570)

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.8Ω- 5.06jΩ	
Return Loss	- 25.9dB	

#### General Antenna Parameters and Design

Electrical Delay (one direction)	1.316 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 semingid 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	
	1		
5			
ficate No: Z21-60303	Page 4 of 6		



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

Date: 08.27.2021

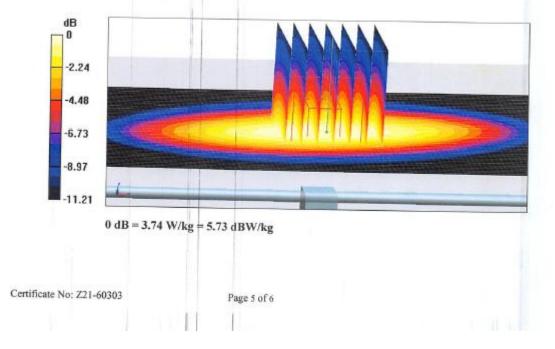
DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN: 1d077 Communication System: UID 0, CW; Frequency: 900 MHz; Duty Cycle: 1:1 Medium parameters used: f = 900 MHz;  $\sigma = 0.96$  S/m;  $\epsilon_r = 41.22$ ;  $\rho = 1000$  kg/m<sup>3</sup> Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 SN7517; ConvF(9.4, 9.4, 9.4) @ 900 MHz; Calibrated: 2021-02-03
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn536; Calibrated: 2020-11-06
- 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)

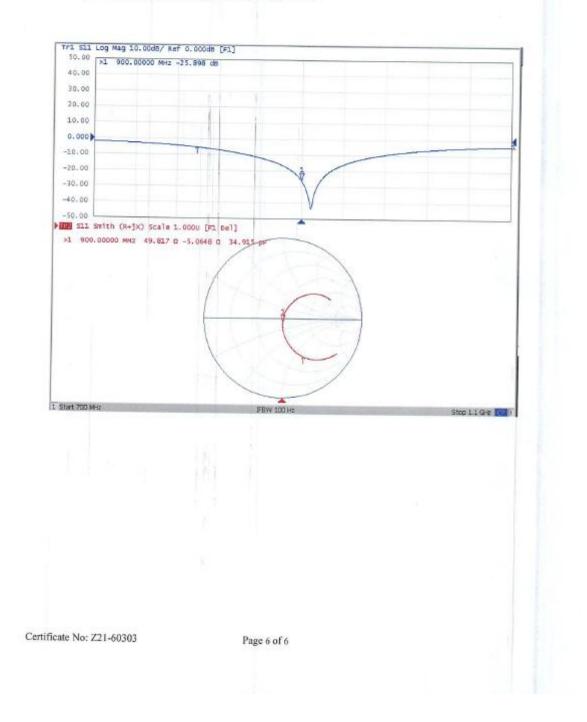
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 61.13 V/m; Power Drift = -0.06 dB Peak SAR (extrapolated) = 4.31 W/kg SAR(1 g) = 2.72 W/kg; SAR(10 g) = 1.74 W/kg Smallest distance from peaks to all points 3 dB below = 17 mm Ratio of SAR at M2 to SAR at M1 = 63.1% Maximum value of SAR (measured) = 3.74 W/kg





## Impedance Measurement Plot for Head TSL



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Add; No.51 Xueyua Tel: +86-10-623046 E-mail: cttl@chinatt	n Road, Haidian Dist 33-2079 Fax: +	TON LABORATORY trict, Beijing, 100191, China 86-10-62304633-2504 www.chinattl.cn	校准 CALIBRATIO CNAS L0570
Client SMQ	100 million 100	Certificate No: Z20	-60038
CALIBRATION CE	ERTIFICAT	E	
Object	D1750	/2 - SN: 1108	
Calibration Procedure(s)	FF-Z11	003.01	
		tion Procedures for dipole validation kits	
Calibration date:	January	/ 3, 2020	
pages and are part of the ce	rtificate.	the uncertainties with confidence probability the closed laboratory facility: environment	
Calibration Equipment used	(M&TE critical fo		Scheduled Calibration
Calibration Equipment used		Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605)	Scheduled Calibration Apr-20
Calibration Equipment used Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	
Calibration Equipment used Primary Standards Power Meter NRP2	ID # 106276 101369	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605)	Apr-20
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A	ID # 106276 101369	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605)	Apr-20 Apr-20
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4	ID # 106276 101369 SN 3617	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19(SPEAG,No.EX3-3617_Jan19)	Apr-20 Apr-20 Jan-20 Aug-20
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4	ID # 106276 101369 SN 3617 SN 1555	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19(SPEAG,No.EX3-3617_Jan19) 22-Aug-19(CTTL-SPEAG,No.Z19-60295)	Apr-20 Apr-20 Jan-20 Aug-20
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards	ID # 106276 101369 SN 3617 SN 1555 ID #	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19(SPEAG,No.EX3-3617_Jan19) 22-Aug-19(CTTL-SPEAG,No.Z19-60295) Cal Date(Calibrated by, Certificate No.)	Apr-20 Apr-20 Jan-20 Aug-20 Scheduled Calibration
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ID # 106276 101369 SN 3617 SN 1555 ID # MY49071430	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19(SPEAG,No.EX3-3617_Jan19) 22-Aug-19(CTTL-SPEAG,No.Z19-60295) Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336)	Apr-20 Apr-20 Jan-20 Aug-20 Scheduled Calibration Jan-20
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	ID # 106276 101369 SN 3617 SN 1555 ID # MY49071430 MY46110673	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19(SPEAG,No.EX3-3617_Jan19) 22-Aug-19(CTTL-SPEAG,No.Z19-60295) Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336) 24-Jan-19 (CTTL, No.J19X00547)	Apr-20 Apr-20 Jan-20 Aug-20 Scheduled Calibration Jan-20 Jan-20
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ID # 106276 101369 SN 3617 SN 1555 ID # MY49071430 MY46110673 Name	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19(SPEAG,No.EX3-3617_Jan19) 22-Aug-19(CTTL-SPEAG,No.Z19-60295) Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336) 24-Jan-19 (CTTL, No.J19X00547) Function	Apr-20 Apr-20 Jan-20 Aug-20 Scheduled Calibration Jan-20 Jan-20
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C Calibrated by: Reviewed by:	ID # 106276 101369 SN 3617 SN 1555 ID # MY49071430 MY46110673 Name Zhao Jing	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19(SPEAG,No.EX3-3617_Jan19) 22-Aug-19(CTTL-SPEAG,No.Z19-60295) Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336) 24-Jan-19 (CTTL, No.J19X00547) Function SAR Test Engineer	Apr-20 Apr-20 Jan-20 Aug-20 Scheduled Calibration Jan-20 Jan-20
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	ID # 106276 101369 SN 3617 SN 1555 ID # MY49071430 MY46110673 Name Zhao Jing Lin Hao	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19(SPEAG,No.EX3-3617_Jan19) 22-Aug-19(CTTL-SPEAG,No.Z19-60295) Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336) 24-Jan-19 (CTTL, No.J19X00547) Function SAR Test Engineer SAR Test Engineer	Apr-20 Apr-20 Jan-20 Aug-20 Scheduled Calibration Jan-20 Jan-20 Signature

Certificate No: Z20-60038

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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%.

