Test Laboratory: Huatongwei International Inspection Co., Ltd., SAR Lab

LTE Band 17 Body-worn

Communication System: UID 0, Generic LTE-FDD (0); Frequency: 710 MHz;Duty Cycle: 1:1 Medium parameters used: f = 710 MHz; $\sigma = 0.886$ S/m; $\varepsilon_r = 43.179$; $\rho = 1000$ kg/m³ Phantom section: Flat Section Ambient Temperature:22.7°C;Liquid Temperature:22.2°C;

DASY Configuration:

- Probe: EX3DV4 SN7494; ConvF(10.8, 10.8, 10.8) @ 710 MHz; Calibrated: 4/17/2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1549; Calibrated: 3/27/2023
- Phantom: Twin-SAM V8.0; Type: QD 000 P41 AA; Serial: 1974
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

Rear/CH23790/Area Scan (51x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm Maximum value of SAR (interpolated) = 0.218 W/kg

Rear/CH23790/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm Reference Value = 14.34 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 0.262 W/kg SAR(1 g) = 0.149 W/kg; SAR(10 g) = 0.102 W/kg

Maximum value of SAR (measured) = 0.206 W/kg



Test Laboratory: Huatongwei International Inspection Co., Ltd., SAR Lab

LTE Band 66 Body-worn

Communication System: UID 0, Generic LTE-FDD (0); Frequency: 1745 MHz;Duty Cycle: 1:1 Medium parameters used: f = 1745 MHz; $\sigma = 1.378$ S/m; $\varepsilon_r = 41.403$; $\rho = 1000$ kg/m³ Phantom section: Flat Section Ambient Temperature:22.7°C;Liquid Temperature:22.2°C;

DASY Configuration:

- Probe: EX3DV4 SN7494; ConvF(8.99, 8.99, 8.99) @ 1745 MHz; Calibrated: 4/17/2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1549; Calibrated: 3/27/2023
- Phantom: Twin-SAM V8.0; Type: QD 000 P41 AA; Serial: 1974
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

Rear 15mm/CH132322/Area Scan (51x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm Maximum value of SAR (interpolated) = 1.05 W/kg

Rear 15mm/CH132322/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm Peferanea Value = 13 47 V/m: Power Drift = 0.04 dP

Reference Value = 13.47 V/m; Power Drift = -0.04 dB Peak SAR (extrapolated) = 1.21 W/kg SAR(1 g) = 0.685 W/kg; SAR(10 g) = 0.385 W/kg Maximum value of SAR (measured) = 1.01 W/kg



0 dB = 1.05 W/kg = 0.22 dBW/kg

Test Laboratory: Huatongwei International Inspection Co., Ltd., SAR Lab

Date: 9/28/2023

BT Body-worn

Communication System: UID 0, Generic BT (0); Frequency: 2402 MHz;Duty Cycle: 1:1 Medium parameters used (interpolated): f = 2402 MHz; $\sigma = 1.771$ S/m; $\varepsilon_r = 40.217$; $\rho = 1000$ kg/m³ Phantom section: Flat Section

Ambient Temperature:22.7°C;Liquid Temperature:22.2°C;

DASY Configuration:

- Probe: EX3DV4 SN7494; ConvF(8.01, 8.01, 8.01) @ 2402 MHz; Calibrated: 4/17/2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1549; Calibrated: 3/27/2023
- Phantom: Twin-SAM V8.0; Type: QD 000 P41 AA; Serial: 1974
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

Rear 15mm/CH0/Area Scan (61x101x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Info: Interpolated medium parameters used for SAR evaluation. Maximum value of SAR (interpolated) = 0.0158 W/kg

Rear 15mm/CH0/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 1.867 V/m; Power Drift = -0.15 dB Peak SAR (extrapolated) = 0.00824 W/kg SAR(1 g) = 0.00443 W/kg; SAR(10 g) = 0.00348 W/kg

Info: Interpolated medium parameters used for SAR evaluation. Maximum value of SAR (measured) = 0.00676 W/kg



0 dB = 0.0158 W/kg = -18.02 dBW/kg

1. DAE4 Calibration Certificate

Add: No.52 HuaYuanBei Road Tel: +86-10-62304633-2117 E-mail: emf@caiet av.cm	I, Haidian District, Bei	jing, 100191, China	CALIBRATION CNAS L0570
Client : HT	N	Certificate	No: J23Z60202
CALIBRATION	CERTIFICA	TE	
Dbject	DAE	4 - SN: 1549	
Calibration Procedure(s)	EE.7	11.002.01	
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Calibration date:	Marc	h 27, 2023	
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CALIBRA	TION LABORATORY	
Add: No.52 HuaYuan	Bei Road, Haidian District, Beijing, 100191, China	
Tel: +86-10-6230463 E-mail: emf@caict.ac	3-2117 .cn http://www.caict.ac.cn	
Glossary:		
DAE	data acquisition electronics	
Connector angle	information used in DASY system to a	align probe sensor X

Methods Applied and Interpretation of Parameters:

- DC Voltage Measurement: Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- Connector angle: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The report provide only calibration results for DAE, it does not contain other performance test results.



