

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China  
 Tel: +86-10-62304633-2117  
 E-mail: emf@caict.ac.cn <http://www.caict.ac.cn>



**Glossary:**

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

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

- a) 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	835 MHz ± 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	42.3 ± 6 %	0.92 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	---	---

### SAR result with Head TSL

SAR averaged over 1 $cm^3$ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.46 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.74 W/kg ± 18.8 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.62 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.43 W/kg ± 18.7 % (k=2)



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

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.8Ω- 3.20jΩ
Return Loss	- 29.9dB

#### General Antenna Parameters and Design

Electrical Delay (one direction)	1.300 ns
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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: 2024-05-08

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d187

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

Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.917$  S/m;  $\epsilon_r = 42.31$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3846; ConvF(8.5, 9.01, 9.47) @ 835 MHz; Calibrated: 2023-05-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2024-01-03
- 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 = 59.10 V/m; Power Drift = 0.00 dB

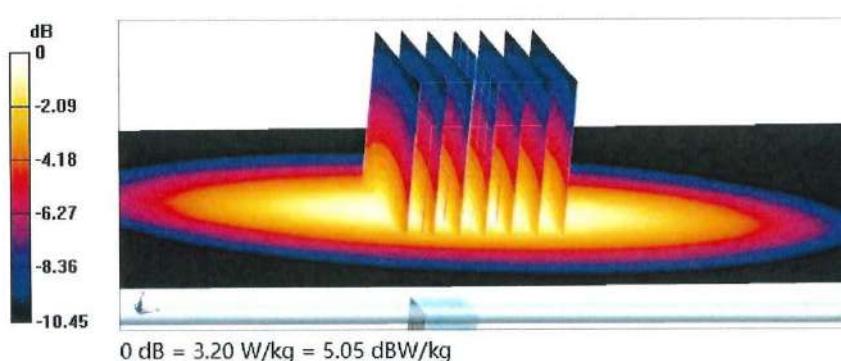
Peak SAR (extrapolated) = 3.51 W/kg

**SAR(1 g) = 2.46 W/kg; SAR(10 g) = 1.62 W/kg**

Smallest distance from peaks to all points 3 dB below = 16.2 mm

Ratio of SAR at M2 to SAR at M1 = 70%

Maximum value of SAR (measured) = 3.20 W/kg



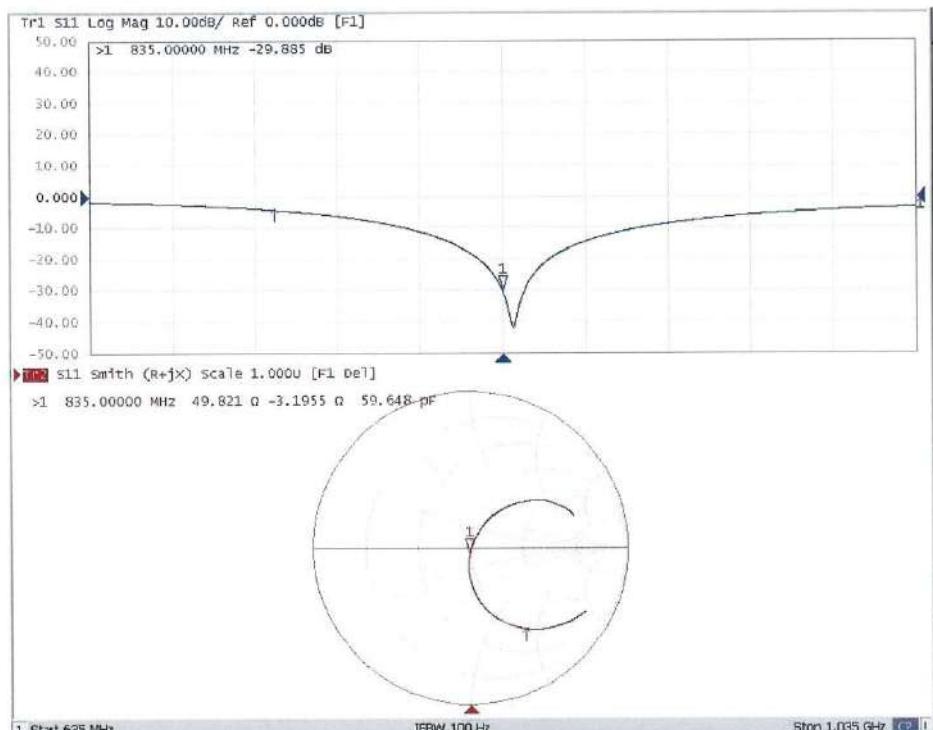


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### Impedance Measurement Plot for Head TSL



## F.7 1750 MHz Dipole



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Client Baluntek

Certificate No: 24J02Z000388

**CALIBRATION CERTIFICATE**

Object D1750V2 - SN: 1130

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

Calibration date: May 8, 2024

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&amp;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
ReferenceProbe EX3DV4	SN 3846	31-May-23(SPEAG, No.EX-3846_May23)	May-24
DAE4	SN 1556	03-Jan-24(CTTL-SPEAG, No.24J02Z80002)	Jan-25
Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	25-Dec-23 (CTTL, No. J23X13426)	Dec-24
NetworkAnalyzer E5071C	MY46110673	25-Dec-23 (CTTL, No. J23X13425)	Dec-24
OCP DAK-3.5(weighted)	1040	22-Jan-24(SPEAG, No.OCP-DAK3.5-1040_Jan24)	Jan-25

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

Issued: May 13, 2024

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



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

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

- a) 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.

<b>DASY Version</b>	DASY52	52.10.4
<b>Extrapolation</b>	Advanced Extrapolation	
<b>Phantom</b>	Triple Flat Phantom 5.1C	
<b>Distance Dipole Center - TSL</b>	10 mm	with Spacer
<b>Zoom Scan Resolution</b>	dx, dy, dz = 5 mm	
<b>Frequency</b>	1750 MHz ± 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Head TSL parameters</b>	22.0 °C	40.1	1.37 mho/m
<b>Measured Head TSL parameters</b>	(22.0 ± 0.2) °C	40.0 ± 6 %	1.35 mho/m ± 6 %
<b>Head TSL temperature change during test</b>	<1.0 °C	---	---

### SAR result with Head TSL

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b>	Condition	
SAR measured	250 mW input power	9.15 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	37.0 W/kg ± 18.8 % (k=2)
<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b>	Condition	
SAR measured	250 mW input power	4.90 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	19.7 W/kg ± 18.7 % (k=2)



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### Measurement Conditions

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

<b>DASY Version</b>	DASY52	52.10.4
<b>Extrapolation</b>	Advanced Extrapolation	
<b>Phantom</b>	Triple Flat Phantom 5.1C	
<b>Distance Dipole Center - TSL</b>	10 mm	with Spacer
<b>Zoom Scan Resolution</b>	dx, dy, dz = 5 mm	
<b>Frequency</b>	1750 MHz ± 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Head TSL parameters</b>	22.0 °C	40.1	1.37 mho/m
<b>Measured Head TSL parameters</b>	(22.0 ± 0.2) °C	40.0 ± 6 %	1.35 mho/m ± 6 %
<b>Head TSL temperature change during test</b>	<1.0 °C	---	---

### SAR result with Head TSL

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b>	Condition	
SAR measured	250 mW input power	9.15 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	37.0 W/kg ± 18.8 % (k=2)
<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b>	Condition	
SAR measured	250 mW input power	4.90 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	19.7 W/kg ± 18.7 % (k=2)



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

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	47.8Ω- 0.53jΩ
Return Loss	- 32.7dB

#### General Antenna Parameters and Design

Electrical Delay (one direction)	1.128 ns
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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: 2024-05-08

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1130

Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 1750$  MHz;  $\sigma = 1.348$  S/m;  $\epsilon_r = 40.02$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3846; ConvF(7.47, 7.79, 8.45) @ 1750 MHz; Calibrated: 2023-05-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2024-01-03
- 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 = 95.47 V/m; Power Drift = 0.01 dB

