## 1.1. D750V3 Dipole Calibration Certificate

Add: No.51 Xueyuan Ro	070 Eav: +86-1	10-62304633-2504	CNAS L0570
Tel: +86-10-62304633-2 E-mail: cttl@chinattl.com		Certificate No: Z21-6	0016
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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: Z21-60016

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#### S e p g а CALIBRATION LABORATORY

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#### **Measurement Conditions**

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

Head TSL parameters The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	42.3 ± 6 %	0.91 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

#### SAR result with Head TSL

Condition	
250 mW input power	2.13 W/kg
normalized to 1W	8.43 W/kg ± 18.8 % (k=2)
Condition	
250 mW input power	1.41 W/kg
normalized to 1W	5.59 W/kg ± 18.7 % (k=2)
	250 mW input power normalized to 1W Condition 250 mW input power

Certificate	No:	Z21	-60016	
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#### Appendix (Additional assessments outside the scope of CNAS L0570)

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.6Ω- 1.34jΩ		
Return Loss	- 28.6dB		

#### General Antenna Parameters and Design

Electrical Delay (one direction)	0.944 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

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### DASY5 Validation Report for Head TSL

Date: 01.22.2021

Test Laboratory: CTTL, Beijing, China DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1180

Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1 Medium parameters used: f = 750 MHz; σ = 0.905 S/m; ε<sub>r</sub> = 42.25; ρ = 1000 kg/m3

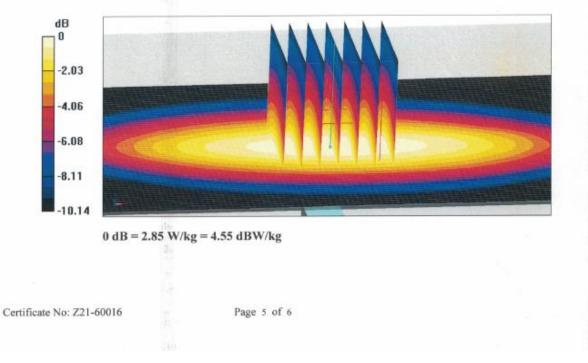
Phantom section: Right Section

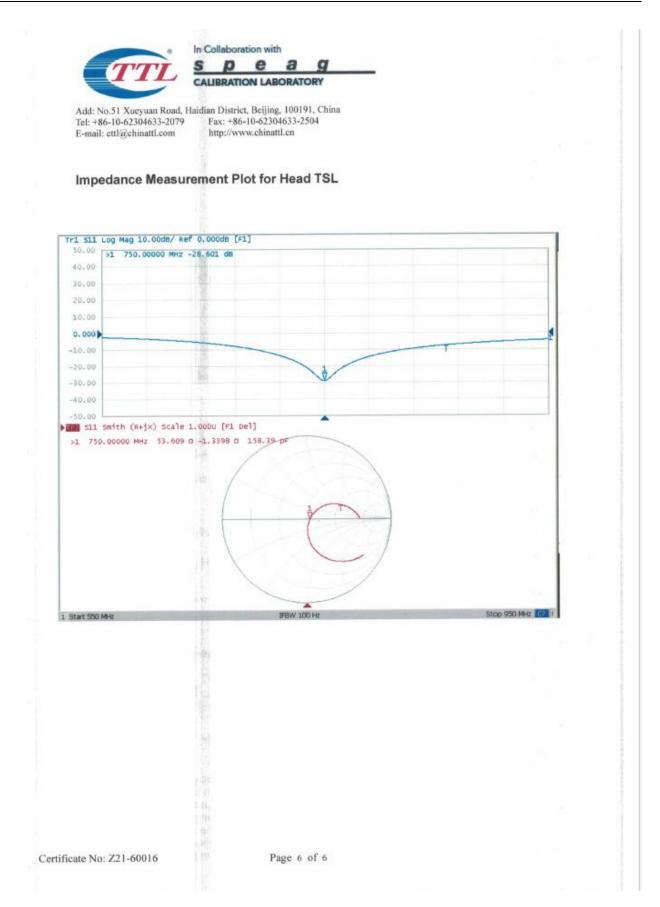
DASY5 Configuration:

- Probe: EX3DV4 SN7600; ConvF(10.88, 10.88, 10.88) @ 750 MHz; Calibrated: 2020-11-30
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2020-02-10
- Phantom: MFP\_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

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

Reference Value = 54.99 V/m; Power Drift = 0.00 dB Peak SAR (extrapolated) = 3.25 W/kg SAR(1 g) = 2.13 W/kg; SAR(10 g) = 1.41 W/kg Smallest distance from peaks to all points 3 dB below = 22.7 mm Ratio of SAR at M2 to SAR at M1 = 65.6% Maximum value of SAR (measured) = 2.85 W/kg





Referring to KDB865664 D01, if dipoles are verified in return loss (<-20dB, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

	Head-750								
Date of		Dolto (9/)	Real Impedance	Delta	Imaginary	Delta			
measurement	Return-loss (dB)	Delta (%)	(ohm)	(ohm)	impedance (ohm)	(ohm)			
2021-01-22	-28.6		53.6		-1.34				
2022-01-17	-28.1	1.75	53.5	0.1	-1.11	0.23			

### 1.2. D835V2 Dipole Calibration Certificate

Add: No.51 Xuevu		strict, Beijing, 100191, China	<b>ACN</b>	AS 校准 CALI	BRATION
Tel: +86-10-62304 E-mail: cttl@china	633-2079 Fax: -	+86-10-62304633-2504		CNAS	S L0570
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Object	D835V	/2 - SN: 4d238			
Calibration Procedure(s)		222.24			
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	Galibra	ation Procedures for cipole validation is	urs.		
Calibration date:	Januar	y 22, 2021			
All calibrations have been	n conducted in	the closed laboratory facility: enviro	onment tem	perature(22±3)	c and
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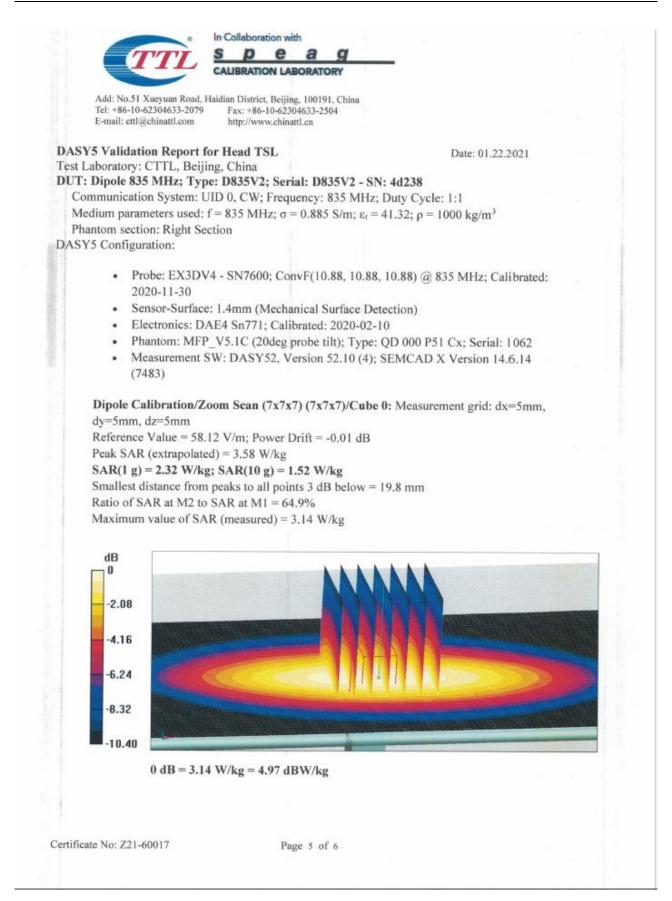
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	)-62304633-2079 @chinattl.com	Fax: +86-10-62304633-2 http://www.chinattl.cn	2504		
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Glossary:	- 14				
TSL	tissue sim	nulating liquid			
ConvF	sensitivity	y in TSL / NORMx	,y,z		
N/A	not applica	able or not measu	red		
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Calibration is	Performed Ac	cording to the Fe	ollowing Stand	lards:	
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		measure the Spe	acific Absorption	Rate (SAR) Fo	r wireless
communicat	ion devices use	ed in close proxim	ity to the human	n body (frequenc	y range of
	GHz)", March 2				
d) KDB865664	, SAR Measure	ement Requirement	nts for 100 MHz	to 6 GHz	
	cumentation:	.le			
E) DAS 14/5 53	stem Handboo	R.			
Methods Appl	ied and Interp	retation of Paran	neters:		
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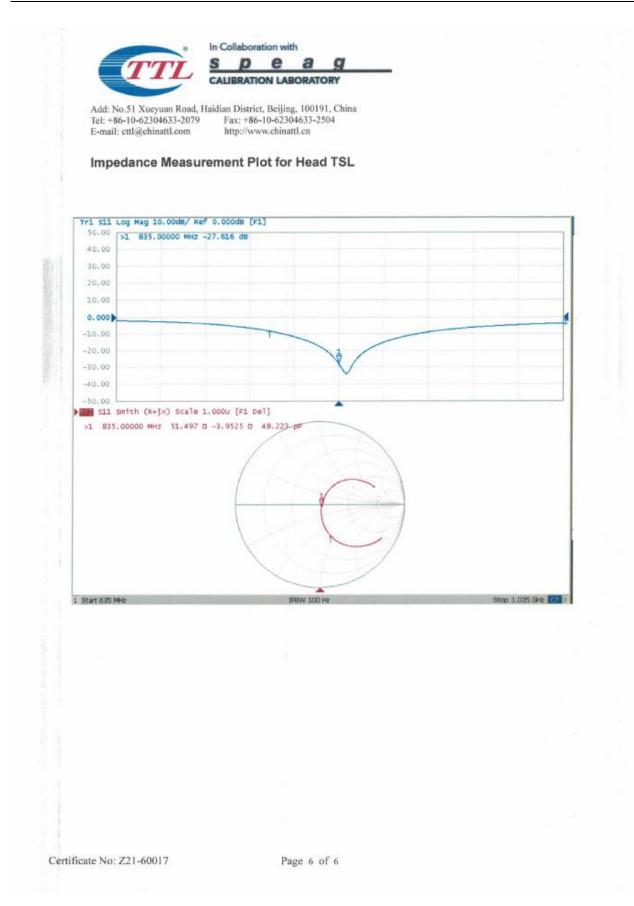
S S	Collaboration w	ith ag			
Add: No.51 Xueyuan Road, Haidi Tel: +86-10-62304633-2079 E-mail: cttl@chinattl.com	an District, Beijir Fax: +86-10-623 http://www.china	ng, 100191, China 04633-2504			
DASY system configuration, as far	as not given o				
DASY Version		DASY52			V52.10.4
Extrapolation	Advan	ced Extrapolation			
Phantom	Triple	Flat Phantom 5.1C			
Distance Dipole Center - TSL		15 mm		55	with Spacer
Zoom Scan Resolution	dx,	dy, dz = 5 mm			
Frequency	835	MHz ± 1 MHz			
lead TSL parameters The following parameters and calc	ulations were a	pplied. Temperature	Permitti	vity	Conductivity
Nominal Head TSL parameters		22.0 °C	41.5		0.90 mho/m
Measured Head TSL paramete	rs	(22.0 ± 0.2) °C	41.3 ± 6	3 %	0.89 mho/m ± 6 %
Head TSL temperature change	during test	<1.0 °C			
AR result with Head TSL		Condit	ion		
AR result with Head TSL SAR averaged over 1 cm <sup>3</sup> (1 g	) of Head TSL	oonan	250 mW input power		2.32 W/kg
A second s	) of Head TSL		put power	9.39 W/kg ± 18.8 % (k=2)	
SAR averaged over 1 $cm^3$ (1 g				9.39	W/kg ± 18.8 % ( <i>k</i> =2)
SAR averaged over 1 cm <sup>3</sup> (1 g SAR measured	meters	250 mW in normalize	d to 1W	9.39	W/kg ± 18.8 % (k=2)
SAR averaged over 1 cm <sup>3</sup> (1 g SAR measured SAR for nominal Head TSL para	meters	250 mW in normalize	d to 1W ion	9.39	W/kg ± 18.8 % (k=2) 1.52 W/kg