2. Probe Calibration Certificate

Add: No.52 HuaYuanBei Road, Tel: +86-10-62304633-2117 E-mail: emfidenict ac en	Haidian District, Beijing	, 100191, China	CNAS L0570
Client HTW		Certificate No: 2	223-60186
CALIBRATION CEL	DTIEICATE		
CALIBRATION CEI	ATTICAL		and the second second
Object	EX3DV4 - S	N : 7494	
Calibration Procedure(s)			
	FF-Z11-004-	V2	
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Add: No 32 Har VisaBit Real, Haidian District, Beijing, 100191, China Tet: +48: Ho6204033177 Benuit: emfigeatcl.a.cm Glossary: TSL tissue simulating liquid NORMX, y.z sensitivity in Tfe e space Corruf sensitivity in Tfe e space Corruf sensitivity in Tfe e space Corruf correct factor (11/duty_coycle) of the RF signal A,B,C,D modulation dependent linearization parameters Polarization 0 0 rotation around a nak that is in the plane normal to probe axis (at measurement center B or totation around a nak that is in the plane normal to probe axis (at measurement center B or totation around an axis that is in the plane normal to probe axis (at measurement center B or totation around an axis that is in the plane normal to probe axis (at measurement center B or totation around an axis that is in the plane normal to probe axis (at measurement center B or totation around an axis that is in the plane normal to probe axis (at measurement center B or totation around an axis that is in the plane normal to probe axis (at measurement center B or totation around an axis that is in the plane normal to probe axis (at measurement center B or totation around an axis that is in the plane normal to probe axis Connector Angle Information used in DASY system to align probe sensor X to the robot coordinate system Calibration is Performed According to the Following Standards: a) IEEE 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) form hand-heid and body-mounted devices used next to the ear (frequency range of 30 MHz to 6 GHz)", July 2016 c) IEE 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", July 2016 c) NORM x, yz: Assessed to E-field polarization 0 = (SS00MHz in TEM-cell; 1> 1800MHz; waveguide). NORMX, yz: Assessed to E-field polarization 0 = (SS00MHz in TEM-cell; 1> 1800MHz; waveguide). NORMX, yz: Assessed to E-field polarization 0 = (SS	TTL	s p e a g
Add: No 32 Har NumBei Read, Haldian Diseriet, Beijing, 100191, China Tel: +4x-1042010633171 TSL bissue simulating liquid NORMX, yz sensitivity in Tree space ConvF sensitivity in Tree space Polarization 0 drotation dependent linearization parameters Polarization 0 drotation around an axis that is in the plane normal to probe axis (at measurement center 8 de 0 is normal to probe axis Connector Angle information used in DASY system to align probe sensor X to the robot coordinate system 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, 'Neasurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)'', July 2016 C) IEC 62209-2, 'Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 300 MHz to 6 GHz)'', March 2010 c) IKDB 855664, "SAR Measurement Requirements for 100 MHz to 6 GHz' Mothod Applied and Interpretation of Parameters: • NORMX, yz are only intermediate values, i.e., the uncertainties of NORMx, yz does not effect the <i>E'</i> -field uncertainty inside TSL (see below ConvF). • NORMX, yz are NORMX, yz at the only intermediate values, i.e., the uncertainties of NORMx, yz does not effect the <i>E'</i> -field uncertainty inside TSL (see below ConvF). • NORMX, yz are NORMX, yz at the Normation parameters assessed based on the data of power sweep (ro uncertainty required). DCP does not depend		CALIBRATION LABORATORY
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Glossary: Tst. tissue simulating liquid TSL tissue simulating liquid NORMx,y,z sensitivity in FSL / NORMx,y,z DCP clode compression point CF crest factor (1/duty, eycle) of the RF signal A.B.C,D modulation dependent linearization parameters Polarization Φ 0 rotation around probe axis Polarization Φ 0 rotation around probe axis Camector Angle Information used in DASY system to align probe sensor X to the robot coordinate system Calibration is Performed According to the Following Standards: a) a) IEEE Skd 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques', June 2013 b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from inad-heid and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016 c) IEC 82209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 300 MHz to 6 GHz)", March 2010 O) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz' Morthdy,y,z = ANDRMx,y,z * fore of CF-field polarization 0=0 (65000MHz in TE	E-mail: emf@	Joness-arr/ leaiet.ac.en http://www.caiet.ac.en
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 b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016 c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010 d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz" Methods Applied and Interpretation of Parameters: NORMX, y.z are only intermediate values, i.e., the uncertainties of NORMX, y.z does not effect the E²-field uncertainty inside TSL (see below ConvF). NORMX, y.z are only intermediate values, i.e., the uncertainties of NORMX, y.z does not effect the E²-field uncertainty inside TSL (see below ConvF). NORM(h), y.z = NORMX, y.z* frequency_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF. DCPx, y.z: DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media. PAR: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics. Ax, y.z; Bx, y.z; Cx, y.z; VRx, y, z; A, B, C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. ConvF and Boundary Effect Parameters: Assessed in flat phantom using E-field (or Temperature Transfer Standard for f>800MHz) and inside waveguide using analytical field distributions based on power measurements for 1>800MHz. The same setups are used for assessment of the parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL co	Measurement 7	fechniques", June 2013
 hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz), July 2016 O IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010 OKDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz" Methods Applied and Interpretation of Parameters: NORMx, y.z Assessed for E-field polarization 8=0 (fs900MHz in TEM-cell; f>1800MHz: waveguide). NORMx, y.z are only intermediate values, i.e., the uncertainties of NORMx, y.z on ot effect the E²-field uncertainty inside TSL (see below ConvF). NORM(f)x, y.z = NORMx, y.z* frequency_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF. DCPX, y.z: DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media. PAR: bAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics. Ax, y.z; Bx, y.z; Cx, y.z; VRx, y.z:A, B, C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode. ConvF and Boundary Effect Parameters: Assessed in flat phantom using E-field (or Temperature Transfer Standard for fS800MHz). The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty valued are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORMx, y.z* ConvF whereby the uncertainty corresponds to that giv	b) IEC 62209-1,	"Measurement procedure for the assessment of Specific Absorption Rate (SAR) from
 b) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010 b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz" Methods Applied and Interpretation of Parameters: NORMx, y,z assessed for E-field polarization θ=0 (fs900MHz in TEM-cell; f>1800MHz: waveguide). NORMx, y,z are only intermediate values, i.e., the uncertainties of NORMx, y,z does not effect the E¹-field uncertainty inside TSL (see below Con/F). NORM(f)x, y,z = NORMx, y,z * frequency_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of convF. DCPx, y,z: DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media. PAR: bar, y,z; Kx, y,z; AB, C are numerical linearization parameters assessed based on the signal characteristics. Ax, y,z; Bx, y,z; Cx, y,z; VRx, y,z; A, B, C are numerical linearization parameters do not depend on frequency nor media. PAR: bar, Boundary Effect Parameters: Assessed in flat phantom using E-field (or Temperature Transfer Standard for fs800MHz) and inside waveguide using analytical field distributions based on power measurements for 1-800MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from±50MHz to±100MHz. Spherical isotropy (3D deviation form isotropy): in a field of low gradients realized using a flat phantom exposed by a patch antenna. Sensor Offset: The sensor offset corresponds to the offset of virtual me	hand-held and	body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)',
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CAICT