Certificate No: Z20-60038

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#### Measurement Conditions

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

DASY Version	DASY52	V52.10.3
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	40.5 ± 6 %	1.37 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	8.89 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	35.7 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	4.69 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	18.8 W/kg ± 18.7 % (k=2)

Body TSL parameters The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.6 ± 6 %	1.50 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	تعلته	

#### SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.23 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	36.8 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	4.89 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	19.5 W/kg ± 18.7 % (k=2)

Certificate No: Z20-60038

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#### Appendix (Additional assessments outside the scope of CNAS L0570)

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.2Ω- 0.65 jΩ	
Return Loss	- 39.7 dB	

#### Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.8Ω- 1.02 jΩ	
Return Loss	- 26.8 dB	

#### General Antenna Parameters and Design

Electrical Delay (one direction)	1.084 ns	
----------------------------------	----------	--

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

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

#### Additional EUT Data

Manufactured by	SPEAG

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

Date: 01.03.2020

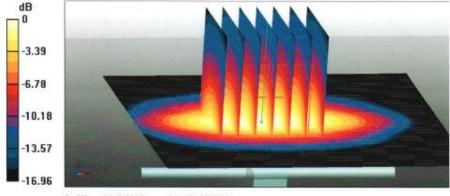
#### **DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1108** Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1750 MHz; $\sigma = 1.365$ S/m; $\varepsilon_r = 40.52$ ; $\rho = 1000$ kg/m3 Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 SN3617; ConvF(8.38, 8.38, 8.38) @ 1750 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; Calibrated: 8/22/2019
- Phantom: MFP\_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

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

Reference Value = 97.57 V/m; Power Drift = 0.00 dB Peak SAR (extrapolated) = 16.7 W/kg SAR(1 g) = 8.89 W/kg; SAR(10 g) = 4.69 W/kg Smallest distance from peaks to all points 3 dB below = 10 mm Ratio of SAR at M2 to SAR at M1 = 54% Maximum value of SAR (measured) = 13.9 W/kg



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

Certificate No: Z20-60038

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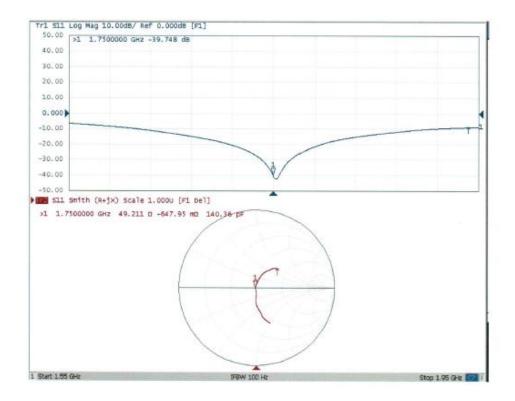


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#### Impedance Measurement Plot for Head TSL



Certificate No: Z20-60038

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

Date: 01.03.2020

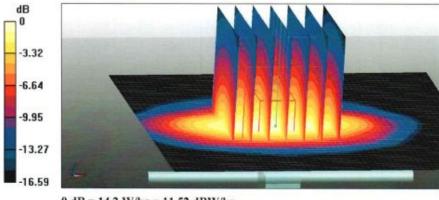
**DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1108** Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1750 MHz; σ = 1.499 S/m; ε<sub>r</sub> = 53.62; ρ = 1000 kg/m3 Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 SN3617; ConvF(8.03, 8.03, 8.03) @ 1750 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; Calibrated: 8/22/2019
- Phantom: MFP\_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 89.57 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 16.8 W/kg SAR(1 g) = 9.23 W/kg; SAR(10 g) = 4.89 W/kg Smallest distance from peaks to all points 3 dB below = 9.2 mm Ratio of SAR at M2 to SAR at M1 = 55.7% Maximum value of SAR (measured) = 14.2 W/kg



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

Certificate No: Z20-60038

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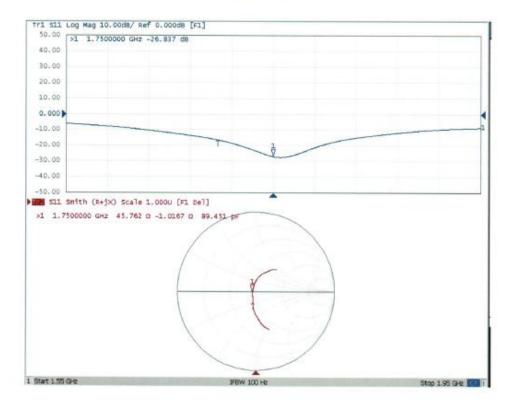


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#### Impedance Measurement Plot for Body TSL