Certificate No: Z21-60017

Page 3 of 6

TTL	CALIBRATION LABORATORY		
Add: No.51 Xueyuan Road, H Tel: +86-10-62304633-2079 E-mail: ettl@chinattl.com	aidian District, Beijing, 100191, China Fax: +86-10-62304633-2504 http://www.chinattl.cn		
Appendix (Additional as	sessments outside the sco	pe of CNAS L0570)	
Antenna Parameters with	n Head TSL		
Impedance, transformed to fe	ed point	51.5Ω- 3.95jΩ	
Return Loss		- 27.6dB	
General Antenna Parame	ters and Design		
Electrical Delay (one direction	))	1.298 ns	
he measured. The dipole is made of standard onnected to the second arm of f the dipoles, small end caps ccording to the position as ex ffected by this change. The or lo excessive force must be ap	radiated power, only a slight war d semirigid coaxial cable. The cer of the dipole. The antenna is there are added to the dipole arms in o plained in the "Measurement Cor verall dipole length is still accordi plied to the dipole arms, because t may be damaged.	ter conductor of the feeding fore short-circuited for DC-s rder to improve matching wh ditions" paragraph. The SAF ng to the Standard.	line is directly ignals. On sor ien loaded R data are not
The dipole is made of standard onnected to the second arm of f the dipoles, small end caps ccording to the position as ex ffected by this change. The or lo excessive force must be ap onnections near the feedpoint	d semirigid coaxial cable. The cer of the dipole. The antenna is there are added to the dipole arms in c plained in the "Measurement Co verall dipole length is still accordi plied to the dipole arms, because	ter conductor of the feeding fore short-circuited for DC-s rder to improve matching wh ditions" paragraph. The SAF ng to the Standard.	line is directly ignals. On sor ien loaded R data are not
he measured. The dipole is made of standard onnected to the second arm of f the dipoles, small end caps a ccording to the position as ex ffected by this change. The or	d semirigid coaxial cable. The cer of the dipole. The antenna is there are added to the dipole arms in c plained in the "Measurement Co verall dipole length is still accordi plied to the dipole arms, because	ter conductor of the feeding fore short-circuited for DC-s rder to improve matching wh ditions" paragraph. The SAF ng to the Standard.	line is directly ignals. On sor ien loaded R data are not
The dipole is made of standard onnected to the second arm of f the dipoles, small end caps according to the position as ex ffected by this change. The or lo excessive force must be ap onnections near the feedpoint	d semirigid coaxial cable. The cer of the dipole. The antenna is there are added to the dipole arms in c plained in the "Measurement Co verall dipole length is still accordi plied to the dipole arms, because	Iter conductor of the feeding fore short-circuited for DC-s rder to improve matching wh iditions" paragraph. The SAF ing to the Standard. Ite they might bend or the sold	line is directly ignals. On sor ien loaded R data are not
The dipole is made of standard onnected to the second arm of f the dipoles, small end caps ccording to the position as ex ffected by this change. The or lo excessive force must be ap onnections near the feedpoint	d semirigid coaxial cable. The cer of the dipole. The antenna is there are added to the dipole arms in c plained in the "Measurement Co verall dipole length is still accordi plied to the dipole arms, because	Iter conductor of the feeding fore short-circuited for DC-s rder to improve matching wh iditions" paragraph. The SAF ing to the Standard. Ite they might bend or the sold	line is directly ignals. On sor ien loaded R data are not
The dipole is made of standard onnected to the second arm of f the dipoles, small end caps ccording to the position as ex ffected by this change. The or lo excessive force must be ap onnections near the feedpoint	d semirigid coaxial cable. The cer of the dipole. The antenna is there are added to the dipole arms in c plained in the "Measurement Co verall dipole length is still accordi plied to the dipole arms, because	Iter conductor of the feeding fore short-circuited for DC-s rder to improve matching wh iditions" paragraph. The SAF ing to the Standard. Ite they might bend or the sold	line is directly ignals. On sor ien loaded R data are not
The dipole is made of standard onnected to the second arm of f the dipoles, small end caps according to the position as ex ffected by this change. The or lo excessive force must be ap onnections near the feedpoint	d semirigid coaxial cable. The cer of the dipole. The antenna is there are added to the dipole arms in c plained in the "Measurement Co verall dipole length is still accordi plied to the dipole arms, because	Iter conductor of the feeding fore short-circuited for DC-s rder to improve matching wh iditions" paragraph. The SAF ing to the Standard. Ite they might bend or the sold	line is directly ignals. On sor ien loaded R data are not
The dipole is made of standard onnected to the second arm of f the dipoles, small end caps ccording to the position as ex ffected by this change. The or lo excessive force must be ap onnections near the feedpoint	d semirigid coaxial cable. The cer of the dipole. The antenna is there are added to the dipole arms in c plained in the "Measurement Co verall dipole length is still accordi plied to the dipole arms, because	Iter conductor of the feeding fore short-circuited for DC-s rder to improve matching wh iditions" paragraph. The SAF ing to the Standard. Ite they might bend or the sold	line is directly ignals. On sor ien loaded R data are not
The dipole is made of standard onnected to the second arm of f the dipoles, small end caps ccording to the position as ex ffected by this change. The or lo excessive force must be ap onnections near the feedpoint	d semirigid coaxial cable. The cer of the dipole. The antenna is there are added to the dipole arms in c plained in the "Measurement Co verall dipole length is still accordi plied to the dipole arms, because	Iter conductor of the feeding fore short-circuited for DC-s rder to improve matching wh iditions" paragraph. The SAF ing to the Standard. Ite they might bend or the sold	line is directly ignals. On sor ien loaded R data are not
The dipole is made of standard onnected to the second arm of f the dipoles, small end caps ccording to the position as ex ffected by this change. The or lo excessive force must be ap onnections near the feedpoint	d semirigid coaxial cable. The cer of the dipole. The antenna is there are added to the dipole arms in c plained in the "Measurement Co verall dipole length is still accordi plied to the dipole arms, because	Iter conductor of the feeding fore short-circuited for DC-s rder to improve matching wh iditions" paragraph. The SAF ing to the Standard. Ite they might bend or the sold	line is directly ignals. On sor ien loaded R data are not



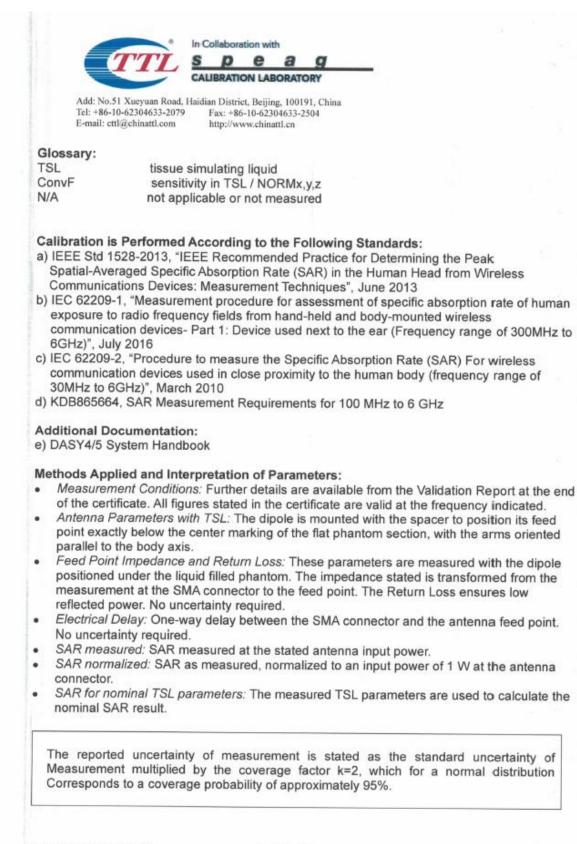


Referring to KDB865664 D01, if dipoles are verified in return loss (<-20dB, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

			Head-835			
Date of	Return-loss (dB)	Delta (%)	Real Impedance	Delta	Imaginary	Delta
measurement	Return-1055 (ub)		(ohm)	(ohm)	impedance (ohm)	(ohm)
2022-01-22	-27.6		51.5		-3.95	
2022-01-17	-27.3	1.09	51.8	0.3	-3.45	0.5

