

ANNEX F: D835V2 Dipole Calibration Certificate

Add. No. 51 Vuonna		TON LABORATORY	Hac-MRA	ČNA	国际互认 校准 CALIBRATION
Tel: +86-10-623046: E-mail: cttl@chinatt	33-2079 Fax: +	86-10-62304633-2504 www.chinattl.cn	a Manulation		CNAS L0570
	anghai)		Certificate No:	Z20-60296	3
CALIBRATION CE	RTIFICAT	E		al and the	
Dbject	D835V2	2 - SN: 4d020		(BAN	
Calibration Procedure(s)	FF-Z11	-003-01			
		tion Procedures for d	ipole validation kits		
Calibration date:	August	28, 2020			
All calibrations have been numidity<70%. Calibration Equipment used			y facility: environm	ient tempera	ture(22±3)°C and
umidity<70%. Calibration Equipment used		or calibration)	y facility: environm d by, Certificate No.		ture(22±3)℃ and
umidity<70%. Calibration Equipment used Primary Standards	(M&TE critical fo	or calibration)	d by, Certificate No.		÷
umidity<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, 12-May-20 (CTTL,	d by, Certificate No. No.J20X02965) No.J20X02965)) Schedi	uled Calibration May-21 May-21
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umidity<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 3617 SN 771 ID # MY49071430 MY46110673 Name Zhao Jing	Cal Date(Calibrate 12-May-20 (CTTL, 12-May-20 (CTTL, 30-Jan-20(SPEAG, 10-Feb-20(CTTL-S) Cal Date(Calibrated 25-Feb-20 (CTTL, 1 10-Feb-20 (CTTL, 1 10-Feb-20 (CTTL, 1 Function SAR Test Eng	d by, Certificate No. No.J20X02965) No.EX3-3617_Jan20 PEAG,No.Z20-6001 I by, Certificate No.) No.J20X00516) No.J20X00515)) Schedu 0) 7) Schedu	Jed Calibration May-21 May-21 Jan-21 Feb-21 Jed Calibration Feb-21 Feb-21
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Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

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Page 2 of 8



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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.

	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	41.2 ± 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^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.65 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.57 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.37 W/kg ± 18.7 % (k=2)

Body TSL parameters The following parameters and calculations were applied.

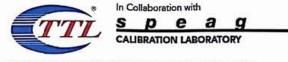
	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.0 ± 6 %	0.96 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	7	

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.42 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	9.76 W /kg ± 18.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.59 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	6.40 W/kg ± 18.7 % (k=2)

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Page 3 of 8



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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.8Ω+ 1.73jΩ	
Return Loss	- 26.2dB	

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.0Ω- 2.47jΩ	
Return Loss	- 26.2dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.258 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.

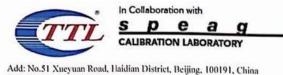
Additional EUT Data

Manufactured by	SPEAG

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Page 4 of 8





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DASY5 Validation Report for Head TSL

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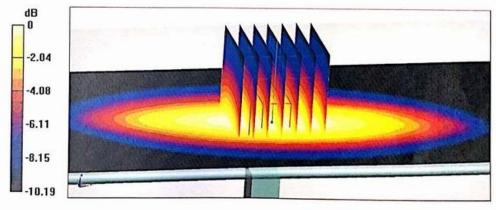
Date: 08.28.2020

Test Laboratory: CTTL, Beijing, China **DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d020** Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1 Medium parameters used: f = 835 MHz; $\sigma = 0.877$ S/m; $\varepsilon_r = 41.23$; $\rho = 1000$ kg/m³ Phantom section: Center Section DASY5 Configuration:

- Probe: EX3DV4 SN3617; ConvF(9.66, 9.66, 9.66) @ 835 MHz; Calibrated: 2020-01-30
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2020-02-10
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 58.09 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 3.46 W/kg SAR(1 g) = 2.37 W/kg; SAR(10 g) = 1.57 W/kg Smallest distance from peaks to all points 3 dB below = 16.6 mm Ratio of SAR at M2 to SAR at M1 = 68.1% Maximum value of SAR (measured) = 3.12 W/kg