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DASY/EASY - Parameters of Probe: EX3DV4 - SN:7494

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm(µV/(V/m)2)^	0.40	0.47	0.41	±10.0%
DCP(mV) ^a	97.0	98.5	97.6	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dBõV	c	D dB	VR mV	Unc ^E (<i>k</i> =2)
0	CW	X	0.0	0.0	1.0	0.00	148.8	±2.0%
		Y	0.0	0.0	1.0		160.0	
		z	0.0	0.0	1.0		149.1	

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%.

^A The uncertainties of Norm X, Y, Z do not affect the E²-field uncertainty inside TSL (see Page 4). ^B Numerical linearization parameter: uncertainty not required.

^E Uncertainly is determined using the max, deviation from linear response applying rectangular distribution and is expressed for the square of the field value.





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DASY/EASY – Parameters of Probe: EX3DV4 – SN:7494

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz] ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unct. (k=2)
750	41.9	0.89	10.80	10.80	10.80	0.13	1.41	±12.7%
835	41.5	0.90	10.40	10.40	10.40	0.12	1.50	±12.7%
1750	40.1	1.37	8.99	8.99	8.99	0.26	0.92	±12.7%
1900	40.0	1.40	8.64	8.64	8.64	0.26	1.03	±12.7%
2000	40.0	1.40	8.73	8.73	8.73	0.23	1.04	±12.7%
2300	39.5	1.67	8.35	8.35	8.35	0.63	0.64	±12.7%
2450	39.2	1.80	8.01	8.01	8.01	0.33	0.99	±12.7%
2600	39.0	1.96	7.83	7.83	7.83	0.55	0.71	±12.7%
5250	35.9	4.71	5.67	5.67	5.67	0.40	1.55	±13.9%
5600	35.5	5.07	5.07	5.07	5.07	0.45	1.45	±13.9%
5750	35.4	5.22	5.14	5.14	5.14	0.40	1.55	±13.9%

^c Frequency validity above 300 MHz of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

F At frequency up to 6 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.