## 1.3. D1750V2 Dipole Calibration Certificate

	attl.com http	: +86-10-62304633-2504	CNAS L0570
Client HTW	ME ST	Certificate No: Z2	1-60018
CALIBRATION C	ERTIFICA	TE	La Station Stream
Object	0476		
object	D1/5	0V2 - SN: 1164	
Calibration Procedure(s)	FE-71	11-003-01	
		ration Procedures for dipole validation kits	
Collibration data:			
Calibration date:	Janua	ary 22, 2021	
ages and are part of the c All calibrations have been numidity<70%.		the closed laboratory facility: environmen	it temperature(22±3)°C and
Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Primary Standards Power Meter NRP2	ID # 106276	Cal Date(Calibrated by, Certificate No.) 12-May-20 (CTTL, No.J20X02965)	May-21
Primary Standards Power Meter NRP2 Power sensor NRP6A	ID # 106276 101369	Cal Date(Calibrated by, Certificate No.) 12-May-20 (CTTL, No.J20X02965) 12-May-20 (CTTL, No.J20X02965)	May-21 May-21
Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4	ID # 106276	Cal Date(Calibrated by, Certificate No.) 12-May-20 (CTTL, No.J20X02965)	May-21
Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4	ID # 106276 101369 SN 7600	Cal Date(Calibrated by, Certificate No.) 12-May-20 (CTTL, No.J20X02965) 12-May-20 (CTTL, No.J20X02965) 30-Nov-20(CTTL-SPEAG,No.Z20-60421)	May-21 May-21 Nov-21
Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards	ID # 106276 101369 SN 7600 SN 771 ID #	Cal Date(Calibrated by, Certificate No.) 12-May-20 (CTTL, No.J20X02965) 12-May-20 (CTTL, No.J20X02965) 30-Nov-20(CTTL-SPEAG,No.Z20-60421) 10-Feb-20(CTTL-SPEAG,No.Z20-60017) Cal Date(Calibrated by, Certificate No.)	May-21 May-21 Nov-21 Feb-21 Scheduled Calibration
Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ID # 106276 101369 SN 7600 SN 771 ID # MY49071430	Cal Date(Calibrated by, Certificate No.) 12-May-20 (CTTL, No.J20X02965) 12-May-20 (CTTL, No.J20X02965) 30-Nov-20(CTTL-SPEAG,No.Z20-60421) 10-Feb-20(CTTL-SPEAG,No.Z20-60017) Cal Date(Calibrated by, Certificate No.) 25-Feb-20 (CTTL, No.J20X00516)	May-21 May-21 Nov-21 Feb-21 Scheduled Calibration Feb-21
Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ID # 106276 101369 SN 7600 SN 771 ID #	Cal Date(Calibrated by, Certificate No.) 12-May-20 (CTTL, No.J20X02965) 12-May-20 (CTTL, No.J20X02965) 30-Nov-20(CTTL-SPEAG,No.Z20-60421) 10-Feb-20(CTTL-SPEAG,No.Z20-60017) Cal Date(Calibrated by, Certificate No.) 25-Feb-20 (CTTL, No.J20X00516)	May-21 May-21 Nov-21 Feb-21 Scheduled Calibration
Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ID # 106276 101369 SN 7600 SN 771 ID # MY49071430	Cal Date(Calibrated by, Certificate No.) 12-May-20 (CTTL, No.J20X02965) 12-May-20 (CTTL, No.J20X02965) 30-Nov-20(CTTL-SPEAG,No.Z20-60421) 10-Feb-20(CTTL-SPEAG,No.Z20-60017) Cal Date(Calibrated by, Certificate No.) 25-Feb-20 (CTTL, No.J20X00516)	May-21 May-21 Nov-21 Feb-21 Scheduled Calibration Feb-21
Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	ID # 106276 101369 SN 7600 SN 771 ID # MY49071430	Cal Date(Calibrated by, Certificate No.) 12-May-20 (CTTL, No.J20X02965) 12-May-20 (CTTL, No.J20X02965) 30-Nov-20(CTTL-SPEAG,No.Z20-60421) 10-Feb-20(CTTL-SPEAG,No.Z20-60017) Cal Date(Calibrated by, Certificate No.) 25-Feb-20 (CTTL, No.J20X00516)	May-21 May-21 Nov-21 Feb-21 Scheduled Calibration Feb-21
Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	ID # 106276 101369 SN 7600 SN 771 ID # MY49071430 MY46110673	Cal Date(Calibrated by, Certificate No.) 12-May-20 (CTTL, No.J20X02965) 12-May-20 (CTTL, No.J20X02965) 30-Nov-20(CTTL-SPEAG,No.Z20-60421) 10-Feb-20(CTTL-SPEAG,No.Z20-60017) Cal Date(Calibrated by, Certificate No.) 25-Feb-20 (CTTL, No.J20X00516) 10-Feb-20 (CTTL, No.J20X00515)	May-21 May-21 Nov-21 Feb-21 Scheduled Calibration Feb-21 Feb-21
Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	ID # 106276 101369 SN 7600 SN 771 ID # MY49071430 MY46110673 Name	Cal Date(Calibrated by, Certificate No.)           12-May-20 (CTTL, No.J20X02965)           12-May-20 (CTTL, No.J20X02965)           30-Nov-20(CTTL-SPEAG,No.Z20-60421)           10-Feb-20(CTTL-SPEAG,No.Z20-60017)           Cal Date(Calibrated by, Certificate No.)           25-Feb-20 (CTTL, No.J20X00516)           10-Feb-20 (CTTL, No.J20X00515)	May-21 May-21 Nov-21 Feb-21 Scheduled Calibration Feb-21 Feb-21
Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	ID # 106276 101369 SN 7600 SN 771 ID # MY49071430 MY46110673 Name Zhao Jing	Cal Date(Calibrated by, Certificate No.) 12-May-20 (CTTL, No.J20X02965) 12-May-20 (CTTL, No.J20X02965) 30-Nov-20(CTTL-SPEAG,No.Z20-60421) 10-Feb-20(CTTL-SPEAG,No.Z20-60017) Cal Date(Calibrated by, Certificate No.) 25-Feb-20 (CTTL, No.J20X00516) 10-Feb-20 (CTTL, No.J20X00515) Function SAR Test Engineer	May-21 May-21 Nov-21 Feb-21 Scheduled Calibration Feb-21 Feb-21
Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ID # 106276 101369 SN 7600 SN 771 ID # MY49071430 MY46110673 Name Zhao Jing Lin Hao	Cal Date(Calibrated by, Certificate No.) 12-May-20 (CTTL, No.J20X02965) 12-May-20 (CTTL, No.J20X02965) 30-Nov-20(CTTL-SPEAG,No.Z20-60421) 10-Feb-20(CTTL-SPEAG,No.Z20-60017) Cal Date(Calibrated by, Certificate No.) 25-Feb-20 (CTTL, No.J20X00516) 10-Feb-20 (CTTL, No.J20X00515) Function SAR Test Engineer SAR Test Engineer SAR Project Leader	May-21 May-21 Nov-21 Feb-21 Scheduled Calibration Feb-21 Feb-21



Certificate No: Z21-60018

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		n page 1.	1		
DASY Version		DASY52			V52.10.4
Extrapolation	Advan	ced Extrapolation			
Phantom	Triple	Flat Phantom 5.1C			
Distance Dipole Center - TSL		10 mm			with Spacer
Zoom Scan Resolution	dx,	dy, dz = 5 mm			
Frequency	175	50 MHz ± 1 MHz			
The following parameters and calcula Nominal Head TSL parameters	ations were a	applied. Temperature 22.0 °C	Permitti 40.1	vity	Conductivit
	ations were a	Temperature			1.37 mho/m
Nominal Head TSL parameters		Temperature 22.0 °C	40.1		1.37 mho/m
Nominal Head TSL parameters Measured Head TSL parameters		Temperature           22.0 °C           (22.0 ± 0.2) °C	40.1		Conductivity 1.37 mho/m 1.37 mho/m ± 6
Nominal Head TSL parameters Measured Head TSL parameters Head TSL temperature change d	uring test	Temperature           22.0 °C           (22.0 ± 0.2) °C	40.1 39.8 ± 6		1.37 mho/m
Nominal Head TSL parameters Measured Head TSL parameters Head TSL temperature change d AR result with Head TSL	uring test	Temperature 22.0 °C (22.0 ± 0.2) °C <1.0 °C	40.1 39.8 ± 6		1.37 mho/m
Nominal Head TSL parameters Measured Head TSL parameters Head TSL temperature change d AR result with Head TSL SAR averaged over 1 cm <sup>3</sup> (1 g) o	uring test f Head TSL	Temperature           22.0 °C           (22.0 ± 0.2) °C           <1.0 °C	40.1 39.8 ± 6 	5 %	1.37 mho/m 1.37 mho/m ± 6
Nominal Head TSL parameters Measured Head TSL parameters Head TSL temperature change d AR result with Head TSL SAR averaged over 1 cm <sup>3</sup> (1 g) o SAR measured	uring test	Temperature           22.0 °C           (22.0 ± 0.2) °C           <1.0 °C	40.1 39.8 ± (  tion put power d to 1W	5 %	1.37 mho/m 1.37 mho/m ± 6  9.13 W/kg
Nominal Head TSL parameters Measured Head TSL parameters Head TSL temperature change d AR result with Head TSL SAR averaged over 1 cm <sup>3</sup> (1 g) o SAR measured SAR for nominal Head TSL parameters	uring test	Temperature           22.0 °C           (22.0 ± 0.2) °C           <1.0 °C	40.1 39.8 ± 0  tion put power d to 1W	5 %	1.37 mho/m 1.37 mho/m ± 6  9.13 W/kg

Certificate No: Z21-60018

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 Fax: +86-10-62304633-2504

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

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

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.9Ω- 3.86jΩ	
Return Loss	- 28.3 dB	

#### General Antenna Parameters and Design

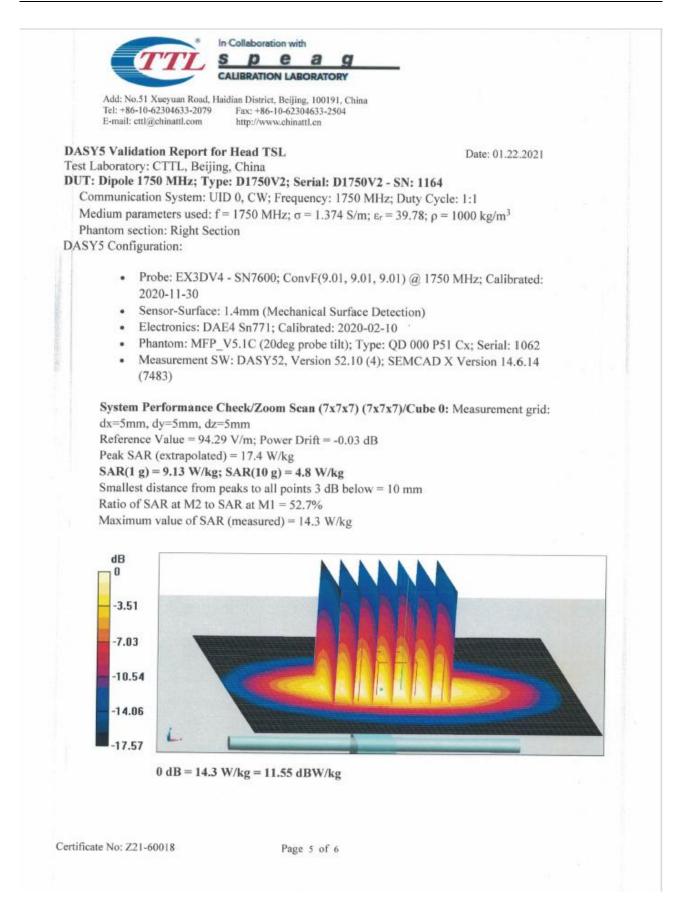
Electrical Delay (one direction)	1.124 ns
----------------------------------	----------