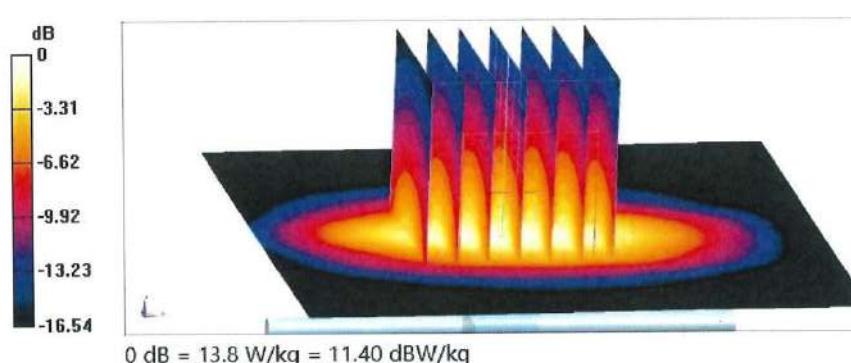
Peak SAR (extrapolated) = 16.2 W/kg

**SAR(1 g) = 9.15 W/kg; SAR(10 g) = 4.9 W/kg**

Smallest distance from peaks to all points 3 dB below = 9.8 mm

Ratio of SAR at M2 to SAR at M1 = 57.1%

Maximum value of SAR (measured) = 13.8 W/kg



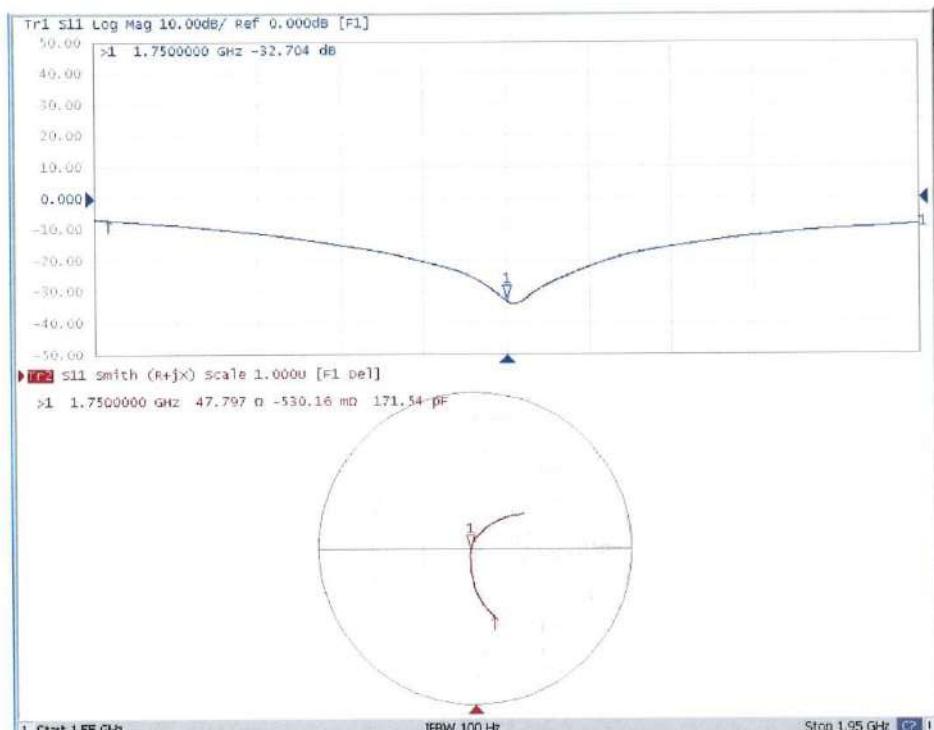


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### Impedance Measurement Plot for Head TSL



## F.8 1950 MHzDipole



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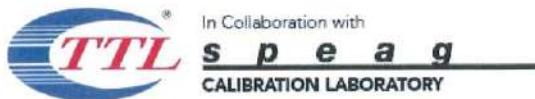


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 校准  
 CALIBRATION  
 CNAS L0570

Client: baluntek

Certificate No: 24J02Z000458

CALIBRATION CERTIFICATE				
Object	D1950V3 - SN: 1240			
Calibration Procedure(s)	FF-Z11-003-01 Calibration Procedures for dipole validation kits			
Calibration date:	August 22, 2024			
<p>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.</p> <p>All calibrations have been conducted in the closed laboratory facility: environment temperature (22±3)°C and humidity&lt;70%.</p> <p>Calibration Equipment used (M&amp;TE critical for calibration)</p>				
Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration	
Power Meter NRP2	106276	17-May-24 (CTTL, No. J24X04107)	May-25	
Power sensor NRP6A	101369	17-May-24 (CTTL, No. J24X04107)	May-25	
Reference Probe EX3DV4	SN 7464	22-Jan-24(SPEAG, No. EX-7464_Jan24)	Jan-25	
DAE4	SN 1556	03-Jan-24(CTTL-SPEAG, No.24J02Z80002)	Jan-25	
Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration	
Signal Generator E4438C	MY49071430	25-Dec-23 (CTTL, No. J23X13426)	Dec-24	
NetworkAnalyzer E5071C	MY46110673	25-Dec-23 (CTTL, No. J23X13425)	Dec-24	
OCP DAK-3.5(weighted)	1040	22-Jan-24(SPEAG, No.OCP-DAK3.5-1040_Jan24)	Jan-25	
Calibrated by:	Name	Function	Signature	
	Zhao Jing	SAR Test Engineer		
Reviewed by:	Lin Jun	SAR Test Engineer		
Approved by:	Qi Dianyuan	SAR Project Leader		
Issued: August 30, 2024				
<p>This calibration certificate shall not be reproduced except in full without written approval of the laboratory.</p>				



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**Glossary:**

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

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

- a) 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.

<b>DASY Version</b>	DASY52	52.10.4
<b>Extrapolation</b>	Advanced Extrapolation	
<b>Phantom</b>	Triple Flat Phantom 5.1C	
<b>Distance Dipole Center - TSL</b>	10 mm	with Spacer
<b>Zoom Scan Resolution</b>	dx, dy, dz = 5 mm	
<b>Frequency</b>	1950 MHz ± 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Head TSL parameters</b>	22.0 °C	40.0	1.40 mho/m
<b>Measured Head TSL parameters</b>	(22.0 ± 0.2) °C	41.1 ± 6 %	1.41 mho/m ± 6 %
<b>Head TSL temperature change during test</b>	<1.0 °C	---	---

### SAR result with Head TSL

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b>	Condition	
SAR measured	250 mW input power	10.4 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	41.7 W/kg ± 18.8 % (k=2)
<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b>	Condition	
SAR measured	250 mW input power	5.42 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	21.7 W/kg ± 18.7 % (k=2)



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

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	44.7Ω+ 1.82jΩ
Return Loss	- 24.5dB

#### General Antenna Parameters and Design

Electrical Delay (one direction)	1.099 ns
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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: 2024-08-22

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 1950 MHz; Type: D1950V2; Serial: D1950V2 - SN: 1240**

Communication System: UID 0, CW; Frequency: 1950 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 1950$  MHz;  $\sigma = 1.408$  S/m;  $\epsilon_r = 41.07$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(7.57, 7.71, 7.88) @ 1950 MHz; Calibrated: 2024-01-22
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2024-01-03
- 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 = 99.93 V/m; Power Drift = 0.01 dB

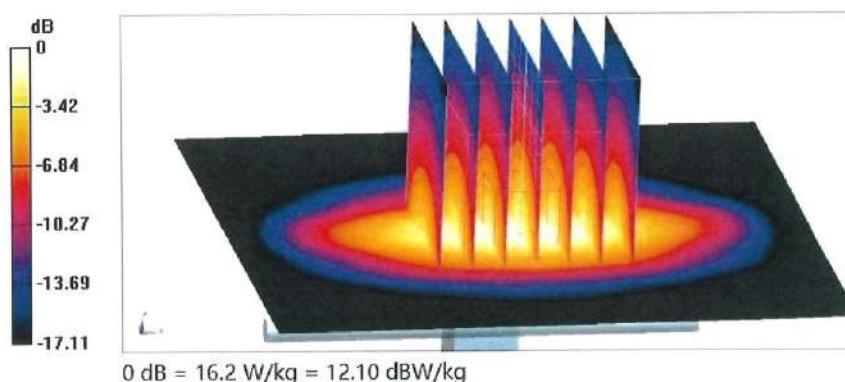
Peak SAR (extrapolated) = 19.0 W/kg

**SAR(1 g) = 10.4 W/kg; SAR(10 g) = 5.42 W/kg**

Smallest distance from peaks to all points 3 dB below = 9 mm

Ratio of SAR at M2 to SAR at M1 = 55.8%

Maximum value of SAR (measured) = 16.2 W/kg

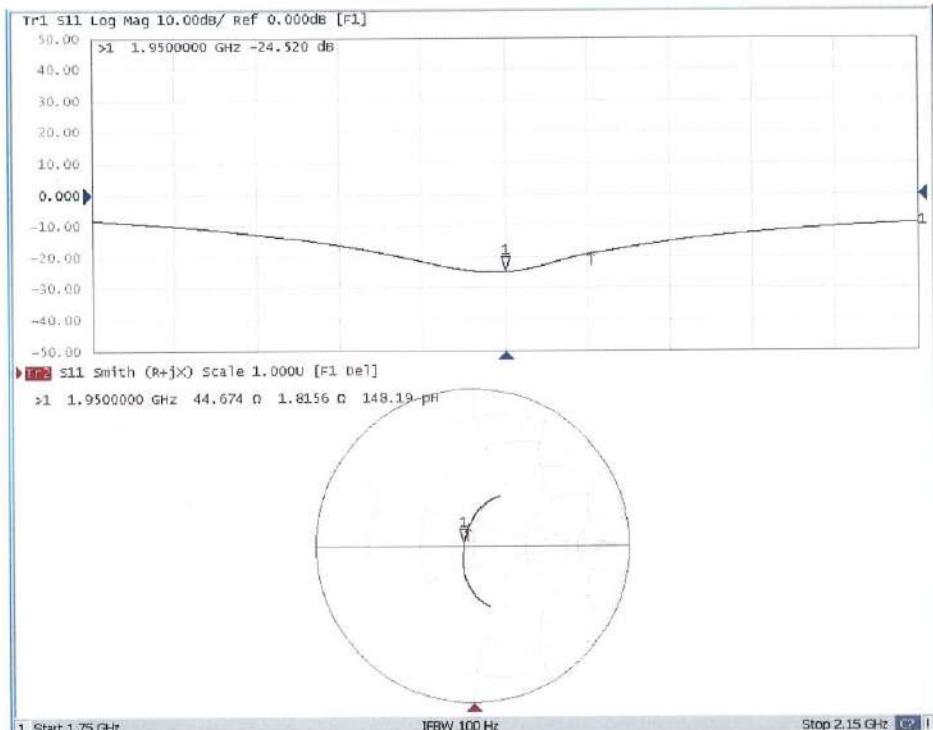




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### Impedance Measurement Plot for Head TSL