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Tel: +86-10-62304 E-mail: cttl@chini	4633-2079 Fax: attl.com http:	n District, Beijing, 100191, Chi +86-10-62304633-2504 //www.chinattLen	CALIBRATIO CNAS L0570
Client SMC			21-60306
CALIBRATION	ERTIFICA	IE	
Object	D2450	VV2 - SN: 818	
Calibration Procedure(s)	FF-Z1	1-003-01	
	Calibra	ation Procedures for dipole validation kits	
Calibration date:	Augus	t 26, 2021	
All collection to the	1000 AL 1100 AL 1000	20 m	
All calibrations have been humidity<70%, Calibration Equipment used		the closed laboratory facility: environment	temperature (22±3)°C and
humidity<70%. Calibration Equipment used Primary Standards			temperature (22±3)°C and Scheduled Calibration
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2	ID # 106277	or calibration) Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336)	
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S	ID # 106277 104291	Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336)	Scheduled Calibration Sep-21 Sep-21
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2	ID # 106277 104291	or calibration) Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336)	Scheduled Calibration Sep-21
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4	ID # 106277 104291 SN 7517	or calibration) Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 03-Feb-21(CTTL-SPEAG,No.Z21-60001) 06-Nov-20(CTTL-SPEAG,No.Z20-60452)	Scheduled Calibration Sep-21 Sep-21 Feb-22 Nov-21
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE3	ID # 106277 104291 SN 7517 SN 536	Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 03-Feb-21(CTTL-SPEAG,No.Z21-60001)	Scheduled Calibration Sep-21 Sep-21 Feb-22
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE3 Secondary Standards	ID # 106277 104291 SN 7517 SN 536 ID #	Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 03-Feb-21(CTTL-SPEAG,No.Z21-60001) 06-Nov-20(CTTL-SPEAG,No.Z20-60452) Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration Sep-21 Sep-21 Feb-22 Nov-21 Scheduled Calibration
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE3 Secondary Standards Signal Generator E4438C	ID # 106277 104291 SN 7517 SN 536 ID # MY49071430 MY46110673	Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 03-Feb-21(CTTL-SPEAG,No.Z21-60001) 06-Nov-20(CTTL-SPEAG,No.Z20-60452) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593) 14-Jan-21 (CTTL, No.J21X00232)	Scheduled Calibration Sep-21 Sep-21 Feb-22 Nov-21 Scheduled Calibration Jan-22 Jan-22
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE3 Secondary Standards Signal Generator E4438C	ID # 106277 104291 SN 7517 SN 536 ID # MY49071430	Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 03-Feb-21(CTTL-SPEAG,No.Z21-60001) 06-Nov-20(CTTL-SPEAG,No.Z20-60452) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593)	Scheduled Calibration Sep-21 Sep-21 Feb-22 Nov-21 Scheduled Calibration Jan-22
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE3 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	d (M&TE critical f ID # 106277 104291 SN 7517 SN 536 ID # MY49071430 MY46110673 Name	Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 03-Feb-21(CTTL-SPEAG,No.Z21-60001) 06-Nov-20(CTTL-SPEAG,No.Z20-60452) 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 Feb-22 Nov-21 Scheduled Calibration Jan-22 Jan-22
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE3 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	d (M&TE critical f ID # 106277 104291 SN 7517 SN 536 ID # MY49071430 MY46110673 Name Zhao Jing	Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 03-Feb-21(CTTL-SPEAG,No.Z21-60001) 06-Nov-20(CTTL-SPEAG,No.Z20-60452) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593) 14-Jan-21 (CTTL, No.J21X00232) Function SAR Test Engineer	Scheduled Calibration Sep-21 Sep-21 Feb-22 Nov-21 Scheduled Calibration Jan-22 Jan-22



#### Glossary:

oroodary.	
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: Z21-60306

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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
22.0 °C	39.2	1.80 mho/m
(22.0 ± 0.2) °C	40.0 ± 6 %	1.77 mho/m ± 6 %
<1.0 °C		
	22.0 °C (22.0 ± 0.2) °C	22.0 °C         39.2           (22.0 ± 0.2) °C         40.0 ± 6 %

#### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	12.9 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	52.2 W/kg ± 18.8 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.91 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.8 W/kg ± 18.7 % (k=2)

Certificate No: Z21-60306

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## Appendix (Additional assessments outside the scope of CNAS L0570)

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.7Ω+ 3.89jΩ	
Return Loss	- 25.7dB	

#### General Antenna Parameters and Design

Electrical Delay (one direction)	1.071 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		
	1			
ificate No: Z21-60306	Page 4 of 6			



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**DASY5 Validation Report for Head TSL** 

Date: 08.26.2021

Test Laboratory: CTTL, Beijing, China DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 818 Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1 Medium parameters used: f = 2450 MHz;  $\sigma = 1.772 \text{ S/m}$ ;  $\epsilon_r = 40.04$ ;  $\rho = 1000 \text{ kg/m}^3$ Phantom section: Right Section DASY5 Configuration:

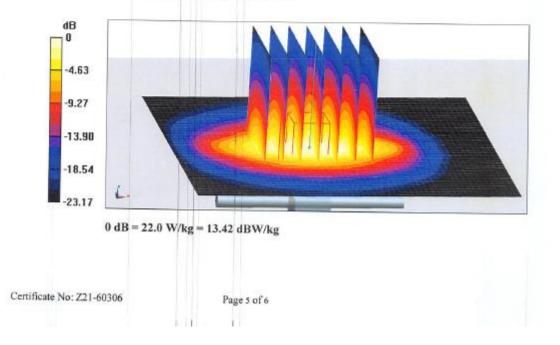
- Probe: EX3DV4 SN7517; ConvF(7.34, 7.34, 7.34) @ 2450 MHz; Calibrated: 2021-02-03
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn536; Calibrated: 2020-11-06
- Phantom: MFP\_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- · Measurement SW: DASY52, Version 52.10 (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 = 107.9 V/m; Power Drift = -0.02 dB Peak SAR (extrapolated) = 27.4 W/kg

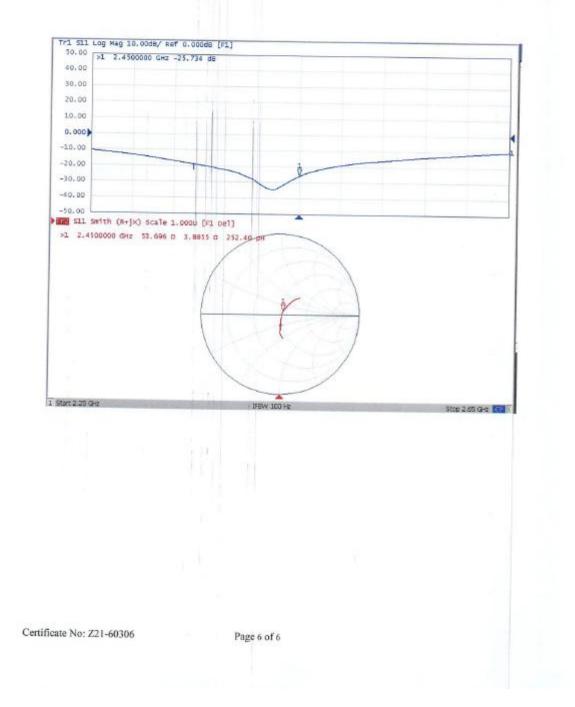
SAR(1 g) = 12.9 W/kg; SAR(10 g) = 5.91 W/kg

Smallest distance from peaks to all points 3 dB below = 9 mm Ratio of SAR at M2 to SAR at M1 = 46.9% Maximum value of SAR (measured) = 22.0 W/kg





#### Impedance Measurement Plot for Head TSL



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_	TTL	spe	ag			中国认可国际互认
	-	CALIBRATION LAB	ORATORY	lac-MRA	<b>CNAS</b>	校准
Tel: +1	No.51 Xueyuan Road 86-10-62304633-207 I: ettl@chinattl.com	Haidian District, Beljin 9 Fax: +86-10-623 http://www.china	04633-2504	2000	-	CALIBRATION CNAS L0570
Client	SMQ			Certificate No:	Z20-60040	
CALIBRAT	ION CERT	IFICATE				
Object		D2600V2 - SN:	1074			
Calibration Proce	dure(s)	FF-Z11-003-01				
		Calibration Proc	cedures for	dipole validation kits		
Calibration date:		January 2, 2020	0			
	I). The measure	ments and the unce		nal standards, which ith confidence proba		

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)C and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106276	11-Apr-19 (CTTL, No.J19X02605)	Apr-20
Power sensor NRP6A	101369	11-Apr-19 (CTTL, No.J19X02605)	Apr-20
Reference Probe EX3DV4	SN 3617	31-Jan-19(SPEAG,No.EX3-3617_Jan19)	Jan-20
DAE4	SN 1555	22-Aug-19(CTTL-SPEAG,No.Z19-60295)	) Aug-20
Secondary Standards	ID#	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	23-Jan-19 (CTTL, No.J19X00336)	Jan-20
Network Analyzer E5071C	MY46110673	24-Jan-19 (CTTL, No.J19X00547)	Jan-20
	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	221
Reviewed by:	Lin Hao	SAR Test Engineer	三林的
Approved by:	Qi Dianyuan	SAR Project Leader	and the
		Issued: Ja	nuary 8, 2020
This calibration certificate sh	all not be repro-	duced except in full without written approva	al of the laboratory.

