

Client: **SRTC**
Beijing

Certificate No: 25J02Z000784

CALIBRATION CERTIFICATE

Object: DAE4 - SN: 546

Calibration Procedure(s): FF-Z11-002-01
Calibration Procedure for the Data Acquisition Electronics (DAEx)

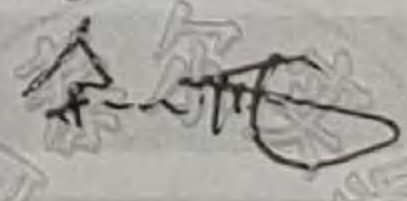
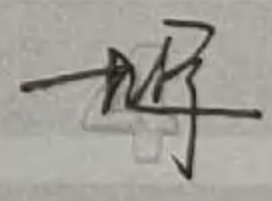
Calibration date: November 19, 2025

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements(SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Process Calibrator 753	1971018	11-Jun-25 (CTTL, No.25J02X004977)	Jun-26

	Name	Function	Signature
Calibrated by:	Yu Zongying	SAR Test Engineer	
Reviewed by:	Lin Jun	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: November 21, 2025

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Glossary:

DAE data acquisition electronics
Connector angle information used in DASY system to align probe sensor X to the robot coordinate system.

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.



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DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1 μ V, full range = -100...+300 mV

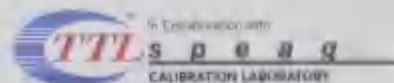
Low Range: 1LSB = 61nV, full range = -1.....+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	405.365 $\pm$ 0.15% (k=2)	404.122 $\pm$ 0.15% (k=2)	404.245 $\pm$ 0.15% (k=2)
Low Range	3.98785 $\pm$ 0.7% (k=2)	3.95857 $\pm$ 0.7% (k=2)	3.97995 $\pm$ 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	247.5° $\pm$ 1 °
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Client: **SRTC**
Beijing



中国合格评定
国家认可
校准
CALIBRATION
CNAS 10172

Certificate No: 25J02Z000909

CALIBRATION CERTIFICATE

Object: **EX30V4 - SN 9708**

Calibration Procedure(s): **HF-211-0004-03**
Calibration Procedure for Domestic E-field Probe

Calibration date: **January 13, 2025**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurement(SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.
All calibrations have been conducted in the closed laboratory facility: environment temperature(23±3)°C and humidity(50%±5%).
Calibration Equipment used (MATE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by: Certificate No.)	Scheduled Calibration
Power Meter: NRP2	106277	20-Oct-25(CITL, No.25J02X100272)	Oct-26
Power sensor: NRP25	104261	20-Oct-25(CITL, No.25J02X100272)	Oct-26
Power sensor: NRP25	104262	20-Oct-25(CITL, No.25J02X100272)	Oct-26
Reference: 10dBAttenuator	18NSDW-10dB	22-Jan-25(CITL, No.25J02X000465)	Jan-27
Reference: 20dBAttenuator	18NSDW-20dB	22-Jan-25(CITL, No.25J02X000465)	Jan-27
Reference Probe: EX30V4-DAE4	SN 7307	27-May-25(SPEAG, No.25J02X000465)	May-28
	SN 771	22-Jan-25(SPEAG, No.25J02X000465)	Jan-26
Secondary Standards	ID #	Cal Date(Calibrated by: Certificate No.)	Scheduled Calibration
Signal Generator: MAG3700A	6201052805	10-Jun-25(CITL, No.25J02X000465)	Jun-26
Signal Generator: APSIN25G	181-33ASD0700-1059	27-Mar-25(CITL, No.25J02X000465)	Mar-26
Network Analyzer: E5071C	MY46110673	28-Nov-25(CITL, No.25J02X102468)	Nov-26
Reference: 10dBAttenuator	B10520	15-May-25(CITL, No.25J02X000465)	May-27
Reference: 20dBAttenuator	B10267	15-May-25(CITL, No.25J02X000465)	May-27
DCF: DAKS-0.5	SN 0015	20-Oct-25(SPEAG, No.25J02X000465)	Oct-26

	Name	Function	Signature
Calibrated by:	Yu Zongying	SAR Test Engineer	
Reviewed by:	Li Jun	SAR Test Engineer	
Approved by:	Chen Guohua	SAR Project Leader	

Issued January 14, 2025

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TEL

TSR	helps simulating most
NORM.y,z	sensitivity in free space
CompF	sensitivity in TSRL/NORM.y,z
LOC	disk compression point
Q	cross-facial stability index of the RF signal
A/R/G/D	resistivity dependent interaction parameters
Polarization & Rotation θ	1) θ - rotation around probe axis 2) θ - rotation around an axis that is in the plane normal to probe axis (at measurement location) A-R-G-D normal to probe axis

Connected to Android information used in DASY system to align mobile sensor A to the robot coordinate system

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2014, "IEEE Recommended Practice for Determining the Peak Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices Using Instrumented Techniques," June 2015.
- IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) for hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)," July 2015.
- 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 2015.
- IEEE Std 1528-2014, "SAR Measurement Guidelines for 100 MHz to 6 GHz."

Methods: Applying and Interpretation of Parameters:

- $NORM_{xy,z}$: Assessed for E-field polarization S-B (1000MHz) in TSV-hole ($> 1600MHz$ waveguide). $NORM_{xy,z}$ at large and intermediate values (e.g. the uncertainty of $NORM_{xy,z}$ does not effect the TSM field uncertainty inside TSV (see below ConvF).
- $NORM_{dx,y,z} = NORM_{xy,z} \times 2^{frequency_response}$ (see Frequency Response Chart). This compensation is implemented in DA3Y4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- $DOCP_{xy,z}$: DOCP are numerical linearization parameters assessed based on the data of power sweep (ie Uncertainty required). DOCP 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.
- At y,z : $B_{xy,z}$, $C_{xy,z}$, $z_{TVR,xy,z}$, A,B,C are numerical linearization parameters assessed based on the data of power sweep for specific modulator signal. The parameters do not depend on frequency nor media. z_{TVR} 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 1000MHz) and inside waveguide using analytical field distributions based on power measurements (for $> 300MHz$). The same setups are used for assessment of the parameters support for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DA3Y4 software to improve probe accuracy close to the boundary. The sensitivity in TSM corresponds to $NORM_{xy,z} \times 2^{ConvF}$ whereas the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DA3Y4 version 4.4 and higher which allows exceeding the validity 1mm/60MHz to 100MHz.
- Spherical isotropy (3D deviation from isotropy): in a field of low gradients realized using a flat phantom equipped by a patch antenna.
- Surface Offset: The surface offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle: The angle is assessed using the information gained by determining the $NORM_{xy,z}$ (no uncertainty required).

DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3708

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc. (k=2)
Norm(uV/Vm) ^{1/2}	0.52	0.52	0.55	±10.0%
DCR(uV/V)	108.3	106.4	110.8	

Calibration Results for Modulation Response

UID	Communication System Name	A dB	B dB/μV	C	D dB	VR mV	Max Dev	Max Unc. ² (k=2)
0	CW	X: 0.0	0.0	1.0	0.00	178.3	±2.1%	±8.7%
		Y: 0.0	0.0	1.0		177.7		
		Z: 0.0	0.0	1.0		187.2		
10332-AAA	Pulse Waveform (200Hz, 10%)	X: 1.67	01.23	5.40		80	±1.1%	±9.6%
		Y: 1.43	00.14	5.50	10.00	80		
		Z: 1.49	00.41	5.51		80		
10333-AAA	Pulse Waveform (200Hz, 30%)	X: 0.83	00.00	4.58		30	±2.4%	±9.6%
		Y: 0.00	00.00	7.00	0.99	30		
		Z: 0.84	00.00	4.48		30		
10354-AAA	Pulse Waveform (200Hz, 40%)	X: 0.01	127.36	1.51		35	±2.1%	±9.6%
		Y: 0.12	127.34	2.59	3.53	35		
		Z: 0.34	145.97	0.30		35		
10355-AAA	Pulse Waveform (200Hz, 60%)	X: 0.80	154.21	35.57		120	±1.2%	±9.6%
		Y: 11.83	157.84	17.37	2.22	120		
		Z: 10.05	158.84	5.00		120		
10357-AAA	QPSK Waveform, 1 MHz	X: 0.44	01.20	8.87		150	±4.1%	±9.6%
		Y: 0.44	01.20	7.85	1.00	150		
		Z: 0.52	01.58	9.75		150		
10358-AAA	QPSK Waveform, 10 MHz	X: 1.15	00.59	13.19		150	±1.1%	±9.6%
		Y: 1.15	00.84	12.07	0.00	150		
		Z: 0.24	04.10	12.23		150		
10395-AAA	64-QAM Waveform, 100 kHz	X: 1.20	04.56	18.15		150	±0.0%	±9.6%
		Y: 1.05	04.00	18.86	3.11	150		
		Z: 1.62	05.63	15.54		150		
10414-AAA	WLAN CCDF, 8s-QAM, 40MHz	X: 0.78	00.12	15.05		150	±4.2%	±5.6%
		Y: 0.80	00.09	15.05	0.00	150		
		Z: 0.84	00.09	14.85		150		

Note: For details on UID parameters see Appendix

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%.

¹ The uncertainties of Norm X, Y, Z do not affect the E-field uncertainty basis (See Page 6 and Page 8)

² Non-saturation parameters: uncertainty not required.

³ Uncertainty is determined using the max. deviation from mean response applying rectangular distribution and is 1 divided by the square of the field value.

DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3708

Sensor Model Parameters

	C1	C2	α	T1	T2	T3	T4	T5	T6
	fF	fF	V ⁻¹	ms.V ⁻²	ms.V ⁻²	ms	V ⁻²	V ⁻¹	
X	9.18	65.96	32.84	2.85	0.00	4.90	0.39	0.00	1.01
Y	9.26	67.69	33.84	1.51	0.00	4.90	0.11	0.03	1.01
Z	11.02	79.07	32.74	4.52	0.00	4.90	0.61	0.00	1.01

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	166.7
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

f [MHz] ¹	Relative Permittivity ¹	Conductivity (S/m)	ConvF X	ConvF Y	ConvF Z	Alpha ²	Depth ³ (mm)	Unc. (±%)
2460	39.2	1.80	7.33	7.33	7.33	0.38	0.78	± 13%
4100	37.2	1.53	6.31	6.31	6.31	0.30	1.35	± 14%
4200	37.1	1.63	6.20	6.20	6.20	0.30	1.50	± 14%
4950	36.3	4.40	5.82	5.82	5.82	0.35	1.50	± 14%
5200	36.0	4.66	5.40	5.40	5.40	0.40	1.45	± 14%
5300	35.9	4.78	5.09	5.09	5.09	0.40	1.50	± 14%
5500	35.6	4.96	4.74	4.74	4.74	0.55	1.20	± 14%
5800	35.5	5.07	4.60	4.60	4.60	0.45	1.40	± 14%
5800	35.3	5.27	4.72	4.72	4.72	0.60	1.30	± 14%

¹² AlphaDepth are determined during calibration. SPEACD warrants that the remaining deviation due to the boundary effect after compensation is always less than $\pm 1\%$ for frequencies below 3 GHz and below $\pm 2\%$ for the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

DASY/EASY – Parameters of Probe: EX3DV4 – SN:3708

Calibration Parameter Determined in Head Tissue Simulating Media

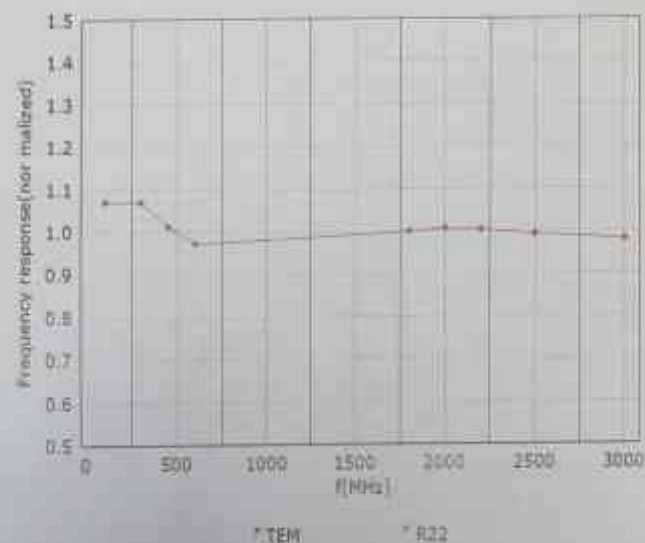
f (MHz) ^c	Relative Permittivity ^e	Conductivity (S/m) ^e	ConvF X	ConvF Y	ConvF Z	Alpha ^d	Depth ^d (mm)	Unct. (k=2)
6500	34.5	6.07	5.38	5.38	5.38	0.15	1.30	±19%

^c Frequency validity at 6.5 GHz is -800/+700 MHz, and ±700 MHz at or above 7 GHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

^e The probes are calibrated using tissue simulating liquids (TSL) that deviate for ϵ and σ by less than ±10% from the target values (typically better than ±6%) and are valid for TSL with deviations of up to ±10%.

^d 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, below ±2% for frequencies between 3-5 GHz, and below ±4% for frequencies between 5-10 GHz at any distance larger than half the probe tip diameter from the boundary.

Frequency Response of E-Field (TEM-Cell: if110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field: $\pm 7.4\%$ ($k=2$)

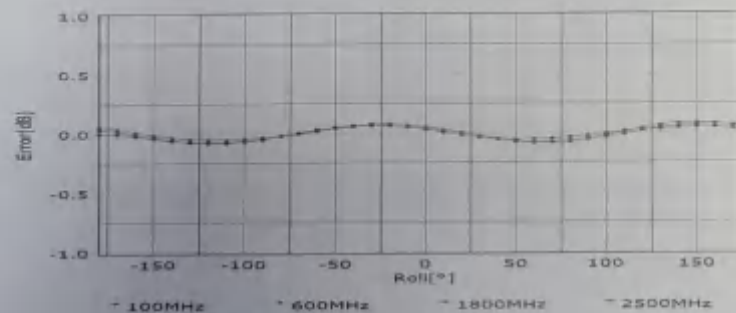
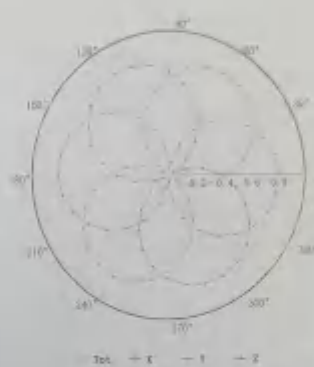
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Receiving Pattern (Φ), $\theta=0^\circ$

f=600 MHz, TEM



f=1800 MHz, R22



Uncertainty of Axial Isotropy Assessment: $\pm 1.2\%$ ($k=2$)

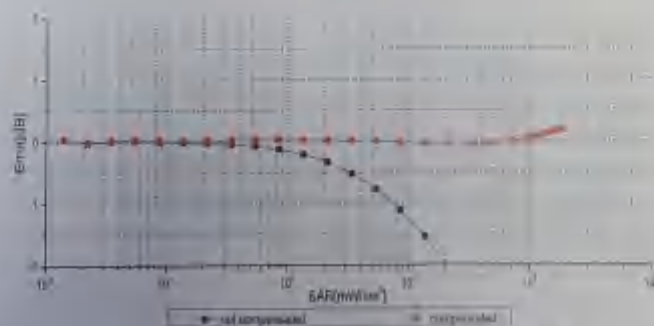
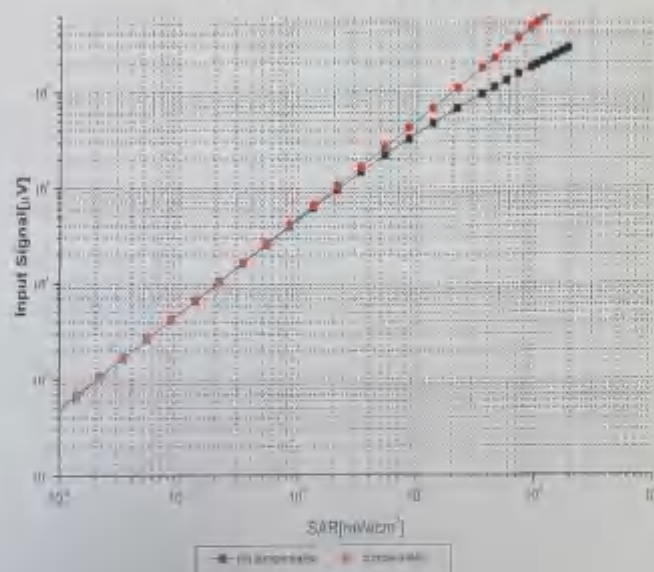


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Dynamic Range f(SAR_{head}) (TEM cell, f = 900 MHz)

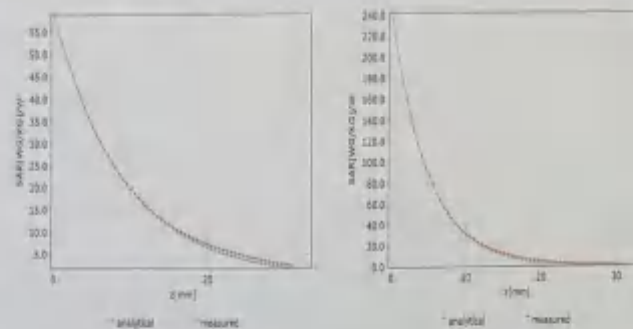


Uncertainty of Linearity Assessment: ±0.9% (k=2)