Appendix E: DAE and Probe Calibration Certificate





sensor Arrangement	Triangular
Connector Angle (°)	23.2
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	9mm
Tip Diameter	2.5mm
Probe Tip to Sensor X Calibration Point	1mm
Probe Tip to Sensor Y Calibration Point	1mm
Probe Tip to Sensor Z Calibration Point	1mm
Recommended Measurement Distance from Surface	1.4mm

1.1. D750V3 Dipole Calibration Certificate

Add: No.51 Xueyuan Ro Tel: +86-10-62304633-2/ E-mail: cttl@chinattl.cor	ad, Haidian District, 079 Fax: +86-1 n http://www	Beijing, 100191, China 10-62304633-2504 w.chinattl.cn	CALIBRATION CNAS L0570
Client HTW		Certificate No: 221-000	
ALIBRATION CER	TIFICATE		
		011 1120	123
bject	D750V3 -	SN: 1180	
alibration Procedure(s)	FE-711-0	03-01	
andration i recession ()	Calibratio	on Procedures for dipole validation kits	
		22 2021	
alibration date:	January 2	22, 2021	husiaal upite (
here a	conducted in th	he closed laboratory facility: environment temp	perature(22±3)°C an
All calibrations have been on humidity<70%. Calibration Equipment used ()	conducted in th M&TE critical fo	ne closed laboratory facility: environment temp or calibration)	perature(22±3)°C an
All calibrations have been on humidity<70%. Calibration Equipment used (conducted in th M&TE critical fo	ne closed laboratory facility: environment temp or calibration) Cal Date(Calibrated by, Certificate No.) So	heduled Calibration
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All calibrations have been on humidity<70%. Calibration Equipment used (Primary Standards Power Meter NRP2 Power sensor NRP6A	Conducted in the M&TE critical for ID # 106276 101369	ne closed laboratory facility: environment temp or calibration) Cal Date(Calibrated by, Certificate No.) So 12-May-20 (CTTL, No.J20X02965) 12-May-20 (CTTL, No.J20X02965)	heduled Calibration May-21 May-21 Nov-21
All calibrations have been on humidity<70%. Calibration Equipment used (Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4	Conducted in the M&TE critical for ID # 106276 101369 SN 7600	ne closed laboratory facility: environment temp or calibration) Cal Date(Calibrated by, Certificate No.) So 12-May-20 (CTTL, No.J20X02965) 12-May-20 (CTTL, No.J20X02965) 30-Nov-20(CTTL-SPEAG,No.Z20-60421)	heduled Calibration May-21 May-21 Nov-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: Z21-60016

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S p e а g CALIBRATION LABORATORY

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Measurement Conditions

ASY system configuration, as far as	not given on page 1.	
DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

Head TSL parameters The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	42.3 ± 6 %	0.91 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	2.7777	

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.13 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.43 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.41 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.59 W/kg ± 18.7 % (k=2)

Certificate N	: 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
----------------------------------	----------

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	
	4.0		
ificate No: Z21-60016	Page 4 of 6		



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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; $\sigma = 0.905$ S/m; $\epsilon_r = 42.25$; $\rho = 1000$ 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



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-750			
Date of	Potura logo (dP)		Real Impedance	Delta	Imaginary	Delta
measurement	Return-1055 (dB)	Della (%)	(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
2023-01-15	-28.3	-1.05	53.3	0.3	-1.22	0.12

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.