Certificate No: Z20-60040

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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	V52.10.3
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	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	38.5 ± 6 %	1.94 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

#### SAR result with Head TSL

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	14.2 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	56.9 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.29 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	25.2 W/kg ± 18.7 % (k=2)

#### Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.5	2.16 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.7 ± 6 %	2.15 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	_	-

#### SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.6 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	54.6 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	6.02 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	24.1 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	49.1Ω- 6.89jΩ
Return Loss	- 23.1dB

#### Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.2Ω- 5.65jΩ	
Return Loss	- 23.0dB	

#### General Antenna Parameters and Design

Electrical Delay (one direction)	1.012 ns	
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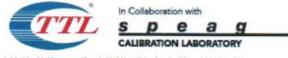
After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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
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 http://www.chinattl.cn

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

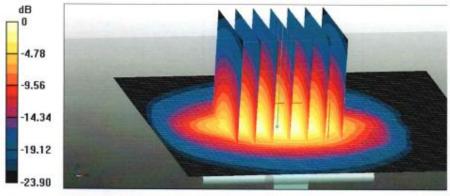
Date: 01.02.2020

**DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1074** Communication System: UID 0, CW; Frequency: 2600 MHz; Duty Cycle: 1:1 Medium parameters used: f = 2600 MHz;  $\sigma = 1.943$  S/m;  $\varepsilon_r = 38.52$ ; p = 1000 kg/m3 Phantom section: Center Section DASY5 Configuration:

- Probe: EX3DV4 SN3617; ConvF(7.19, 7.19, 7.19) @ 2600 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; Calibrated: 8/22/2019
- Phantom: MFP\_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

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

Reference Value = 103.8 V/m; Power Drift = 0.04 dB Peak SAR (extrapolated) = 30.9 W/kg SAR(1 g) = 14.2 W/kg; SAR(10 g) = 6.29 W/kg Smallest distance from peaks to all points 3 dB below = 9 mm Ratio of SAR at M2 to SAR at M1 = 46.4% Maximum value of SAR (measured) = 24.4 W/kg



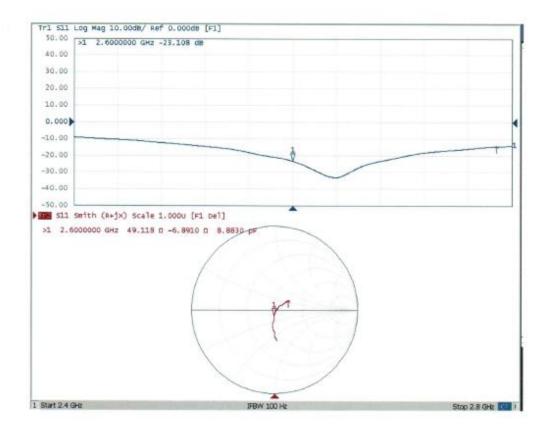
0 dB = 24.4 W/kg = 13.87 dBW/kg

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#### Impedance Measurement Plot for Head TSL



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#### DASY5 Validation Report for Body TSL

Date: 01.02.2020

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1074

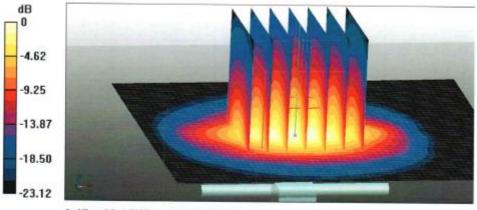
Communication System: UID 0, CW; Frequency: 2600 MHz; Duty Cycle: 1:1 Medium parameters used: f = 2600 MHz;  $\sigma = 2.145$  S/m;  $\epsilon_r = 52.74$ ;  $\rho = 1000$  kg/m3 Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 SN3617; ConvF(7.49, 7.49, 7.49) @ 2600 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; Calibrated: 8/22/2019
- Phantom: MFP\_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

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

Reference Value = 95.00 V/m; Power Drift = 0.05 dB Peak SAR (extrapolated) = 29.4 W/kg SAR(1 g) = 13.6 W/kg; SAR(10 g) = 6.02 W/kg Smallest distance from peaks to all points 3 dB below = 8 mm Ratio of SAR at M2 to SAR at M1 = 47.2% Maximum value of SAR (measured) = 23.4 W/kg



0 dB = 23.4 W/kg = 13.69 dBW/kg

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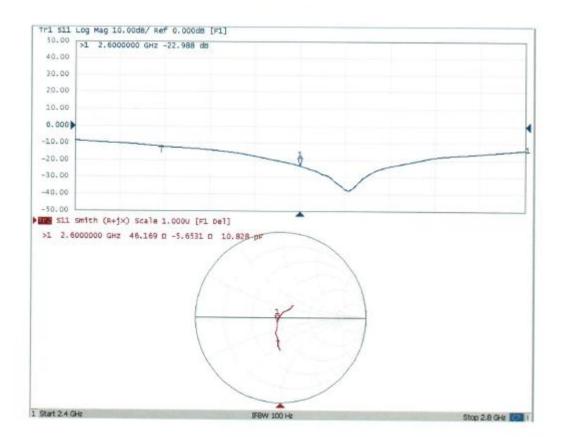


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#### Impedance Measurement Plot for Body TSL