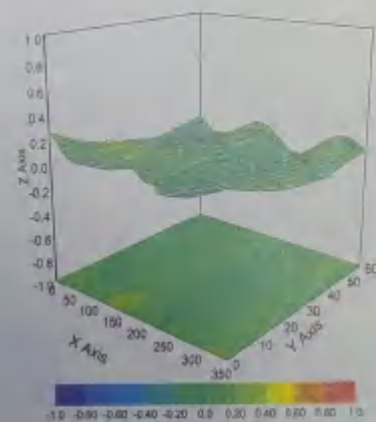
Conversion Factor Assessment

f=2450 MHz,WGLS R26(H_convF)

f=4100 MHz,WGLS xxxx(H_convF)



Deviation from Isotropy in Liquid



Uncertainty of Spherical Isotropy Assessment: 13.2% (k=2)

UIC	Rev	Communication System Name	Group	Freq (MHz)	Offset (Hz)
0		NAV	NAV	0.00	-0.00
0010	CAL	SAR Weather (Open) - Marine (Open)	NAV	10.00	-0.00
0011	CAL	INTL FIC (W/DM)	NAV	0.01	-0.00
0012	CAL	EEC-802.15.4 (W/DM) (100MHz)	NAV	1.00	-0.00
0013	CAL	EEC-802.15.4 (W/DM) (433MHz)	NAV	0.05	-0.00
0021	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.00	-0.00
0023	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.01	-0.00
0024	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.02	-0.00
0025	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.03	-0.00
0026	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.04	-0.00
0027	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.05	-0.00
0028	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.06	-0.00
0029	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.07	-0.00
0030	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.08	-0.00
0031	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.09	-0.00
0032	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.10	-0.00
0033	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.11	-0.00
0034	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.12	-0.00
0035	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.13	-0.00
0036	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.14	-0.00
0037	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.15	-0.00
0038	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.16	-0.00
0039	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.17	-0.00
0040	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.18	-0.00
0041	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.19	-0.00
0042	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.20	-0.00
0043	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.21	-0.00
0044	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.22	-0.00
0045	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.23	-0.00
0046	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.24	-0.00
0047	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.25	-0.00
0048	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.26	-0.00
0049	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.27	-0.00
0050	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.28	-0.00
0051	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.29	-0.00
0052	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.30	-0.00
0053	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.31	-0.00
0054	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.32	-0.00
0055	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.33	-0.00
0056	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.34	-0.00
0057	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.35	-0.00
0058	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.36	-0.00
0059	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.37	-0.00
0060	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.38	-0.00
0061	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.39	-0.00
0062	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.40	-0.00
0063	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.41	-0.00
0064	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.42	-0.00
0065	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.43	-0.00
0066	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.44	-0.00
0067	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.45	-0.00
0068	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.46	-0.00
0069	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.47	-0.00
0070	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.48	-0.00
0071	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.49	-0.00
0072	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.50	-0.00
0073	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.51	-0.00
0074	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.52	-0.00
0075	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.53	-0.00
0076	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.54	-0.00
0077	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.55	-0.00
0078	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.56	-0.00
0079	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.57	-0.00
0080	CAL	GSN-FDD (DMA, 100MHz)	GSN	0.58	-0.00
008					

Figure 12.10

Call	Frequency	Power	Mode	Frequency	Power	Mode
001	147.000	10W	FM	147.000	10W	FM
002	147.000	10W	FM	147.000	10W	FM
003	147.000	10W	FM	147.000	10W	FM
004	147.000	10W	FM	147.000	10W	FM
005	147.000	10W	FM	147.000	10W	FM
006	147.000	10W	FM	147.000	10W	FM
007	147.000	10W	FM	147.000	10W	FM
008	147.000	10W	FM	147.000	10W	FM
009	147.000	10W	FM	147.000	10W	FM
010	147.000	10W	FM	147.000	10W	FM
011	147.000	10W	FM	147.000	10W	FM
012	147.000	10W	FM	147.000	10W	FM
013	147.000	10W	FM	147.000	10W	FM
014	147.000	10W	FM	147.000	10W	FM
015	147.000	10W	FM	147.000	10W	FM
016	147.000	10W	FM	147.000	10W	FM
017	147.000	10W	FM	147.000	10W	FM
018	147.000	10W	FM	147.000	10W	FM
019	147.000	10W	FM	147.000	10W	FM
020	147.000	10W	FM	147.000	10W	FM
021	147.000	10W	FM	147.000	10W	FM
022	147.000	10W	FM	147.000	10W	FM
023	147.000	10W	FM	147.000	10W	FM
024	147.000	10W	FM	147.000	10W	FM
025	147.000	10W	FM	147.000	10W	FM
026	147.000	10W	FM	147.000	10W	FM
027	147.000	10W	FM	147.000	10W	FM
028	147.000	10W	FM	147.000	10W	FM
029	147.000	10W	FM	147.000	10W	FM
030	147.000	10W	FM	147.000	10W	FM
031	147.000	10W	FM	147.000	10W	FM
032	147.000	10W	FM	147.000	10W	FM
033	147.000	10W	FM	147.000	10W	FM
034	147.000	10W	FM	147.000	10W	FM
035	147.000	10W	FM	147.000	10W	FM
036	147.000	10W	FM	147.000	10W	FM
037	147.000	10W	FM	147.000	10W	FM
038	147.000	10W	FM	147.000	10W	FM
039	147.000	10W	FM	147.000	10W	FM
040	147.000	10W	FM	147.000	10W	FM
041	147.000	10W	FM	147.000	10W	FM
042	147.000	10W	FM	147.000	10W	FM
043	147.000	10W	FM	147.000	10W	FM
044	147.000	10W	FM	147.000	10W	FM
045	147.000	10W	FM	147.000	10W	FM
046	147.000	10W	FM	147.000	10W	FM
047	147.000	10W	FM	147.000	10W	FM
048	147.000	10W	FM	147.000	10W	FM
049	147.000	10W	FM	147.000	10W	FM
050	147.000	10W	FM	147.000	10W	FM
051	147.000	10W	FM	147.000	10W	FM
052	147.000	10W	FM	147.000	10W	FM
053	147.000	10W	FM	147.000	10W	FM
054	147.000	10W	FM	147.000	10W	FM
055	147.000	10W	FM	147.000	10W	FM
056	147.000	10W	FM	147.000	10W	FM
057	147.000	10W	FM	147.000	10W	FM
058	147.000	10W	FM	147.000	10W	FM
059	147.000	10W	FM	147.000	10W	FM
060	147.000	10W	FM	147.000	10W	FM
061	147.000	10W	FM	147.000	10W	FM
0						

Page 16 of 31

10001	AA0	1.00	10001	AA0	1.00	AA0	1.00	AA0	AA0
10002	AA1	1.00	10002	AA1	1.00	AA1	1.00	AA1	AA1
10003	AA2	1.00	10003	AA2	1.00	AA2	1.00	AA2	AA2
10004	AA3	1.00	10004	AA3	1.00	AA3	1.00	AA3	AA3
10005	AA4	1.00	10005	AA4	1.00	AA4	1.00	AA4	AA4
10006	AA5	1.00	10006	AA5	1.00	AA5	1.00	AA5	AA5
10007	AA6	1.00	10007	AA6	1.00	AA6	1.00	AA6	AA6
10008	AA7	1.00	10008	AA7	1.00	AA7	1.00	AA7	AA7
10009	AA8	1.00	10009	AA8	1.00	AA8	1.00	AA8	AA8
10010	AA9	1.00	10010	AA9	1.00	AA9	1.00	AA9	AA9
10011	AA0	1.00	10011	AA0	1.00	AA0	1.00	AA0	AA0
10012	AA1	1.00	10012	AA1	1.00	AA1	1.00	AA1	AA1
10013	AA2	1.00	10013	AA2	1.00	AA2	1.00	AA2	AA2
10014	AA3	1.00	10014	AA3	1.00	AA3	1.00	AA3	AA3
10015	AA4	1.00	10015	AA4	1.00	AA4	1.00	AA4	AA4
10016	AA5	1.00	10016	AA5	1.00	AA5	1.00	AA5	AA5
10017	AA6	1.00	10017	AA6	1.00	AA6	1.00	AA6	AA6
10018	AA7	1.00	10018	AA7	1.00	AA7	1.00	AA7	AA7
10019	AA8	1.00	10019	AA8	1.00	AA8	1.00	AA8	AA8
10020	AA9	1.00	10020	AA9	1.00	AA9	1.00	AA9	AA9
10021	AA0	1.00	10021	AA0	1.00	AA0	1.00	AA0	AA0
10022	AA1	1.00	10022	AA1	1.00	AA1	1.00	AA1	AA1
10023	AA2	1.00	10023	AA2	1.00	AA2	1.00	AA2	AA2
10024	AA3	1.00	10024	AA3	1.00	AA3	1.00	AA3	AA3
10025	AA4	1.00	10025	AA4	1.00	AA4	1.00	AA4	AA4
10026	AA5	1.00	10026	AA5	1.00	AA5	1.00	AA5	AA5
10027	AA6	1.00	10027	AA6	1.00	AA6	1.00	AA6	AA6
10028	AA7	1.00	10028	AA7	1.00	AA7	1.00	AA7	AA7
10029	AA8	1.00	10029	AA8	1.00	AA8	1.00	AA8	AA8
10030	AA9	1.00	10030	AA9	1.00	AA9	1.00	AA9	AA9
10031	AA0	1.00	10031	AA0	1.00	AA0	1.00	AA0	AA0
10032	AA1	1.00	10032	AA1	1.00	AA1	1.00	AA1	AA1
10033	AA2	1.00	10033	AA2	1.00	AA2	1.00	AA2	AA2
10034	AA3	1.00	10034	AA3	1.00	AA3	1.00	AA3	AA3
10035	AA4	1.00	10035	AA4	1.00	AA4	1.00	AA4	AA4
10036	AA5	1.00	10036	AA5	1.00	AA5	1.00	AA5	AA5
10037	AA6	1.00	10037	AA6	1.00	AA6	1.00	AA6	AA6
10038	AA7	1.00	10038	AA7	1.00	AA7	1.00	AA7	AA7
10039	AA8	1.00	10039	AA8	1.00	AA8	1.00	AA8	AA8
10040	AA9	1.00	10040	AA9	1.00	AA9	1.00	AA9	AA9
10041	AA0	1.00	10041	AA0	1.00	AA0	1.00	AA0	AA0
10042	AA1	1.00	10042	AA1	1.00	AA1	1.00	AA1	AA1
10043	AA2	1.00	10043	AA2	1.00	AA2	1.00	AA2	AA2
10044	AA3	1.00	10044	AA3	1.00	AA3	1.00	AA3	AA3
10045	AA4	1.00	10045	AA4	1.00	AA4	1.00	AA4	AA4
10046	AA5	1.00	10046	AA5	1.00	AA5	1.00	AA5	AA5
10047	AA6	1.00	10047	AA6	1.00	AA6	1.00	AA6	AA6
10048	AA7	1.00	10048	AA7	1.00	AA7	1.00	AA7	AA7
10049	AA8	1.00	10049	AA8	1.00	AA8	1.00	AA8	AA8
10050	AA9	1.00	10050	AA9	1.00	AA9	1.00	AA9	AA9
10051	AA0	1.00	10051	AA0	1.00	AA0	1.00	AA0	AA0
10052	AA1	1.00	10052	AA1	1.00	AA1	1.00	AA1	AA1
10053	AA2	1.00	10053	AA2	1.00	AA2	1.00	AA2	AA2
10054	AA3	1.00	10054	AA3	1.00	AA3	1.00	AA3	AA3
10055	AA4	1.00	10055	AA4	1.00	AA4	1.00	AA4	AA4
10056	AA5	1.00	10056	AA5	1.00	AA5	1.00	AA5	AA5
10057	AA6	1.00	10057	AA6	1.00	AA6	1.00	AA6	AA6
10058	AA7	1.00	10058	AA7	1.00	AA7	1.00	AA7	AA7
10059	AA8	1.00	10059	AA8	1.00	AA8	1.00	AA8	AA8
10060	AA9	1.00	10060	AA9	1.00	AA9	1.00	AA9	AA9
10061	AA0	1.00	10061	AA0	1.00	AA0	1.00	AA0	AA0
10062	AA1	1.00	10062	AA1	1.00	AA1	1.00	AA1	AA1
10063	AA2	1.00	10063	AA2	1.00	AA2	1.00	AA2	AA2
10064	AA3	1.00	10064	AA3	1.00	AA3	1.00	AA3	AA3
10065	AA4	1.00	10065	AA4	1.00	AA4	1.00	AA4	AA4
10066	AA5	1.00	10066	AA5	1.00	AA5	1.00	AA5	AA5
10067	AA6	1.00	10067	AA6	1.00	AA6	1.00	AA6	AA6
10068	AA7	1.00	10068	AA7	1.00	AA7	1.00	AA7	AA7
10069	AA8	1.00	10069	AA8	1.00	AA8	1.00	AA8	AA8
10070	AA9	1.00	10070	AA9	1.00	AA9	1.00	AA9	AA9
10071	AA0	1.00	10071	AA0	1.00	AA0	1.00	AA0	AA0
10072	AA1	1.00	10072	AA1	1.00	AA1	1.00	AA1	AA1
10073	AA2	1.00	10073	AA2	1.00	AA2	1.00	AA2	AA2
10074	AA3	1.00	10074	AA3	1.00	AA3	1.00	AA3	AA3
10075	AA4	1.00	10075	AA4	1.00	AA4	1.00	AA4	AA4
10076	AA5	1.00	10076	AA5	1.00	AA5	1.00	AA5	AA5
10077	AA6	1.00	10077	AA6	1.00	AA6	1.00	AA6	AA6
10078	AA7	1.00	10078	AA7	1.00	AA7	1.00	AA7	AA7
10079	AA8	1.00	10079	AA8	1.00	AA8	1.00	AA8	AA8
10080	AA9	1.00	10080	AA9	1.00	AA9	1.00	AA9	AA9
10081	AA0	1.00	10081	AA0	1.00	AA0	1.00	AA0	AA0
10082	AA1	1.00	10082	AA1	1.00	AA1	1.00	AA1	AA1
10083	AA2	1.00	10083	AA2	1.00	AA2	1.00	AA2	AA2
10084	AA3	1.00	10084	AA3	1.00	AA3	1.00	AA3	AA3
10085	AA4	1.00	10085	AA4	1.00	AA4	1.00	AA4	AA4
10086	AA5	1.00	10086	AA5	1.00	AA5	1.00	AA5	AA5
10087	AA6	1.00	10087	AA6	1.00	AA6	1.00	AA6	AA6
10088	AA7	1.00	10088	AA7	1.00	AA7	1.00	AA7	AA7
10089	AA8	1.00	10089	AA8	1.00	AA8	1.00	AA8	AA8
10090	AA9	1.00	10090	AA9	1.00	AA9	1.00	AA9	AA9
10091	AA0	1.00	10091	AA0	1.00	AA0	1.00	AA0	AA0
10092	AA1	1.00	10092	AA1	1.00	AA1	1.00	AA1	AA1
10093	AA2	1.00	10093	AA2	1.00	AA2	1.00	AA2	AA2
10094	AA3	1.00	10094	AA3	1.00	AA3	1.00	AA3	AA3
10095	AA4	1.00	10095	AA4	1.00	AA4	1.00	AA4	AA4
10096	AA5	1.00	10096	AA5	1.00	AA5	1.00	AA5	AA5
10097	AA6	1.00	10097	AA6	1.00	AA6	1.00	AA6	AA6
10098	AA7	1.00	10098	AA7	1.00	AA7	1.00	AA7	AA7
10099	AA8	1.00	10099	AA8	1.00	AA8	1.00	AA8	AA8
10100	AA9	1.00	10100	AA9	1.00	AA9	1.00	AA9	AA9

1. *Paraffin*: Wax or oil-based substances used for sealing or coating.