1.2. D835V2 Dipole Calibration Certificate

	CALIBRA			INAS	校准
Add: No.51 Xueyu Tel: +86-10-62304 E-mail: ettl@china	an Road, Haidian Di 633-2079 Fax: - http:/	strict, Beijing, 100191, China +86-10-62304633-2504 /www.chinattl.cn	andulululu		CNAS L0570
Client HTW		Certifi	cate No: Z	21-60017	
CALIBRATION C	ERTIFICAT	E	. R. 201	S The sector	No. of Contraction
			and the second of the		A TOTAL OF
Object	D835V	2 - SN: 4d238			
	and the second second				
Calibration Procedure(s)	FF-Z11	-003-01			
	Calibra	tion Procedures for dipole va	alidation kits		e
Calibration date:	Januar	y 22, 2021		CHARLES HAVE	
		NE 20/14/8 201 - 52 - 10 - 55 - 1			the last of
This calibration Certificate	documents the	traceability to national stand	dards, which re	ealize the physi	ical units of
neasurements(SI). The me	asurements and	the uncertainties with confid	ence probabilit	y are given on t	he following
pages and are part of the c	ertificate.				
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	In Collaboration w	vith				
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	CALIBRATION LA	BORAT	ORY			
Add: No.51 Xueyuan Road, Ha Tel: +86-10-62304633-2079 E-mail: et/@obinattl.com	idian District, Beiji Fax: +86-10-62	ng, 1001 304633-2	91, China 504			
L-man. etu metimatit.com	http://www.enin	autten				
easurement Conditions						
DASY system configuration, as	far as not given o	n page	1.			
DASY Version	26.00.00	DASY	52		_	V52.10.4
Extrapolation	Advan	ced Ext	rapolation			
Phantom	Triple	Flat Ph	antom 5.1C			
Distance Dipole Center - TS	L	15 mn	n			with Spacer
Zoom Scan Resolution	dx,	dy, dz	= 5 mm			
Frequency	835	5 MHz ±	1 MHz			
1 701						
ad ISL parameters	la dationa com					
The following parameters and ca	alculations were a	applied.	perature	Permitti	vitv	Conductivity
The following parameters and ca	alculations were a	Temp	perature	Permitti	vity	Conductivity
The following parameters and ca Nominal Head TSL parameter	alculations were a	Temp 22.	oerature 0 °C	Permitti 41.5	vity	Conductivity 0.90 mho/m
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The following parameters The following parameters and ca Nominal Head TSL parameter Measured Head TSL parameter Head TSL temperature chan AR result with Head TSL SAR averaged over 1 cm ³ (1 SAR measured SAR for nominal Head TSL pa	alculations were a	22. (22.0 ±	Derature 0 °C ± 0.2) °C 0 °C Condi 250 mW in normalize	Permitti 41.5 41.3 ± tion put power d to 1W	9.39	Conductivity 0.90 mho/m 0.89 mho/m ± 6 % 2.32 W/kg W/kg ± 18.8 % (k=2)
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Certificate No: Z21-60017

Page 3 of 6

TTI	s p e a g		
	CALIBRATION LABORATORY		
Add: No.51 Xueyuan Road, Hai Tel: +86-10-62304633-2079 E-mail: ettl@chinattl.com	idian District, Beijing, 100191, China Fax: +86-10-62304633-2504 http://www.chinattl.cn		
Appendix (Additional ass	essments outside the sco	pe of CNAS L0570)	
Antonio Donomotore with			
Antenna Parameters with	Head ISL		
Impedance, transformed to fee	ed point	51.5Ω- 3.95jΩ	
Return Loss		- 27.6dB	
General Antenna Paramet	ers and Design		
Electrical Delay (one direction)		1.298 ns	
fter long term use with 100W ne measured. The dipole is made of standard sonnected to the second arm of f the dipoles, small end caps an ccording to the position as expl ffected by this change. The over lo excessive force must be app onnections near the feedpoint r	adiated power, only a slight was semirigid coaxial cable. The cen the dipole. The antenna is there re added to the dipole arms in c lained in the "Measurement Con erall dipole length is still accordi blied to the dipole arms, because may be damaged.	ming of the dipole hear the f ter conductor of the feeding fore short-circuited for DC-s rder to improve matching wi nditions" paragraph. The SAI ng to the Standard. a they might bend or the solo	line is directly signals. On some nen loaded R data are not dered
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After long term use with 100W rate measured. The dipole is made of standard at onnected to the second arm of fine dipoles, small end caps an according to the position as expliced by this change. The over the excessive force must be approximate on the feedpoint of the dipolet	adiated power, only a slight was semirigid coaxial cable. The cer the dipole. The antenna is then re added to the dipole arms in c lained in the "Measurement Coo erall dipole length is still accordi lied to the dipole arms, because may be damaged.	ming of the dipole near the f effore short-circuited for DC-s rder to improve matching wh aditions" paragraph. The SAI ng to the Standard. a they might bend or the solo	line is directly signals. On some nen loaded R data are not dered
After long term use with 100W rate measured. The dipole is made of standard at onnected to the second arm of of the dipoles, small end caps at ccording to the position as explicated by this change. The over lo excessive force must be apprimented by the feedpoint results of the feedpoint r	adiated power, only a slight war semirigid coaxial cable. The cer the dipole. The antenna is there re added to the dipole arms in c lained in the "Measurement Coi erall dipole length is still accordi lied to the dipole arms, because may be damaged.	ming of the dipole near the f efore short-circuited for DC-s rder to improve matching wh aditions" paragraph. The SAI ng to the Standard. a they might bend or the sold SPEAG	I line is directly signals. On some nen loaded R data are not dered
After long term use with 100W rate measured. The dipole is made of standard at onnected to the second arm of of the dipoles, small end caps at according to the position as explicated by this change. The over lo excessive force must be approximate the feedpoint re- additional EUT Data	adiated power, only a slight was semirigid coaxial cable. The cent the dipole. The antenna is there re added to the dipole arms in c lained in the "Measurement Cor- erall dipole length is still accordi- blied to the dipole arms, because may be damaged.	ming of the dipole near the f nter conductor of the feeding efore short-circuited for DC-s rder to improve matching wh aditions" paragraph. The SAI ng to the Standard. a they might bend or the solo	Ine is directly signals. On some nen loaded R data are not dered

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-835			
Date of	Poturo logo (dP)		Real Impedance	Delta	Imaginary	Delta
measurement	Return-1055 (dB)	Della (%)	(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
2023-01-15	-27.5	-0.36	51.6	0.1	-3.55	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.

