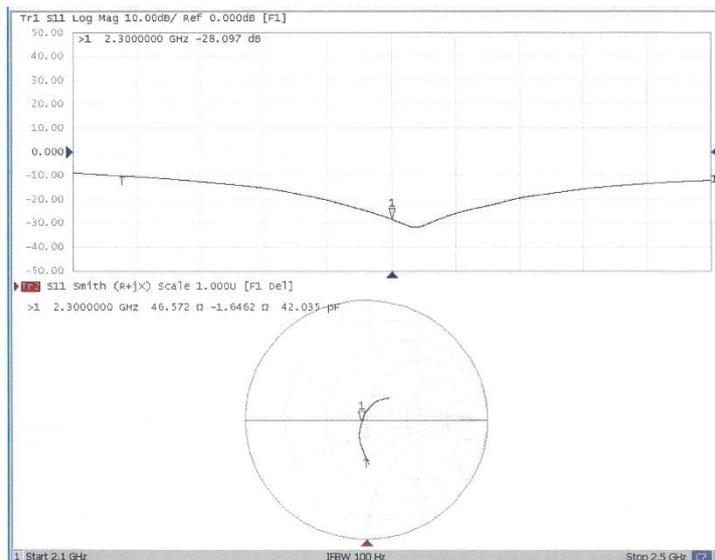




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Impedance Measurement Plot for Head TSL



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**Calibration Laboratory of  
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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

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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 **SGS**

Taoyuan City

Certificate No. **D2600V2-1005\_Jan24**

## CALIBRATION CERTIFICATE

Object: **D2600V2 - SN:1005**

Calibration procedure(s): **QA CAL-05.v12  
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz**

Calibration date: **January 22, 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 (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: 7349	03-Nov-23 (No. EX3-7349_Nov23)	Nov-24
DAE4	SN: 601	03-Oct-23 (No. DAE4-601_Oct23)	Oct-24
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-22)	In house check: Oct-24
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24

Calibrated by: **Paulo Pina** (Name), **Laboratory Technician** (Function), *[Signature]* (Signature)

Approved by: **Sven Kühn** (Name), **Technical Manager** (Function), *[Signature]* (Signature)

Issued: January 22, 2024

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The Swiss Accreditation Service is one of the signatories to the EA  
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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:**

- 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.
- b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

**Additional Documentation:**

- c) 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 source is mounted in a touch configuration below the center marking of the flat phantom.
- *Return Loss:* This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). 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	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2600 MHz ± 1 MHz	

**Head TSL parameters**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.9 ± 6 %	2.02 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	---	---

**SAR result with Head TSL**

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	14.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>56.0 W/kg ± 17.0 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.36 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>25.2 W/kg ± 16.5 % (k=2)</b>

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**Appendix (Additional assessments outside the scope of SCS 0108)**

**Antenna Parameters with Head TSL**

Impedance, transformed to feed point	48.8 $\Omega$ - 3.4 j $\Omega$
Return Loss	-28.8 dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.153 ns
----------------------------------	----------

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

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

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

**Additional EUT Data**

Manufactured by	SPEAG
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**DASY5 Validation Report for Head TSL**

Date: 22.01.2024

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN:1005**

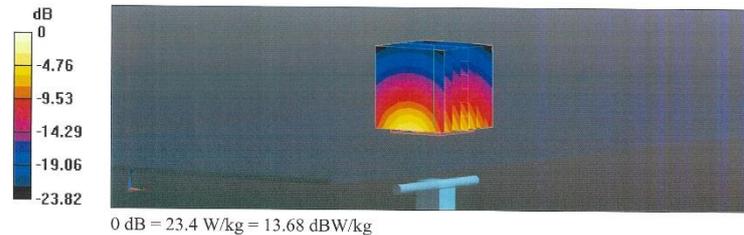
Communication System: UID 0 - CW; Frequency: 2600 MHz  
 Medium parameters used:  $f = 2600$  MHz;  $\sigma = 2.02$  S/m;  $\epsilon_r = 37.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.84, 7.84, 7.84) @ 2600 MHz; Calibrated: 03.11.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 03.10.2023
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

**Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:**

Measurement grid: dx=5mm, dy=5mm, dz=5mm  
 Reference Value = 116.7 V/m; Power Drift = 0.01 dB  
 Peak SAR (extrapolated) = 28.4 W/kg  
**SAR(1 g) = 14.3 W/kg; SAR(10 g) = 6.36 W/kg**  
 Smallest distance from peaks to all points 3 dB below = 8.9 mm  
 Ratio of SAR at M2 to SAR at M1 = 50.1%  
 Maximum value of SAR (measured) = 23.4 W/kg

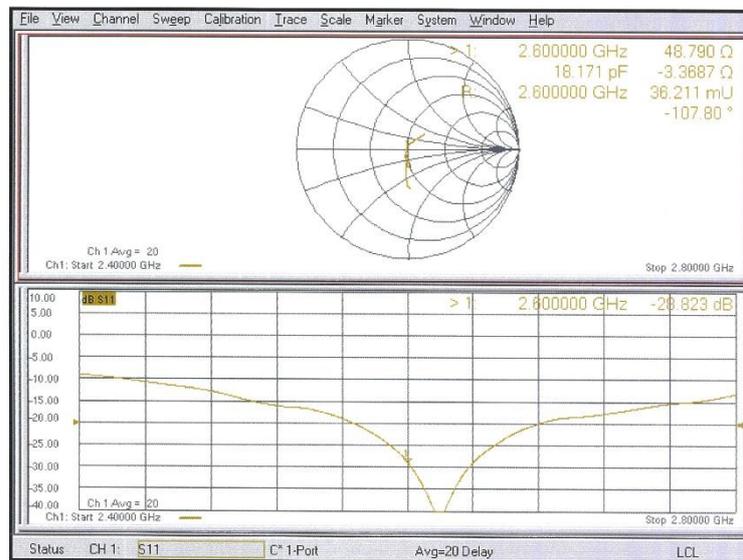


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Impedance Measurement Plot for Head TSL



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 Tel: +86-10-62304633-2117  
 E-mail: cttl@chinattl.com http://www.caict.ac.cn



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 CALIBRATION  
 CNAS L0570



Client **SGS**

Certificate No: **24J02Z000793**

CALIBRATION CERTIFICATE			
Object	D3500V2 - SN: 1009		
Calibration Procedure(s)	FF-Z11-003-01 Calibration Procedures for dipole validation kits		
Calibration date:	September 26, 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 Zhao Jing	Function SAR Test Engineer	Signature 
Reviewed by:	Name Lin Jun	Function SAR Test Engineer	Signature 
Approved by:	Name Qi Dianyuan	Function SAR Project Leader	Signature 
Issued: October 19, 2024			
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**Glossary:**

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM <sub>x,y,z</sub>
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	3500 MHz ± 1 MHz	

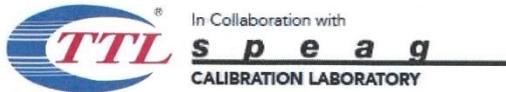
### Head TSL parameters

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	38.0 ± 6 %	2.92 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	100 mW input power	6.60 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>66.0 W/kg ± 24.4 % (k=2)</b>
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.58 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>25.8 W/kg ± 24.2 % (k=2)</b>



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

**Antenna Parameters with Head TSL**

Impedance, transformed to feed point	55.5Ω- 3.79jΩ
Return Loss	- 24.0dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.038 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.

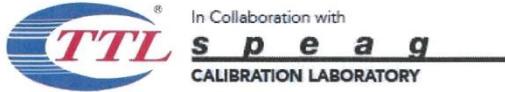
**Additional EUT Data**

Manufactured by	SPEAG
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 E-mail: cttl@chinattl.com http://www.caict.ac.cn

**DASY5 Validation Report for Head TSL**

Date: 2024-09-26

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 3500 MHz; Type: D3500V2; Serial: D3500V2 - SN: 1009**

Communication System: UID 0, CW; Frequency: 3500 MHz

Medium parameters used:  $f = 3500$  MHz;  $\sigma = 2.923$  S/m;  $\epsilon_r = 38.02$ ;  $\rho = 1000$  kg/m<sup>3</sup>