Aut. No. M-144/2010-1944, issued March 2010, pursuant to
the Act (WZPOM/1/11)²

Issued: 2010-03-20 10:00:00

0602	ALA	IEEE 802.11a (40MHz)	MC51	20pc d0	VLAM	0.9	1.0	1.0
0603	ARA	IEEE 802.11a (40MHz)	MC52	20pc d0	VLAM	0.9	1.0	1.0
0604	ARA	IEEE 802.11a (40MHz)	MC53	20pc d0	VLAM	0.9	1.0	1.0
0605	ALA	IEEE 802.11a (40MHz)	MC54	20pc d0	VLAM	0.9	1.0	1.0
0606	ALA	IEEE 802.11a (40MHz)	MC55	20pc d0	VLAM	0.9	1.0	1.0
0701	ARA	IEEE 802.11a (40MHz)	MC56	20pc d0	VLAM	0.9	1.0	1.0
0702	ARA	IEEE 802.11a (40MHz)	MC57	20pc d0	VLAM	0.9	1.0	1.0
0703	ALA	IEEE 802.11a (40MHz)	MC58	20pc d0	VLAM	0.9	1.0	1.0
0704	ALA	IEEE 802.11a (40MHz)	MC59	20pc d0	VLAM	0.9	1.0	1.0
0705	ALA	IEEE 802.11a (40MHz)	MC60	20pc d0	VLAM	0.9	1.0	1.0
0706	ALA	IEEE 802.11a (40MHz)	MC61	20pc d0	VLAM	0.9	1.0	1.0
0707	ALA	IEEE 802.11a (40MHz)	MC62	20pc d0	VLAM	0.9	1.0	1.0
0708	ALA	IEEE 802.11a (40MHz)	MC63	20pc d0	VLAM	0.9	1.0	1.0
0709	ALA	IEEE 802.11a (40MHz)	MC64	20pc d0	VLAM	0.9	1.0	1.0
0710	ALA	IEEE 802.11a (40MHz)	MC65	20pc d0	VLAM	0.9	1.0	1.0
0711	ALA	IEEE 802.11a (40MHz)	MC66	20pc d0	VLAM	0.9	1.0	1.0
0712	ALA	IEEE 802.11a (40MHz)	MC67	20pc d0	VLAM	0.9	1.0	1.0
0713	ALA	IEEE 802.11a (40MHz)	MC68	20pc d0	VLAM	0.9	1.0	1.0
0714	ALA	IEEE 802.11a (40MHz)	MC69	20pc d0	VLAM	0.9	1.0	1.0
0715	ALA	IEEE 802.11a (40MHz)	MC70	20pc d0	VLAM	0.9	1.0	1.0
0716	ARA	IEEE 802.11a (40MHz)	MC71	20pc d0	VLAM	0.9	1.0	1.0
0717	ALA	IEEE 802.11a (40MHz)	MC72	20pc d0	VLAM	0.9	1.0	1.0
0718	ARA	IEEE 802.11a (40MHz)	MC73	20pc d0	VLAM	0.9	1.0	1.0
0719	ARA	IEEE 802.11a (40MHz)	MC74	20pc d0	VLAM	0.9	1.0	1.0
0720	ALA	IEEE 802.11a (40MHz)	MC75	20pc d0	VLAM	0.9	1.0	1.0
0721	ARA	IEEE 802.11a (40MHz)	MC76	20pc d0	VLAM	0.9	1.0	1.0
0722	ARA	IEEE 802.11a (40MHz)	MC77	20pc d0	VLAM	0.9	1.0	1.0
0723	ARA	IEEE 802.11a (40MHz)	MC78	20pc d0	VLAM	0.9	1.0	1.0
0724	ARA	IEEE 802.11a (40MHz)	MC79	20pc d0	VLAM	0.9	1.0	1.0
0725	ALA	IEEE 802.11a (40MHz)	MC80	20pc d0	VLAM	0.9	1.0	1.0
0726	ARA	IEEE 802.11a (40MHz)	MC81	20pc d0	VLAM	0.9	1.0	1.0
0727	ARA	IEEE 802.11a (40MHz)	MC82	20pc d0	VLAM	0.9	1.0	1.0
0728	ARA	IEEE 802.11a (40MHz)	MC83	20pc d0	VLAM	0.9	1.0	1.0
0729	ARA	IEEE 802.11a (40MHz)	MC84	20pc d0	VLAM	0.9	1.0	1.0
0730	ARA	IEEE 802.11a (40MHz)	MC85	20pc d0	VLAM	0.9	1.0	1.0
0731	ARA	IEEE 802.11a (40MHz)	MC86	20pc d0	VLAM	0.9	1.0	1.0
0732	ARA	IEEE 802.11a (40MHz)	MC87	20pc d0	VLAM	0.9	1.0	1.0
0733	ARA	IEEE 802.11a (40MHz)	MC88	20pc d0	VLAM	0.9	1.0	1.0
0734	ARA	IEEE 802.11a (40MHz)	MC89	20pc d0	VLAM	0.9	1.0	1.0
0735	ARA	IEEE 802.11a (40MHz)	MC90	20pc d0	VLAM	0.9	1.0	1.0
0736	ARA	IEEE 802.11a (40MHz)	MC91	20pc d0	VLAM	0.9	1.0	1.0
0737	ARA	IEEE 802.11a (40MHz)	MC92	20pc d0	VLAM	0.9	1.0	1.0
0738	ARA	IEEE 802.11a (40MHz)	MC93	20pc d0	VLAM	0.9	1.0	1.0
0739	ARA	IEEE 802.11a (40MHz)	MC94	20pc d0	VLAM	0.9	1.0	1.0
0740	ARA	IEEE 802.11a (40MHz)	MC95	20pc d0	VLAM	0.9	1.0	1.0
0741	ARA	IEEE 802.11a (40MHz)	MC96	20pc d0	VLAM	0.9	1.0	1.0
0742	ARA	IEEE 802.11a (40MHz)	MC97	20pc d0	VLAM	0.9	1.0	1.0
0743	ARA	IEEE 802.11a (40MHz)	MC98	20pc d0	VLAM	0.9	1.0	1.0
0744	ARA	IEEE 802.11a (40MHz)	MC99	20pc d0	VLAM	0.9	1.0	1.0
0745	ARA	IEEE 802.11a (40MHz)	MC100	20pc d0	VLAM	0.9	1.0	1.0
0746	ARA	IEEE 802.11a (40MHz)	MC101	20pc d0	VLAM	0.9	1.0	1.0
0747	ARA	IEEE 802.11a (40MHz)	MC102	20pc d0	VLAM	0.9	1.0	1.0
0748	ARA	IEEE 802.11a (40MHz)	MC103	20pc d0	VLAM	0.9	1.0	1.0
0749	ARA	IEEE 802.11a (40MHz)	MC104	20pc d0	VLAM	0.9	1.0	1.0
0750	ARA	IEEE 802.11a (40MHz)	MC105	20pc d0	VLAM	0.9	1.0	1.0
0751	ARA	IEEE 802.11a (40MHz)	MC106	20pc d0	VLAM	0.9	1.0	1.0
0752	ARA	IEEE 802.11a (40MHz)	MC107	20pc d0	VLAM	0.9	1.0	1.0
0753	ARA	IEEE 802.11a (40MHz)	MC108	20pc d0	VLAM	0.9	1.0	1.0
0754	ARA	IEEE 802.11a (40MHz)	MC109	20pc d0	VLAM	0.9	1.0	1.0

Environ. Biol. Fish. (2015) 98:1011–1020

[illegible]

Figure 11.10.1

[illegible]



Accredited by the Swiss Accreditation Service (SAS)
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Multilateral Agreement for the recognition of calibration certificates

Client **SRTC** Certificate No. **D450V2-1024_Nov23**
Beijing City

CALIBRATION CERTIFICATE

Object **D450V2 - SN:1024**

Calibration procedure(s) **QA CAL-15.v10**
Calibration Procedure for SAR Validation Sources below 700 MHz

Calibration date: **November 28, 2023**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP2	SN: 104778	30-Mar-23 (No. 217-03804/03805)	Mar-24
Power sensor NRP-Z91	SN: 103244	30-Mar-23 (No. 217-03804)	Mar-24
Power sensor NRP-Z91	SN: 103245	30-Mar-23 (No. 217-03805)	Mar-24
Reference 20 dB Attenuator	SN: BH9394 (20k)	30-Mar-23 (No. 217-03809)	Mar-24
Type-N mismatch combination	SN: 310982 / 06327	30-Mar-23 (No. 217-03810)	Mar-24
Reference Probe EX3DV4	SN: 3877	06-Jan-23 (No. EX3-3877_Jan23)	Jan-24
DAE4	SN: 654	27-Jan-23 (No. DAE4-654_Jan23)	Jan-24
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter NRP2	SN: 107193	08-Nov-21 (in house check Dec-22)	In house check: Dec-24
Power sensor NRP-Z91	SN: 100922	15-Dec-09 (in house check Dec-22)	In house check: Dec-24
Power sensor NRP-Z91	SN: 100418	01-Jan-04 (in house check Dec-22)	In house check: Dec-24
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-22)	In house check: Jun-24
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24

Calibrated by: **Krešimir Franjić** Function **Laboratory Technician**

Approved by: **Sven Kühn** Technical Manager

Signature

Signature

Issued: November 29, 2023

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



Accredited by the Swiss Accreditation Service (SAS)

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

Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

- IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY 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%.

Measurement Conditions

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

DASY Version	DASY5	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	ELI4 Flat Phantom	Shell thickness: 2 ± 0.2 mm
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	$dx, dy, dz = 5$ mm	
Frequency	$450 \text{ MHz} \pm 1 \text{ MHz}$	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	$22.0 \text{ }^{\circ}\text{C}$	43.5	0.87 mho/m
Measured Head TSL parameters	$(22.0 \pm 0.2) \text{ }^{\circ}\text{C}$	$44.1 \pm 6 \%$	$0.87 \text{ mho/m} \pm 6 \%$
Head TSL temperature change during test	$< 0.5 \text{ }^{\circ}\text{C}$	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.16 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	$4.65 \text{ W/kg} \pm 18.1 \%$ (k=2)

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	0.776 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	$3.11 \text{ W/kg} \pm 17.6 \%$ (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	55.9 Ω - 6.3 j Ω
Return Loss	- 21.8 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.351 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
-----------------	-------

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 450 MHz; Type: D450V2; Serial: D450V2 - SN:1024

Communication System: UID 0 - CW; Frequency: 450 MHz
Medium parameters used: $f = 450 \text{ MHz}$; $\sigma = 0.87 \text{ S/m}$; $\epsilon_r = 44.1$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3877; ConvF(10.64, 10.64, 10.64) @ 450 MHz; Calibrated: 06.01.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 27.01.2023
- Phantom: ELI v6.0; Type: QDOVA003AA; Serial: TP:2034
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

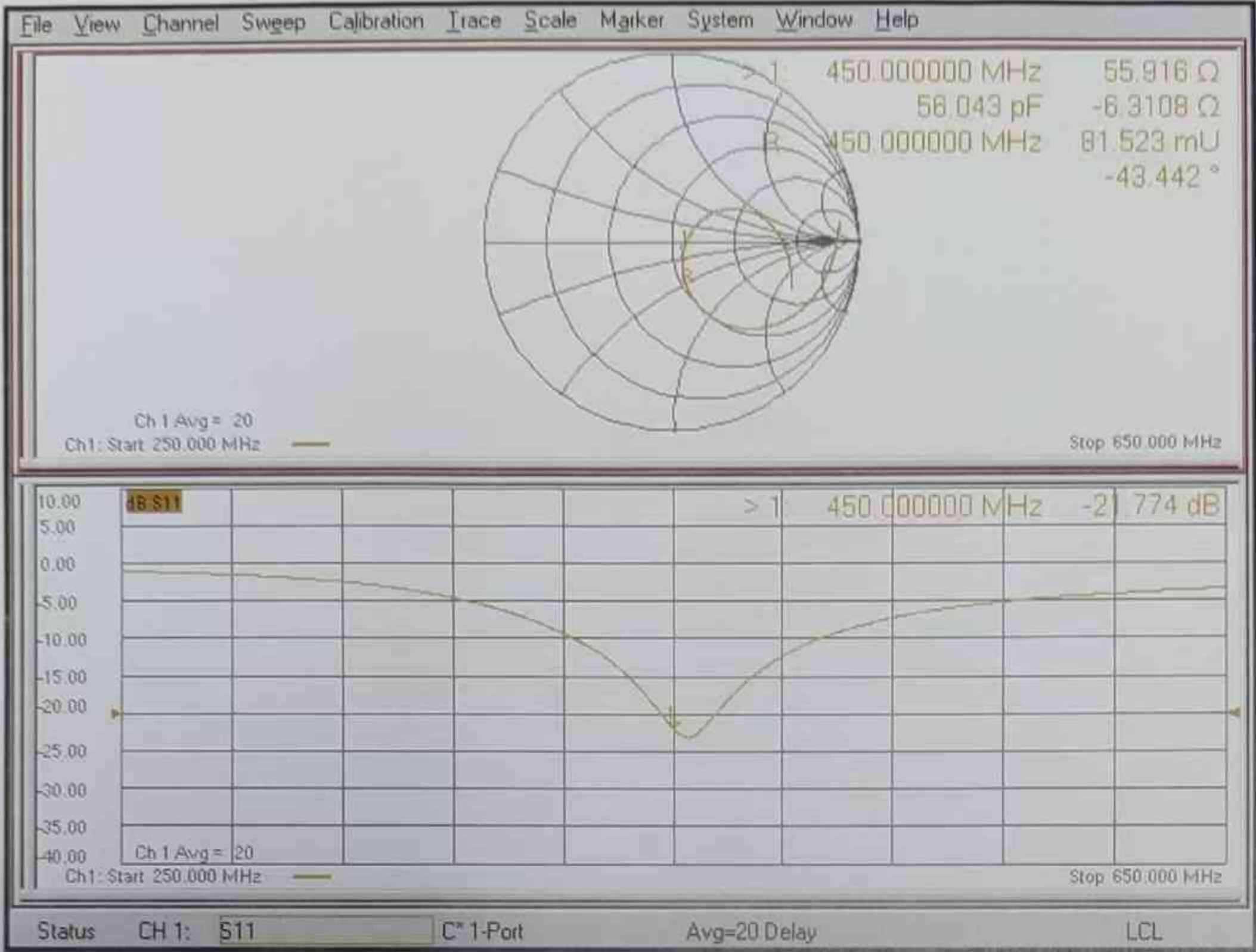
Dipole Calibration for Head Tissue/ $d=15\text{mm}$, $P_{in}=250\text{mW}$ /Zoom Scan (7x7x7)/Cube 0:

Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$
Reference Value = 39.33 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 1.81 W/kg
SAR(1 g) = 1.16 W/kg; SAR(10 g) = 0.776 W/kg
Smallest distance from peaks to all points 3 dB below: Larger than measurement grid ($> 15 \text{ mm}$)
Ratio of SAR at M2 to SAR at M1 = 64.3%
Maximum value of SAR (measured) = 1.57 W/kg



0 dB = 1.57 W/kg = 1.96 dBW/kg

Impedance Measurement Plot for Head TSL



Client

SRTC

Certificate No: **23J02Z80085**

CALIBRATION CERTIFICATE

Object **D750V3 - SN: 1101**

Calibration Procedure(s) **FF-Z11-003-01**
Calibration Procedures for dipole validation kits

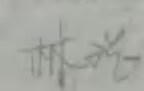
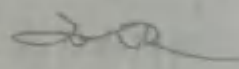
Calibration date: **October 19, 2023**

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106276	15-May-23 (CTTL, No.J23X04183)	May-24
Power sensor NRP6A	101369	15-May-23 (CTTL, No.J23X04183)	May-24
Reference Probe EX3DV4	SN 3617	31-Mar-23(CTTL-SPEAG,No.Z23-60161)	Mar-24
DAE4	SN 1556	11-Jan-23(CTTL-SPEAG,No.Z23-60034)	Jan-24
Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	05-Jan-23 (CTTL, No. J23X00107)	Jan-24
Network Analyzer E5071C	MY46110673	10-Jan-23 (CTTL, No. J23X00104)	Jan-24

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: October 31, 2023

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E-mail: gmfi@caict.ac.cn <http://www.caict.ac.cn>

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM _{x,y,z}
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020
- b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- c) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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



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Measurement Conditions

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

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

Head TSL parameters

The following parameters and calculations were applied:

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	42.0	0.90 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	42.2 $\pm$ 6 %	0.91 mho/m $\pm$ 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	2.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.55 W/kg $\pm$ 18.8 % ($k=2$)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.43 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.65 W/kg $\pm$ 18.7 % ($k=2$)



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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.00- 0.30jΩ
Return Loss	- 30.8dB

General Antenna Parameters and Design

Electrical Delay (one direction)	0,940 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point 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 feed-point may be damaged.