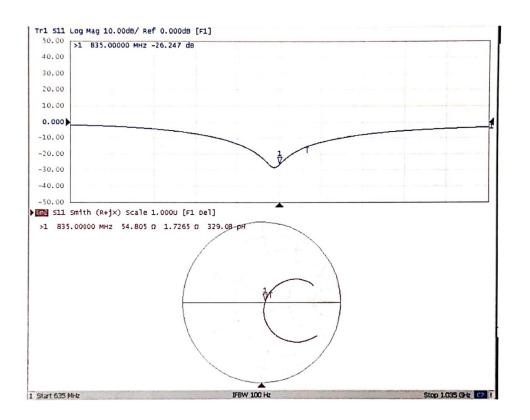
0 dB = 3.12 W/kg = 4.94 dBW/kg

Certificate No: Z20-60296

Page 5 of 8

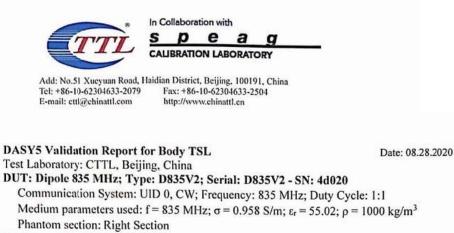


Impedance Measurement Plot for Head TSL



Certificate No: Z20-60296

Page 6 of 8

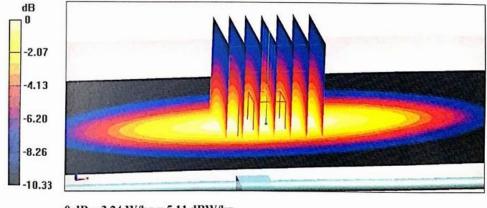


DASY5 Configuration:

- Probe: EX3DV4 SN3617; ConvF(9.53, 9.53, 9.53) @ 835 MHz; Calibrated: 2020-01-30
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2020-02-10
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

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

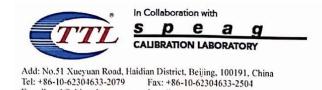
Reference Value = 56.88 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 3.65 W/kg SAR(1 g) = 2.42 W/kg; SAR(10 g) = 1.59 W/kg Smallest distance from peaks to all points 3 dB below = 15.8 mm Ratio of SAR at M2 to SAR at M1 = 66.5% Maximum value of SAR (measured) = 3.24 W/kg



0 dB = 3.24 W/kg = 5.11 dBW/kg

Certificate No: Z20-60296

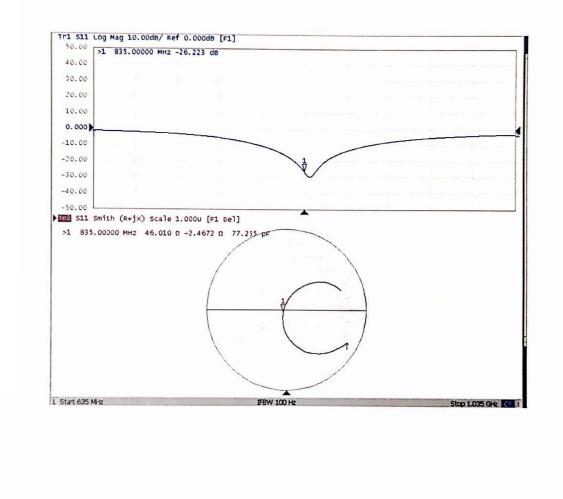
Page 7 of 8



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Impedance Measurement Plot for Body TSL

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Page 8 of 8



ANNEX G: D1750V2 Dipole Calibration Certificate

Client TA(Shar	and the second	Certificate No: Z	20-60079
	AULICAL	E	in the second state of the
- No. of Sec. of Sec.			
Object	D1750	/2 - SN: 1033	
Calibration Procedure(s)	FF-Z11-	003.01	
		tion Procedures for dipole validation kits	
Calibration date:		ry 25, 2020	
	rebuild	y 20, 2020	
pages and are part of the certi	ificate.	the uncertainties with confidence probabil the closed laboratory facility: environme	•
numiaity<70%.			
Calibration Equipment used (N	M&TE critical fo	or calibration)	
Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Dis Course and Accessibility of States and Arganisms	106276	11-Apr-19 (CTTL, No.J19X02605)	Apr-20
	101369	11-Apr-19 (CTTL, No.J19X02605)	Apr-20
	SN 3846	25-Mar-19(CTTL-SPEAG,No.Z19-60064	
DAE4	SN 1555	22-Aug-19(CTTL-SPEAG,No.Z19-60295	i) Aug-20
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
9	MY49071430	10-Feb-20 (CTTL, No.J20X00516)	Feb-21
NetworkAnalyzer E5071C	MY46110673	10-Feb-20 (CTTL, No.J20X00515)	Feb-21
	Name	Function	Signature
Calibrated by: Z	Zhao Jing	SAR Test Engineer	A SERVICE
Reviewed by:	in Hao	SAR Test Engineer	E TAKE
Approved by:	Qi Dianyuan	SAR Project Leader	JEAN ANTHE
		Insued: E-	
This calibration certificate shal	Il not be reproc	duced except in full without written approve	aburary 29, 2020
			ar of the laboratory.