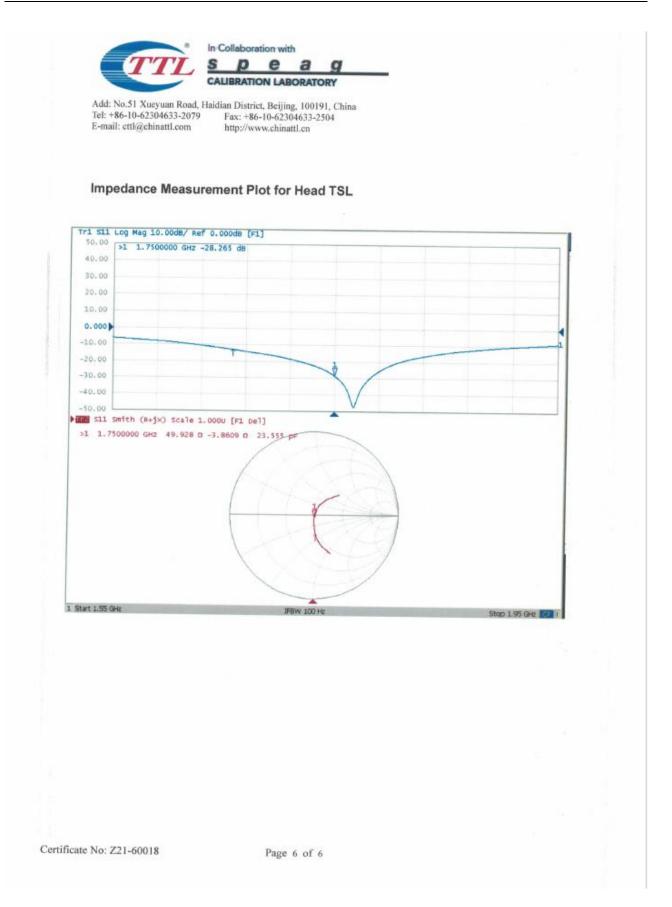
After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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	
ficate No: Z21-60018	Page 4 of 6		





Referring to KDB865664 D01, if dipoles are verified in return loss (<-20dB, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

			Head-1750			
Date of	Return-loss (dB)	Delta (%)	Real Impedance	Delta	Imaginary	Delta
measurement	Return-1055 (ub)		(ohm)	(ohm)	impedance (ohm)	(ohm)
2021-01-22	-28.3		49.9		-3.86	
2022-01-17	-27.9	1.41	50.4	0.5	-3.46	0.4

## 1.4. D1900V2 Dipole Calibration Certificate

E-mail: ettl@chinattl Client HTW	2224		Certificate No: Z21	
CALIBRATION CE			Certificate No. 22	1-60019
	RTIFICAT	E		1
Dbject	D1900V	2 - SN:	: 5d226	
Calibration Procedure(s)	FF-Z11- Calibrat		l ocedures for dipole validation kits	
Calibration date:	January	22, 20	021	
humidity<70%.			osed laboratory facility: environment	temperature(22±3)°C and
numidity<70%. Calibration Equipment used Primary Standards	(M&TE critical f	or calib	oration) Date(Calibrated by, Certificate No.)	Scheduled Calibration May-21
numidity<70%. Calibration Equipment used	(M&TE critical f	or calib Cal 12-M 12-M 30-N	oration)	Scheduled Calibration
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4	(M&TE critical fr ID # 106276 101369 SN 7600 SN 771	Call 12-M 12-M 30-N 10-F	Date(Calibrated by, Certificate No.) lay-20 (CTTL, No.J20X02965) lay-20 (CTTL, No.J20X02965) lov-20(CTTL-SPEAG,No.Z20-60421) eb-20(CTTL-SPEAG,No.Z20-60017)	Scheduled Calibration May-21 May-21 Nov-21 Feb-21 Scheduled Calibration
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4	(M&TE critical fi ID # 106276 101369 SN 7600 SN 771 ID # MY49071430	Call 12-M 12-M 30-N 10-F Cal [ 25-F	Date(Calibrated by, Certificate No.) lay-20 (CTTL, No.J20X02965) lay-20 (CTTL, No.J20X02965) lov-20(CTTL-SPEAG,No.Z20-60421)	Scheduled Calibration May-21 May-21 Nov-21 Feb-21
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	(M&TE critical fi ID # 106276 101369 SN 7600 SN 771 ID # MY49071430 MY46110673	Call 12-M 12-M 30-N 10-F Cal [ 25-F	Date(Calibrated by, Certificate No.) lay-20 (CTTL, No.J20X02965) lay-20 (CTTL, No.J20X02965) lov-20(CTTL-SPEAG,No.Z20-60421) eb-20(CTTL-SPEAG,No.Z20-60017) Date(Calibrated by, Certificate No.) reb-20 (CTTL, No.J20X00516)	Scheduled Calibration May-21 May-21 Nov-21 Feb-21 Scheduled Calibration Feb-21
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	(M&TE critical fi ID # 106276 101369 SN 7600 SN 771 ID # MY49071430	Call 12-M 12-M 30-N 10-F Cal [ 25-F	Date(Calibrated by, Certificate No.) lay-20 (CTTL, No.J20X02965) lay-20 (CTTL, No.J20X02965) lov-20(CTTL-SPEAG,No.Z20-60421) eb-20(CTTL-SPEAG,No.Z20-60017) Date(Calibrated by, Certificate No.) eb-20 (CTTL, No.J20X00516) eb-20 (CTTL, No.J20X00515)	Scheduled Calibration May-21 May-21 Nov-21 Feb-21 Scheduled Calibration Feb-21 Feb-21
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	(M&TE critical fi ID # 106276 101369 SN 7600 SN 771 ID # MY49071430 MY46110673 Name	Call 12-M 12-M 30-N 10-F Cal [ 25-F	Date(Calibrated by, Certificate No.) lay-20 (CTTL, No.J20X02965) lay-20 (CTTL, No.J20X02965) lov-20(CTTL-SPEAG,No.Z20-60421) eb-20(CTTL-SPEAG,No.Z20-60017) Date(Calibrated by, Certificate No.) eb-20 (CTTL, No.J20X00516) eb-20 (CTTL, No.J20X00515) Function	Scheduled Calibration May-21 May-21 Nov-21 Feb-21 Scheduled Calibration Feb-21 Feb-21
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	(M&TE critical fi ID # 106276 101369 SN 7600 SN 771 ID # MY49071430 MY46110673 Name Zhao Jing	Call 12-M 12-M 30-N 10-F Cal [ 25-F	Date(Calibrated by, Certificate No.) lay-20 (CTTL, No.J20X02965) lay-20 (CTTL, No.J20X02965) lov-20(CTTL-SPEAG,No.Z20-60421) eb-20(CTTL-SPEAG,No.Z20-60017) Date(Calibrated by, Certificate No.) eb-20 (CTTL, No.J20X00516) eb-20 (CTTL, No.J20X00515) Function SAR Test Engineer	Scheduled Calibration May-21 May-21 Nov-21 Feb-21 Scheduled Calibration Feb-21 Feb-21



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

#### lossary:

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

#### Calibration is Performed According to the Following Standards:

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

#### Additional Documentation:

e) DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

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

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

Certificate No: Z21-60019

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#### Measurement Conditions

DASY system configuration, as far as not given on page 1. DASY Version DASY52

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	40.1 ± 6 %	1.38 mlho/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	9.85 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	39.8 W/kg ± 18.8 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.05 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	20.3 W/kg ± 18.7 % (k=2)

Certificate No: Z21-60019

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

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.5Ω+ 7.88jΩ	
Return Loss	- 21.6dB	

#### General Antenna Parameters and Design

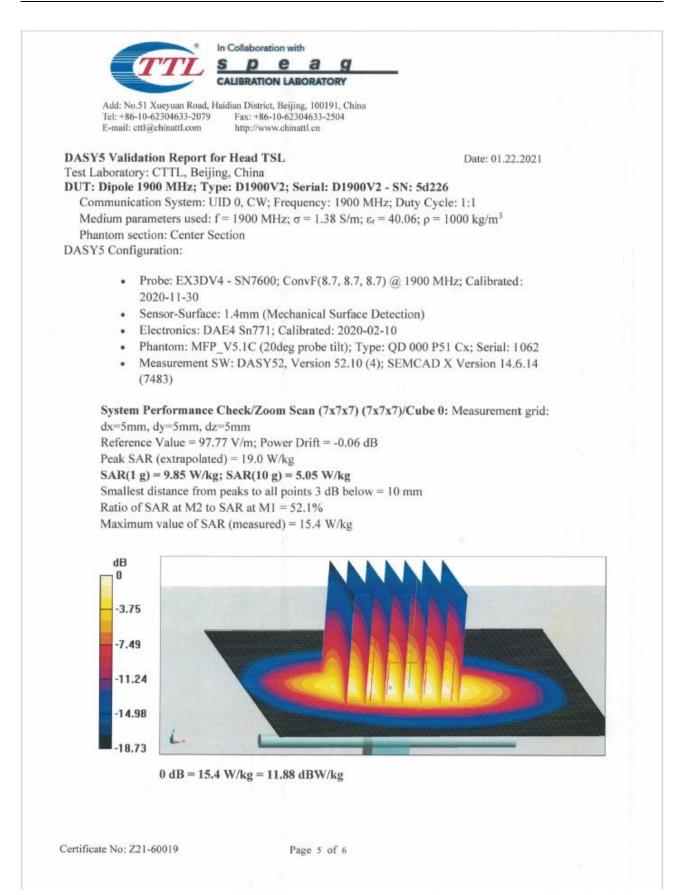
Electrical Delay (one direction)	1.102 ns	
----------------------------------	----------	--