Additional EUT Data

Manufactured by	SPEAG
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DASY5 Validation Report for Head TSL

Date: 2023-10-19

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1101

Communication System: UID 0, CW; Frequency: 750 MHz

Medium parameters used: $f = 750 \text{ MHz}$; $\sigma = 0.91 \text{ S/m}$; $\epsilon_r = 42.24$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(10.1, 10.1, 10.1) @ 750 MHz; Calibrated: 2023-03-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2023-01-11
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- DASY52.52.10.4(1535); SEMCAD X 14.6.14(7501)

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

Reference Value = 52.06 V/m; Power Drift = -0.03 dB

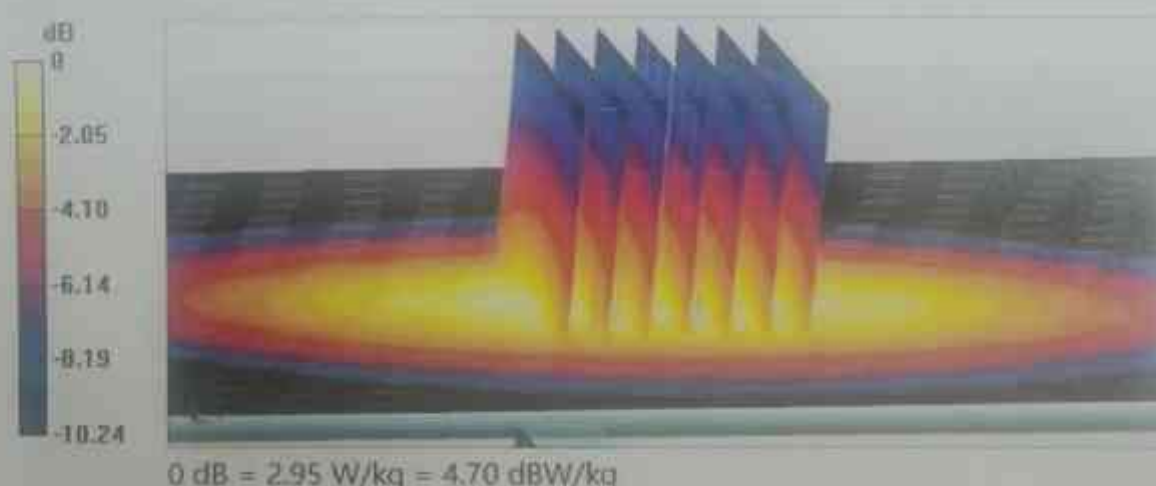
Peak SAR (extrapolated) = 3.42 W/kg

SAR(1 g) = 2.17 W/kg; SAR(10 g) = 1.43 W/kg

Smallest distance from peaks to all points 3 dB below = 18.6 mm

Ratio of SAR at M2 to SAR at M1 = 63.9%

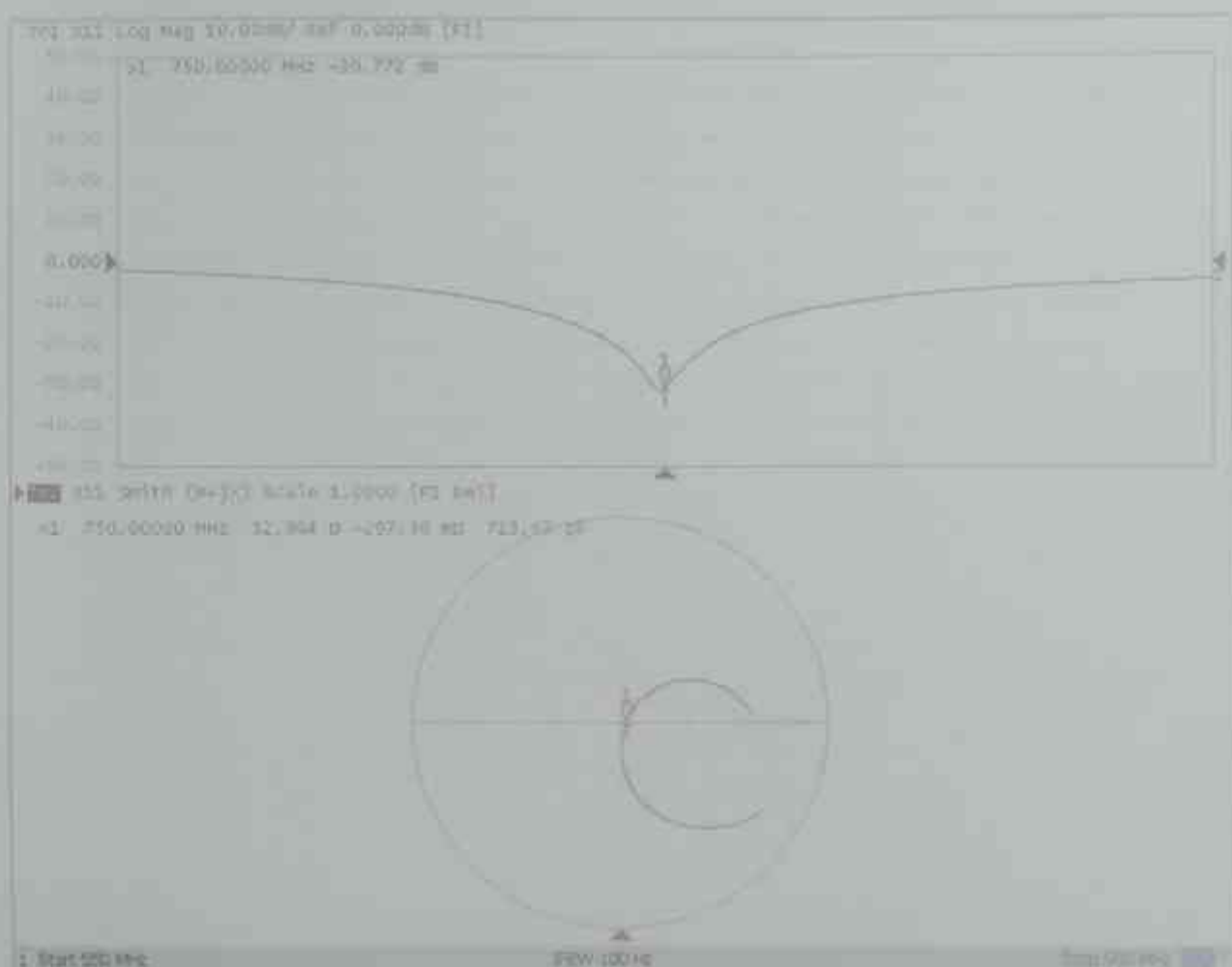
Maximum value of SAR (measured) = 2.95 W/kg





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Impedance Measurement Plot for Head TSL



Client **SRTC**

Certificate No: **23J02Z80086**

CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d023**

Calibration Procedure(s) **FF-Z11-003-01**
Calibration Procedures for dipole validation kits

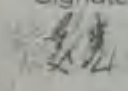
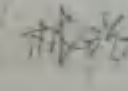
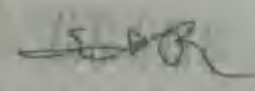
Calibration date: **October 25, 2023**

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22\pm3)^{\circ}\text{C}$ and humidity $<70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106276	15-May-23 (CTTL, No.J23X04183)	May-24
Power sensor NRP6A	101369	15-May-23 (CTTL, No.J23X04183)	May-24
Reference Probe EX3DV4	SN 3617	31-Mar-23(CTTL-SPEAG,No.Z23-60161)	Mar-24
DAE4	SN 1556	11-Jan-23(CTTL-SPEAG,No.Z23-60034)	Jan-24
Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	05-Jan-23 (CTTL, No. J23X00107)	Jan-24
NetworkAnalyzer E5071C	MY46110673	10-Jan-23 (CTTL, No. J23X00104)	Jan-24

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: October 31, 2023

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Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM _{x,y,z}
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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



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Measurement Conditions

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

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz $\pm$ 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 $\pm$ 0.2) °C	41.2 $\pm$ 6 %	0.88 mho/m $\pm$ 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	2.40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.75 W/kg $\pm$ 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	6.36 W/kg $\pm$ 18.7 % ($k=2$)



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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.1Ω- 3.22jΩ
Return Loss	- 29.5dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.297 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point 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 feed-point may be damaged.

Additional EUT Data

Manufactured by	SPEAG
-----------------	-------

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E-mail: emf@caict.ac.cn

<http://www.caict.ac.cn>
DASY5 Validation Report for Head TSL

Date: 2023-10-25

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d023

Communication System: UID 0, CW; Frequency: 835 MHz

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.879 \text{ S/m}$; $\epsilon_r = 41.18$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(10.1, 10.1, 10.1) @ 835 MHz; Calibrated: 2023-03-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2023-01-11
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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

Reference Value = 58.95 V/m; Power Drift = -0.01 dB

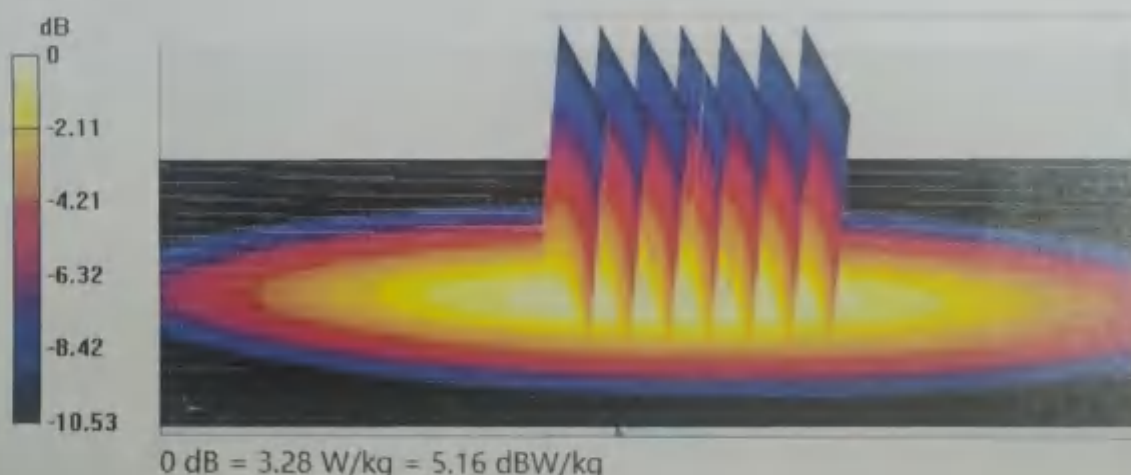
Peak SAR (extrapolated) = 3.79 W/kg

SAR(1 g) = 2.4 W/kg; SAR(10 g) = 1.57 W/kg

Smallest distance from peaks to all points 3 dB below = 18 mm

Ratio of SAR at M2 to SAR at M1 = 63.7%

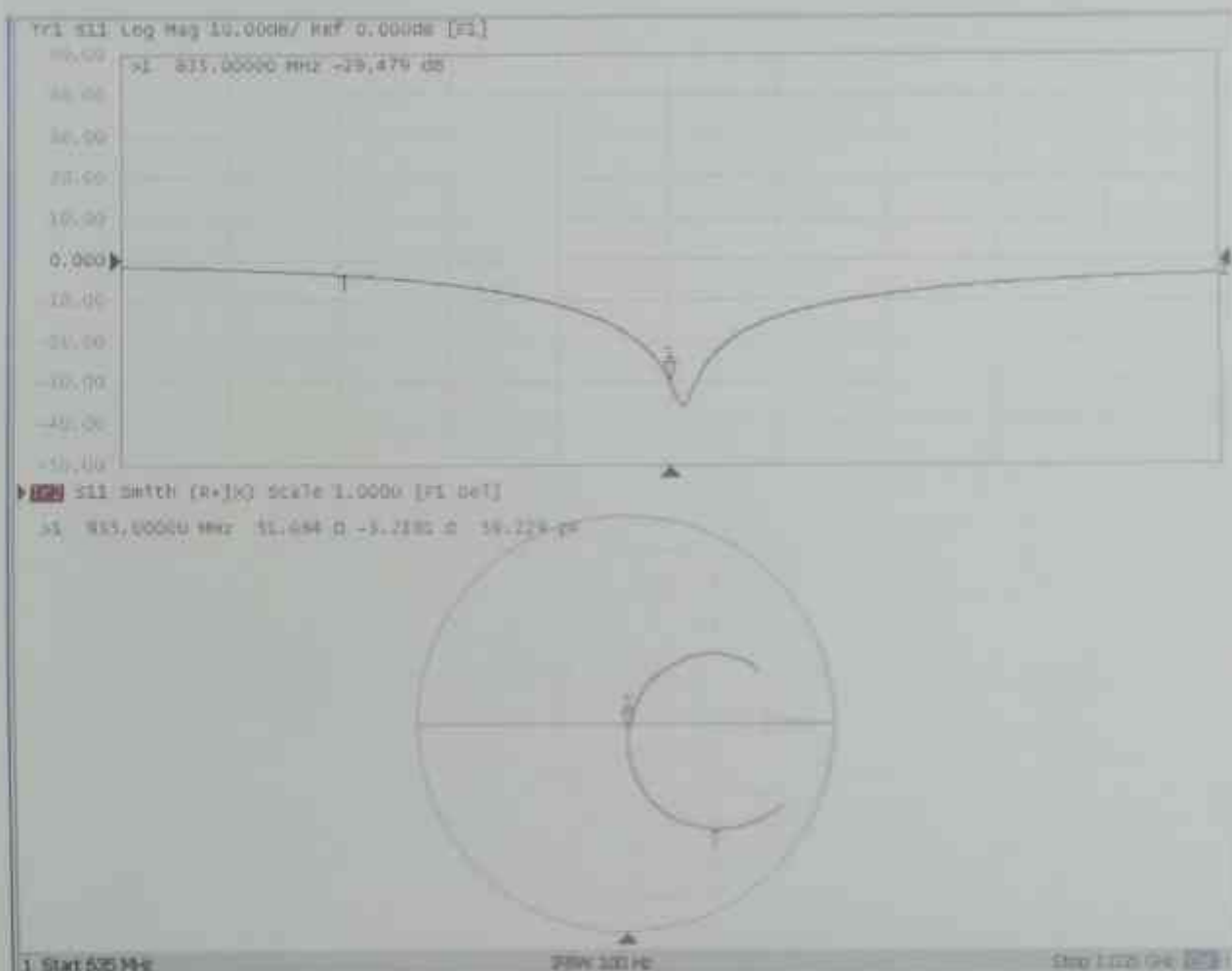
Maximum value of SAR (measured) = 3.28 W/kg





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Impedance Measurement Plot for Head TSL



Client

SRTC

Certificate No: 23J02Z80025

CALIBRATION CERTIFICATE

Object D900V2 - SN: 171

Calibration Procedure(s) FF-Z11-003-01
Calibration Procedures for dipole validation kits

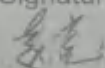
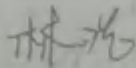
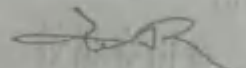
Calibration date: September 19, 2023

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22\pm3)^{\circ}\text{C}$ and humidity $<70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106277	22-Sep-22 (CTTL, No. J22X09561)	Sep-23
Power sensor NRP8S	104291	22-Sep-22 (CTTL, No. J22X09561)	Sep-23
Reference Probe EX3DV4	SN 3617	31-Mar-23(CTTL-SPEAG, No. Z23-60161)	Mar-24
DAE4	SN 1556	11-Jan-23(CTTL-SPEAG, No. Z23-60034)	Jan-24
Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	05-Jan-23 (CTTL, No. J23X00107)	Jan-24
NetworkAnalyzer E5071C	MY46110673	10-Jan-23 (CTTL, No. J23X00104)	Jan-24

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: September 26, 2023

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Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM _{x,y,z}
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020
- b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- c) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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



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Measurement Conditions

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

DASY Version	DASY52	52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	900 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.97 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	41.3 $\pm$ 6 %	0.98 mho/m $\pm$ 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	2.73 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	10.8 W/kg $\pm$ 18.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.74 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.91 W/kg $\pm$ 18.7 % (k=2)



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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.90- 6.17jΩ
Return Loss	- 24.0dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.307 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point 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 feed-point may be damaged.

Additional EUT Data

Manufactured by	SPEAG
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DASY5 Validation Report for Head TSL

Date: 2023-09-19

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN: 171

Communication System: UID 0, CW; Frequency: 900 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 900 \text{ MHz}$; $\sigma = 0.981 \text{ S/m}$; $\epsilon_r = 41.27$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(9.68, 9.68, 9.68) @ 900 MHz; Calibrated: 2023-03-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2023-01-11
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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

Reference Value = 58.56 V/m; Power Drift = -0.03 dB

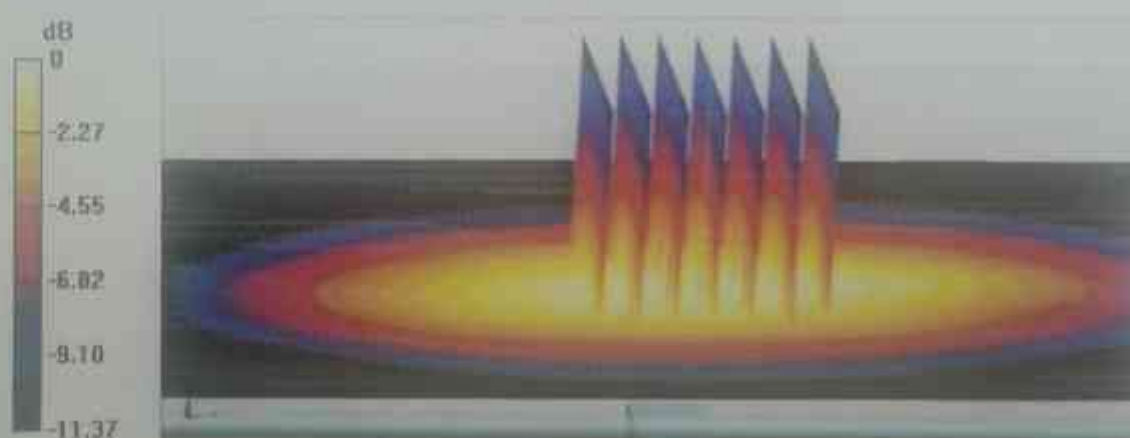
Peak SAR (extrapolated) = 4.42 W/kg

SAR(1 g) = 2.73 W/kg; SAR(10 g) = 1.74 W/kg

Smallest distance from peaks to all points 3 dB below = 16 mm

Ratio of SAR at M2 to SAR at M1 = 62.1%

Maximum value of SAR (measured) = 3.79 W/kg

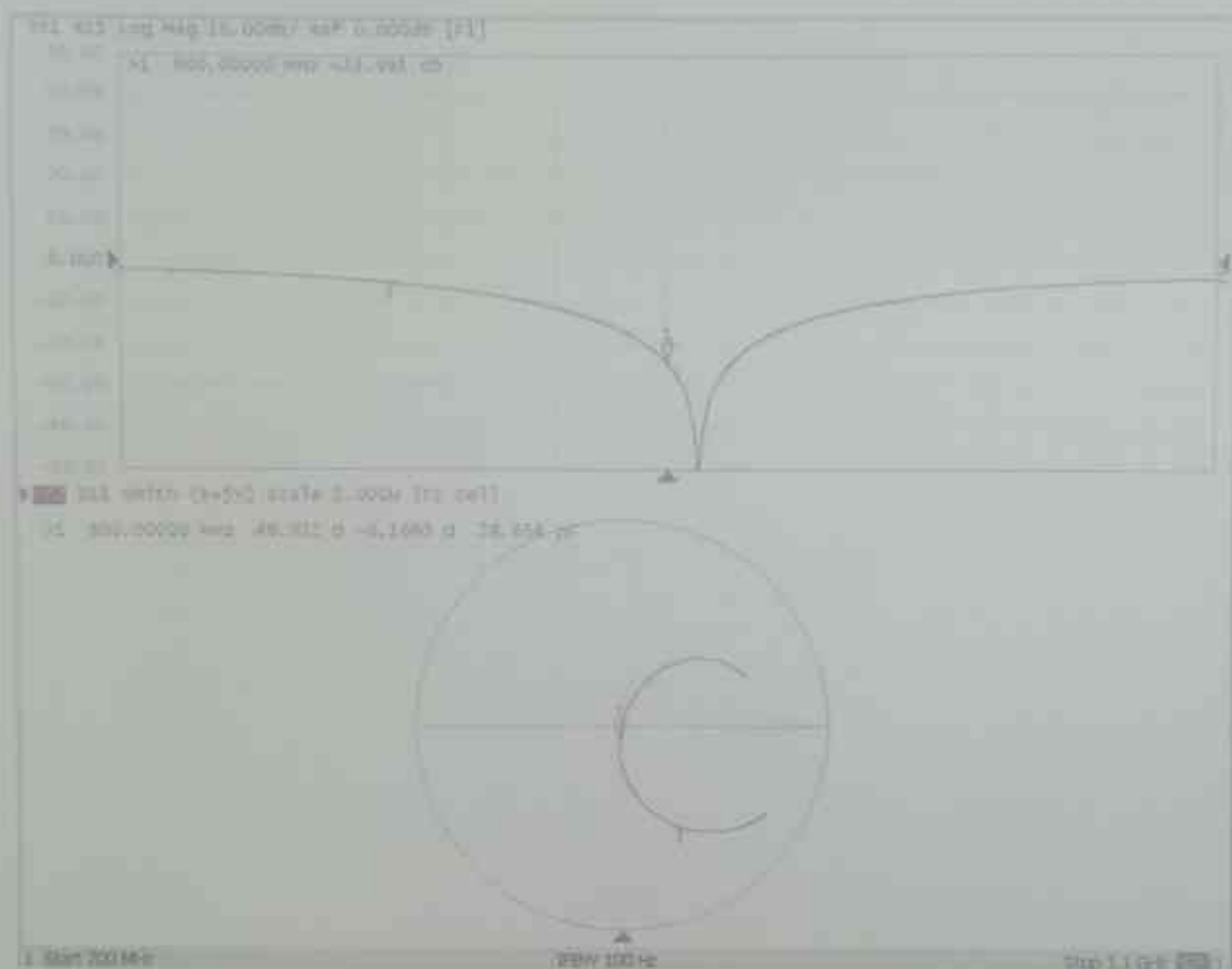


0 dB = 3.79 W/kg = 5.79 dBW/kg



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Impedance Measurement Plot for Head TSL