Certificate No: Z20-60040

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		e a g	中国认可国际互认
		3	CNAS 校准 CALIBRATION
Tel: +86-10-6230465	33-2512 Fax: +	trict, Beijing, 100191, China 344444	CNAS L0570
E-mail: ettl@chinatt		www.chinattl.cn Certificate No:	Z20-60041
Cilent			220-00041
CALIBRATION CE	RTIFICAT	E	
Object	D5GHz	V2 - SN: 1185	
Calibration Procedure(s)	EE 711	-003-01	
		tion Procedures for dipole validation kits	
O-Ib-rates data			
Calibration date:	Decem	ber 31, 2019	
pages and are part of the ce	rtificate.	the uncertainties with confidence probabi the closed laboratory facility: environm	
Calibration Equipment used	(M&TE critical f	or calibration)	
	(M&TE critical f		) Scheduled Calibration
Calibration Equipment used Primary Standards Power Meter NRP2		Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605)	Scheduled Calibration Apr-20
Primary Standards	ID#	Cal Date(Calibrated by, Certificate No.)	
Primary Standards Power Meter NRP2	ID# 106276	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605)	Apr-20 Apr-20
Primary Standards Power Meter NRP2 Power sensor NRP6A	ID# 106276 101369	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605)	Apr-20 Apr-20 ) Jan-20
Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4	ID # 106276 101369 SN 3617 SN 1555	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19(SPEAG,No.EX3-3617_Jan19 22-Aug-19(CTTL-SPEAG,No.Z19-60298	Apr-20 Apr-20 9) Jan-20 5) Aug-20
Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards	ID # 106276 101369 SN 3617	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19 (SPEAG, No.EX3-3617_Jan19 22-Aug-19 (CTTL-SPEAG, No.Z19-6029 Cal Date(Calibrated by, Certificate No.)	Apr-20 Apr-20 ) Jan-20
Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4	ID # 106276 101369 SN 3617 SN 1555 ID #	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19(SPEAG,No.EX3-3617_Jan19 22-Aug-19(CTTL-SPEAG,No.Z19-60298	Apr-20 Apr-20 ) Jan-20 5) Aug-20 Scheduled Calibration
Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ID # 106276 101369 SN 3617 SN 1555 ID # MY49071430 MY46110673	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19(SPEAG,No.EX3-3617_Jan19 22-Aug-19(CTTL-SPEAG,No.Z19-60295 Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336) 24-Jan-19 (CTTL, No.J19X00547)	Apr-20 Apr-20 3) Jan-20 5) Aug-20 Scheduled Calibration Jan-20 Jan-20
Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ID # 106276 101369 SN 3617 SN 1555 ID # MY49071430 MY46110673 Name	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19 (SPEAG, No.EX3-3617_Jan19 22-Aug-19 (CTTL-SPEAG, No.Z19-60293 Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336) 24-Jan-19 (CTTL, No.J19X00547) Function	Apr-20 Apr-20 3) Jan-20 5) Aug-20 Scheduled Calibration Jan-20
Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzerE5071C	ID # 106276 101369 SN 3617 SN 1555 ID # MY49071430 MY46110673	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19(SPEAG,No.EX3-3617_Jan19 22-Aug-19(CTTL-SPEAG,No.Z19-60295 Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336) 24-Jan-19 (CTTL, No.J19X00547)	Apr-20 Apr-20 3) Jan-20 5) Aug-20 Scheduled Calibration Jan-20 Jan-20
Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzerE5071C	ID # 106276 101369 SN 3617 SN 1555 ID # MY49071430 MY46110673 Name	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19 (SPEAG, No.EX3-3617_Jan19 22-Aug-19 (CTTL-SPEAG, No.Z19-60293 Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336) 24-Jan-19 (CTTL, No.J19X00547) Function	Apr-20 Apr-20 3) Jan-20 5) Aug-20 Scheduled Calibration Jan-20 Jan-20
Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzerE5071C Calibrated by:	ID # 106276 101369 SN 3617 SN 1555 ID # MY49071430 MY46110673 Name Zhao Jing	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19 (SPEAG, No.EX3-3617_Jan19 22-Aug-19 (CTTL-SPEAG, No.Z19-60298 Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336) 24-Jan-19 (CTTL, No.J19X00547) Function SAR Test Engineer	Apr-20 Apr-20 3) Jan-20 5) Aug-20 Scheduled Calibration Jan-20 Jan-20
Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzerE5071C Calibrated by: Reviewed by:	ID # 106276 101369 SN 3617 SN 1555 ID # MY49071430 MY46110673 Name Zhao Jing Lin Hao	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19 (SPEAG, No.EX3-3617_Jan19 22-Aug-19 (CTTL-SPEAG, No.Z19-60298 Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336) 24-Jan-19 (CTTL, No.J19X00547) Function SAR Test Engineer SAR Test Engineer SAR Project Leader	Apr-20 Apr-20 3) Jan-20 5) Aug-20 Scheduled Calibration Jan-20 Jan-20

Certificate No: Z20-60041

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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	V52.10.3
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
Nominal Head TSL parameters	22.0 °C	35.9	4.71 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.8 ± 6 %	4.65 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

## 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	7.61 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	76.5 W/kg ± 24.4 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	21.8 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	36.2 ± 6 %	5.03 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	1000	

## SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.99 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	80.2 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.27 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.8 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	36.0 ± 6 %	5.19 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

## SAR result with Head TSL at 5750 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.80 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	78.2 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.21 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.2 W/kg ± 24.2 % (k=2)

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## Body TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	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	48.7 ± 6 %	5.32 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		

## 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	7.43 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	74.2 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	
SAR measured	100 mW input power	2.08 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.8 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	48.0 ± 6 %	5.79 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 <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.70 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	76.9 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	
SAR measured	100 mW input power	2.17 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.7 W/kg ± 24.2 % (k=2)

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

	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	47.7 ± 6 %	6.02 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		

## 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	7.30 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	72.9 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	
SAR measured	100 mW input power	2.03 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.2 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	49.3Ω - 5.08jΩ	
Return Loss	- 25.8dB	

## Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	55.2Ω - 2.17jΩ	
Return Loss	- 25.5dB	

## Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	55.6Ω - 0.52jΩ	
Return Loss	- 25.5dB	

## Antenna Parameters with Body TSL at 5250 MHz

Impedance, transformed to feed point	49.3Ω - 3.89jΩ	
Return Loss	- 28.0dB	

## Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	53.9Ω - 2.71jΩ	
Return Loss	- 26.7dB	

## Antenna Parameters with Body TSL at 5750 MHz

Impedance, transformed to feed point	55.8Ω - 2.17jΩ	
Return Loss	- 24.7dB	



## General Antenna Parameters and Design

Electrical Delay (one direction)	1.066 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
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## DASY5 Validation Report for Head TSL

Test Laboratory: CTTL, Beijing, China

Date: 12.31.2019

## DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1185

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

Medium parameters used: f = 5250 MHz;  $\sigma$  = 4.652 S/m;  $\epsilon_r$  = 36.81;  $\rho$  = 1000 kg/m3, Medium parameters used: f = 5600 MHz;  $\sigma$  = 5.027 S/m;  $\epsilon_r$  = 36.19;  $\rho$  = 1000 kg/m3, Medium parameters used: f = 5750 MHz;  $\sigma$  = 5.19 S/m;  $\epsilon_r$  = 35.96;  $\rho$  = 1000 kg/m3,

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 SN3617; ConvF(5.39, 5.39, 5.39) @ 5250 MHz; ConvF(5.06, 5.06, 5.06) @ 5600 MHz; ConvF(5.07, 5.07, 5.07) @ 5750 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; Calibrated: 8/22/2019
- Phantom: MFP\_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