## F.9 2450 MHz Dipole



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Client **Baluntek**Certificate No: **24J02Z000389****CALIBRATION CERTIFICATE**Object **D2450V2 - SN: 952**Calibration Procedure(s) **FF-Z11-003-01**  
Calibration Procedures for dipole validation kitsCalibration date: **May 7, 2024**

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&amp;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
ReferenceProbe EX3DV4	SN 3846	31-May-23(SPEAG, No.EX-3846_May23)	May-24
DAE4	SN 1556	03-Jan-24(CTTL-SPEAG, No.24J02Z00002)	Jan-25
Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	25-Dec-23 (CTTL, No. J23X13426)	Dec-24
NetworkAnalyzer E5071C	MY46110673	25-Dec-23 (CTTL, No. J23X13425)	Dec-24
OCP DAK-3.5(weighted)	1040	22-Jan-24(SPEAG, No.OCP-DAK3.5-1040_Jan24)	Jan-25

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

Issued: May 13, 2024

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**Glossary:**

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

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

- a) 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	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.5 ± 6 %	1.79 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	---	---

### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	52.6 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.15 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.7 W/kg ± 18.7 % (k=2)



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

##### **Antenna Parameters with Head TSL**

Impedance, transformed to feed point	51.6Ω+ 3.78jΩ
Return Loss	- 27.9dB

##### **General Antenna Parameters and Design**

Electrical Delay (one direction)	1.068 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: 2024-05-07

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 952

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

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.792$  S/m;  $\epsilon_r = 39.47$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3846; ConvF(6.8, 7.06, 7.55) @ 2450 MHz; Calibrated: 2023-05-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2024-01-03
- 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 = 106.6 V/m; Power Drift = 0.05 dB

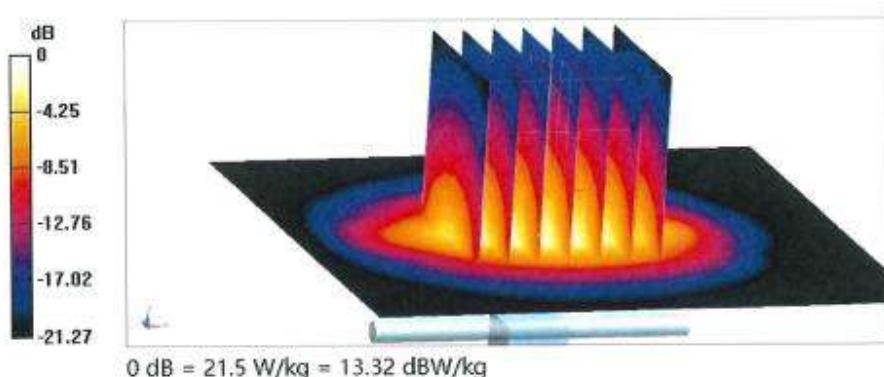
Peak SAR (extrapolated) = 25.9 W/kg

SAR(1 g) = 13.1 W/kg; SAR(10 g) = 6.15 W/kg

Smallest distance from peaks to all points 3 dB below = 9 mm

Ratio of SAR at M2 to SAR at M1 = 51.3%

Maximum value of SAR (measured) = 21.5 W/kg

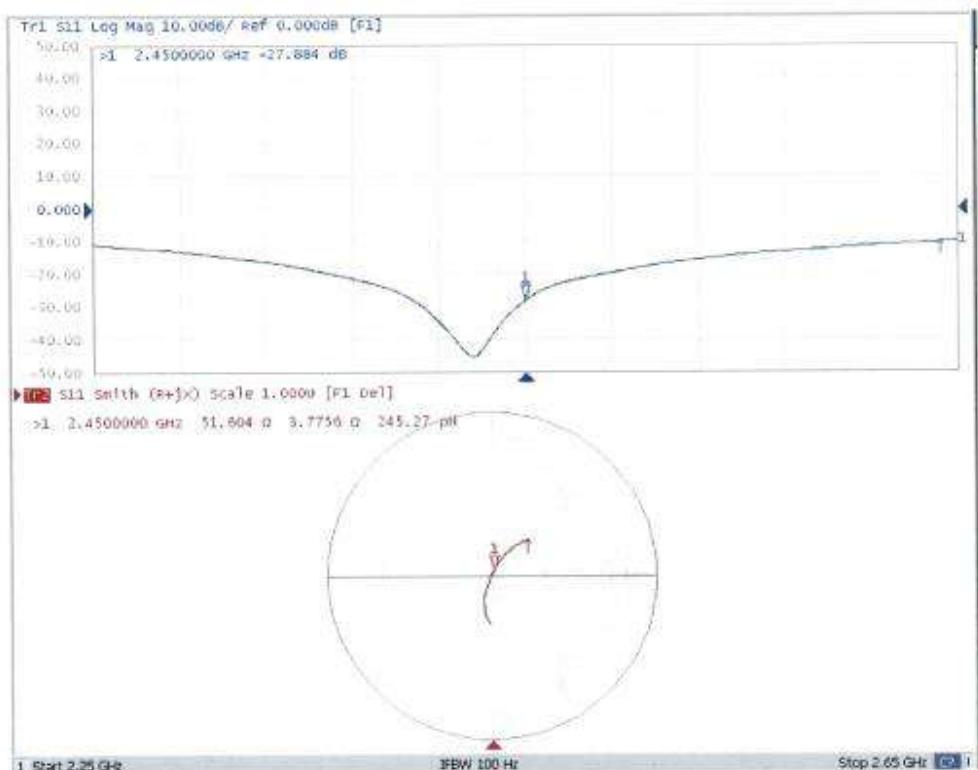




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### Impedance Measurement Plot for Head TSL



## F.10 2600 MHz Dipole



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CNAS L0570

**CAICT**

**Client:** Baluntek

**Certificate No:** 24J02Z000390

## CALIBRATION CERTIFICATE

Object D2600V2 - SN: 1095

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

Calibration date: May 8, 2024

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%.

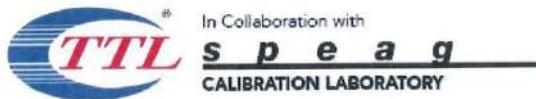
Calibration Equipment used (M&TE critical for calibration)

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
ReferenceProbe EX3DV4	SN 3846	31-May-23(SPEAG, No.EX-3846_May23)	May-24
DAE4	SN 1556	03-Jan-24(CTTL-SPEAG, No.24J02Z80002)	Jan-25
Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	25-Dec-23 (CTTL, No. J23X13426)	Dec-24
NetworkAnalyzer E5071C	MY46110673	25-Dec-23 (CTTL, No. J23X13425)	Dec-24
OCP DAK-3.5(weighted)	1040	22-Jan-24(SPEAG, No.OCP-DAK3.5-1040_Jan24)	Jan-25

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

Issued: May 13, 2024

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**Glossary:**

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

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

- a) 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.