1.3. D1750V2 Dipole Calibration Certificate

Client HTW			
		Certificate No: Z2	1-60018
CALIBRATION C	ERTIFICA	TE	A Real Property in the Party of
Object	D1750	0V2 - SN: 1164	
Collibration Dragodura(a)			
Calibration Procedure(s)	FF-Z1	1-003-01	and the second sec
	Calibr	ation Procedures for dipole validation kits	
Calibration date:	Janua	ry 22, 2021	
This calibration Cartificate	documente the	transhiliki ta patianel standarda statu	Real de later faire de la companya
measurements(SI). The measurements	asurements and	traceability to national standards, which re the uncertainties with confidence probability	alize the physical units of
pages and are part of the c	ertificate.		, and given on the following
All calibrations have been	n conducted in	the closed laboratory facility: environmen	t temperature(22+3)°C and
			in temperatore (ana
humidity<70%.			
humidity<70%. Calibration Equipment used	M&TE critical	for calibration)	
humidity<70%. Calibration Equipment used	d (M&TE critical	for calibration)	
humidity<70%. Calibration Equipment used Primary Standards	ID #	for calibration) Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2	ID # 106276	for calibration) Cal Date(Calibrated by, Certificate No.) 12-May-20 (CTTL, No.J20X02965)	Scheduled Calibration May-21
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A	ID # 106276 101369	for calibration) Cal Date(Calibrated by, Certificate No.) 12-May-20 (CTTL, No.J20X02965) 12-May-20 (CTTL, No.J20X02965)	Scheduled Calibration May-21 May-21
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(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-Eeb-20(CTTL-SPEAG,No.Z20-60017)	Scheduled Calibration May-21 May-21 Nov-21 Eeb-21
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(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 Calibration May-21 May-21 Nov-21 Feb-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(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 Calibration May-21 May-21 Nov-21 Feb-21 Scheduled Calibration
humidity<70%. Calibration Equipment used 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	for calibration) 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 Calibration May-21 May-21 Nov-21 Feb-21 Scheduled Calibration 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	ID # 106276 101369 SN 7600 SN 771 ID # MY49071430 MY46110673	for calibration) 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 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	ID # 106276 101369 SN 7600 SN 771 ID # MY49071430 MY46110673	for calibration) 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 Calibration May-21 May-21 Nov-21 Feb-21 Scheduled Calibration Feb-21 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	ID # 106276 101369 SN 7600 SN 771 ID # MY49071430 MY46110673 Name	for calibration) 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 Calibration May-21 May-21 Nov-21 Feb-21 Scheduled Calibration Feb-21 Feb-21 Signature
humidity<70%. Calibration Equipment used 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	for calibration) 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 Calibration May-21 May-21 Nov-21 Feb-21 Scheduled Calibration Feb-21 Feb-21 Signature
humidity<70%. Calibration Equipment used 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	for calibration) 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 Calibration May-21 May-21 Nov-21 Feb-21 Scheduled Calibration Feb-21 Feb-21 Signature
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humidity<70%. 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:	d (M&TE critical 1 ID # 106276 101369 SN 7600 SN 771 ID # MY49071430 MY46110673 Name Zhao Jing Lin Hao Qi Dianyuan	for calibration) 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	Scheduled Calibration May-21 May-21 Nov-21 Feb-21 Scheduled Calibration Feb-21 Feb-21 Signature
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Certificate No: Z21-60018