Glossary:

TSL

N/A

ConvF





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> 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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Page 2 of 8



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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	1750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.1 ± 6 %	1.35 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	8.93 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	35.9 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	4.71 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	18.9 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	52.4 ± 6 %	1.48 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	100	

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition		
SAR measured	250 mW input power	9.24 W/kg	
SAR for nominal Body TSL parameters	normalized to 1W	36.9 W/kg ± 18.8 % (k=2)	
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition		
SAR measured	250 mW input power	4.95 W/kg	
SAR for nominal Body TSL parameters	normalized to 1W	19.8 W/kg ± 18.7 % (k=2)	

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Page 3 of 8



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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.8Ω- 0.06 jΩ
Return Loss	- 38.3 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	44.5Ω- 0.85 jΩ	
Return Loss	- 24.5 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.085 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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Page 4 of 8

SAR Test Report



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

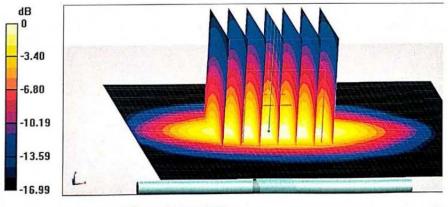
Date: 02.25.2020

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1033 Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1750 MHz; $\sigma = 1.349 \text{ S/m}$; $\varepsilon_r = 39.06$; $\rho = 1000 \text{ kg/m3}$ Phantom section: Right Section DASY5 Configuration:

- Probe: EX3DV4 SN3846; ConvF(8.2, 8.2, 8.2) @ 1750 MHz; Calibrated: 2019-03-25
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; Calibrated: 2019-08-22
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

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

Reference Value = 98.26 V/m; Power Drift = -0.02 dB Peak SAR (extrapolated) = 16.9 W/kg SAR(1 g) = 8.93 W/kg; SAR(10 g) = 4.71 W/kg Smallest distance from peaks to all points 3 dB below = 10 mm Ratio of SAR at M2 to SAR at M1 = 53.5% Maximum value of SAR (measured) = 13.9 W/kg



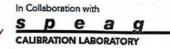
0 dB = 13.9 W/kg = 11.43 dBW/kg

Certificate No: Z20-60079

Page 5 of 8

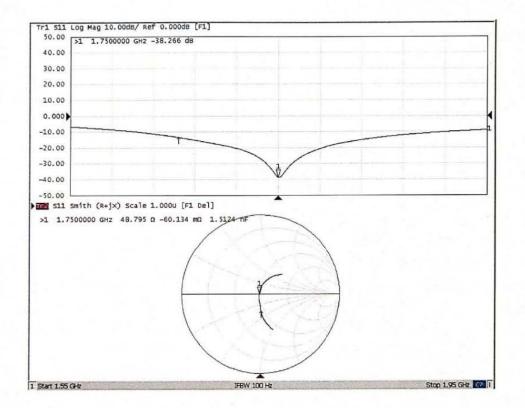
SAR Test Report

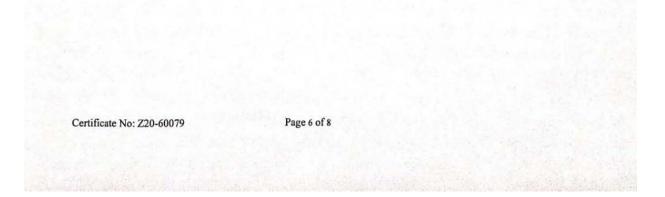
TTL



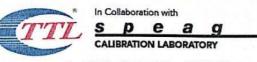
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Impedance Measurement Plot for Head TSL