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 = 64.41 V/m; Power Drift = -0.02 dB Peak SAR (extrapolated) = 31.5 W/kg SAR(1 g) = 7.61 W/kg; SAR(10 g) = 2.17 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 65.3% Maximum value of SAR (measured) = 18.1 W/kg

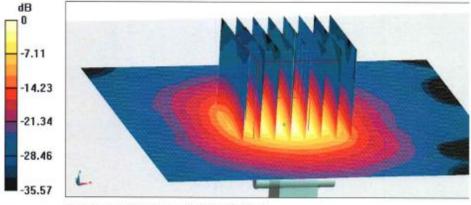
Dipole Calibration /Pin=100mW, d=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 64.02 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 36.2 W/kg SAR(1 g) = 7.99 W/kg; SAR(10 g) = 2.27 W/kg Smallest distance from peaks to all points 3 dB below = 7.4 mm Ratio of SAR at M2 to SAR at M1 = 62.7% Maximum value of SAR (measured) = 19.5 W/kg

Certificate No: Z20-60041

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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 = 63.14 V/m; Power Drift = 0.01 dB Peak SAR (extrapolated) = 36.9 W/kg SAR(1 g) = 7.8 W/kg; SAR(10 g) = 2.21 W/kg Smallest distance from peaks to all points 3 dB below = 7.5 mm Ratio of SAR at M2 to SAR at M1 = 59.5% Maximum value of SAR (measured) = 19.3 W/kg



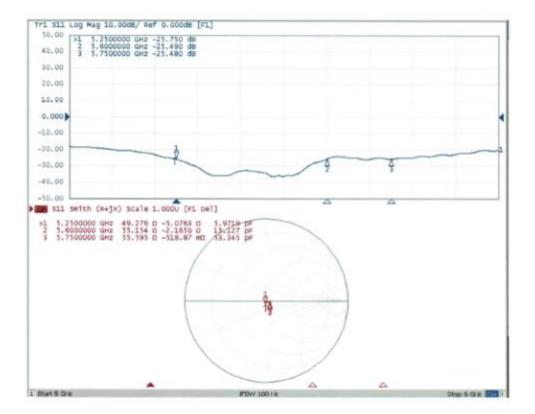
0 dB = 19.3 W/kg = 12.86 dBW/kg

Certificate No: Z20-60041

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## Impedance Measurement Plot for Head TSL



Certificate No: Z20-60041

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## DASY5 Validation Report for Body TSL

Date: 12.30.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1185

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

Medium parameters used: f = 5250 MHz;  $\sigma$  = 5.317 S/m;  $\epsilon_r$  = 48.69;  $\rho$  = 1000 kg/m3, Medium parameters used: f = 5600 MHz;  $\sigma$  = 5.79 S/m;  $\epsilon_r$  = 48.02;  $\rho$  = 1000 kg/m3, Medium parameters used: f = 5750 MHz;  $\sigma$  = 6.019 S/m;  $\epsilon_r$  = 47.69;  $\rho$  = 1000 kg/m3,

Phantom section: Right Section

DASY5 Configuration:

- Probe: SN3617; ConvF(4.76, 4.76, 4.76) @ 5250 MHz; ConvF(4.23, 4.23, 4.23)
   @ 5600 MHz; ConvF(4.36, 4.36, 4.36) @ 5750 MHz; Calibrated: 1/31/2019,
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; Calibrated: 8/22/2019
- Phantom: MFP\_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

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 = 66.27 V/m; Power Drift = -0.04 dB Peak SAR (extrapolated) = 29.5 W/kg SAR(1 g) = 7.43 W/kg; SAR(10 g) = 2.08 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 65.1% Maximum value of SAR (measured) = 17.5 W/kg

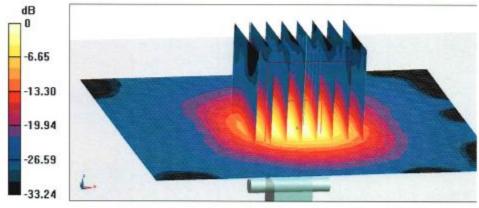
Dipole Calibration /Pin=100mW, d=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 66.02 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 34.0 W/kg SAR(1 g) = 7.7 W/kg; SAR(10 g) = 2.17 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 61.7% Maximum value of SAR (measured) = 18.8 W/kg

Certificate No: Z20-60041

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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 = 63.40 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 34.0 W/kg SAR(1 g) = 7.3 W/kg; SAR(10 g) = 2.03 W/kg Smallest distance from peaks to all points 3 dB below = 7.4 mm Ratio of SAR at M2 to SAR at M1 = 59.9% Maximum value of SAR (measured) = 18.1 W/kg



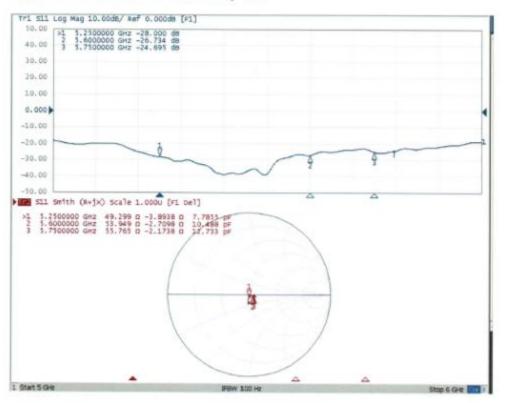
0 dB = 18.1 W/kg = 12.58 dBW/kg

Certificate No: Z20-60041

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## Impedance Measurement Plot for Body TSL