<b>DASY Version</b>	DASY52	52.10.4
<b>Extrapolation</b>	Advanced Extrapolation	
<b>Phantom</b>	Triple Flat Phantom 5.1C	
<b>Distance Dipole Center - TSL</b>	10 mm	with Spacer
<b>Zoom Scan Resolution</b>	dx, dy, dz = 5 mm	
<b>Frequency</b>	2600 MHz ± 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Head TSL parameters</b>	22.0 °C	39.0	1.96 mho/m
<b>Measured Head TSL parameters</b>	(22.0 ± 0.2) °C	38.5 ± 6 %	1.99 mho/m ± 6 %
<b>Head TSL temperature change during test</b>	<1.0 °C	---	---

### SAR result with Head TSL

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b>	Condition	
SAR measured	250 mW input power	14.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	55.9 W/kg ± 18.8 % (k=2)
<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b>	Condition	
SAR measured	250 mW input power	6.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	25.4 W/kg ± 18.7 % (k=2)



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

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.2Ω- 4.78jΩ
Return Loss	- 25.7dB

#### General Antenna Parameters and Design

Electrical Delay (one direction)	1.057 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

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### DASY5 Validation Report for Head TSL

Date: 2024-05-08

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1095

Communication System: UID 0, CW; Frequency: 2600 MHz

Medium parameters used:  $f = 2600$  MHz;  $\sigma = 1.985$  S/m;  $\epsilon_r = 38.52$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3846; ConvF(6.72, 7.04, 7.5) @ 2600 MHz; Calibrated: 2023-05-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2024-01-03
- 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 = 96.20 V/m; Power Drift = -0.03 dB

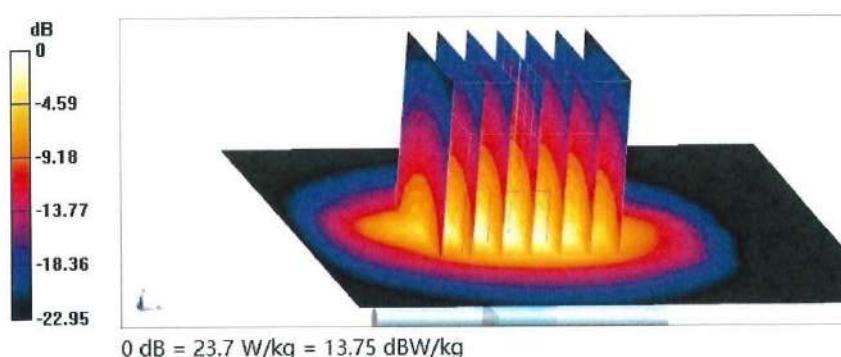
Peak SAR (extrapolated) = 29.2 W/kg

**SAR(1 g) = 14.1 W/kg; SAR(10 g) = 6.37 W/kg**

Smallest distance from peaks to all points 3 dB below = 8.9 mm

Ratio of SAR at M2 to SAR at M1 = 49.4%

Maximum value of SAR (measured) = 23.7 W/kg



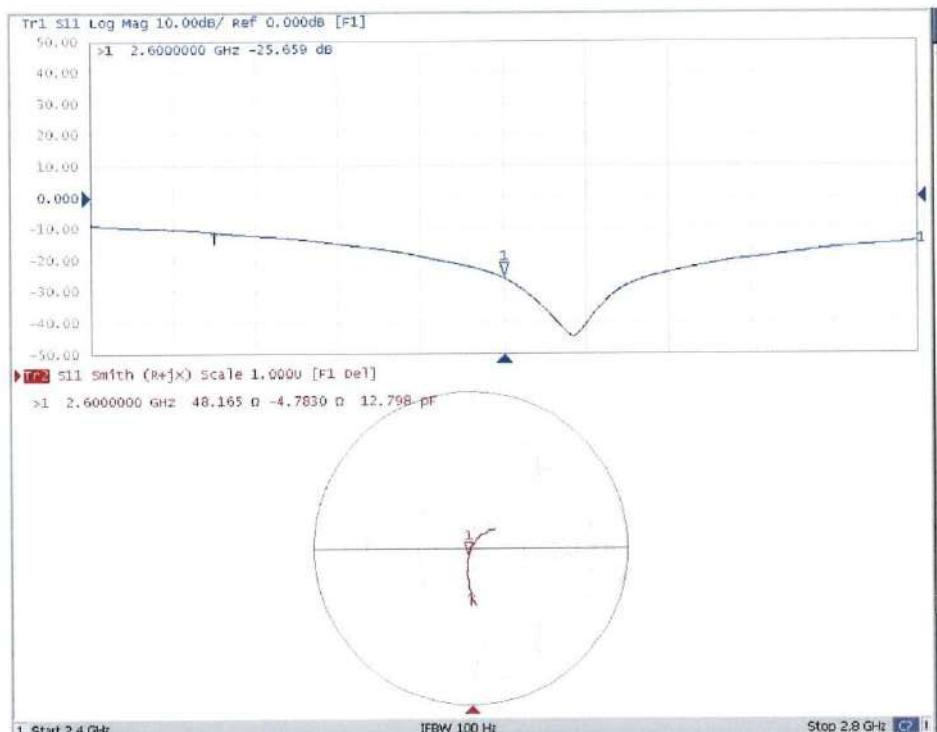


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### Impedance Measurement Plot for Head TSL



## F.11 3.5GHz Dipole



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 CNAS L0570

Client baluntek

Certificate No: 24J02Z000459

**CALIBRATION CERTIFICATE**

Object D3500V2 - SN: 1129

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

Calibration date: July 19, 2024

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&amp;TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106276	17-May-24 (CTTL, No. J24X04107)	May-25
Power sensor NRP6A	101369	17-May-24 (CTTL, No. J24X04107)	May-25
Reference Probe EX3DV4	SN 7464	22-Jan-24(SPEAG, No. EX-7464_Jan24)	Jan-25
DAE4	SN 1556	03-Jan-24(CTTL-SPEAG, No.24J02Z80002)	Jan-25
Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	25-Dec-23 (CTTL, No. J23X13426)	Dec-24
NetworkAnalyzer E5071C	MY46110673	25-Dec-23 (CTTL, No. J23X13425)	Dec-24
OCP DAK-3.5(weighted)	1040	22-Jan-24(SPEAG, No.OCP-DAK3.5-1040_Jan24)	Jan-25

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

Issued: July 26, 2024

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**Glossary:**

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

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

- a) 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.

<b>DASY Version</b>	DASY52	52.10.4
<b>Extrapolation</b>	Advanced Extrapolation	
<b>Phantom</b>	Triple Flat Phantom 5.1C	
<b>Distance Dipole Center - TSL</b>	10 mm	with Spacer
<b>Zoom Scan Resolution</b>	$dx, dy = 4 \text{ mm}, dz = 1.4 \text{ mm}$	Graded Ratio = 1.4 (Z direction)
<b>Frequency</b>	$3400 \text{ MHz} \pm 1 \text{ MHz}$ $3500 \text{ MHz} \pm 1 \text{ MHz}$	

### Head TSL parameters at 3400 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Head TSL parameters</b>	22.0 °C	38.0	2.81 mho/m
<b>Measured Head TSL parameters</b>	(22.0 ± 0.2) °C	38.6 ± 6 %	2.80 mho/m ± 6 %
<b>Head TSL temperature change during test</b>	<1.0 °C	---	---

### SAR result with Head TSL at 3400 MHz

<b>SAR averaged over 1 <math>\text{cm}^3</math> (1 g) of Head TSL</b>	Condition	
SAR measured	100 mW input power	6.65 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	66.8 W/kg ± 24.4 % (k=2)
<b>SAR averaged over 10 <math>\text{cm}^3</math> (10 g) of Head TSL</b>	Condition	
SAR measured	100 mW input power	2.56 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	25.7 W/kg ± 24.2 % (k=2)

### Head TSL parameters at 3500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Head TSL parameters</b>	22.0 °C	37.9	2.91 mho/m
<b>Measured Head TSL parameters</b>	(22.0 ± 0.2) °C	38.2 ± 6 %	2.88 mho/m ± 6 %
<b>Head TSL temperature change during test</b>	<1.0 °C	---	---

### SAR result with Head TSL at 3500 MHz

<b>SAR averaged over 1 <math>\text{cm}^3</math> (1 g) of Head TSL</b>	Condition	
SAR measured	100 mW input power	6.77 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	68.0 W/kg ± 24.4 % (k=2)
<b>SAR averaged over 10 <math>\text{cm}^3</math> (10 g) of Head TSL</b>	Condition	
SAR measured	100 mW input power	2.60 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	26.1 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 3400 MHz

Impedance, transformed to feed point	$41.1\Omega - 0.40j\Omega$
Return Loss	- 20.2dB

##### Antenna Parameters with Head TSL at 3500 MHz

Impedance, transformed to feed point	$48.4\Omega + 4.18j\Omega$
Return Loss	- 26.8dB

##### General Antenna Parameters and Design

Electrical Delay (one direction)	1.040 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

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### DASY5 Validation Report for Head TSL

Date: 2024-07-19

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 3500 MHz; Type: D3500V2; Serial: D3500V2 - SN: 1129**

Communication System: CW; Frequency: 3400 MHz, CW; Frequency: 3500 MHz,

Medium parameters used:  $f = 3400$  MHz;  $\sigma = 2.795$  S/m;  $\epsilon_r = 38.59$ ;  $\rho = 1000$  kg/m $^3$ ,

Medium parameters used:  $f = 3500$  MHz;  $\sigma = 2.88$  S/m;  $\epsilon_r = 38.24$ ;  $\rho = 1000$  kg/m $^3$ ,