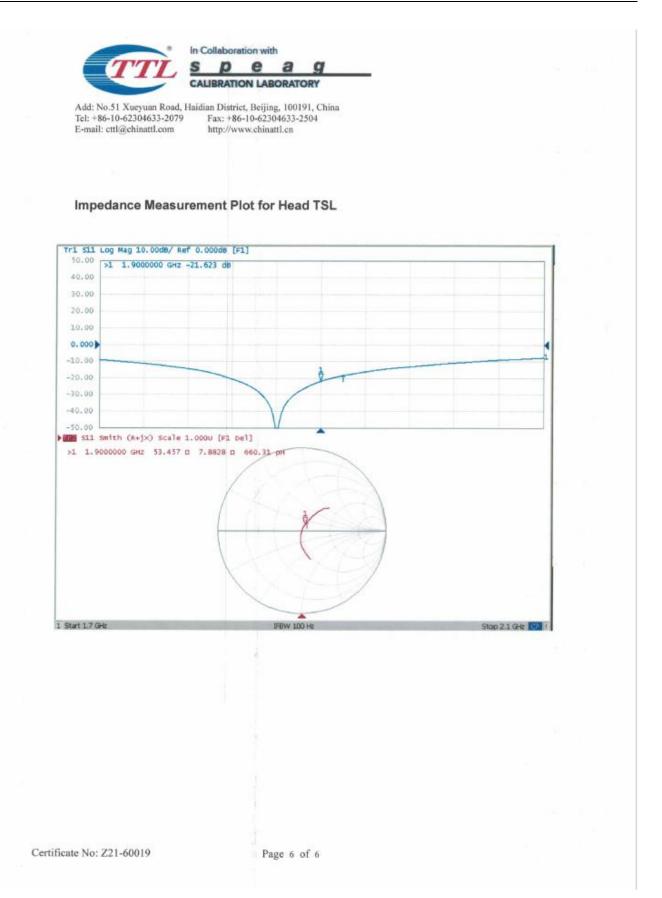
After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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

### Additional EUT Data

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ficate No: Z21-60019	Page 4 of 6		
licate No. 2.21-00019	rage 4 of 6		





Referring to KDB865664 D01, if dipoles are verified in return loss (<-20dB, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

			Head-1900			
Date of	Poturn loop (dP)	Dolta $(9/)$	Real Impedance	Delta	Imaginary	Delta
measurement	Return-loss (dB)	Delta (%)	(ohm)	(ohm)	impedance (ohm)	(ohm)
2021-01-22	-21.6		53.5		7.88	
2022-01-17	-22.4	-3.70	53.9	0.4	4.35	0.53

## 1.5. D2450V2 Dipole Calibration Certificate

		ON LABORATORY	Hac-MRA	GIVA	<b>S校准</b> CALIBRATION
Tel: +86-10-62304633	5-2079 Fax: +8	ct, Beijing, 100191, China 6-10-62304633-2504 ww.chinattl.cn	Maladaladate		CNAS L0570
E-mail: cttl@chinattl.	com nup.//w		ertificate No:	Z21-60020	)
Client	DTICICATI	ALS SERVER		33.00	
CALIBRATION CE	RTIFICATI	Constant and		and the second	
Dbject	D2450V	2 - SN: 1009			
					_
Calibration Procedure(s)	FF-Z11-		anto unlidetion kits		
	Calibrati	on Procedures for di	pole validation kits	,	
Calibration date:	January	25, 2021			
All calibrations have been	conducted in t	he closed laborator	y facility: environ	ment tempera	ature(22±3)°C and
All calibrations have been numidity<70%. Calibration Equipment used			y facility: environ		
numidity<70%.		or calibration) Cal Date(Calibrate	d by, Certificate N		duled Calibration
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2	(M&TE critical fo ID # 106276	or calibration) Cal Date(Calibrate 12-May-20 (CTTL, I	d by, Certificate N No.J20X02965)		duled Calibration May-21
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A	(M&TE critical fo ID # 106276 101369	Cal Date(Calibrate 12-May-20 (CTTL, I 12-May-20 (CTTL, I	d by, Certificate N No.J20X02965) No.J20X02965)	o.) Scheo	duled Calibration
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2	(M&TE critical fo ID # 106276	or calibration) Cal Date(Calibrate 12-May-20 (CTTL, I	d by, Certificate N No.J20X02965) No.J20X02965) PEAG,No.Z20-604	o.) Scher 421)	duled Calibration May-21 May-21
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numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4	(M&TE critical fo ID # 106276 101369 SN 7600 SN 771 ID # MY49071430	or calibration) Cal Date(Calibrate 12-May-20 (CTTL, 1 12-May-20 (CTTL, 1 30-Nov-20(CTTL-SI 10-Feb-20(CTTL-SI	d by, Certificate N No.J20X02965) No.J20X02965) PEAG,No.Z20-604 PEAG,No.Z20-604 d by, Certificate No No.J20X00516)	o.) Sched 421) 017)	duled Calibration May-21 May-21 Nov-21 Feb-21 duled Calibration
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	(M&TE critical fo ID # 106276 101369 SN 7600 SN 771 ID # MY49071430	Cal Date(Calibrate 12-May-20 (CTTL, 1 12-May-20 (CTTL, 1 30-Nov-20(CTTL-SI 10-Feb-20(CTTL-SI Cal Date(Calibrated 25-Feb-20 (CTTL, 1	d by, Certificate N No.J20X02965) No.J20X02965) PEAG,No.Z20-604 PEAG,No.Z20-604 d by, Certificate No No.J20X00516)	o.) Sched 421) 017) 5.) Sche	duled Calibration May-21 May-21 Nov-21 Feb-21 duled Calibration Feb-21
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	(M&TE critical fo ID # 106276 101369 SN 7600 SN 771 ID # MY49071430 MY46110673	Cal Date(Calibrate 12-May-20 (CTTL, 1 12-May-20 (CTTL, 1 30-Nov-20(CTTL-Si 10-Feb-20(CTTL-Si Cal Date(Calibrated 25-Feb-20 (CTTL, 1 10-Feb-20 (CTTL, 1	d by, Certificate N No.J20X02965) No.J20X02965) PEAG,No.Z20-604 PEAG,No.Z20-604 Dep, Certificate No No.J20X00516) No.J20X00515)	o.) Sched 421) 017) 5.) Sche	duled Calibration May-21 May-21 Nov-21 Feb-21 duled Calibration Feb-21 Feb-21 Feb-21
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C Calibrated by:	(M&TE critical fo ID # 106276 101369 SN 7600 SN 771 ID # MY49071430 MY46110673 Name Zhao Jing	Cal Date(Calibrate 12-May-20 (CTTL, 1 12-May-20 (CTTL, 1 30-Nov-20(CTTL-SI 10-Feb-20(CTTL-SI Cal Date(Calibrated 25-Feb-20 (CTTL, 1 10-Feb-20 (CTTL, 1 Function SAR Test Eng	d by, Certificate N No.J20X02965) No.J20X02965) PEAG,No.Z20-604 PEAG,No.Z20-600 d by, Certificate No No.J20X00516) No.J20X00515)	o.) Sched 421) 017) 5.) Sche	duled Calibration May-21 May-21 Nov-21 Feb-21 duled Calibration Feb-21 Feb-21 Feb-21
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	(M&TE critical fo ID # 106276 101369 SN 7600 SN 771 ID # MY49071430 MY46110673 Name	Cal Date(Calibrate 12-May-20 (CTTL, I 12-May-20 (CTTL, I 30-Nov-20(CTTL-SI 10-Feb-20(CTTL-SI Cal Date(Calibrated 25-Feb-20 (CTTL, I 10-Feb-20 (CTTL, I 10-Feb-20 (CTTL, I	d by, Certificate N No.J20X02965) No.J20X02965) PEAG,No.Z20-604 PEAG,No.Z20-600 d by, Certificate No No.J20X00516) No.J20X00515)	o.) Sched 421) 017) 5.) Sche	duled Calibration May-21 May-21 Nov-21 Feb-21 duled Calibration Feb-21 Feb-21 Feb-21
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C Calibrated by:	(M&TE critical fo ID # 106276 101369 SN 7600 SN 771 ID # MY49071430 MY46110673 Name Zhao Jing	Cal Date(Calibrate 12-May-20 (CTTL, 1 12-May-20 (CTTL, 1 30-Nov-20 (CTTL-SI 10-Feb-20 (CTTL-SI Cal Date(Calibrated 25-Feb-20 (CTTL, 1 10-Feb-20 (CTTL, 1 Function SAR Test Eng	d by, Certificate N No.J20X02965) No.J20X02965) PEAG,No.Z20-604 PEAG,No.Z20-604 d by, Certificate No No.J20X00516) No.J20X00515) gineer	o.) Sched 421) 017) 5.) Sche	duled Calibration May-21 May-21 Nov-21 Feb-21 duled Calibration Feb-21 Feb-21 Feb-21
Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C Calibrated by: Reviewed by:	(M&TE critical fo ID # 106276 101369 SN 7600 SN 771 ID # MY49071430 MY46110673 Name Zhao Jing Lin Hao Qi Dianyuan	Cal Date(Calibrate 12-May-20 (CTTL, 1 12-May-20 (CTTL, 1 30-Nov-20 (CTTL-SI 10-Feb-20 (CTTL-SI Cal Date(Calibrated 25-Feb-20 (CTTL, 1 10-Feb-20 (CTTL, 1 10-Feb-20 (CTTL, 1 SAR Test Eng SAR Test Eng SAR Test Eng	d by, Certificate N No.J20X02965) No.J20X02965) PEAG,No.Z20-604 PEAG,No.Z20-604 d by, Certificate No No.J20X00516) No.J20X00515) gineer gineer Leader	0.) Scher 421) 017) 5.) Sche 421 5.) Sche 4: January 29.	duled Calibration May-21 May-21 Nov-21 Feb-21 duled Calibration Feb-21 Feb-21 Signature



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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: Z21-60020

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### Measurement Conditions

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

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

#### Head TSL parameters

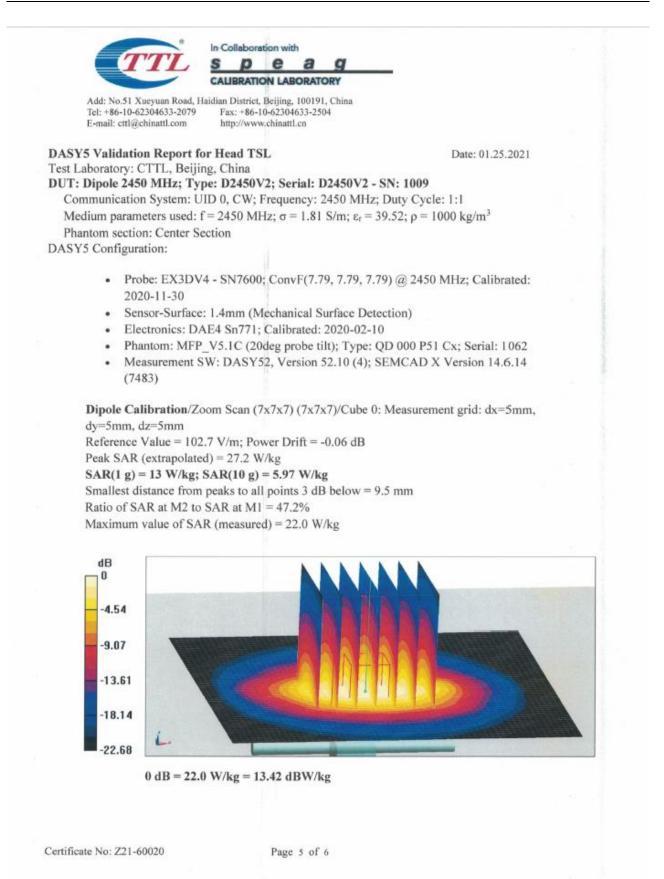
The following parameters and calculations were applied.