Client

SRTC

Certificate No: **23J02Z80087**

CALIBRATION CERTIFICATE

Object **D1450V2 - SN: 1065**

Calibration Procedure(s) **FF-Z11-003-01**
Calibration Procedures for dipole validation kits

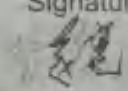
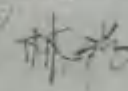
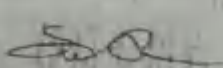
Calibration date: **October 17, 2023**

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility; environment temperature $(22\pm3)^{\circ}\text{C}$ and humidity $<70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106276	15-May-23 (CTTL, No.J23X04183)	May-24
Power sensor NRP6A	101369	15-May-23 (CTTL, No.J23X04183)	May-24
Reference Probe EX3DV4	SN 3617	31-Mar-23(CTTL-SPEAG,No.Z23-60161)	Mar-24
DAE4	SN 1556	11-Jan-23(CTTL-SPEAG,No.Z23-60034)	Jan-24
Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	05-Jan-23 (CTTL, No. J23X00107)	Jan-24
NetworkAnalyzer E5071C	MY46110673	10-Jan-23 (CTTL, No. J23X00104)	Jan-24

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: October 31, 2023

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Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM _{x,y,z}
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY4/5 System Handbook

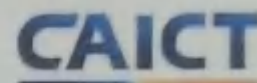
Methods Applied and Interpretation of Parameters:

- 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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<http://www.caict.ac.cn>**Measurement Conditions**

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

DASY Version	DASY52	52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1450 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.5	1.20 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	39.8 $\pm$ 6 %	1.22 mho/m $\pm$ 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	7.19 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	28.3 W/kg $\pm$ 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	4.04 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	16.0 W/kg $\pm$ 18.7 % (k=2)



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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.4Ω- 2.30jΩ
Return Loss	- 31.5dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.164 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point 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 feed-point may be damaged.

Additional EUT Data

Manufactured by	SPEAG
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DASY5 Validation Report for Head TSL

Date: 2023-10-17

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1450 MHz; Type: D1450V2; Serial: D1450V2 - SN: 1065

Communication System: UID 0, CW; Frequency: 1450 MHz

Medium parameters used: $f = 1450$ MHz; $\sigma = 1.221$ S/m; $\epsilon_r = 39.82$; $\rho = 1000$ kg/m³

Phantom section: Right Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(8.77, 8.77, 8.77) @ 1450 MHz; Calibrated: 2023-03-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2023-01-11
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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

Reference Value = 86.02 V/m; Power Drift = -0.04 dB

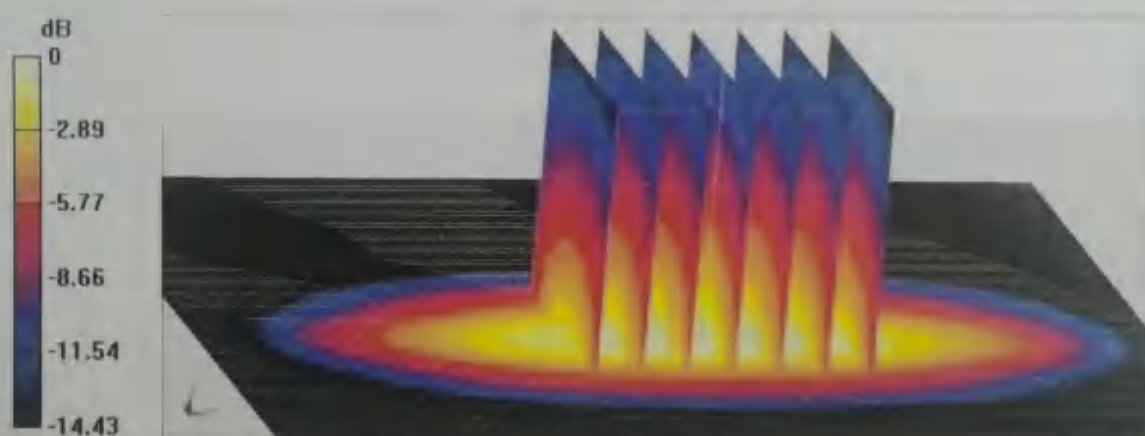
Peak SAR (extrapolated) = 13.1 W/kg

SAR(1 g) = 7.19 W/kg; SAR(10 g) = 4.04 W/kg

Smallest distance from peaks to all points 3 dB below = 10 mm

Ratio of SAR at M2 to SAR at M1 = 55.6%

Maximum value of SAR (measured) = 10.9 W/kg

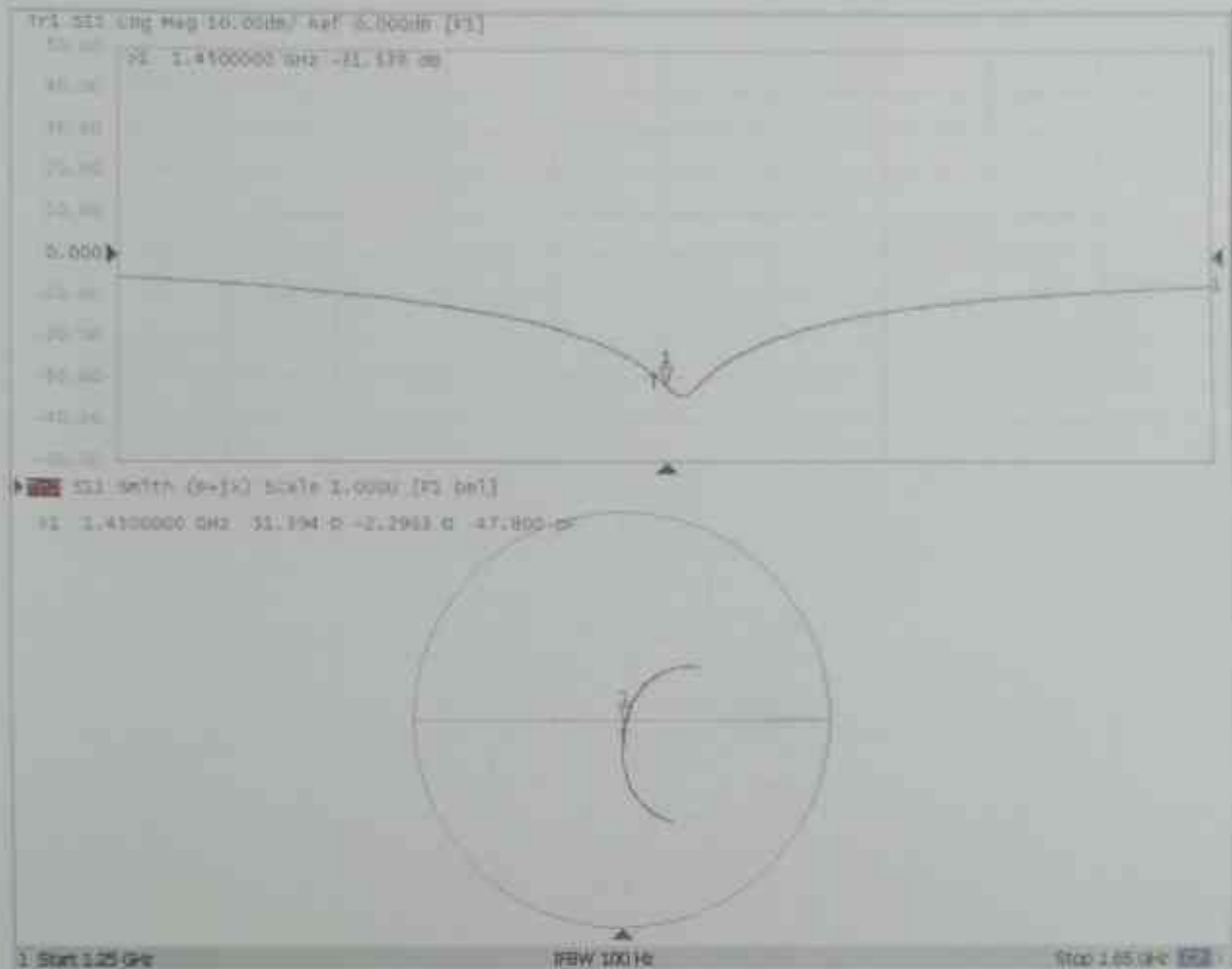


0 dB = 10.9 W/kg = 10.37 dBW/kg



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Impedance Measurement Plot for Head TSL



Client **SRTC**

Certificate No: **23J02Z80026**

CALIBRATION CERTIFICATE

Object **D1800V2 - SN: 2d084**

Calibration Procedure(s) **FF-Z11-003-01**
Calibration Procedures for dipole validation kits

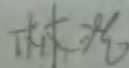
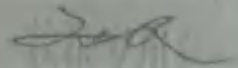
Calibration date: **September 18, 2023**

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22\pm3)^{\circ}\text{C}$ and humidity $<70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106277	22-Sep-22 (CTTL, No.J22X09561)	Sep-23
Power sensor NRP8S	104291	22-Sep-22 (CTTL, No.J22X09561)	Sep-23
Reference Probe EX3DV4	SN 3617	31-Mar-23(CTTL-SPEAG,No.Z23-60161)	Mar-24
DAE4	SN 1556	11-Jan-23(CTTL-SPEAG,No.Z23-60034)	Jan-24
Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	05-Jan-23 (CTTL, No. J23X00107)	Jan-24
NetworkAnalyzer E5071C	MY46110673	10-Jan-23 (CTTL, No. J23X00104)	Jan-24

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: September 26, 2023

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Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM _{x,y,z}
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020
- b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- c) 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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<http://www.caict.ac.cn>**Measurement Conditions**

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

DASY Version	DASY52	52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5,1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	$dx, dy, dz = 5 \text{ mm}$	
Frequency	$1800 \text{ MHz} \pm 1 \text{ MHz}$	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	$22.0 \text{ }^{\circ}\text{C}$	40.0	1.40 mho/m
Measured Head TSL parameters	$(22.0 \pm 0.2) \text{ }^{\circ}\text{C}$	$40.2 \pm 6 \%$	$1.39 \text{ mho/m} \pm 6 \%$
Head TSL temperature change during test	$<1.0 \text{ }^{\circ}\text{C}$	—	—

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.67 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	$38.9 \text{ W/kg} \pm 18.8 \%$ (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.08 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	$20.3 \text{ W/kg} \pm 18.7 \%$ (k=2)



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<http://www.caict.ac.cn>**Appendix (Additional assessments outside the scope of CNAS L0570)****Antenna Parameters with Head TSL**

Impedance, transformed to feed point	48.40-2.19jΩ
Return Loss	-31.2dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.118 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point 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 feed-point may be damaged.

Additional EUT Data

Manufactured by	SPEAG
-----------------	-------

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DASY5 Validation Report for Head TSL

Date: 2023-09-18

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN: 2d084

Communication System: UTD 0, CW; Frequency: 1800 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1800$ MHz; $\sigma = 1.389$ S/m; $\epsilon_r = 40.17$; $\rho = 1000$ kg/m³

Phantom section: Right Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(8.4, 8.4, 8.4) @ 1800 MHz; Calibrated: 2023-03-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2023-01-11
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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

Reference Value = 94.04 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 18.2 W/kg

SAR(1 g) = 9.67 W/kg; SAR(10 g) = 5.06 W/kg

Smallest distance from peaks to all points 3 dB below = 9.5 mm

Ratio of SAR at M2 to SAR at M1 = 53.6%

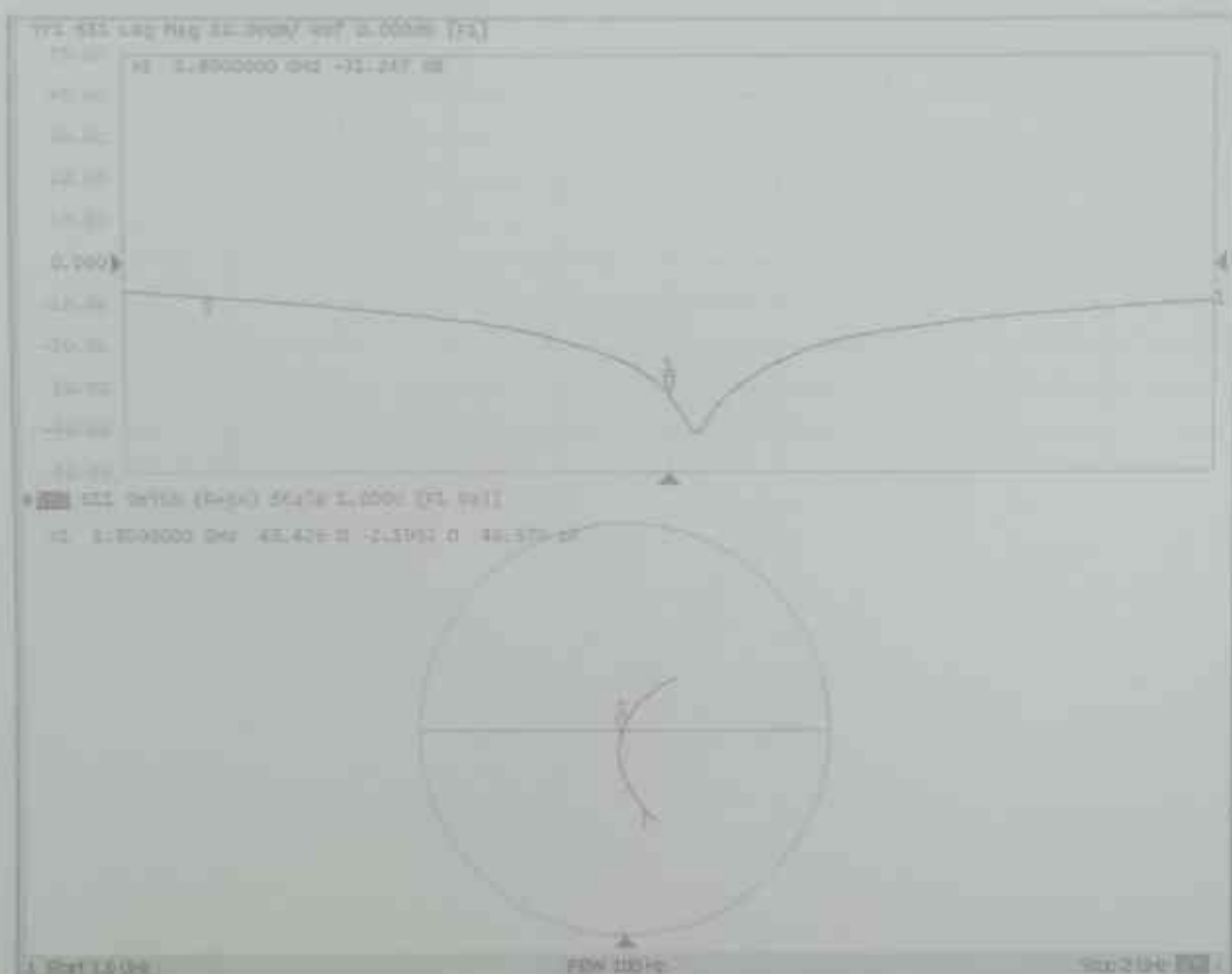
Maximum value of SAR (measured) = 15.1 W/kg





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E-mail: cnll@china-ttl.com <http://www.caict.ac.cn>

Impedance Measurement Plot for Head TSL



Client **SRTC**

Certificate No: **23J02Z80088**

CALIBRATION CERTIFICATE

Object **D2000V2 - SN: 1009**

Calibration Procedure(s) **FF-Z11-003-01**
Calibration Procedures for dipole validation kits

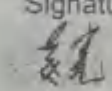
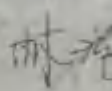
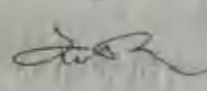
Calibration date: **October 23, 2023**

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22\pm3)^{\circ}\text{C}$ and humidity $<70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106276	15-May-23 (CTTL, No.J23X04183)	May-24
Power sensor NRP6A	101369	15-May-23 (CTTL, No.J23X04183)	May-24
Reference Probe EX3DV4	SN 3617	31-Mar-23(CTTL-SPEAG,No.Z23-60161)	Mar-24
DAE4	SN 1556	11-Jan-23(CTTL-SPEAG,No.Z23-60034)	Jan-24
Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	05-Jan-23 (CTTL, No. J23X00107)	Jan-24
NetworkAnalyzer E5071C	MY46110673	10-Jan-23 (CTTL, No. J23X00104)	Jan-24

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: October 31, 2023

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Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM _{x,y,z}
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

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Measurement Conditions

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

DASY Version	DASY52	52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2000 MHz $\pm$ 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 $\pm$ 0.2) °C	40.5 $\pm$ 6 %	1.39 mho/m $\pm$ 6 %
Head TSL temperature change during test	<1.0 °C	—	—

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	41.5 W/kg $\pm$ 18.8 % (k=2)
SAR averaged over 10 cm³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.21 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	20.9 W/kg $\pm$ 18.7 % (k=2)



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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.3Ω-2.23jΩ
Return Loss	-30.9dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.088 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point 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 feed-point may be damaged.