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(6.74, 6.84, 6.97) @ 3400 MHz;  
 ConvF(6.73, 6.82, 6.94) @ 3500 MHz; Calibrated: 2024-01-22
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2024-01-03
- 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)

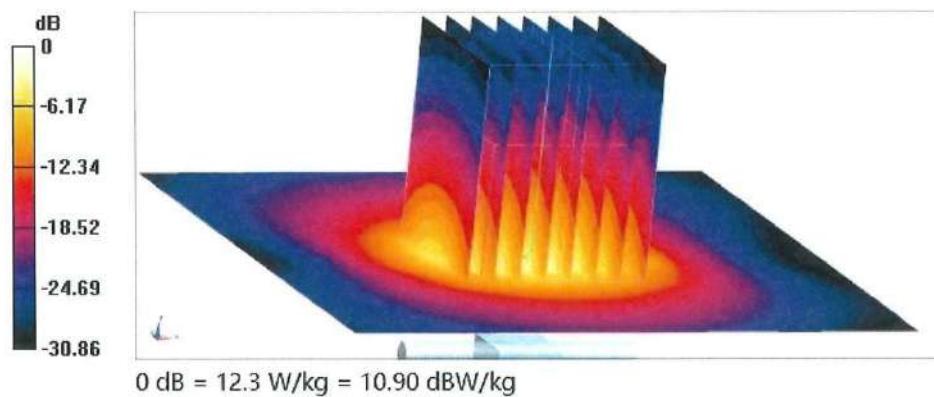
**Dipole Calibration /Pin=100mW, d=10mm, f=3400 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm  
 Reference Value = 65.78 V/m; Power Drift = -0.06 dB  
 Peak SAR (extrapolated) = 16.4 W/kg  
**SAR(1 g) = 6.65 W/kg; SAR(10 g) = 2.56 W/kg**  
 Smallest distance from peaks to all points 3 dB below = 8 mm  
 Ratio of SAR at M2 to SAR at M1 = 77.8%  
 Maximum value of SAR (measured) = 12.1 W/kg

**Dipole Calibration /Pin=100mW, d=10mm, f=3500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm  
 Reference Value = 67.72 V/m; Power Drift = -0.04 dB  
 Peak SAR (extrapolated) = 16.9 W/kg  
**SAR(1 g) = 6.77 W/kg; SAR(10 g) = 2.6 W/kg**  
 Smallest distance from peaks to all points 3 dB below = 8 mm  
 Ratio of SAR at M2 to SAR at M1 = 77.1%  
 Maximum value of SAR (measured) = 12.3 W/kg



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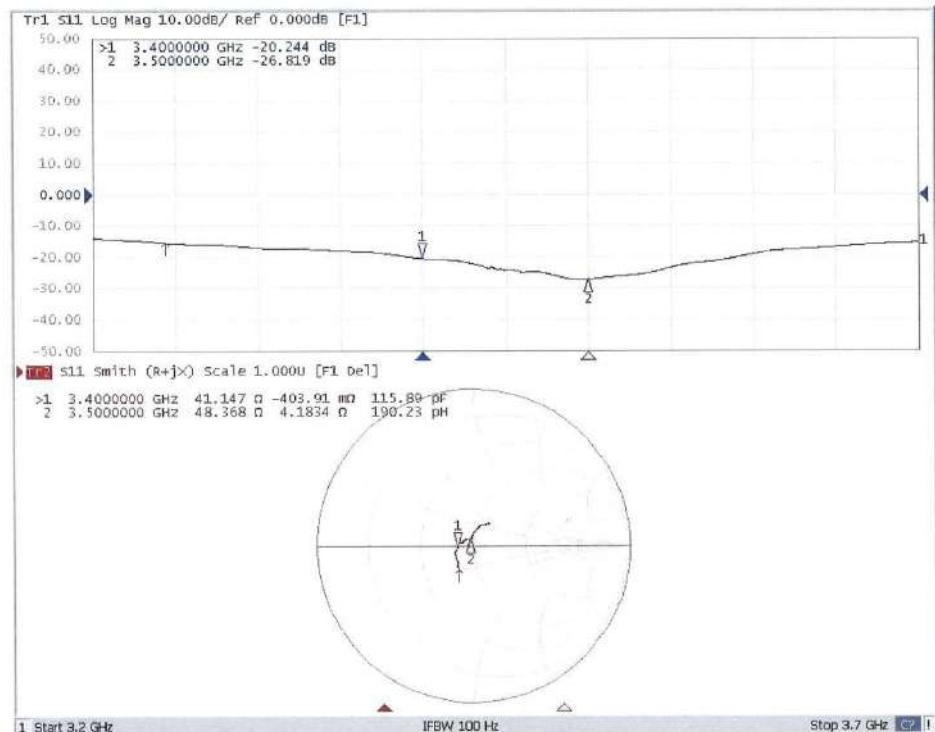




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### Impedance Measurement Plot for Head TSL



## F.123.7GHz Dipole



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Certificate No: 24J02Z000460

### CALIBRATION CERTIFICATE

Object D3700V2 - SN: 1101

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

Calibration date: July 18, 2024

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	17-May-24 (CTTL, No. J24X04107)	May-25
Power sensor NRP6A	101369	17-May-24 (CTTL, No. J24X04107)	May-25
Reference Probe EX3DV4	SN 7464	22-Jan-24(SPEAG, No. EX-7464_Jan24)	Jan-25
DAE4	SN 1556	03-Jan-24(CTTL-SPEAG, No.24J02Z80002)	Jan-25
Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	25-Dec-23 (CTTL, No. J23X13426)	Dec-24
NetworkAnalyzer E5071C	MY46110673	25-Dec-23 (CTTL, No. J23X13425)	Dec-24
OCP DAK-3.5(weighted)	1040	22-Jan-24(SPEAG, No.OCP-DAK3.5-1040_Jan24)	Jan-25

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

Issued: July 26, 2024

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**Glossary:**

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

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

- a) 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.

<b>DASY Version</b>	DASY52	52.10.4
<b>Extrapolation</b>	Advanced Extrapolation	
<b>Phantom</b>	Triple Flat Phantom 5.1C	
<b>Distance Dipole Center - TSL</b>	10 mm	with Spacer
<b>Zoom Scan Resolution</b>	dx, dy = 4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
<b>Frequency</b>	3700 MHz ± 1 MHz	

### Head TSL parameters at 3700 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Head TSL parameters</b>	22.0 °C	37.7	3.12 mho/m
<b>Measured Head TSL parameters</b>	(22.0 ± 0.2) °C	38.0 ± 6 %	3.15 mho/m ± 6 %
<b>Head TSL temperature change during test</b>	<1.0 °C	---	---

### SAR result with Head TSL at 3700 MHz

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b>	Condition	
SAR measured	100 mW input power	6.67 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	66.7 W/kg ± 24.4 % (k=2)
<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b>	Condition	
SAR measured	100 mW input power	2.46 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.6 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 3700 MHz

Impedance, transformed to feed point	46.7Ω + 2.82jΩ
Return Loss	- 26.9dB

#### General Antenna Parameters and Design

Electrical Delay (one direction)	1.035 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

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### DASY5 Validation Report for Head TSL

Date: 2024-07-18

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 3700 MHz; Type: D3700V2; Serial: D3700V2 - SN: 1101

Communication System: UID 0, CW; Frequency: 3700 MHz;

Medium parameters used:  $f = 3700$  MHz;  $\sigma = 3.147$  S/m;  $\epsilon_r = 38.02$ ;  $\rho = 1000$  kg/m<sup>3</sup>

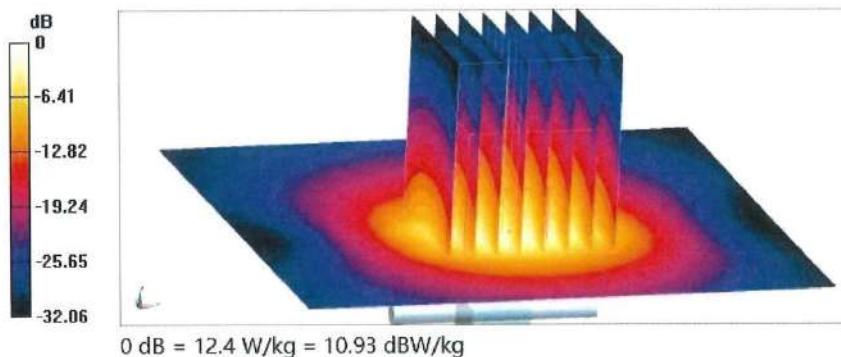
Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(6.48, 6.59, 6.69) @ 3700 MHz;  
 Calibrated: 2024-01-22
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2024-01-03
- Phantom: MFP\_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial:  
 1062
- DASY5 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration /Pin=100mW, d=10mm, f=3700 MHz/Zoom Scan,  
 dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm  
 Reference Value = 51.47 V/m; Power Drift = -0.06 dB  
 Peak SAR (extrapolated) = 17.6 W/kg  
**SAR(1 g) = 6.67 W/kg; SAR(10 g) = 2.46 W/kg**  
 Smallest distance from peaks to all points 3 dB below = 8 mm  
 Ratio of SAR at M2 to SAR at M1 = 76.1%  
 Maximum value of SAR (measured) = 12.4 W/kg