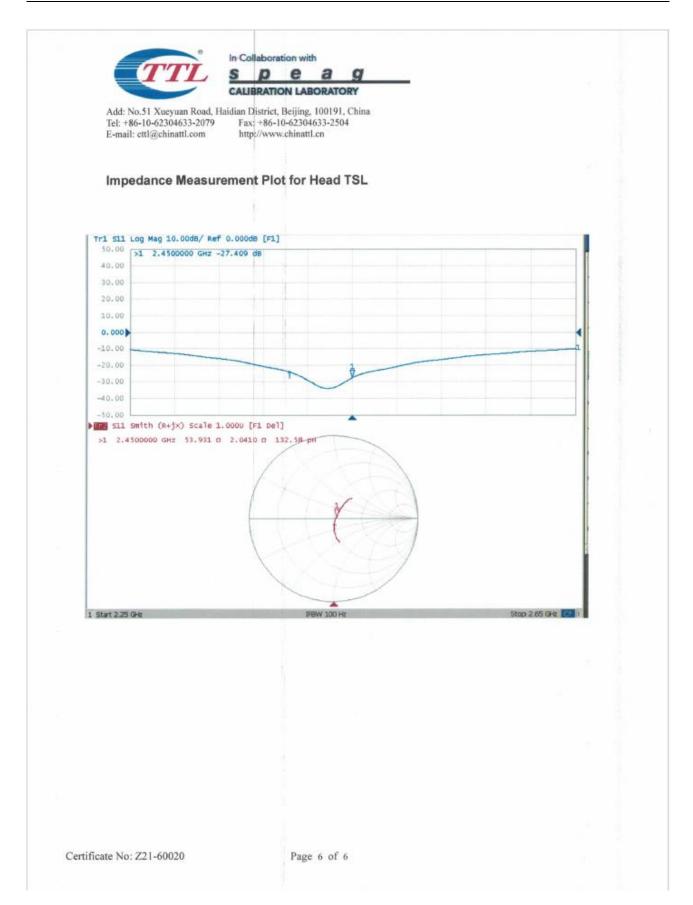
	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.5 ± 6 %	1.81 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

#### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.0 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	52.0 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	5.97 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.9 W/kg ± 18.7 % (k=2)

E-mail: cttl@chinattl.com htt		ppe of CNAS L0570)	
Antenna Parameters with Hea		ope of CNAS L0570)	
Appendix (Additional assess Antenna Parameters with Hea		ppe of CNAS L0570)	
	ad TSL		
	ad TSL		
Impedance, transformed to feed po			
	int	53.9Ω+ 2.04jΩ	
Return Loss		- 27.4dB	
2 22 2 22 2			
General Antenna Parameters	and Design		
Electrical Delay (one direction)		1.064 ns	
After long term use with 100W radia	ted power, only a slight wa	rming of the dipole near the	feedpoint can
be measured.			
The dipole is made of standard sem	irigid coaxial cable. The ce	nter conductor of the feeding	line is directly
connected to the second arm of the	dipole. The antenna is ther	efore short-circuited for DC-	signals. On some
of the dipoles, small end caps are a according to the position as explain			
affected by this change. The overall	dipole length is still accord	ing to the Standard.	
No excessive force must be applied connections near the feedpoint may		e they might bend or the sol	dered
connectione near the recuperint may	be duringed.		
Additional EUT Data			
Additional EUT Data		SPEAG	
		SPEAG	





Referring to KDB865664 D01, if dipoles are verified in return loss (<-20dB, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

			Head-2450			
Date of	Doturn loop (dD)	Delta (%)	Real Impedance	Delta	Imaginary	Delta
measurement	Return-loss (dB)		(ohm)	(ohm)	impedance (ohm)	(ohm)
2021-01-25	-27.4		53.9		2.04	
2022-01-17	-27.9	-1.82	53.5	0.4	2.34	0.3

## 1.6. D2600V2 Dipole Calibration Certificate

Add: No.51 Xueyuan Ro Tel: +86-10-62304633- E-mail: cttl@chinatl.c	2079 Fax: +80-	vw.chinattl.cn	CNAS L0570			
Client HTW		The state of the second state of the second				
CALIBRATION CER	RTIFICATE					
Dbject	D2600V2	2 - SN: 1150				
Calibration Procedure(s)	FF-Z11-0 Calibratio	FF-Z11-003-01 Calibration Procedures for dipole validation kits				
Calibration date:	January	25, 2021	27322			
All calibrations have been of	conducted in th	he closed laboratory facility: environment	temperaturo(2220)			
All calibrations have been of humidity<70%. Calibration Equipment used (						
humidity<70%. Calibration Equipment used (		or calibration) Cal Date(Calibrated by, Certificate No.)	Scheduled Calibratio			
humidity<70%.	M&TE critical fo	or calibration)				
humidity<70%. Calibration Equipment used ( Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4	M&TE critical fo ID # 106276 101369 SN 7600 SN 771	Cal Date(Calibrated by, Certificate No.) 12-May-20 (CTTL, No.J20X02965) 12-May-20 (CTTL, No.J20X02965) 30-Nov-20(CTTL-SPEAG,No.Z20-60421) 10-Feb-20(CTTL-SPEAG,No.Z20-60017)	Scheduled Calibratio May-21 May-21 Nov-21 Feb-21 Scheduled Calibratio			
humidity<70%. Calibration Equipment used ( Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4	M&TE critical fo ID # 106276 101369 SN 7600	Cal Date(Calibrated by, Certificate No.) 12-May-20 (CTTL, No.J20X02965) 12-May-20 (CTTL, No.J20X02965) 30-Nov-20(CTTL-SPEAG,No.Z20-60421) 10-Feb-20(CTTL-SPEAG,No.Z20-60017) Cal Date(Calibrated by, Certificate No.)	Scheduled Calibratio May-21 May-21 Nov-21 Feb-21			
humidity<70%. Calibration Equipment used ( Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	M&TE critical fo ID # 106276 101369 SN 7600 SN 771 ID # MY49071430 MY46110673	Cal Date(Calibrated by, Certificate No.) 12-May-20 (CTTL, No.J20X02965) 12-May-20 (CTTL, No.J20X02965) 30-Nov-20(CTTL-SPEAG,No.Z20-60421) 10-Feb-20(CTTL-SPEAG,No.Z20-60017) Cal Date(Calibrated by, Certificate No.) 25-Feb-20 (CTTL, No.J20X00516)	Scheduled Calibratio May-21 May-21 Nov-21 Feb-21 Scheduled Calibratio Feb-21			
humidity<70%. Calibration Equipment used ( Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	M&TE critical fo ID # 106276 101369 SN 7600 SN 771 ID # MY49071430	Cal Date(Calibrated by, Certificate No.) 12-May-20 (CTTL, No.J20X02965) 12-May-20 (CTTL, No.J20X02965) 30-Nov-20(CTTL-SPEAG,No.Z20-60421) 10-Feb-20(CTTL-SPEAG,No.Z20-60017) Cal Date(Calibrated by, Certificate No.) 25-Feb-20 (CTTL, No.J20X00516) 10-Feb-20 (CTTL, No.J20X00515)	Scheduled Calibratio May-21 May-21 Nov-21 Feb-21 Scheduled Calibratio Feb-21 Feb-21			
humidity<70%. Calibration Equipment used ( Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C Network Analyzer E5071C	M&TE critical fo ID # 106276 101369 SN 7600 SN 771 ID # MY49071430 MY46110673 Name	Cal Date(Calibrated by, Certificate No.) 12-May-20 (CTTL, No.J20X02965) 12-May-20 (CTTL, No.J20X02965) 30-Nov-20(CTTL-SPEAG,No.Z20-60421) 10-Feb-20(CTTL-SPEAG,No.Z20-60017) Cal Date(Calibrated by, Certificate No.) 25-Feb-20 (CTTL, No.J20X00516) 10-Feb-20 (CTTL, No.J20X00515) Function	Scheduled Calibratio May-21 May-21 Nov-21 Feb-21 Scheduled Calibratio Feb-21 Feb-21			
humidity<70%. Calibration Equipment used ( Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C Network Analyzer E5071C Calibrated by:	M&TE critical fo ID # 106276 101369 SN 7600 SN 771 ID # MY49071430 MY46110673 Name Zhao Jing	Cal Date(Calibrated by, Certificate No.) 12-May-20 (CTTL, No.J20X02965) 12-May-20 (CTTL, No.J20X02965) 30-Nov-20(CTTL-SPEAG,No.Z20-60421) 10-Feb-20(CTTL-SPEAG,No.Z20-60017) Cal Date(Calibrated by, Certificate No.) 25-Feb-20 (CTTL, No.J20X00516) 10-Feb-20 (CTTL, No.J20X00515) Function SAR Test Engineer	Scheduled Calibratio May-21 May-21 Nov-21 Feb-21 Scheduled Calibratio Feb-21 Feb-21			



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#### Glossary:

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

#### Calibration is Performed According to the Following Standards:

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

#### Additional Documentation:

e) DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

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

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

Certificate No: Z21-60021

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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	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	39.7 ± 6 %	1.97 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