Additional EUT Data

Manufactured by	SPEAG
-----------------	-------

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<http://www.caict.ac.cn>
DASY5 Validation Report for Head TSL

Date: 2023-10-23

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2000 MHz; Type: D2000V2; Serial: D2000V2 - SN: 1009

Communication System: UID 0, CW; Frequency: 2000 MHz

Medium parameters used: $f = 2000$ MHz; $\sigma = 1.388$ S/m; $\epsilon_r = 40.49$; $\rho = 1000$ kg/m³

Phantom section: Right Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(8.2, 8.2, 8.2) @ 2000 MHz; Calibrated: 2023-03-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2023-01-11
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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

Reference Value = 104.2 V/m; Power Drift = 0.07 dB

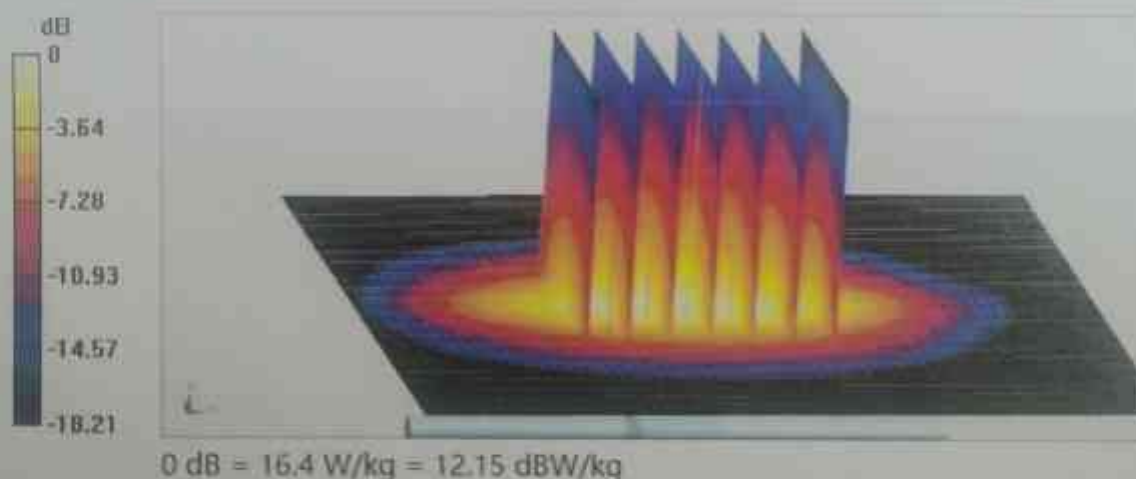
Peak SAR (extrapolated) = 19.7 W/kg

SAR(1 g) = 10.3 W/kg; SAR(10 g) = 5.21 W/kg

Smallest distance from peaks to all points 3 dB below = 9.5 mm

Ratio of SAR at M2 to SAR at M1 = 53%

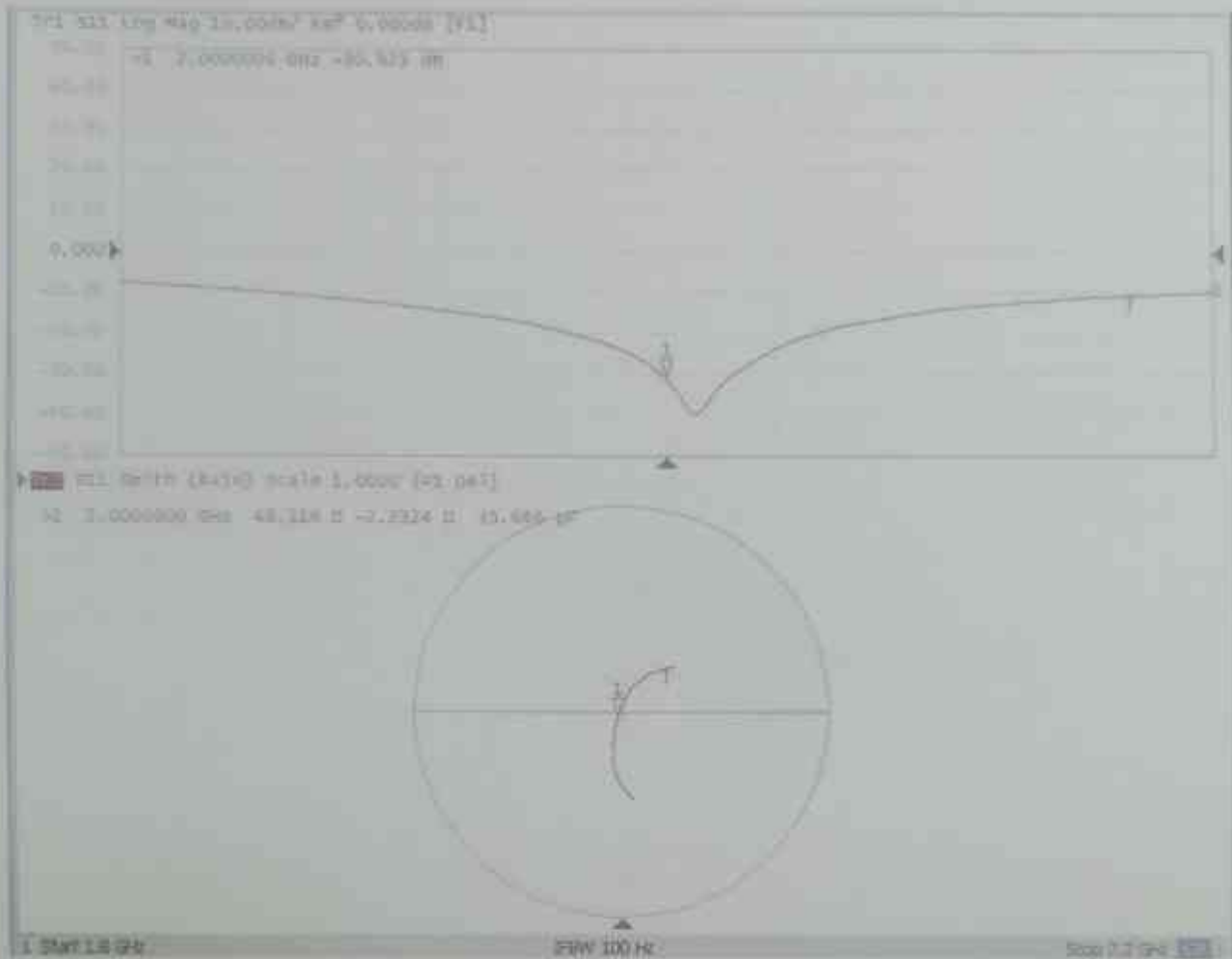
Maximum value of SAR (measured) = 16.4 W/kg





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Impedance Measurement Plot for Head TSL



Client **SRTC**

Certificate No: **23J02Z80089**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 738**

Calibration Procedure(s) **FF-Z11-003-01**
Calibration Procedures for dipole validation kits

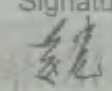
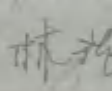
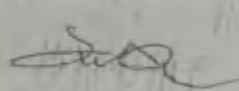
Calibration date: **October 23, 2023**

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22\pm3)^{\circ}\text{C}$ and humidity $<70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106276	15-May-23 (CTTL, No.J23X04183)	May-24
Power sensor NRP6A	101369	15-May-23 (CTTL, No.J23X04183)	May-24
Reference Probe EX3DV4	SN 3617	31-Mar-23(CTTL-SPEAG,No.Z23-60161)	Mar-24
DAE4	SN 1556	11-Jan-23(CTTL-SPEAG,No.Z23-60034)	Jan-24
Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	05-Jan-23 (CTTL, No. J23X00107)	Jan-24
NetworkAnalyzer E5071C	MY46110673	10-Jan-23 (CTTL, No. J23X00104)	Jan-24

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: October 31, 2023

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Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM _{x,y,z}
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY4/5 System Handbook

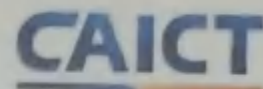
Methods Applied and Interpretation of Parameters:

- 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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<http://www.caict.ac.cn>**Measurement Conditions**

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

DASY Version	DASY52	52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz $\pm$ 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 $\pm$ 0.2) °C	39.6 $\pm$ 6 %	1.81 mho/m $\pm$ 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	13.5 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	53.9 W/kg $\pm$ 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.29 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	25.2 W/kg $\pm$ 18.7 % (k=2)



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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$52.1\Omega + 8.11j\Omega$
Return Loss	-24.0dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.063 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point 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 feed-point may be damaged.

Additional EUT Data

Manufactured by	SPEAG
-----------------	-------

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http://www.caict.ac.cn

DASY5 Validation Report for Head TSL

Date: 2023-10-23

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 738

Communication System: UID 0, CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.813$ S/m; $\epsilon_r = 39.57$; $\rho = 1000$ kg/m³

Phantom section: Right Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(7.68, 7.68, 7.68) @ 2450 MHz; Calibrated: 2023-03-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2023-01-11
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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

Reference Value = 100.8 V/m; Power Drift = -0.07 dB

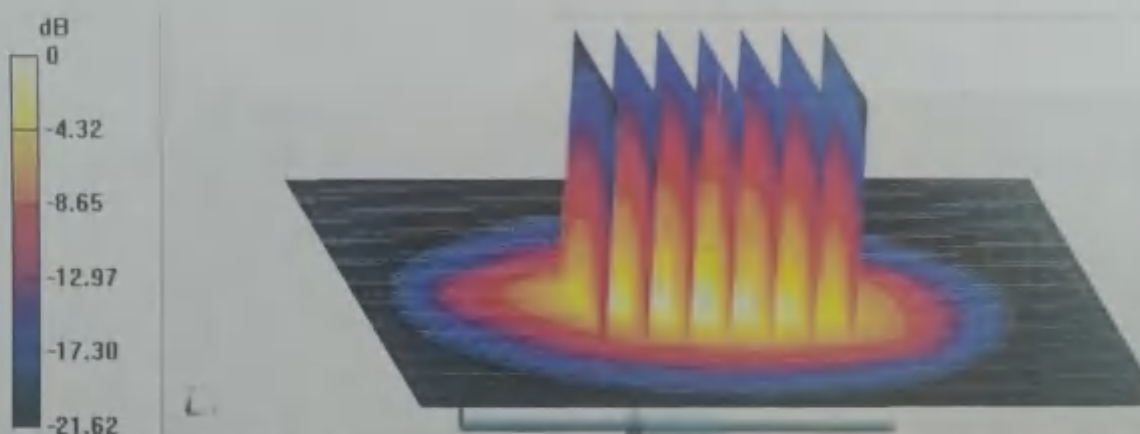
Peak SAR (extrapolated) = 27.9 W/kg

SAR(1 g) = 13.5 W/kg; SAR(10 g) = 6.29 W/kg

Smallest distance from peaks to all points 3 dB below = 8.5 mm

Ratio of SAR at M2 to SAR at M1 = 49.1%

Maximum value of SAR (measured) = 22.7 W/kg

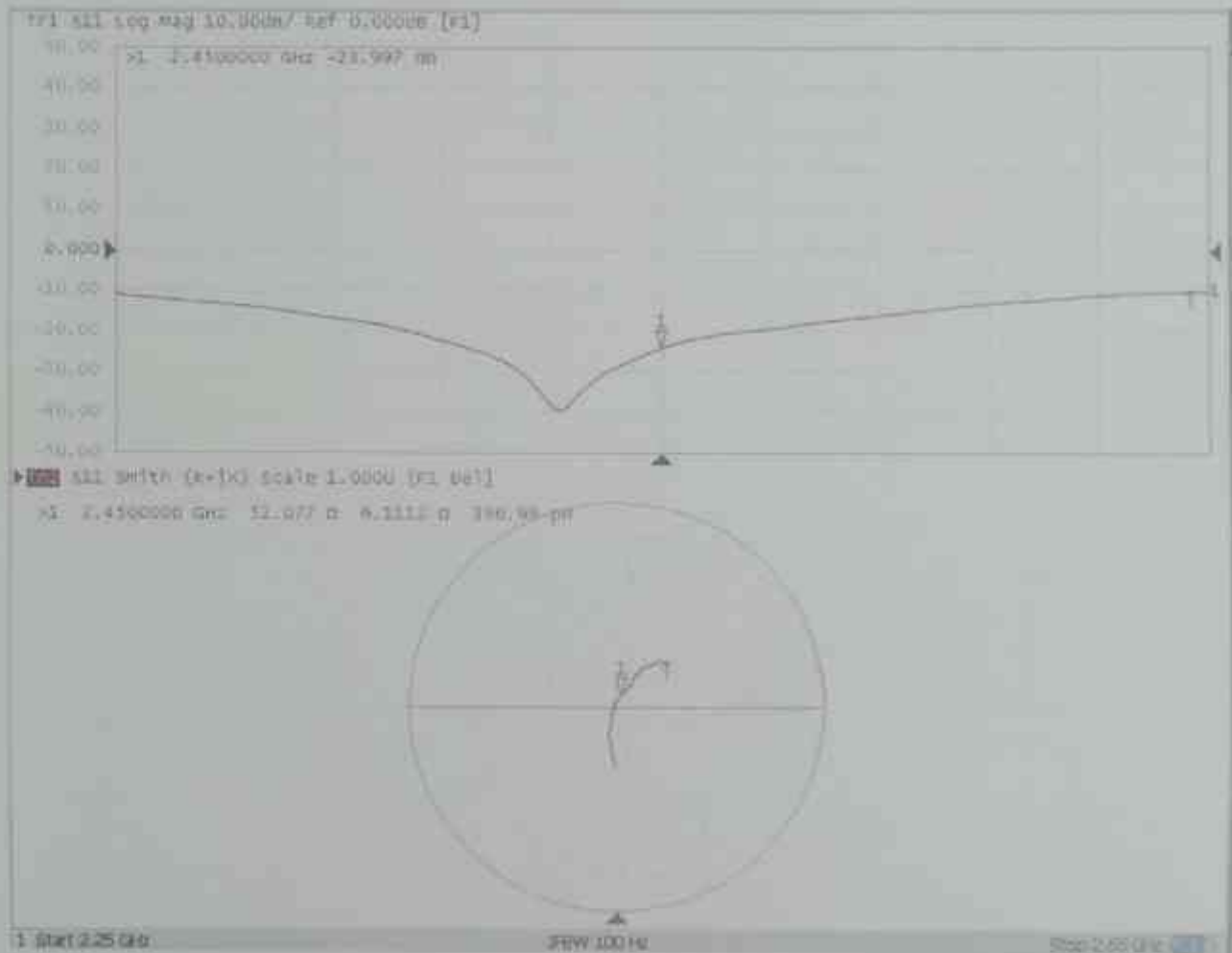


0 dB = 22.7 W/kg = 13.56 dBW/kg



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Impedance Measurement Plot for Head TSL



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Client **SRTC(Beijing)** Certificate No: **25J02Z000787**

CALIBRATION CERTIFICATE

Object D3500V2 - SN: 1090

Calibration Procedure(s) FF-Z11-0003-02
Calibration Procedures for dipole validation kits

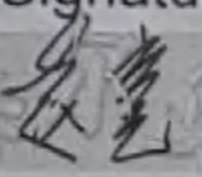
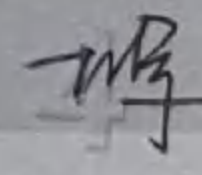
Calibration date: November 4, 2025

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106276	16-May-25 (CTTL, No. 25J02X003423)	May-26
Power sensor NRP6A	101369	16-May-25 (CTTL, No. 25J02X003423)	May-26
Reference Probe EX3DV4	SN 7464	28-Jan-25(SPEAG, No. EX-7464_Jan25)	Jan-26
DAE4	SN 1588	29-Aug-25(CTTL-SPEAG, No. 25J02Z000631)	Aug-26
Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
SignalGeneratorSMA200A	107732	22-Jan-25 (CTTL, No. 25J02X000388)	Jan-26
NetworkAnalyzer E5071C	MY46110673	18-Dec-24 (CTTL, No. 24J02X103932)	Dec-25
OCP DAK-3.5	1040	20-Jan-25(SPEAG, No. OCP-DAK3.5-1040_Jan25)	Jan-26

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Jun	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: November 10, 2025

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Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM _{x,y,z}
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY 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.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

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



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Measurement Conditions

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

DASY Version	DASY6	V17.0.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 5 mm, dz = 1.4 mm	Graded Ratio = 1.5 (Z direction)
Frequency	3500 MHz ± 1 MHz	

Head TSL parameters at 3500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	37.9	2.91 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.7 ± 6 %	2.89 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL at 3500 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	20 dBm input power	6.53 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	65.3 W/kg ± 24 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	20 dBm input power	2.48 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.8 W/kg ± 24 % (k=2)

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL at 3500 MHz

Impedance, transformed to feed point	49.5Ω+ 4.45jΩ
Return Loss	- 26.9dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.047 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point 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 feed-point may be damaged.