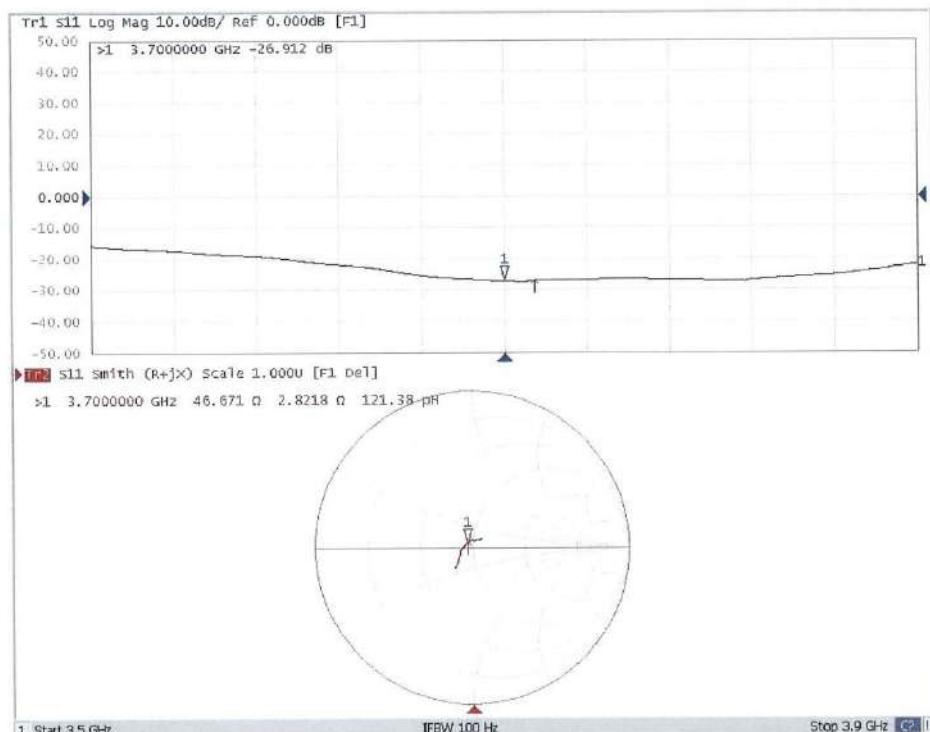




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### Impedance Measurement Plot for Head TSL



Certificate No: 24J02Z000460

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## F.133.9GHz Dipole



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Certificate No: 24J02Z000461

**CALIBRATION CERTIFICATE**

Object D3900V2 - SN: 1077

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

Calibration date: July 19, 2024

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&amp;TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106276	17-May-24 (CTTL, No. J24X04107)	May-25
Power sensor NRP6A	101369	17-May-24 (CTTL, No. J24X04107)	May-25
Reference Probe EX3DV4	SN 7464	22-Jan-24(SPEAG, No. EX-7464_Jan24)	Jan-25
DAE4	SN 1556	03-Jan-24(CTTL-SPEAG, No.24J02Z80002)	Jan-25
Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	25-Dec-23 (CTTL, No. J23X13426)	Dec-24
NetworkAnalyzer E5071C	MY46110673	25-Dec-23 (CTTL, No. J23X13425)	Dec-24
OCP DAK-3.5(weighted)	1040	22-Jan-24(SPEAG, No.OCP-DAK3.5-1040_Jan24)	Jan-25

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

Issued: July 26, 2024

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**Glossary:**

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

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

- a) 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.

<b>DASY Version</b>	DASY52		52.10.4
<b>Extrapolation</b>	Advanced Extrapolation		
<b>Phantom</b>	Triple Flat Phantom 5.1C		
<b>Distance Dipole Center - TSL</b>	10 mm		with Spacer
<b>Zoom Scan Resolution</b>	dx, dy = 4 mm, dz = 1.4 mm		Graded Ratio = 1.4 (Z direction)
<b>Frequency</b>	3900 MHz $\pm$ 1 MHz 4100 MHz $\pm$ 1 MHz		

### Head TSL parameters at 3900MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Head TSL parameters</b>	22.0 °C	37.5	3.32 mho/m
<b>Measured Head TSL parameters</b>	(22.0 $\pm$ 0.2) °C	37.5 $\pm$ 6 %	3.29 mho/m $\pm$ 6 %
<b>Head TSL temperature change during test</b>	<1.0 °C	---	---

### SAR result with Head TSL at 3900MHz

SAR averaged over 1 $cm^3$ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	6.75 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	67.6 W/kg $\pm$ 24.4 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.36 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.6 W/kg $\pm$ 24.2 % (k=2)

### Head TSL parameters at 4100MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Head TSL parameters</b>	22.0 °C	37.2	3.53 mho/m
<b>Measured Head TSL parameters</b>	(22.0 $\pm$ 0.2) °C	37.0 $\pm$ 6 %	3.48 mho/m $\pm$ 6 %
<b>Head TSL temperature change during test</b>	<1.0 °C	---	---

### SAR result with Head TSL at 4100MHz

SAR averaged over 1 $cm^3$ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	6.77 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	67.8 W/kg $\pm$ 24.4 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.36 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.6 W/kg $\pm$ 24.2 % (k=2)



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

#### Antenna Parameters with Head TSL at 3900MHz

Impedance, transformed to feed point	47.4Ω- 3.81jΩ
Return Loss	- 26.6dB

#### Antenna Parameters with Head TSL at 4100MHz

Impedance, transformed to feed point	59.5Ω+ 3.70jΩ
Return Loss	- 20.6dB

#### General Antenna Parameters and Design

Electrical Delay (one direction)	1.009 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

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### DASY5 Validation Report for Head TSL

Date: 2024-07-19

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 3900 MHz; Type: D3900V2; Serial: D3900V2 - SN: 1077**

Communication System: UID 0, CW; Frequency: 3900 MHz; Frequency: 4100 MHz;

Medium parameters used:  $f = 3900 \text{ MHz}$ ;  $\sigma = 3.29 \text{ S/m}$ ;  $\epsilon_r = 37.53$ ;  $\rho = 1000 \text{ kg/m}^3$

Medium parameters used:  $f = 4100 \text{ MHz}$ ;  $\sigma = 3.474 \text{ S/m}$ ;  $\epsilon_r = 37.01$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(6.74, 6.84, 6.96) @ 3900 MHz;  
 ConvF(6.72, 6.83, 6.93) @ 4100 MHz; Calibrated: 2024-01-22
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2024-01-03
- 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=3900 MHz/Zoom Scan,  
 dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm,  
 dz=1.4mm**

Reference Value = 56.58 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 18.8 W/kg

**SAR(1 g) = 6.75 W/kg; SAR(10 g) = 2.36 W/kg**

Smallest distance from peaks to all points 3 dB below = 7.9 mm

Ratio of SAR at M2 to SAR at M1 = 74.9%

Maximum value of SAR (measured) = 13.0 W/kg

**Dipole Calibration /Pin=100mW, d=10mm, f=4100 MHz/Zoom Scan,  
 dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm**

Reference Value = 61.50 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 19.4 W/kg

**SAR(1 g) = 6.77 W/kg; SAR(10 g) = 2.36 W/kg**

Smallest distance from peaks to all points 3 dB below = 7.9 mm

Ratio of SAR at M2 to SAR at M1 = 73.6%

Maximum value of SAR (measured) = 13.6 W/kg



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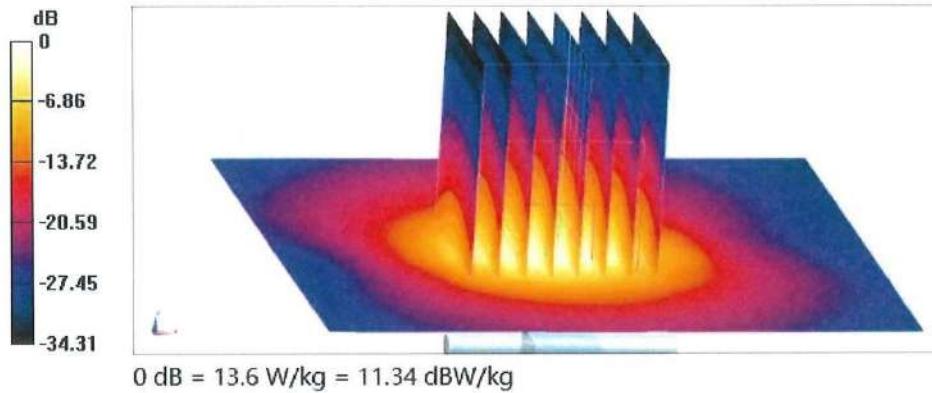