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Me	asurement Conditions					
	DACK enterne contactions	100	2			
	DASY System configuration, as far as	not given o	DASY52	+		V52.10.4
	Extrapolation	Advan	ced Extrapolation			
	Phantom	Triple	Flat Phantom 5.1C			
	Distance Dipole Center - TSL		10 mm		2	with Spacer
	Zoom Scan Resolution	dx,	dy, dz = 5 mm			
	Frequency	175	50 MHz ± 1 MHz		_	
	ad TSL parameters The following parameters and calculati	ons were a	ipplied. Temperature	Permitti	vity	Conductivi
110	ad TSL parameters					
	ad TSL parameters The following parameters and calculati	ons were a	pplied. Temperature	Permitti	vity	Conductivit
	ad TSL parameters The following parameters and calculati Nominal Head TSL parameters	ons were a	Temperature	Permittin 40.1	vity	Conductivit
	ad TSL parameters The following parameters and calculati Nominal Head TSL parameters Measured Head TSL parameters Head TSL temperature chapse due	ons were a	22.0 °C (22.0 ± 0.2) °C	Permitti 40.1 39.8 ± 6	vity 3 %	Conductivit 1.37 mho/m 1.37 mho/m ±
SA	ad TSL parameters The following parameters and calculati Nominal Head TSL parameters Measured Head TSL parameters Head TSL temperature change dur R result with Head TSL	ons were a	22.0 °C (22.0 ± 0.2) °C <1.0 °C	Permitti 40.1 39.8 ± 6	vity 3 %	Conductivit 1.37 mho/m 1.37 mho/m ±
SA	ad TSL parameters The following parameters and calculati Nominal Head TSL parameters Measured Head TSL parameters Head TSL temperature change dur R result with Head TSL SAR averaged over 1 cm^3 (1 g) of	ring test	22.0 °C (22.0 ± 0.2) °C <1.0 °C Condi	Permittin 40.1 39.8 ± 6 	vity 3 %	Conductivit 1.37 mho/m 1.37 mho/m ±
SA	ad TSL parameters The following parameters and calculati Nominal Head TSL parameters Measured Head TSL parameters Head TSL temperature change dur R result with Head TSL SAR averaged over 1 cm ³ (1 g) of SAR measured	ring test	Temperature 22.0 °C (22.0 ± 0.2) °C <1.0 °C	Permittie 40.1 39.8 ± 6 tion put power	s %	Conductivit 1.37 mho/m 1.37 mho/m ± 9.13 W/kg
SA	ad TSL parameters The following parameters and calculati Nominal Head TSL parameters Measured Head TSL parameters Head TSL temperature change dur R result with Head TSL SAR averaged over 1 cm ³ (1 g) of SAR measured SAR for nominal Head TSL parameter	ons were a	Temperature 22.0 °C (22.0 ± 0.2) °C <1.0 °C	Permitti 40.1 39.8 ± 6 tion put power ed to 1W	vity 3 % 36.4	Conductivit 1.37 mho/m 1.37 mho/m ± 9.13 W/kg W/kg ± 18.8 % (k
SA	Ad TSL parameters The following parameters and calculati Nominal Head TSL parameters Measured Head TSL parameters Head TSL temperature change dur R result with Head TSL SAR averaged over 1 cm ³ (1 g) of SAR measured SAR for nominal Head TSL parameter SAR averaged over 10 cm ³ (10 g) of	ons were a	Temperature 22.0 °C (22.0 ± 0.2) °C <1.0 °C	Permittie 40.1 39.8 ± 6 tion put power ed to 1W tion	vity 3 % 36.4	Conductivit 1.37 mho/m 1.37 mho/m ± 9.13 W/kg W/kg ± 18.8 % (k
SA	ad TSL parameters The following parameters and calculati Nominal Head TSL parameters Measured Head TSL parameters Head TSL temperature change dur R result with Head TSL SAR averaged over 1 cm ³ (1 g) of SAR measured SAR for nominal Head TSL parameter SAR averaged over 10 cm ³ (10 g) of SAR measured	ring test Head TSL ers of Head TS	Temperature 22.0 °C (22.0 ± 0.2) °C <1.0 °C	Permittie 40.1 39.8 ± 6 tion put power ed to 1W tion put power	36.4	Conductivit 1.37 mho/m 1.37 mho/m ± 9.13 W/kg W/kg ± 18.8 % (k 4.80 W/kg

Certificate No: Z21-60018

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 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

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	
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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	
icate No: 721-60018	D		

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-1750								
Date of	Poturo logo (dP)		Real Impedance	Delta	Imaginary	Delta			
measurement	Return-1055 (dB)	Della (%)	(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			
2023-01-15	-28.1	-0.71	50.2	0.3	-3.66	0.2			

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.