Additional EUT Data

Manufactured by	SPEAG
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DASY6 Validation Report for Head TSL
Test Laboratory: CTTL, Beijing, China

Date: 2025-11-04

Summary

Dipole	Frequency [MHz]	TSL	Power [dBm]
D3500V2 – SN 1090	3500	HSL	20

Exposure Conditions

Phantom	Position, Test	Band Group,	Frequency	Conversion	TSL Cond.	TSL
Section, TSL	Distance [mm]	UID	[MHz]	Factor	[S/m]	Permittivity
Flat	10	CW,	3500	6.43	2.89	37.7

Hardware Setup

Phantom	TSL	Probe, Calibration Date	DAE, Calibration Date
MFP V8.0 Right	HSL3500	EX3DV4 - SN7464, 2025-01-28	DAE4 Sn1588, 2025-08-29

Scan Setup

Measurement Results

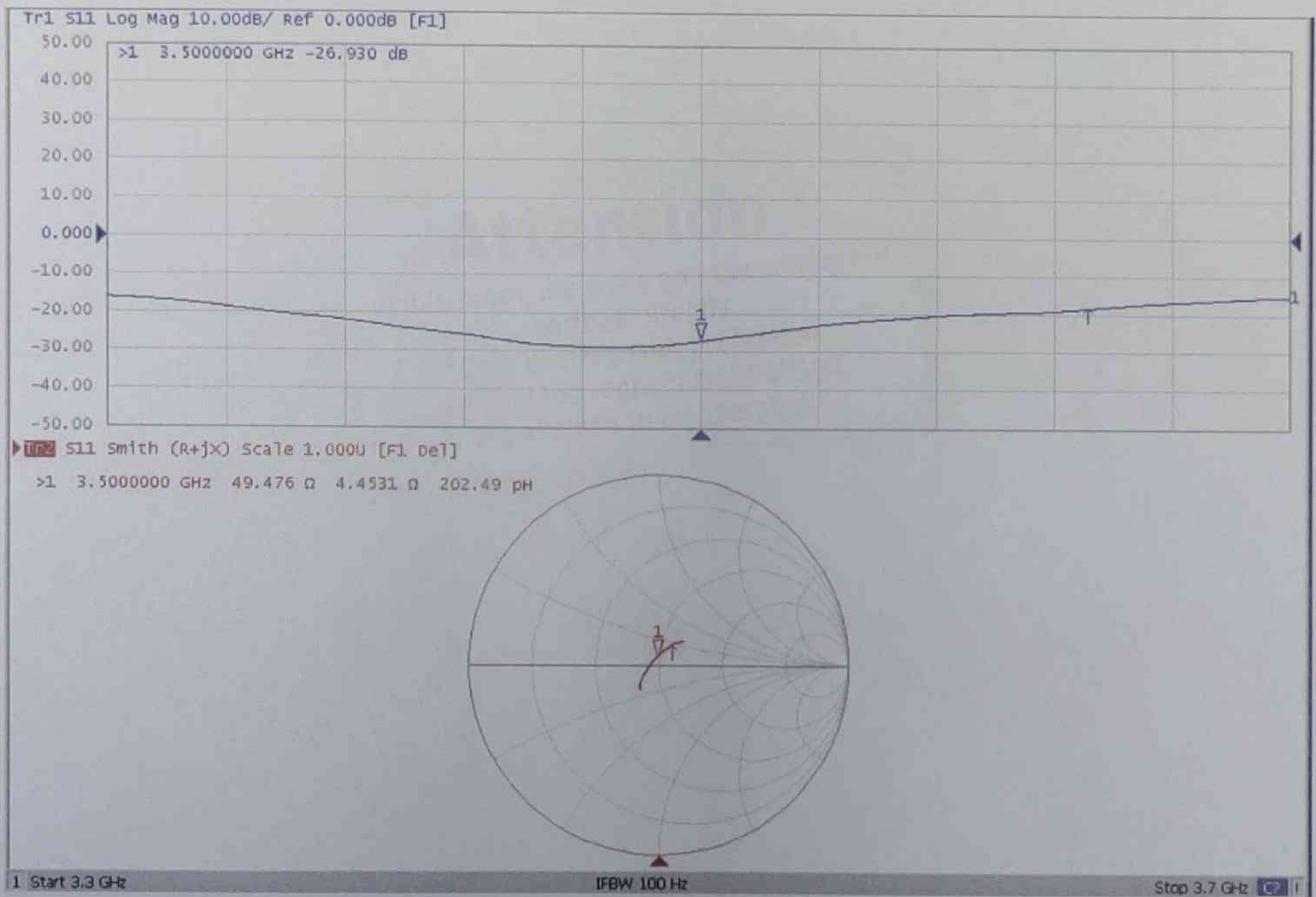
Zoom Scan		Zoom Scan	
Grid Extents [mm]	28.0×28.0×28.0	psSAR1g [W/kg]	6.53
Grid Steps [mm]	5.0×5.0×1.4	psSAR10g [W/kg]	2.48
Sensor Surface [mm]	1.4	Power Drift [dB]	0.00
Graded Grid	Yes	Power Scaling	Disabled
Grading Ratio	1.5	Scaling Factor [dB]	
MAIA	N/A	TSL Correction	No correction
Surface Detection	VMS + 6p	M2/M1 [%]	77.2
Scan Method	Measured	Dist 3dB Peak [mm]	8.0





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Impedance Measurement Plot for Head TSL



Client

SRTC(Beijing)

Certificate No:

25J02Z000788

CALIBRATION CERTIFICATE

ObjectD4200V2 - SN: 1013

Calibration Procedure(s)FF-Z11-0003-02
Calibration Procedures for dipole validation kits

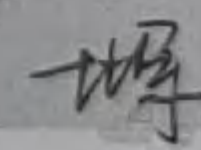
Calibration date:November 4, 2025

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106276	16-May-25 (CTTL, No. 25J02X003423)	May-26
Power sensor NRP6A	101369	16-May-25 (CTTL, No. 25J02X003423)	May-26
Reference Probe EX3DV4	SN 7464	28-Jan-25(SPEAG, No. EX-7464_Jan25)	Jan-26
DAE4	SN 1588	29-Aug-25(CTTL-SPEAG, No. 25J02Z000631)	Aug-26
Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
SignalGeneratorSMA200A	107732	22-Jan-25 (CTTL, No. 25J02X000388)	Jan-26
NetworkAnalyzer E5071C	MY46110673	18-Dec-24 (CTTL, No. 24J02X103932)	Dec-25
OCP DAK-3.5	1040	20-Jan-25(SPEAG, No. OCP-DAK3.5-1040_Jan25)	Jan-26

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Jun	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: November 10, 2025

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Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM _{x,y,z}
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY 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.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

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

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Measurement Conditions

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

DASY Version	DASY6	V17.0.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	4400 MHz ± 1 MHz	

Head TSL parameters at 4400 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	36.9	3.84 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.2± 6 %	3.83 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL at 4400 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	20 dBm input power	6.75 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	67.6 W/kg ± 24 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	20 dBm input power	2.24 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.4 W/kg ± 24 % (k=2)



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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL at 4400 MHz

Impedance, transformed to feed point	$55.6\Omega + 1.03j\Omega$
Return Loss	- 25.4dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.017 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point 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 feed-point may be damaged.

Additional EUT Data

Manufactured by	SPEAG
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DASY6 Validation Report for Head TSL
Test Laboratory: CTTL, Beijing, China

Date: 2025-11-04

Summary

Dipole	Frequency [MHz]	TSL	Power [dBm]
D4200V2 – SN 1013	4400	HSL	20

Exposure Conditions

Phantom	Position, Test	Band Group,	Frequency	Conversion	TSL Cond.	TSL
Section, TSL	Distance [mm]	UID	[MHz]	Factor	[S/m]	Permittivity
Flat	10	CW,	4400	5.99	3.83	37.2

Hardware Setup

Phantom	TSL	Probe, Calibration Date	DAE, Calibration Date
MFP V8.0 Right	HSL4G	EX3DV4 - SN7464, 2025-01-28	DAE4 Sn1588, 2025-08-29

Scan Setup

Measurement Results

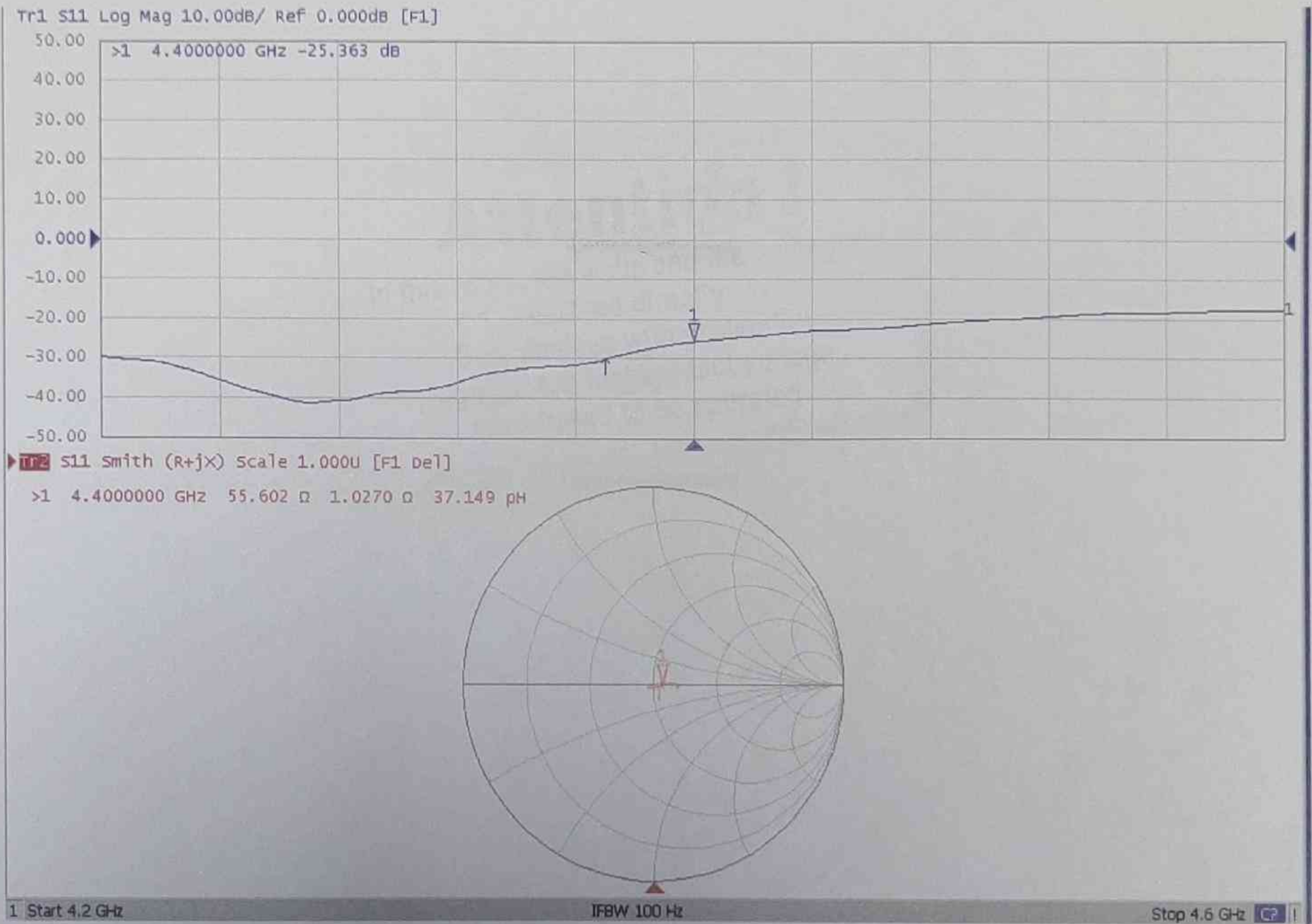
	Zoom Scan		Zoom Scan
Grid Extents [mm]	25.0×25.0×25.0	psSAR1g [W/kg]	6.75
Grid Steps [mm]	4.0×4.0×1.4	psSAR10g [W/kg]	2.24
Sensor Surface [mm]	1.4	Power Drift [dB]	0.00
Graded Grid	Yes	Power Scaling	Disabled
Grading Ratio	1.4	Scaling Factor [dB]	
MAIA	N/A	TSL Correction	No correction
Surface Detection	VMS + 6p	M2/M1 [%]	69.4
Scan Method	Measured	Dist 3dB Peak [mm]	7.9





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Impedance Measurement Plot for Head TSL



Client **SRTC**

Certificate No: **23J02Z80090**

CALIBRATION CERTIFICATE

Object **D5GHzV2 - SN: 1079**

Calibration Procedure(s) **FF-Z11-003-01**
Calibration Procedures for dipole validation kits

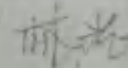
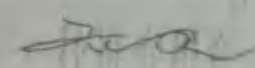
Calibration date: **October 17, 2023**

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22\pm3)^{\circ}\text{C}$ and humidity $<70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106276	15-May-23 (CTTL, No.J23X04183)	May-24
Power sensor NRP6A	101369	15-May-23 (CTTL, No.J23X04183)	May-24
Reference Probe EX3DV4	SN 3617	31-Mar-23(CTTL-SPEAG,No.Z23-60161)	Mar-24
DAE4	SN 1556	11-Jan-23(CTTL-SPEAG,No.Z23-60034)	Jan-24
Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	05-Jan-23 (CTTL, No. J23X00107)	Jan-24
Network Analyzer E5071C	MY46110673	10-Jan-23 (CTTL, No. J23X00104)	Jan-24

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: October 31, 2023

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Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM _{x,y,z}
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- 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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<http://www.caict.ac.cn>**Measurement Conditions**

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

DASY Version	DASY52	52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz $\pm$ 1 MHz 5300 MHz $\pm$ 1 MHz 5500 MHz $\pm$ 1 MHz 5600 MHz $\pm$ 1 MHz 5800 MHz $\pm$ 1 MHz	

Head TSL parameters at 5200MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	36.3 $\pm$ 6 %	4.67 mho/m $\pm$ 6 %
Head TSL temperature change during test	<1.0 °C	—	—

SAR result with Head TSL at 5200MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	7.83 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	78.4 W/kg $\pm$ 24.4 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.20 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.1 W/kg $\pm$ 24.2 % (k=2)



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Head TSL parameters at 5300MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.1 ± 6 %	4.79 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	—	—

SAR result with Head TSL at 5300MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.96 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	79.7 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.25 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.5 W/kg ± 24.2 % (k=2)

Head TSL parameters at 5500MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.8 ± 6 %	5.00 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	—	—

SAR result with Head TSL at 5500MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.27 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	82.8 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.31 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.1 W/kg ± 24.2 % (k=2)



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Head TSL parameters at 5600MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.6 ± 6 %	5.11 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	—	—

SAR result with Head TSL at 5600MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.13 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	81.4 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.29 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.9 W/kg ± 24.2 % (k=2)

Head TSL parameters at 5800MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.3 ± 6 %	5.31 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	—	—

SAR result with Head TSL at 5800MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.88 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	78.8 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.20 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.0 W/kg ± 24.2 % (k=2)

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL at 5200MHz

Impedance, transformed to feed point	50.5Ω- 9.26jΩ
Return Loss	- 20.7dB

Antenna Parameters with Head TSL at 5300MHz

Impedance, transformed to feed point	50.0Ω- 5.75jΩ
Return Loss	- 24.8dB

Antenna Parameters with Head TSL at 5500MHz

Impedance, transformed to feed point	54.4Ω- 4.97jΩ
Return Loss	- 23.9dB

Antenna Parameters with Head TSL at 5600MHz

Impedance, transformed to feed point	57.2Ω- 3.24jΩ
Return Loss	- 22.6dB

Antenna Parameters with Head TSL at 5800MHz

Impedance, transformed to feed point	56.9Ω- 5.03jΩ
Return Loss	- 22.0dB



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General Antenna Parameters and Design

Electrical Delay (one direction)	1.110 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point 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 feed-point may be damaged.