SAR Test Report



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

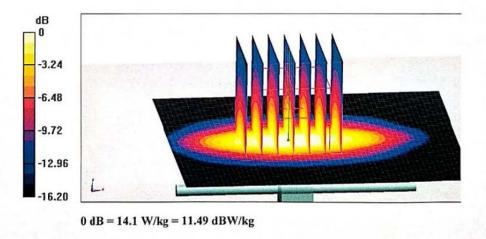
Date: 02.25.2020

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1033 Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1750 MHz; $\sigma = 1.482$ S/m; $\varepsilon_r = 52.35$; $\rho = 1000$ kg/m3 Phantom section: Center Section DASY5 Configuration:

- Probe: EX3DV4 SN3846; ConvF(7.8, 7.8, 7.8) @ 1750 MHz; Calibrated: 2019-03-25
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; Calibrated: 2019-08-22
- 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 = 94.32 V/m; Power Drift = 0.00 dB Peak SAR (extrapolated) = 16.9 W/kg SAR(1 g) = 9.24 W/kg; SAR(10 g) = 4.95 W/kg Smallest distance from peaks to all points 3 dB below = 9.2 mm Ratio of SAR at M2 to SAR at M1 = 56% Maximum value of SAR (measured) = 14.1 W/kg



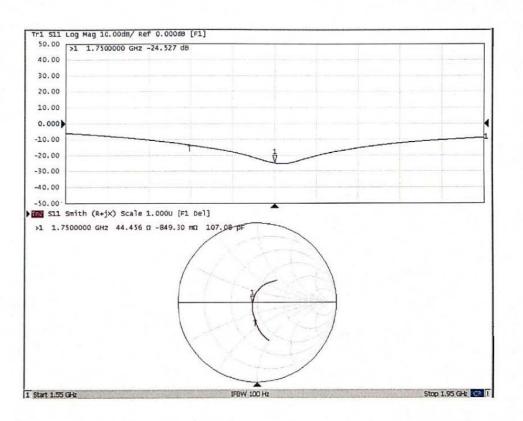
Certificate No: Z20-60079

Page 7 of 8



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Impedance Measurement Plot for Body TSL