Certificate No: Z20-60041

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Add: No.52 Hus Yu Tel: +86-10-62304 E-mail: ettl@china	anBei Road, Haidian 633-2079 Fax:	District, Beijing, 100191, Chi +86-10-62304633-2504 /www.ehinattl.en	校准 CALIBRATIC CNAS L057
Client SM	Q	Certificate No: Z2	21-60305
CALIBRATION C	ERTIFICAT	ΓE	
Object	D1900	V2 - SN: 5d162	
Calibration Procedure(s)		-003-01	
	Calibra	ation Procedures for dipole validation kits	
Calibration date:	Septen	nber 1, 2021	
All calibrations have been humidity<70%. Calibration Equipment used		the closed laboratory facility; environment i or calibration)	temperature (22±3)℃ and
numidity<70%. Calibration Equipment used			
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2	(M&TE critical fi ID # 106277	or calibration) Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336)	
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S	(M&TE critical fi ID # 106277 104291	Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336)	Scheduled Calibration Sep-21 Sep-21
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2	(M&TE critical fi ID # 106277 104291	or calibration) Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 03-Feb-21(CTTL-SPEAG,No.Z21-60001)	Scheduled Calibration Sep-21 Sep-21 Feb-22
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4	(M&TE critical fi ID # 106277 104291 SN 7517 SN 1556	or calibration) Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 03-Feb-21(CTTL-SPEAG,No.Z21-60001) 15-Jan-21(SPEAG,No.DAE4-1556_Jan21)	Scheduled Calibration Sep-21 Sep-21 Feb-22 Jan-22
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards	(M&TE critical fi ID # 106277 104291 SN 7517 SN 1556 ID #	or calibration) Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 03-Feb-21(CTTL-SPEAG,No.Z21-60001) 15-Jan-21(SPEAG,No.DAE4-1556_Jan21) Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration Sep-21 Sep-21 Feb-22 Jan-22 Scheduled Calibration
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4	(M&TE critical fi ID # 106277 104291 SN 7517 SN 1556	or calibration) Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 03-Feb-21(CTTL-SPEAG,No.Z21-60001) 15-Jan-21(SPEAG,No.DAE4-1556_Jan21)	Scheduled Calibration Sep-21 Sep-21 Feb-22
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	(M&TE critical fi ID # 106277 104291 SN 7517 SN 1556 ID # MY49071430	or calibration) Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 03-Feb-21 (CTTL-SPEAG,No.Z21-60001) 15-Jan-21 (SPEAG,No.DAE4-1556_Jan21) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593)	Scheduled Calibration Sep-21 Sep-21 Feb-22 Jan-22 Scheduled Calibration Jan-22
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	(M&TE critical fi ID # 106277 104291 SN 7517 SN 1556 ID # MY49071430 MY46110673	Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 03-Feb-21 (CTTL-SPEAG,No.Z21-60001) 15-Jan-21(SPEAG,No.DAE4-1556_Jan21) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593) 14-Jan-21 (CTTL, No.J21X00232)	Scheduled Calibration Sep-21 Sep-21 Feb-22 Jan-22 Scheduled Calibration Jan-22 Jan-22
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	(M&TE critical fi ID # 106277 104291 SN 7517 SN 1556 ID # MY49071430 MY46110673 Name	Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 03-Feb-21 (CTTL-SPEAG,No.Z21-60001) 15-Jan-21 (SPEAG,No.DAE4-1556_Jan21) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593) 14-Jan-21 (CTTL, No.J21X00232) Function	Scheduled Calibration Sep-21 Sep-21 Feb-22 Jan-22 Scheduled Calibration Jan-22 Jan-22
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	(M&TE critical fi ID # 106277 104291 SN 7517 SN 1556 ID # MY49071430 MY46110673 Name Zhao Jing	Cal Date (Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 03-Feb-21 (CTTL-SPEAG,No.Z21-80001) 15-Jan-21 (SPEAG,No.DAE4-1556_Jan21) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593) 14-Jan-21 (CTTL, No.J21X00232) Function SAR Test Engineer	Scheduled Calibration Sep-21 Sep-21 Feb-22 Jan-22 Scheduled Calibration Jan-22 Jan-22

Certificate No: Z21-60305

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## lossary:

lossaly.	
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

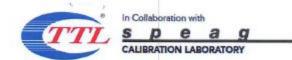
## Methods Applied and Interpretation of Parameters:

- 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: Z21-60305

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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	40.6 ± 6 %	1.39 mho/m ± 6 %
Head TSL temperature change during test	<1.0 *C	1	

## SAR result with Head TSL

SAR averaged over 1 $cm^3$ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.83 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	39.7 W/kg ± 18.8 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.01 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	20.2 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	54.4Ω+ 4.86jΩ	1
Return Loss	- 24.1dB	

## General Antenna Parameters and Design

Electrical Delay (one direction)	1.103 ns	0
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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



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

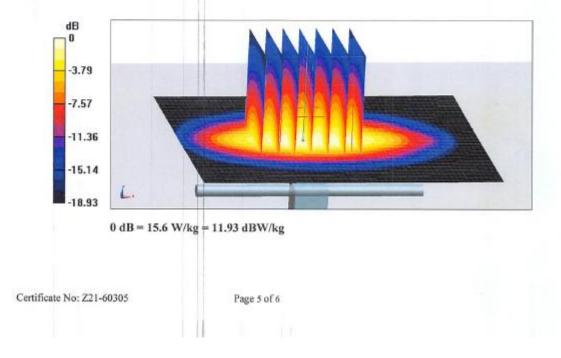
Date: 09.01.2021

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d162** Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1900 MHz;  $\sigma = 1.385$  S/m;  $\epsilon_r = 40.6$ ;  $\rho = 1000$  kg/m<sup>3</sup> Phantom section: Right Section

DASY5 Configuration:

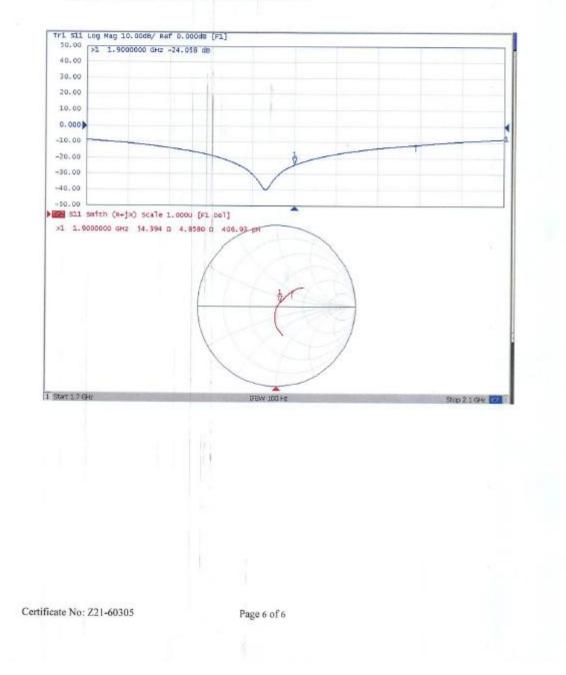
- Probe: EX3DV4 SN7517; ConvF(7.81, 7.81, 7.81) @ 1900 MHz; Calibrated: 2021-02-03
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2021-01-15
- Phantom: MFP\_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 103.2 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 19.1 W/kg SAR(1 g) = 9.83 W/kg; SAR(10 g) = 5.01 W/kg Smallest distance from peaks to all points 3 dB below = 10 mm Ratio of SAR at M2 to SAR at M1 = 51.8% Maximum value of SAR (measured) = 15.6 W/kg