Additional EUT Data

Manufactured by	SPEAG
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DASY5 Validation Report for Head TSL

Date: 2023-10-17

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1079

Communication System: CW; Frequency: 5200 MHz, Frequency: 5300 MHz,

Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz

Medium parameters used: $f = 5200$ MHz; $\sigma = 4.67$ S/m; $\epsilon_r = 36.33$; $\rho = 1000$ kg/m³

Medium parameters used: $f = 5300$ MHz; $\sigma = 4.785$ S/m; $\epsilon_r = 36.13$; $\rho = 1000$ kg/m³

Medium parameters used: $f = 5500$ MHz; $\sigma = 4.996$ S/m; $\epsilon_r = 35.76$; $\rho = 1000$ kg/m³

Medium parameters used: $f = 5600$ MHz; $\sigma = 5.11$ S/m; $\epsilon_r = 35.61$; $\rho = 1000$ kg/m³

Medium parameters used: $f = 5800$ MHz; $\sigma = 5.308$ S/m; $\epsilon_r = 35.34$; $\rho = 1000$ kg/m³

Phantom section: Right Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(5.5, 5.5, 5.5) @ 5200 MHz; ConvF(5.5, 5.5, 5.5) @ 5300 MHz; ConvF(5.01, 5.01, 5.01) @ 5500 MHz; ConvF(5.01, 5.01, 5.01) @ 5600 MHz; ConvF(5.15, 5.15, 5.15) @ 5800 MHz; Calibrated: 2023-03-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2023-01-11
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration /Pin=100mW, d=10mm, f=5200 MHz/Zoom Scan,

dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 57.18 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 31.6 W/kg

SAR(1 g) = 7.83 W/kg; SAR(10 g) = 2.2 W/kg

Smallest distance from peaks to all points 3 dB below = 7.2 mm

Ratio of SAR at M2 to SAR at M1 = 65.3%

Maximum value of SAR (measured) = 18.5 W/kg

Dipole Calibration /Pin=100mW, d=10mm, f=5300 MHz/Zoom Scan,

dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 57.14 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 33.1 W/kg

SAR(1 g) = 7.96 W/kg; SAR(10 g) = 2.25 W/kg

Smallest distance from peaks to all points 3 dB below = 7.2 mm

Ratio of SAR at M2 to SAR at M1 = 64.4%

Maximum value of SAR (measured) = 19.1 W/kg

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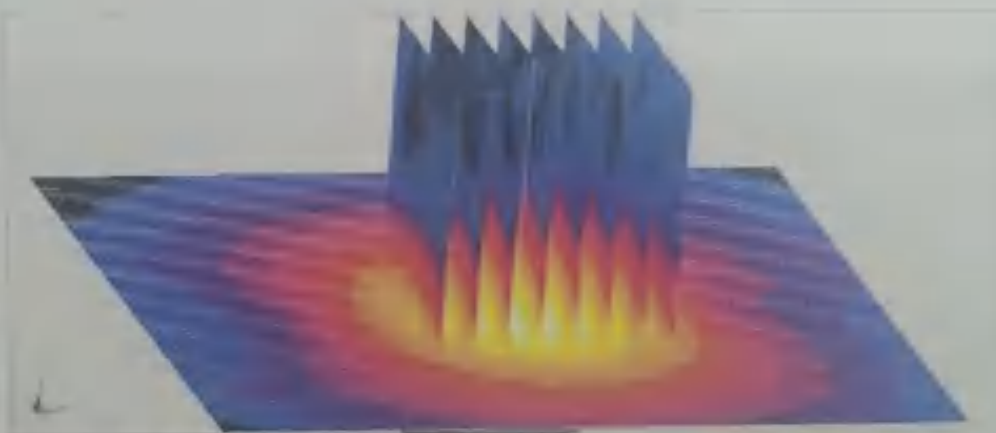
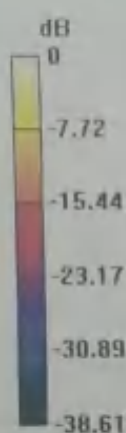
E-mail: emf@caict.ac.cn

http://www.caict.ac.cn

Dipole Calibration /Pin=100mW, d=10mm, f=5500 MHz/Zoom Scan,
dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
 Reference Value = 58.01 V/m; Power Drift = -0.06 dB
 Peak SAR (extrapolated) = 36.1 W/kg
SAR(1 g) = 8.27 W/kg; SAR(10 g) = 2.31 W/kg
 Smallest distance from peaks to all points 3 dB below = 7.4 mm
 Ratio of SAR at M2 to SAR at M1 = 62.9%
 Maximum value of SAR (measured) = 20.0 W/kg

Dipole Calibration /Pin=100mW, d=10mm, f=5600 MHz/Zoom Scan,
dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
 Reference Value = 56.92 V/m; Power Drift = -0.03 dB
 Peak SAR (extrapolated) = 36.4 W/kg
SAR(1 g) = 8.13 W/kg; SAR(10 g) = 2.29 W/kg
 Smallest distance from peaks to all points 3 dB below = 7.2 mm
 Ratio of SAR at M2 to SAR at M1 = 62%
 Maximum value of SAR (measured) = 19.8 W/kg

Dipole Calibration /Pin=100mW, d=10mm, f=5800 MHz/Zoom Scan,
dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
 Reference Value = 55.83 V/m; Power Drift = -0.04 dB
 Peak SAR (extrapolated) = 37.1 W/kg
SAR(1 g) = 7.88 W/kg; SAR(10 g) = 2.2 W/kg
 Smallest distance from peaks to all points 3 dB below = 7.4 mm
 Ratio of SAR at M2 to SAR at M1 = 60.6%
 Maximum value of SAR (measured) = 19.6 W/kg

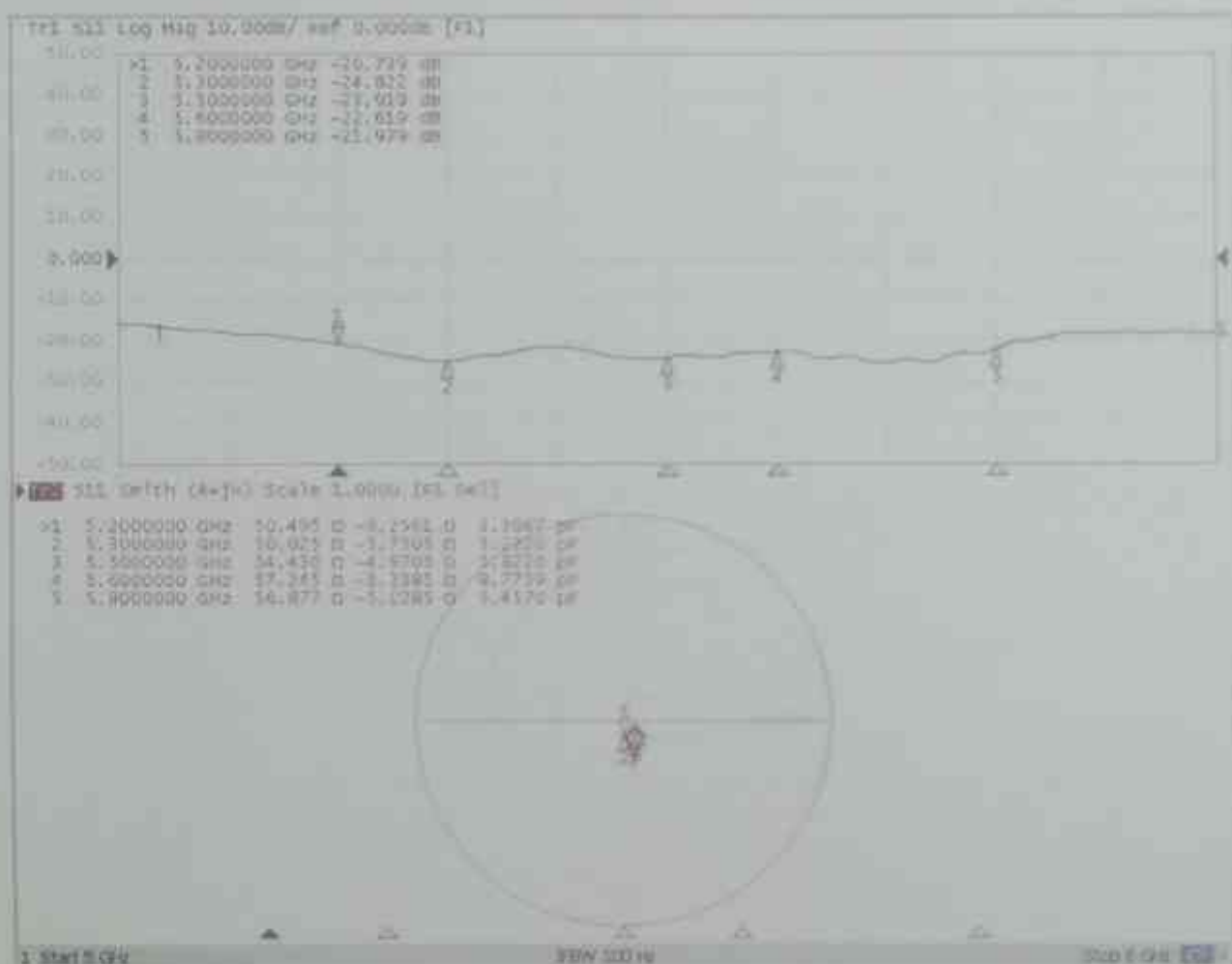


0 dB = 19.6 W/kg = 12.92 dBW/kg



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Impedance Measurement Plot for Head TSL



Client

SRTC(Beijing)

Certificate No:

25J02Z000789

CALIBRATION CERTIFICATE

Object D6.5GHzV2 - SN: 1055

Calibration Procedure(s) FF-Z11-0003-02
Calibration Procedures for dipole validation kits

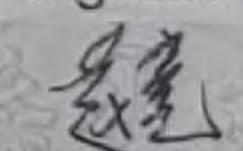
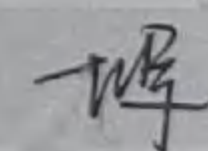
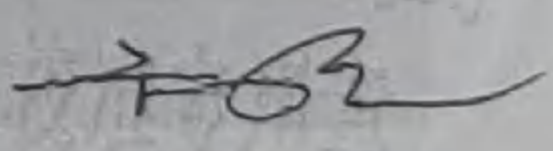
Calibration date: November 18, 2025

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106276	16-May-25 (CTTL, No. 25J02X003423)	May-26
Power sensor NRP50S	101488	30-May-25 (CTTL, No. 25J02X004289)	May-26
Reference Probe EX3DV4	SN 7464	28-Jan-25(SPEAG, No. EX-7464_Jan25)	Jan-26
DAE4	SN 1588	29-Aug-25(CTTL-SPEAG, No. 25J02Z000631)	Aug-26
Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
SignalGeneratorSMA200A	107732	22-Jan-25 (CTTL, No. 25J02X000388)	Jan-26
NetworkAnalyzer E5071C	MY46110673	18-Dec-24 (CTTL, No. 24J02X103932)	Dec-25
OCP DAK-3.5	1040	20-Jan-25(SPEAG, No. OCP-DAK3.5-1040_Jan25)	Jan-26

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Jun	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: November 24, 2025

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



In Collaboration with

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CALIBRATION LABORATORY



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Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM _{x,y,z}
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020

Additional Documentation:

- b) DASY 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.
- *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 absorbed power density (APD):* The absorbed power density is evaluated according to Samarasinghe T, Christ A, Kuster N, "Compliance assessment of the epithelial or absorbed power density above 6GHz using SAR measurement systems", Bioelectromagnetic, 2021 (submitted). The additional evaluation uncertainty of 0.55dB (rectangular distribution) is considered.

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



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Measurement Conditions

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

DASY Version	DASY6	V17.0.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	5 mm	with Spacer
Zoom Scan Resolution	dx, dy = 3.4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	6500 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	34.5	6.07 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	34.2 $\pm$ 6 %	6.01 mho/m $\pm$ 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	100 mW input power	31.2 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	311 W/kg $\pm$ 27 % (k=2)

SAR averaged over 8 cm ³ (8 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.01 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	69.9 W/kg $\pm$ 26 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	5.76 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	57.5 W/kg $\pm$ 26 % (k=2)

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.2Ω+ 2.06jΩ
Return Loss	- 32.6dB

APD (Absorbed Power Density)

APD averaged over 1cm ²	Condition	
APD Measured	100 mW input power	312 W/m ²
APD Measured	normalized to 1W	3120 W/m ² ± 31 % (k=2)

APD averaged over 4cm ²	Condition	
APD Measured	100 mW input power	140 W/m ²
APD Measured	normalized to 1W	1400 W/m ² ± 30 % (k=2)

*The reported APD values have been derived using psSAR8g.

General Antenna Parameters and Design

After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point 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 feed-point may be damaged.

Additional EUT Data

Manufactured by	SPEAG
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DASY6 Validation Report for Head TSL
 Test Laboratory: CTTL, Beijing, China

Date: 2025-11-18

Summary

Dipole	Frequency [MHz]	TSL	Power [dBm]
D6.5GHzV2 – SN 1055	6500	HSL	20

Exposure Conditions

Phantom Section, TSL	Position, Test Distance [mm]	Band Group, UID	Frequency [MHz]	Conversion Factor	TSL Cond. [S/m]	TSL Permittivity
Flat	5	CW,	6500	5.21	6.01	34.2

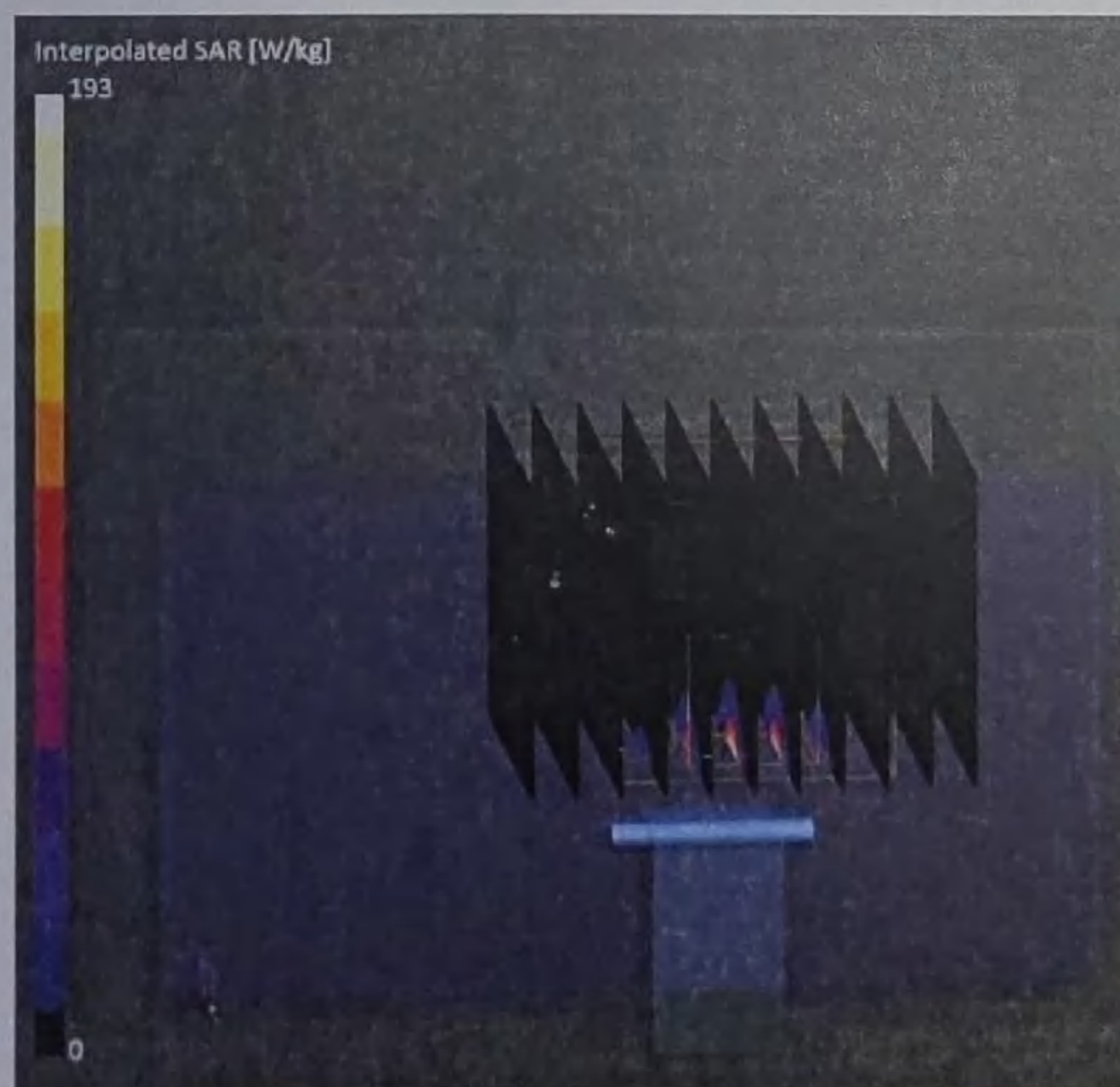
Hardware Setup

Phantom	TSL	Probe, Calibration Date	DAE, Calibration Date
MFP V8.0 Right	HSL6500	EX3DV4 - SN7464, 2025-01-28	DAE4 Sn1588, 2025-08-29

Scan Setup

Measurement Results

	Zoom Scan		Zoom Scan
Grid Extents [mm]	22.0×22.0×22.0	psSAR1g [W/kg]	31.2
Grid Steps [mm]	3.4 x 3.4 x 1.4	psSAR8g [W/kg]	7.01
Sensor Surface [mm]	1.4	psSAR10g [W/kg]	5.76
Graded Grid	Yes	Power Drift [dB]	-0.04
Grading Ratio	1.4	Power Scaling	Disabled
MAIA	N/A	Scaling Factor [dB]	
Surface Detection	All points	TSL Correction	No correction
Scan Method	Measured	M2/M1 [%]	50.1
		Dist 3dB Peak [mm]	4.8





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Impedance Measurement Plot for Head TSL