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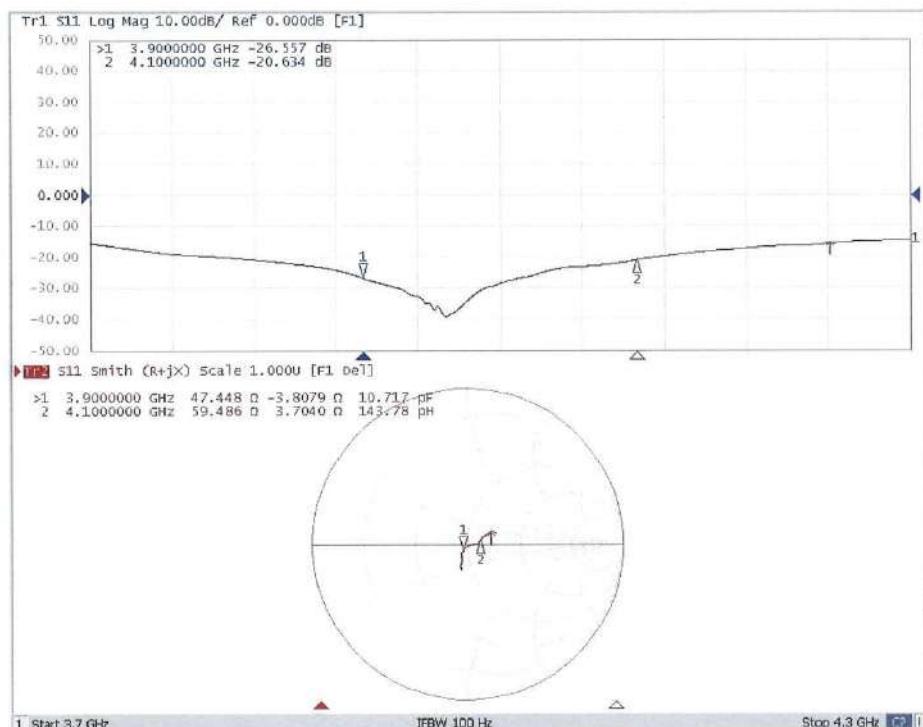




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### Impedance Measurement Plot for Head TSL



## F.14 5GHz Dipole



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Client Baluntek

Certificate No: 24J02Z000391

**CALIBRATION CERTIFICATE**

Object D5GHzV2 - SN: 1200

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

Calibration date: May 9, 2024

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&amp;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
ReferenceProbe EX3DV4	SN 3846	31-May-23(SPEAG, No.EX-3846_May23)	May-24
DAE4	SN 1556	03-Jan-24(CTTL-SPEAG, No.24J02Z80002)	Jan-25
Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	25-Dec-23 (CTTL, No. J23X13426)	Dec-24
NetworkAnalyzer E5071C	MY461110673	25-Dec-23 (CTTL, No. J23X13425)	Dec-24
OCP DAK-3.5(weighted)	1040	22-Jan-24(SPEAG, No.OCP-DAK3.5-1040_Jan24)	Jan-25

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

Issued: May 13, 2024

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



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**Glossary:**

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

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

- a) 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	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5250 MHz ± 1 MHz 5600 MHz ± 1 MHz 5750 MHz ± 1 MHz	

### Head TSL parameters at 5250MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.71 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.0 ± 6 %	4.64 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	---	---

### SAR result with Head TSL at 5250MHz

SAR averaged over 1 $cm^3$ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.77 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	77.7 W/kg ± 24.4 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.20 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.0 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	35.4 ± 6 %	5.01 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	8.14 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	81.3 W/kg ± 24.4 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.31 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.1 W/kg ± 24.2 % (k=2)

### Head TSL parameters at 5750MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.4	5.22 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.2 ± 6 %	5.17 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	—	—

### SAR result with Head TSL at 5750MHz

SAR averaged over 1 $cm^3$ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.77 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	77.6 W/kg ± 24.4 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.19 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	21.9 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 5250MHz

Impedance, transformed to feed point	44.6Ω+ 1.50jΩ
Return Loss	- 24.6dB

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

Impedance, transformed to feed point	49.2Ω+ 8.48jΩ
Return Loss	- 21.4dB

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

Impedance, transformed to feed point	46.4Ω+ 5.71jΩ
Return Loss	- 23.1dB

##### General Antenna Parameters and Design

Electrical Delay (one direction)	1.097 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: 2024-05-09

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1200**

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

Frequency: 5750 MHz

Medium parameters used:  $f = 5250$  MHz;  $\sigma = 4.637$  S/m;  $\epsilon_r = 36.01$ ;  $\rho = 1000$  kg/m<sup>3</sup>Medium parameters used:  $f = 5600$  MHz;  $\sigma = 5.011$  S/m;  $\epsilon_r = 35.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>Medium parameters used:  $f = 5750$  MHz;  $\sigma = 5.173$  S/m;  $\epsilon_r = 35.18$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3846; ConvF(5.05, 5.27, 5.51) @ 5250 MHz;  
 ConvF(4.27, 4.47, 4.7) @ 5600 MHz; ConvF(4.54, 4.76, 4.98) @ 5750 MHz;  
 Calibrated: 2023-05-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2024-01-03
- 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=5250 MHz/Zoom Scan,  
 dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 56.74 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 31.3 W/kg

**SAR(1 g) = 7.77 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 = 64.6%

Maximum value of SAR (measured) = 18.6 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 = 56.54 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 36.0 W/kg

**SAR(1 g) = 8.14 W/kg; SAR(10 g) = 2.31 W/kg**

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

Ratio of SAR at M2 to SAR at M1 = 61.7%

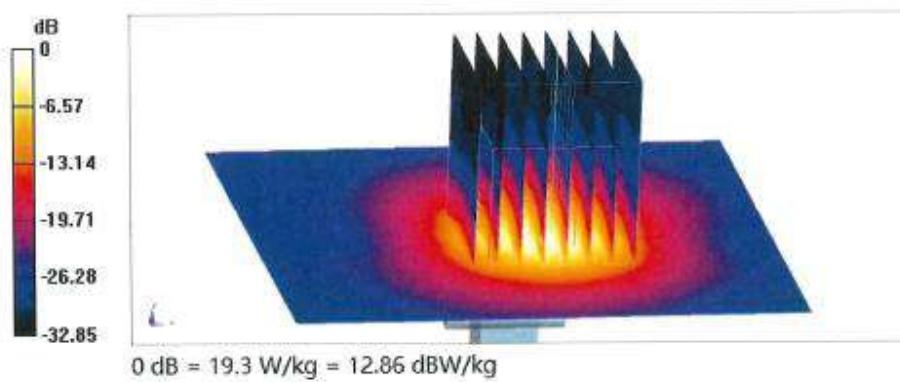
Maximum value of SAR (measured) = 19.9 W/kg



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**Dipole Calibration /Pin=100mW, d=10mm, f=5750 MHz/Zoom Scan,  
dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm  
Reference Value = 54.93 V/m; Power Drift = -0.04 dB  
Peak SAR (extrapolated) = 35.2 W/kg  
**SAR(1 g) = 7.77 W/kg; SAR(10 g) = 2.19 W/kg**  
Smallest distance from peaks to all points 3 dB below = 7.2 mm  
Ratio of SAR at M2 to SAR at M1 = 61%  
Maximum value of SAR (measured) = 19.3 W/kg

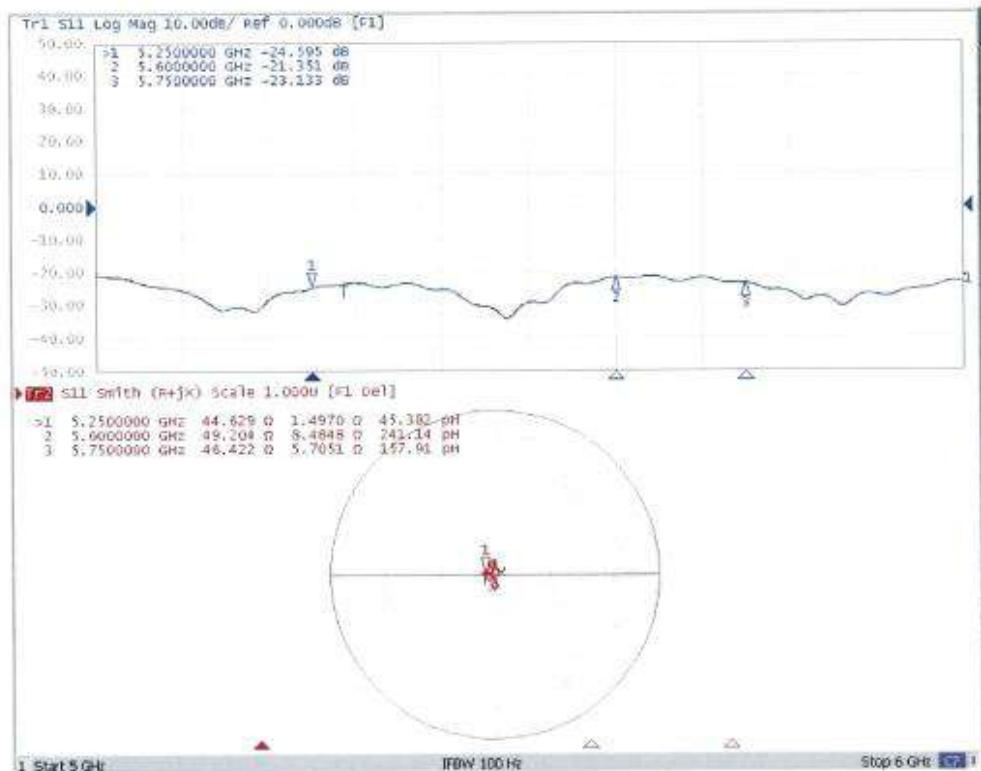




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### Impedance Measurement Plot for Head TSL