## Impedance Measurement Plot for Head TSL



	CALIBRA	TION LABORATORY	NAS 樹际互认
Tel: +86-10-62304	633-2079 Fax: -	District, Beijing, 100191, Chi	CALIBRATIO CNAS L057
E-mail: cttl@china Client SM0	and a second sec	//www.chinattl.cn Certificate No: Z2	1-60304
CALIBRATION C			
Dbject	D1800	V2 - SN: 2d171	
Calibration Procedure(s)	FE 744	1 200 04	
		I-003-01 ation Procedures for dipole validation kits	
Calibration date:			
andration date.	Septen	nber 1, 2021	1
neasurements (SI). The me ages and are part of the co	easurements and artificate.	the uncertainties with confidence probability	
ages and are part of the co	easurements and ertificate. conducted in t	the uncertainties with confidence probability the closed laboratory facility: environment t	
neasurements (SI). The me ages and are part of the co II calibrations have been umidity<70%. alibration Equipment used	easurements and ertificate. conducted in t	the uncertainties with confidence probability the closed laboratory facility: environment t	
reasurements (SI). The me ages and are part of the co II calibrations have been umidity<70%. alibration Equipment used rimary Standards	easurements and ertificate. conducted in t (M&TE critical fi	the uncertainties with confidence probability the closed laboratory facility: environment t or calibration)	emperature (22±3)°C an
neasurements (SI). The me ages and are part of the co II calibrations have been umidity<70%. alibration Equipment used rimary Standards Power Meter NRP2 Power sensor NRP8S	easurements and ertificate. conducted in t (M&TE critical fi ID # 106277 104291	the uncertainties with confidence probability the closed laboratory facility: environment t or calibration) Cal Date(Calibrated by, Certificate No.)	temperature (22±3)°C an Scheduled Calibration
neasurements (SI). The me ages and are part of the co II calibrations have been umidity<70%. alibration Equipment used rimary Standards Power Meter NRP2 Power sensor NRP8S ReferenceProbe EX3DV4	easurements and ertificate. conducted in t (M&TE critical fi ID # 106277 104291 SN 7517	the uncertainties with confidence probability the closed laboratory facility: environment t or calibration) Cal Date(Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 03-Feb-21(CTTL-SPEAG,No.Z21-60001)	Scheduled Calibration Sep-21 Sep-21 Feb-22
neasurements (SI). The me ages and are part of the co II calibrations have been umidity<70%. alibration Equipment used rimary Standards Power Meter NRP2 Power sensor NRP8S ReferenceProbe EX3DV4	easurements and ertificate. conducted in t (M&TE critical fi ID # 106277 104291	the uncertainties with confidence probability the closed laboratory facility: environment t or calibration) Cal Date(Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336)	Scheduled Calibration Sep-21 Sep-21
neasurements (SI). The me ages and are part of the co II calibrations have been umidity<70%. calibration Equipment used rimary Standards Power Meter NRP2 Power sensor NRP8S ReferenceProbe EX3DV4 DAE4	easurements and ertificate. conducted in t (M&TE critical fi ID # 106277 104291 SN 7517	the uncertainties with confidence probability the closed laboratory facility: environment t or calibration) Cal Date(Calibrated by, Certificate No.) 23-Sep-20 (CTTL, No.J20X08336) 23-Sep-20 (CTTL, No.J20X08336) 03-Feb-21(CTTL-SPEAG,No.Z21-60001)	Scheduled Calibration Sep-21 Sep-21 Feb-22
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## lossary:

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

## Calibration is Performed According to the Following Standards:

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

## Additional Documentation:

e) DASY4/5 System Handbook

## Methods Applied and Interpretation of Parameters:

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

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

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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: ettl@ehinattLeom http://www.ehinattLeo

## Measurement Conditions

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

DASY52	V52.10.4
Advanced Extrapolation	
Triple Flat Phantom 5.1C	
10 mm	with Spacer
dx, dy, dz = 5 mm	
1800 MHz ± 1 MHz	
	Advanced Extrapolation Triple Flat Phantom 5.1C 10 mm dx, dy, dz = 5 mm

## Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.9 ± 6 %	1.39 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		-

## SAR result with Head TSL

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.57 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	38.4 W/kg ± 18.8 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	4.94 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	19.8 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	49.8Ω- 2.36jΩ	
Return Loss	- 32.5dB	

## General Antenna Parameters and Design

Electrical Delay (one direction)	1.120 ns

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

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

#### Additional EUT Data

Manufactured by		SPEAG	
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## DASY5 Validation Report for Head TSL

Date: 09.01.2021

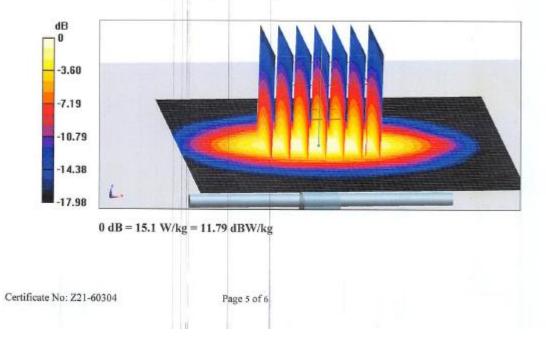
Test Laboratory: CTTL, Beijing, China **DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN: 2d171** Communication System: UID 0, CW; Frequency: 1800 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1800 MHz;  $\sigma = 1.39$  S/m;  $\epsilon_r = 39.92$ ;  $\rho = 1000$  kg/m<sup>3</sup> Phantom section: Right Section DASY5 Configuration:

- Probe: EX3DV4 SN7517; ConvF(8.22, 8.22, 8.22) @ 1800 MHz; Calibrated: 2021-02-03
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2021-01-15
- Phantom: MFP\_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 100.9 V/m; Power Drift = 0.00 dB Peak SAR (extrapolated) = 18.4 W/kg SAR(1 g) = 9.57 W/kg; SAR(10 g) = 4.94 W/kg

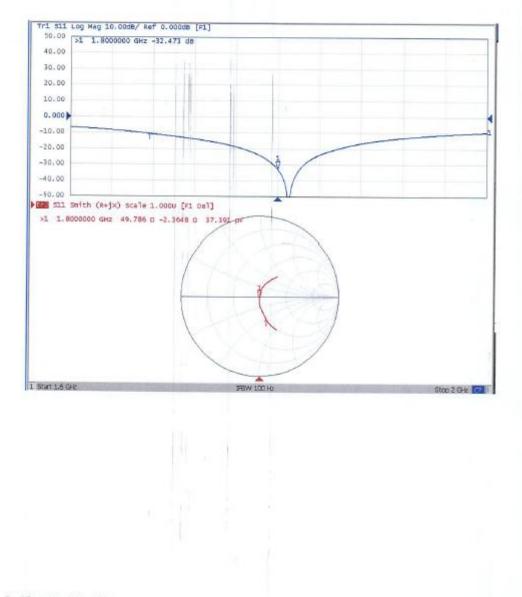
Smallest distance from peaks to all points 3 dB below = 10 mm Ratio of SAR at M2 to SAR at M1 = 52.3%

Maximum value of SAR (measured) = 15.1 W/kg





## Impedance Measurement Plot for Head TSL



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