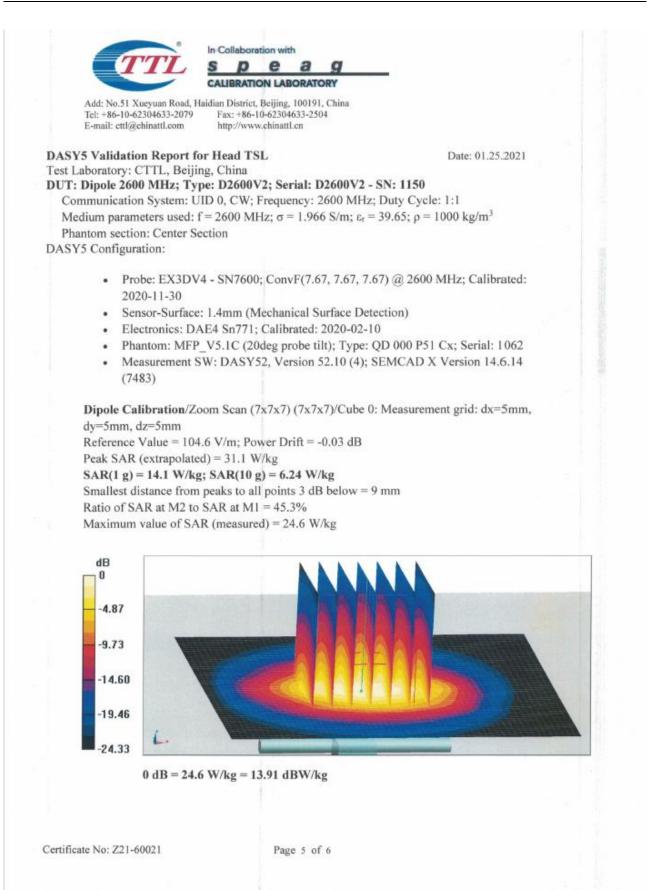
#### SAR result with Head TSL

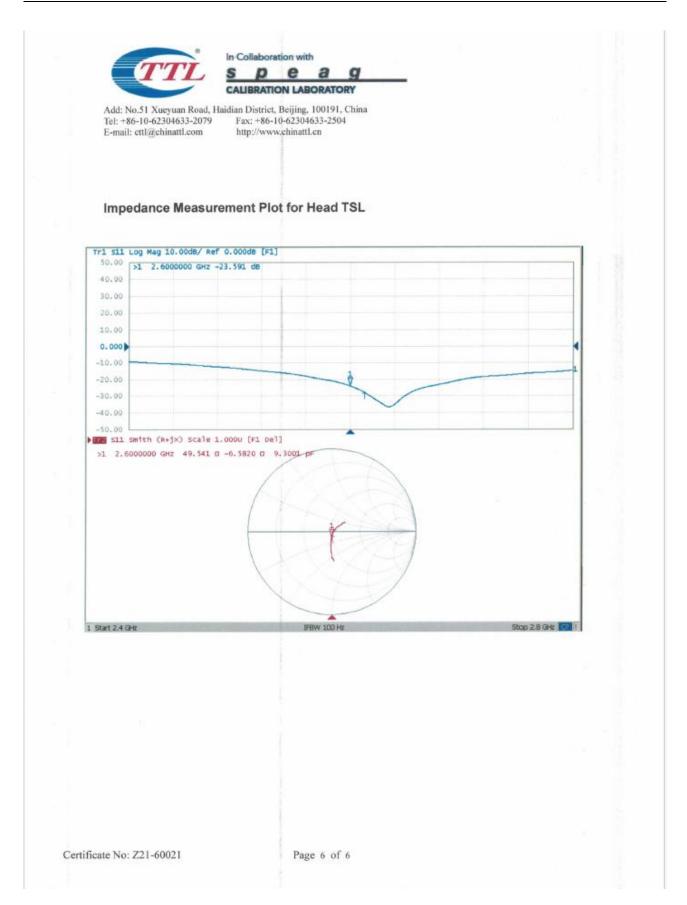
SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	14.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	56.5 W/kg ± 18.8 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.24 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	25.0 W/kg ± 18.7 % (k=2)

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Appendix(Additional asse Antenna Parameters with		he scope of CNAS L0570)
Impedance, transformed to fee	ed point	49.5Ω- 6.58jΩ
Return Loss		- 23.6dB
•		1.047 ns slight warming of the dipole near the feedpoint ca
After long term use with 100W r be measured. The dipole is made of standard connected to the second arm of of the dipoles, small end caps a according to the position as exp affected by this change. The ov	adiated power, only a semirigid coaxial cable the dipole. The antenri re added to the dipole lained in the "Measure erall dipole length is stolied to the dipole arms	slight warming of the dipole near the feedpoint ca b. The center conductor of the feeding line is direct that is therefore short-circuited for DC-signals. On a arms in order to improve matching when loaded ment Conditions'' paragraph. The SAR data are r
After long term use with 100W r be measured. The dipole is made of standard connected to the second arm of of the dipoles, small end caps a according to the position as exp affected by this change. The ov No excessive force must be app	adiated power, only a semirigid coaxial cable the dipole. The antenri re added to the dipole lained in the "Measure erall dipole length is stolied to the dipole arms	slight warming of the dipole near the feedpoint ca b. The center conductor of the feeding line is direct ha is therefore short-circuited for DC-signals. On s arms in order to improve matching when loaded ment Conditions'' paragraph. The SAR data are r Il according to the Standard.
After long term use with 100W r be measured. The dipole is made of standard connected to the second arm of of the dipoles, small end caps a according to the position as exp affected by this change. The ov No excessive force must be app connections near the feedpoint	adiated power, only a semirigid coaxial cable the dipole. The antenri re added to the dipole lained in the "Measure erall dipole length is stolied to the dipole arms	slight warming of the dipole near the feedpoint ca b. The center conductor of the feeding line is direct ha is therefore short-circuited for DC-signals. On s arms in order to improve matching when loaded ment Conditions'' paragraph. The SAR data are r Il according to the Standard.
After long term use with 100W r be measured. The dipole is made of standard connected to the second arm of of the dipoles, small end caps a according to the position as exp affected by this change. The ow No excessive force must be app connections near the feedpoint	adiated power, only a semirigid coaxial cable the dipole. The antenri re added to the dipole lained in the "Measure erall dipole length is stolied to the dipole arms	slight warming of the dipole near the feedpoint ca b. The center conductor of the feeding line is direct that is therefore short-circuited for DC-signals. On a arms in order to improve matching when loaded ment Conditions'' paragraph. The SAR data are r ill according to the Standard. b, because they might bend or the soldered
After long term use with 100W r be measured. The dipole is made of standard connected to the second arm of of the dipoles, small end caps a according to the position as exp affected by this change. The ow No excessive force must be app connections near the feedpoint	adiated power, only a semirigid coaxial cable the dipole. The antenri re added to the dipole lained in the "Measure erall dipole length is stolied to the dipole arms	slight warming of the dipole near the feedpoint ca b. The center conductor of the feeding line is direct that is therefore short-circuited for DC-signals. On a arms in order to improve matching when loaded ment Conditions'' paragraph. The SAR data are r ill according to the Standard. b, because they might bend or the soldered
After long term use with 100W r be measured. The dipole is made of standard connected to the second arm of of the dipoles, small end caps a according to the position as exp affected by this change. The ow No excessive force must be app connections near the feedpoint	adiated power, only a semirigid coaxial cable the dipole. The antenri re added to the dipole lained in the "Measure erall dipole length is stolied to the dipole arms	slight warming of the dipole near the feedpoint ca b. The center conductor of the feeding line is direct that is therefore short-circuited for DC-signals. On a arms in order to improve matching when loaded ment Conditions'' paragraph. The SAR data are r ill according to the Standard. b, because they might bend or the soldered

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# **Extended Dipole Calibrations**

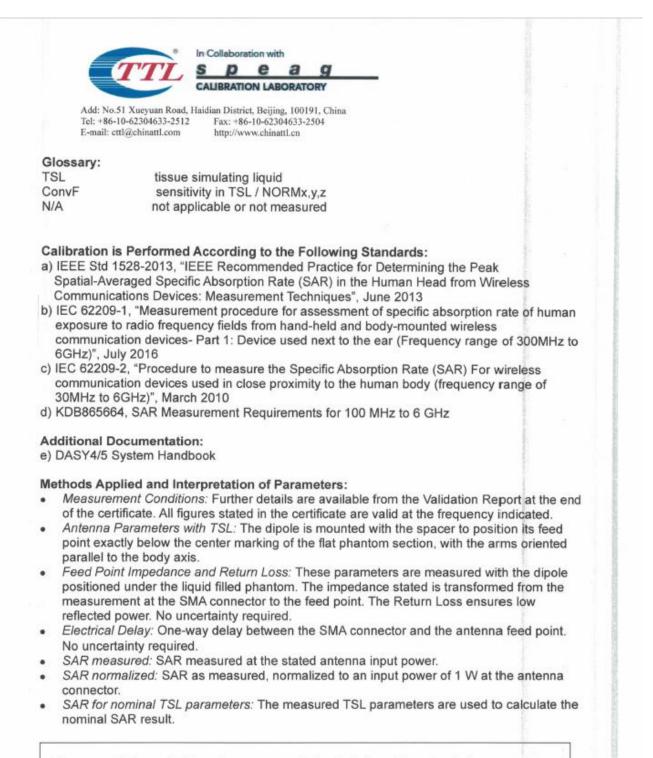
Referring to KDB865664 D01, if dipoles are verified in return loss (<-20dB, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

	Head-2600						
Date of	Doturn loop (dD)	Delta (%)	Real Impedance	Delta	Imaginary	Delta	
measurement	Return-loss (dB)		(ohm)	(ohm)	impedance (ohm)	(ohm)	
2022-01-25	-23.6		49.5		-6.58		
2022-01-17	-24.0	-1.69	49.1	0.4	-6.03	0.55	

The return loss is <-20dB, within 20% of prior calibration; the impedance is within 50hm of prior calibration. Therefore the verification result should support extended calibration.