1.4. D1900V2 Dipole Calibration Certificate

		on chinattl en					
E-mail: ettl@chinattl.c	om map <i>or</i> w	w.emnaur.en	Certificate M	No: Z	221-60019		
ALIBRATION CE	RTIFICATE		and the set				
bject	D1900V2	2 - SN: 5d226	12.02.02	(1)			
calibration Procedure(s)	003-01 on Procedures	03-01 in Procedures for dipole validation kits					
Calibration date:	January	22, 2021					
All calibrations have been	conducted in th	ne closed lab	oratory facility: er	nvironme	ent tempera	ature(22±3)°C	and
All calibrations have been numidity<70%. Calibration Equipment used	conducted in the conduc	ne closed lab r calibration) Cal Date(Ca	oratory facility: er librated by, Certific	nvironme	ent tempera	ature(22±3)°C	and
All calibrations have been numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2	conducted in the conducted in the conducted in the critical for the critic	ne closed lab r calibration) Cal Date(Ca 12-May-20 (C	oratory facility: er librated by, Certific CTTL, No.J20X029	nvironme cate No.) 65)	ent tempera	duled Calibra May-21	and
All calibrations have been numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4	conducted in the conduc	ne closed lab r calibration) Cal Date(Ca 12-May-20 (C 12-May-20 (C 30-Nov-20(C 10-Feb-20(C	oratory facility: er librated by, Certific CTTL, No.J20X029 CTTL, No.J20X029 TTL-SPEAG,No.Z2 TTL-SPEAG,No.Z2	nvironmo cate No.) 65) 65) 20-6042 20-6001	Scher 1)	duled Calibra May-21 May-21 Nov-21 Feb-21	anc
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4	conducted in th (M&TE critical for 10 # 106276 101369 SN 7600 SN 771	ne closed lab r calibration) Cal Date(Ca 12-May-20 (C 12-May-20 (C 30-Nov-20(C 10-Feb-20(C Cal Date(Cal	ibrated by, Certific TTL, No.J20X029 TTL-SPEAG,No.Z TTL-SPEAG,No.Z ibrated by, Certific	ate No.) 65) 65) 20-6042 20-6001 ate No.)	ent tempera Sched 1) 7)	duled Calibra May-21 May-21 Nov-21 Feb-21 duled Calibra	ation
All calibrations have been numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP3 ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	conducted in the conducted in the conducted in the critical for ID # 106276 101369 SN 7600 SN 771 ID # ID # MY49071430 MY46110673	ne closed lab r calibration) Cal Date(Ca 12-May-20 (C 12-May-20 (C 30-Nov-20(C 10-Feb-20(C Cal Date(Cal 25-Feb-20 (C 10-Feb-20 (C	oratory facility: en librated by, Certific CTTL, No.J20X029 CTTL-SPEAG,No.Z TTL-SPEAG,No.Z ibrated by, Certific CTTL, No.J20X005 CTTL, No.J20X005	cate No.) 65) 65) 20-6042 20-6001 ate No.) 16) 15)	ent tempera Sched 1) 7) Sche	duled Calibra May-21 May-21 Nov-21 Feb-21 duled Calibra Feb-21 Feb-21	ation
All calibrations have been numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A ReferenceProbe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	conducted in the conduc	ne closed lab r calibration) Cal Date(Ca 12-May-20 (C 12-May-20 (C 30-Nov-20(C 10-Feb-20(C Cal Date(Cal 25-Feb-20 (C 10-Feb-20 (C	oratory facility: en librated by, Certific CTTL, No.J20X029 CTTL, No.J20X029 TTL-SPEAG,No.Z2 ITL-SPEAG,No.Z2 ibrated by, Certific CTTL, No.J20X005 CTTL, No.J20X005	nvironme cate No.) 65) 65) 20-6042 20-6001 ate No.) 16) 15)	1) Sched Sched	duled Calibra May-21 May-21 Nov-21 Feb-21 duled Calibra Feb-21 Feb-21 Signature	ation
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lossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Certificate No: Z21-60019

Page 2 of 6

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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
 V52.10.4

 Phantom
 Triple Flat Phantom 5.1C
 Vision

 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 ³ (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)

Page 3 of 6

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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

Manufactured by		SPEAG	
lasta Nov 721 60010	D		
Icate No: 221-00019	Page 4 of 6		

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-1900								
Date of	Poturo logo (dP)		Real Impedance	Delta	Imaginary	Delta			
measurement	Return-1055 (dB)	Della (%)	(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	7.35	0.53			
2023-01-15	-22.1	2.31	53.6	0.1	7.46	0.42			

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.

1.5. D2450V2 Dipole Calibration Certificate

	CALIBRATI	ON LABORATORY	Hac-MRA	GNA	う 校准 CALIBRATION
Add: No.51 Xueyuan Tel: +86-10-62304633	Road, Haidian Distri -2079 Fax: +8	ct, Beijing, 100191, China 6-10-62304633-2504	The Andululus		CNAS L0570
E-mail: cttl@chinattl.	com nup://w	C	ertificate No:	Z21-60020)
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CALIBRATION CE	RIFICATI			The second	
Dbject	D2450V	2 - SN: 1009			
					_
Calibration Procedure(s)	FF-Z11- Calibrati	003-01 on Procedures for dig	pole validation kits	3	
Calibration date:	January	25, 2021			
			facility: onviron	ment temper	ature(22±3)°C and
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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 ³ (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^3 (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)

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-2450			
Date of	Poturn loss (dB)	Dolta (%)	Real Impedance	Delta	Imaginary	Delta
measurement	Return-IOSS (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
2023-01-15	-27.3	-0.36	53.7	0.2	2.16	0.12

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.

1.6. D2600V2 Dipole Calibration Certificate

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Client HTW		section .	our and the		
CALIBRATION CER	TIFICATE				
Dbject	D2600V2	- SN: 1150			
Calibration Procedure(s)	FF-Z11-0 Calibratio	03-01 on Procedures fo	r dipole validation kit	S	
Calibration date:	January	25, 2021			1 1 3
All calibrations have been of	conducted in tr	ne closed labora	atory lacinty. enviro	nment tem	
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