**F.15 6.5GHz Dipole**

**Calibration Laboratory of**  
**Schmid & Partner**  
**Engineering AG**  
**Zeughaussstrasse 43, 8004 Zurich, Switzerland**



**S** Schweizerischer Kalibrierdienst  
**C** Service suisse d'étalonnage  
**S** Servizio svizzero di taratura  
**S** Swiss Calibration Service

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**

Client      **Balun**  
 Shenzhen

Certificate No. **D6.5GHzV2-1037\_May24**

### **CALIBRATION CERTIFICATE**

Object      **D6.5GHzV2 - SN:1037**

Calibration procedure(s)      **QA CAL-22.v7**  
 Calibration Procedure for SAR Validation Sources between 3-10 GHz

Calibration date:      **May 28, 2024**

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  $(22 \pm 3)^\circ\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power sensor R&S NRP33T	SN: 100967	28-Mar-24 (No. 217-04038)	Mar-25
Reference 20 dB Attenuator	SN: BH9394 (20k)	26-Mar-24 (No. 217-04046)	Mar-25
Mismatch combination	SN: 84224 / 360D	28-Mar-24 (No. 217-04050)	Mar-25
Reference Probe EX3DV4	SN: 7405	12-Jun-23 (No. EX3-7405_Jun23)	Jun-24
DAE4	SN: 908	27-Mar-24 (No. DAE4-908_Mar24)	Mar-25

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator Anapico APSIN20G	SN: 827	18-Dec-18 (in house check Jan-24)	In house check: Jan-25
Power sensor NRP-Z23	SN: 100169	10-Jan-19 (in house check Jan-24)	In house check: Jan-25
Power sensor NRP-18T	SN: 100950	28-Sep-22 (in house check Jan-24)	In house check: Jan-25
Network Analyzer Keysight E5063A	SN: MY54504221	31-Oct-19 (in house check Oct-22)	In house check: Oct-25

Calibrated by:      Name: **Joanna Lleshaj**      Function: **Laboratory Technician**

Signature:

Approved by:      Name: **Sven Kühn**      Function: **Technical Manager**

Signature:

Issued: June 5, 2024

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**Calibration Laboratory of**  
**Schmid & Partner**  
**Engineering AG**  
 Zeughausstrasse 43, 8004 Zurich, Switzerland



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**C** Service suisse d'étalonnage  
**S** Servizio svizzero di taratura  
**S** Swiss Calibration Service

**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-Worn 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 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 Samaras T, Christ A, Kuster N, "Compliance assessment of the epithelial or absorbed power density above 6 GHz using SAR measurement systems", Bioelectromagnetics, 2021 (submitted). The additional evaluation uncertainty of 0.55 dB (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%.

### Measurement Conditions

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

<b>DASY Version</b>	DASY6	V16.2
<b>Extrapolation</b>	Advanced Extrapolation	
<b>Phantom</b>	Modular Flat Phantom	
<b>Distance Dipole Center - TSL</b>	5 mm	with Spacer
<b>Zoom Scan Resolution</b>	$dx, dy = 3.4 \text{ mm}, dz = 1.4 \text{ mm}$	Graded Ratio = 1.4 (Z direction)
<b>Frequency</b>	$6500 \text{ MHz} \pm 1 \text{ MHz}$	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Head TSL parameters</b>	22.0 °C	34.5	6.07 mho/m
<b>Measured Head TSL parameters</b>	$(22.0 \pm 0.2) \text{ °C}$	$35.2 \pm 6 \text{ %}$	$6.30 \text{ mho/m} \pm 6 \text{ %}$
<b>Head TSL temperature change during test</b>	$< 0.5 \text{ °C}$	----	----

### SAR result with Head TSL

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b>	Condition	
SAR measured	100 mW input power	29.8 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>299 W/kg <math>\pm 24.7 \text{ % (k=2)}</math></b>
<b>SAR averaged over 8 cm<sup>3</sup> (8 g) of Head TSL</b>	Condition	
SAR measured	100 mW input power	6.70 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>67.3 W/kg <math>\pm 24.4 \text{ % (k=2)}</math></b>
<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b>	Condition	
SAR measured	100 mW input power	5.49 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>55.2 W/kg <math>\pm 24.4 \text{ % (k=2)}</math></b>

**Appendix (Additional assessments outside the scope of SCS 0108)**
**Antenna Parameters with Head TSL**

Impedance, transformed to feed point	48.6 $\Omega$ - 2.4 $j\Omega$
Return Loss	- 30.9 dB

**APD (Absorbed Power Density)**

APD averaged over 1 cm <sup>2</sup>	Condition	
APD measured	100 mW input power	299 W/m <sup>2</sup>
APD measured	normalized to 1W	2990 W/m <sup>2</sup> $\pm$ 29.2 % (k=2)

APD averaged over 4 cm <sup>2</sup>	Condition	
APD measured	100 mW input power	134 W/m <sup>2</sup>
APD measured	normalized to 1W	1340 W/m <sup>2</sup> $\pm$ 28.9 % (k=2)

\*The reported APD values have been derived using the psSAR1g and psSAR8g.

**General Antenna Parameters and Design**

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

**Additional EUT Data**

Manufactured by	SPEAG
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**DASY6 Validation Report for Head TSL**

Measurement Report for D6.5GHz-1037, UID 0 , Channel 6500 (6500.0MHz)

**Device under Test Properties**

Name, Manufacturer	Dimensions [mm]	IMEI	DUT Type
D6.5GHz	16.0 x 6.0 x 300.0	SN: 1037	-

**Exposure Conditions**

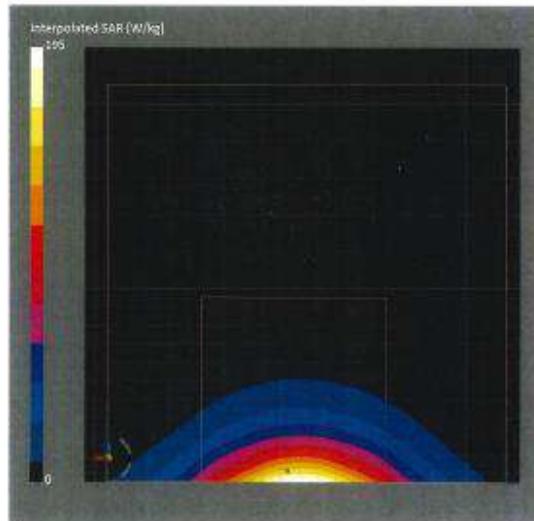
Phantom Section, TSL	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz]	Conversion Factor	TSL Cond. [S/m]	TSL Permittivity
Flat, HSL	5.00	Band	CW,	6500	5.50	6.30	35.2

**Hardware Setup**

Phantom	TSL	Probe, Calibration Date	DAE, Calibration Date
MFP V8.0 Center - 1182	HBBL600-10000V6	EX3DV4 - SN7405, 2023-06-12	DAE4 Sn908, 2024-03-27

**Scan Setup**

	Zoom Scan	Measurement Results	Zoom Scan
Grid Extents [mm]	22.0 x 22.0 x 22.0	Date	2024-05-28, 12:29
Grid Steps [mm]	3.4 x 3.4 x 1.4	psSAR1g [W/Kg]	29.8
Sensor Surface [mm]	1.4	psSARBg [W/Kg]	6.70
Graded Grid	Yes	psSAR10g [W/Kg]	5.49
Grading Ratio	1.4	Power Drift [dB]	0.00
MAIA	N/A	Power Scaling	Disabled
Surface Detection	VMS + 6p	Scaling Factor [dB]	
Scan Method	Measured	TSL Correction	No correction
		M2/M1 [%]	48.7
		Dist 3dB Peak [mm]	4.6



**Impedance Measurement Plot for Head TSL**