## 1.7. D5GHzV2 Dipole Calibration Certificate

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Client HT	W		Certificate No:	Z21-60022	
CALIBRATION C	ERTIFICA	TE	Star Street	Par Starting	A State of S
Object	D5GH	zV2 - SN: 1273			
Calibration Procedure(s)	FE-71	1-003-01			
		ation Procedures for d	ipole validation kits		
Calibration date:		ry 26, 2021			
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4	ID # 106276 101369 SN 7600 SN 771	for calibration) Cal Date(Calibrate 12-May-20 (CTTL, M 12-May-20 (CTTL, M 30-Nov-20(CTTL-SF 10-Feb-20(CTTL-SF	d by, Certificate No. No.J20X02965) No.J20X02965) PEAG,No.Z20-6042 PEAG,No.Z20-60017	) Schediuled Ma Ma 1) No 7) Fe	Calibration ay-21 ay-21 by-21 by-21 b-21
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4	ID # 106276 101369 SN 7600	for calibration) Cal Date(Calibrate 12-May-20 (CTTL, N 12-May-20 (CTTL, N 30-Nov-20(CTTL-SF 10-Feb-20(CTTL-SF Cal Date(Calibrated	d by, Certificate No., No.J20X02965) No.J20X02965) PEAG,No.Z20-6042 PEAG,No.Z20-60017 by, Certificate No.)	) Schedluled Ma 1) No 7) Fe Schedluled	Calibration ay-21 ay-21 by-21 b-21
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards	ID # 106276 101369 SN 7600 SN 771 ID #	for calibration) Cal Date(Calibrate 12-May-20 (CTTL, M 12-May-20 (CTTL, M 30-Nov-20(CTTL-SF 10-Feb-20(CTTL-SF	d by, Certificate No., No.J20X02965) No.J20X02965) PEAG,No.Z20-6042 PEAG,No.Z20-60017 by, Certificate No.) Io.J20X00516)	) Schedluled Ma 1) No 7) Fe Schedluled Fe	Calibration ay-21 ay-21 by-21 b-21 Calibration
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzerE5071C	ID # 106276 101369 SN 7600 SN 771 ID # MY49071430	for calibration) Cal Date(Calibrate 12-May-20 (CTTL, M 12-May-20 (CTTL, M 30-Nov-20(CTTL-SF 10-Feb-20(CTTL-SF Cal Date(Calibrated 25-Feb-20 (CTTL, N	d by, Certificate No., No.J20X02965) No.J20X02965) PEAG,No.Z20-6042 PEAG,No.Z20-60017 by, Certificate No.) Io.J20X00516)	) Schedluled Ma 1) No 7) Fe Schedluled Fe	Calibration ay-21 ay-21 by-21 by-21 by-21 Calibration ab-21 ab-21
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzerE5071C	ID # 106276 101369 SN 7600 SN 771 ID # MY49071430 MY46110673	for calibration) Cal Date(Calibrate 12-May-20 (CTTL, N 12-May-20 (CTTL, SF 30-Nov-20(CTTL-SF 10-Feb-20(CTTL-SF Cal Date(Calibrated 25-Feb-20 (CTTL, N 10-Feb-20 (CTTL, N	d by, Certificate No., No.J20X02965) PEAG,No.Z20-6042 PEAG,No.Z20-60017 by, Certificate No.) Io.J20X00516) Io.J20X00515)	) Schedluled Ma 1) No 7) Fe Schedluled Fe Fe	Calibration ay-21 ay-21 by-21 by-21 by-21 Calibration ab-21 ab-21
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzerE5071C	ID # 106276 101369 SN 7600 SN 771 ID # MY49071430 MY46110673 Name	for calibration) Cal Date(Calibrate 12-May-20 (CTTL, N 12-May-20 (CTTL, N 30-Nov-20(CTTL-SF 10-Feb-20(CTTL-SF Cal Date(Calibrated 25-Feb-20 (CTTL, N 10-Feb-20 (CTTL, N Function	d by, Certificate No., No.J20X02965) PEAG,No.Z20-6042 PEAG,No.Z20-60017 by, Certificate No.) Io.J20X00516) Io.J20X00515)	) Schedluled Ma 1) No 7) Fe Schedluled Fe Fe	Calibration ay-21 ay-21 by-21 by-21 by-21 Calibration ab-21 ab-21
Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ID # 106276 101369 SN 7600 SN 771 ID # MY49071430 MY46110673 Name Zhao Jing	for calibration) Cal Date(Calibrate 12-May-20 (CTTL, N 12-May-20 (CTTL, SF 10-Feb-20 (CTTL-SF Cal Date(Calibrated 25-Feb-20 (CTTL, N 10-Feb-20 (CTTL, N Function SAR Test Eng	d by, Certificate No., No. J20X02965) PEAG, No. Z20-6042 PEAG, No. Z20-60017 by, Certificate No.) Io. J20X00516) Io. J20X00515)	) Schedluled Ma 1) No 7) Fe Schedluled Fe Fe	Calibration ay-21 ay-21 by-21 by-21 by-21 Calibration ab-21 ab-21



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

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

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	-
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5250 MHz ± 1 MHz 5600 MHz ± 1 MHz 5750 MHz ± 1 MHz	

#### Head TSL parameters at 5250 MHz

	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	36.0 ± 6 %	4.68 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		1

#### 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	7.82 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	78.2 W/kg ± 24.4 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.23 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.3 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	35.4 ± 6 %	5.06 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

#### SAR result with Head TSL at 5600 MHz

SAR averaged over 1 $cm^3$ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.16 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	81.6 W/kg ± 24.4 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.33 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.3 W/kg ± 24.2 % (k=2)

#### Head TSL parameters at 5750 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.4	5.22 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.2 ± 6 %	5.22 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		( <u>1111)</u>

#### SAR result with Head TSL at 5750 MHz

SAR averaged over 1 $cm^3$ (1 g) of Head TSL	Condition		
SAR measured	100 mW input power	7.94 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	79.3 W/kg ± 24.4 % (k=2	
SAR averaged over 10 $cm^3$ (10 g) of Head TSL	Condition		
SAR measured	100 mW input power	2.25 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	22.5 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	47.8Ω - 1.46jΩ			
Return Loss	- 31.3dB			

#### Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	51.6Ω + 2.95jΩ		
Return Loss	- 29.6dB		

#### Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	50.0Ω + 3.42jΩ		
Return Loss	- 29.3dB		

#### General Antenna Parameters and Design

Electrical Delay (one direction)	1.101 ns		
	0000000		

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

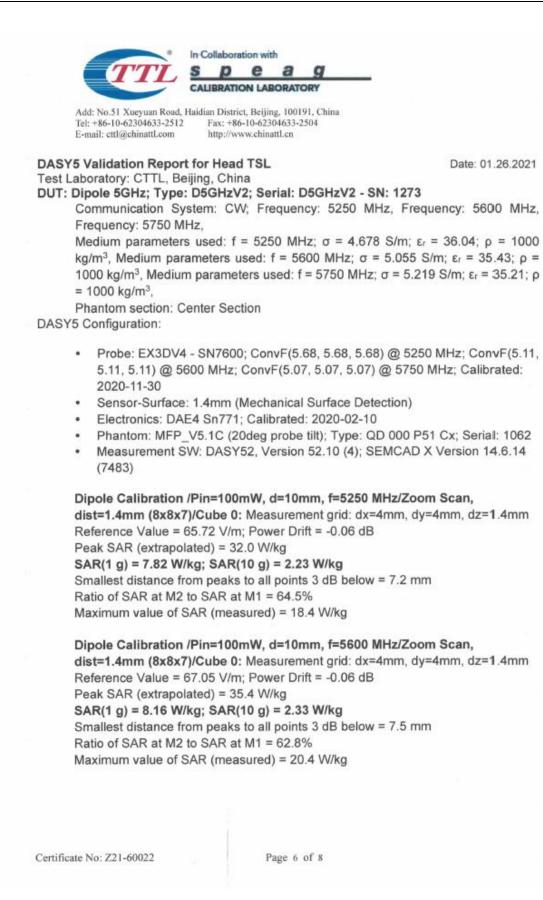
The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching 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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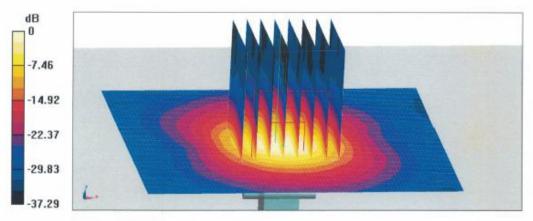
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Dipole Calibration /Pin=100mW, d=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 66.61 V/m; Power Drift = -0.06 dB Peak SAR (extrapolated) = 35.8 W/kg SAR(1 g) = 7.94 W/kg; SAR(10 g) = 2.25 W/kg Smallest distance from peaks to all points 3 dB below = 7.6 mm Ratio of SAR at M2 to SAR at M1 = 61.7% Maximum value of SAR (measured) = 19.7 W/kg



0 dB = 19.7 W/kg = 12.94 dBW/kg

Certificate No: Z21-60022

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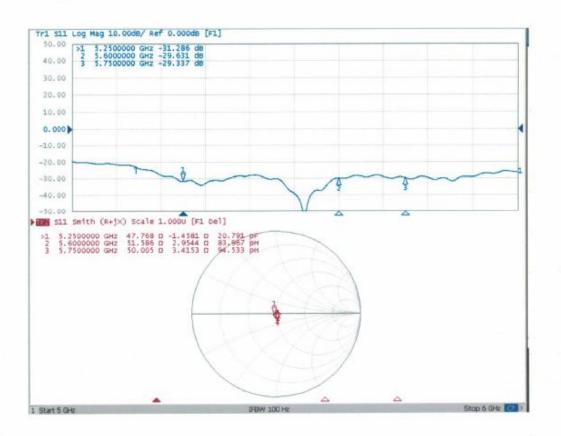


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#### Impedance Measurement Plot for Head TSL



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## **Extended Dipole Calibrations**

Referring to KDB865664 D01, if dipoles are verified in return loss (<-20dB, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

Head-5250						
Date of	Poturn loop (dP)		Real Impedance	Delta	Imaginary	Delta
measurement	Return-loss (dB)	Delta (%)	(ohm)	(ohm)	impedance (ohm)	(ohm)
2021-01-26	-31.3		47.8		-1.46	
2022-01-17	-31.8	1.60	47.3	0.5	-1.06	0.4

Head-5600						
Date of	Doturn loop (dD)	Dolto (9/)	Real Impedance	Delta	Imaginary	Delta
measurement	Return-loss (dB)	Delta (%)	(ohm)	(ohm)	impedance (ohm)	(ohm)
2021-01-26	-29.6		51.6		2.95	
2022-01-17	-30.1	-1.06	51.2	0.4	2.75	0.2

Head-5750						
Date of	Poturn loop (dP)	Dolta $(9/)$	Real Impedance	Delta	Imaginary	Delta
measurement	Return-loss (dB)	Delta (%)	(ohm)	(ohm)	impedance (ohm)	(ohm)
2021-01-26	-29.3		50.0		3.42	
2022-01-17	-29.6	-1.02	50.7	0.7	3.02	0.4

The return loss is <-20dB, within 20% of prior calibration; the impedance is within 50hm of prior calibration. Therefore the verification result should support extended calibration.