Certificate No: Z20-60079

Page 8 of 8



ANNEX H: D1900V2 Dipole Calibration Certificate

	Shanghai)	www.chinattl.cn	Certificate No:	Z20-60297	
CALIBRATION C					
CALIBICATION C	ERTIFICA	-		220-00201	1000
		5	these states in		Contraction of the
Object	D1900	V2 - SN: 5d060			
Calibration Procedure(s)	FE-711	-003-01			
			dipole validation kits		
Calibration date:	August	27, 2020			
humidity<70%.			ory facility: environm	ent temperature	e(22±3)°C and
humidity<70%. Calibration Equipment used		or calibration)	ory facility: environme		e(22±3)°C and
humidity<70%. Calibration Equipment used	d (M&TE critical f	or calibration)	ed by, Certificate No.)	Scheduled	1
numidity<70%. Calibration Equipment used Primary Standards	d (M&TE critical f	or calibration) Cal Date(Calibra	ed by, Certificate No.) , No.J20X02965)	Scheduled	d Calibration
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2	d (M&TE critical f ID # 106276 101369	or calibration) Cal Date(Calibra 12-May-20 (CTTL 12-May-20 (CTTL	ed by, Certificate No.) , No.J20X02965)	Scheduleo M M	d Calibration lay-21
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A	d (M&TE critical f ID # 106276 101369	or calibration) Cal Date(Calibra 12-May-20 (CTTL 12-May-20 (CTTL 30-Jan-20(SPEAC	ed by, Certificate No.) No.J20X02965) No.J20X02965)	Scheduled M M J) J	d Calibration lay-21 lay-21
numidity<70%. Calibration Equipment user Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4	ID # 106276 101369 4 SN 3617	or calibration) Cal Date(Calibra 12-May-20 (CTTL 12-May-20 (CTTL 30-Jan-20(SPEAC 10-Feb-20(CTTL-	ed by, Certificate No.) No.J20X02965) No.J20X02965) S,No.EX3-3617_Jan20	Scheduled M M)) J /) F	d Calibration lay-21 lay-21 lan-21
humidity<70%. Calibration Equipment user Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4	d (M&TE critical f ID # 106276 101369 4 SN 3617 SN 771 ID #	or calibration) Cal Date(Calibra 12-May-20 (CTTL 12-May-20 (CTTL 30-Jan-20(SPEAC 10-Feb-20(CTTL-	ed by, Certificate No.) , No.J20X02965) , No.J20X02965) S,No.EX3-3617_Jan20 SPEAG,No.Z20-60017 ed by, Certificate No.)	Scheduled M M)) J)) F Scheduled	d Calibration lay-21 lay-21 lan-21 eb-21
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards	d (M&TE critical f ID# 106276 101369 SN 3617 SN 771 ID# MY49071430	or calibration) Cal Date(Calibra 12-May-20 (CTTL 12-May-20 (CTTL 30-Jan-20(SPEAC 10-Feb-20(CTTL- Cal Date(Calibrate	ed by, Certificate No.) No.J20X02965) No.J20X02965) S,No.EX3-3617_Jan20 SPEAG,No.Z20-60017 ed by, Certificate No.) No.J20X00516)	Scheduled M) J) F Scheduled F	d Calibration lay-21 lay-21 an-21 eb-21 d Calibration
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	d (M&TE critical f ID# 106276 101369 SN 3617 SN 771 ID# MY49071430	Cal Date(Calibra 12-May-20 (CTTL 12-May-20 (CTTL 30-Jan-20(SPEAC 10-Feb-20(CTTL- Cal Date(Calibrate 25-Feb-20 (CTTL,	ed by, Certificate No.) No.J20X02965) No.J20X02965) S,No.EX3-3617_Jan20 SPEAG,No.Z20-60017 ed by, Certificate No.) No.J20X00516)	Scheduled M) J) F Scheduled F	d Calibration lay-21 lay-21 lan-21 eb-21 d Calibration Feb-21 Feb-21
humidity<70%. Calibration Equipment user Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	d (M&TE critical f ID # 106276 101369 SN 3617 SN 771 ID # MY49071430 MY46110673	Cal Date(Calibra 12-May-20 (CTTL 12-May-20 (CTTL 30-Jan-20(SPEAC 10-Feb-20(CTTL- Cal Date(Calibrate 25-Feb-20 (CTTL, 10-Feb-20 (CTTL,	ed by, Certificate No.) No.J20X02965) No.J20X02965) S,No.EX3-3617_Jan20 SPEAG,No.Z20-60017 ed by, Certificate No.) No.J20X00516) No.J20X00515)	Scheduled M)) J)) F Scheduled F F	d Calibration lay-21 lay-21 lan-21 eb-21 d Calibration Feb-21 Feb-21
Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	d (M&TE critical f ID # 106276 101369 SN 3617 SN 771 ID # MY49071430 MY46110673 Name	Cal Date(Calibra 12-May-20 (CTTL 12-May-20 (CTTL 30-Jan-20(SPEAC 10-Feb-20(CTTL- Cal Date(Calibrate 25-Feb-20 (CTTL, 10-Feb-20 (CTTL, 5-Feb-20 (CTTL,	ed by, Certificate No.) No.J20X02965) No.J20X02965) No.EX3-3617_Jan20 SPEAG,No.Z20-60017 ed by, Certificate No.) No.J20X00516) No.J20X00515)	Scheduled M)) J)) F Scheduled F F	d Calibration lay-21 lay-21 lan-21 eb-21 d Calibration Feb-21 Feb-21

Certificate No: Z20-60297

Page 1 of 8



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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: Z20-60297

Page 2 of 8



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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

 Triple Start 1 MHz
 1000 MHz ± 1 MHz
 1000 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	41.1 ± 6 %	1.40 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.82 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	39.5 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.04 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	20.2 W/kg ± 18.7 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

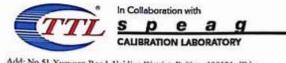
	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.5 ± 6 %	1.51 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.89 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	39.8 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.13 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.6 W/kg ± 18.7 % (k=2)

Certificate No: Z20-60297

Page 3 of 8



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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.5Ω+ 6.58jΩ	
Return Loss	- 23.3dB	_

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.0Ω+ 6.72jΩ	
Return Loss	- 22.9dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.061 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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Page 4 of 8