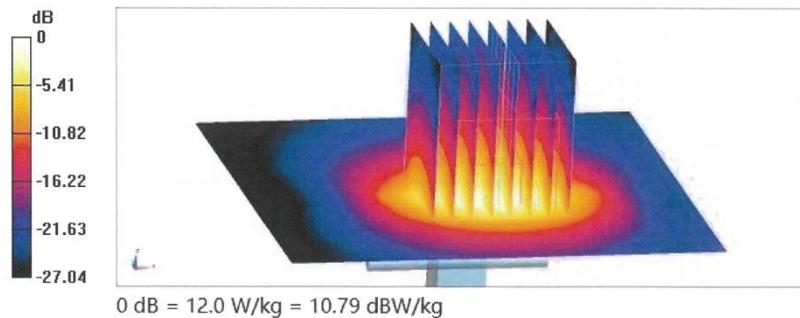
Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(6.73, 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=3500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm  
 Reference Value = 53.08 V/m; Power Drift = 0.02 dB  
 Peak SAR (extrapolated) = 16.2 W/kg  
**SAR(1 g) = 6.6 W/kg; SAR(10 g) = 2.58 W/kg**  
 Smallest distance from peaks to all points 3 dB below = 8.2 mm  
 Ratio of SAR at M2 to SAR at M1 = 77.6%  
 Maximum value of SAR (measured) = 12.0 W/kg



Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

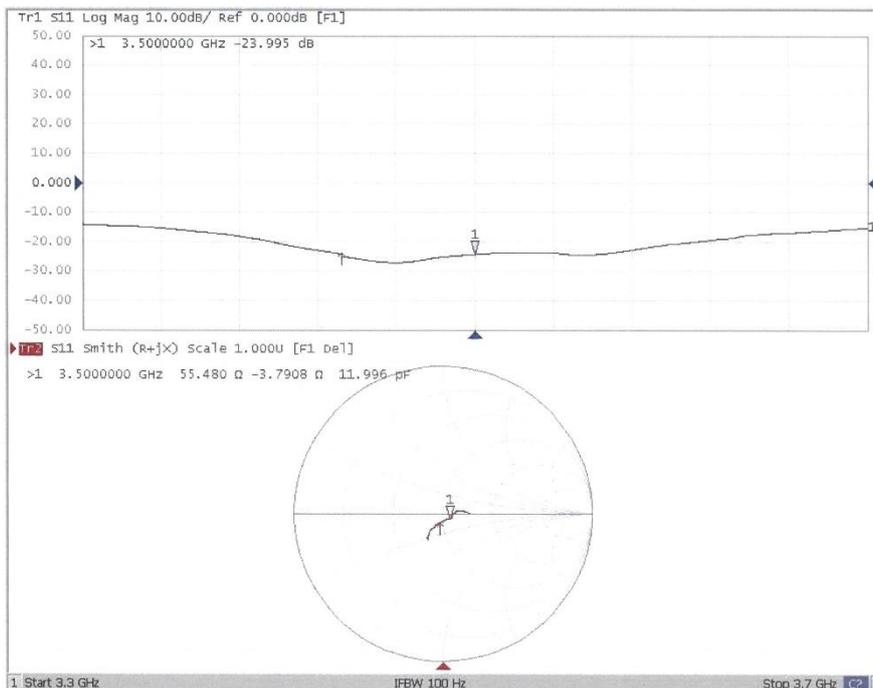
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### Impedance Measurement Plot for Head TSL



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CALIBRATION  
CNAS L0570



Client **SGS**

Certificate No: **24J02Z000932**

## CALIBRATION CERTIFICATE

Object **D3700V2 - SN: 1057**

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

Calibration date: **November 21, 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 7517	21-Feb-24(CTTL-SPEAG, No. 24J02Z80008)	Feb-25
DAE4	SN 1588	13-Sep-24(CTTL-SPEAG, No. 24J02Z000713)	Sep-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
OCF DAK-3.5(weighted)	1040	22-Jan-24(SPEAG, No.OCF-DAK3.5-1040_Jan24)	Jan-25

	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 27, 2024

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

Certificate No: 24J02Z000932

Page 1 of 6

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台灣檢驗科技股份有限公司

t (886-2) 2299-3279

f (886-2) 2298-0488

www.sgs.com.tw

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**Glossary:**

TSL tissue simulating liquid  
 ConvF sensitivity in TSL / NORM<sub>x,y,z</sub>  
 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	3700 MHz ± 1 MHz	

#### Head TSL parameters at 3700 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	37.7	3.12 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.9 ± 6 %	3.03 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	---	---

#### SAR result with Head TSL at 3700 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	6.74 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	67.5 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.46 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.5 W/kg ± 24.2 % (k=2)

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

##### Antenna Parameters with Head TSL at 3700 MHz

Impedance, transformed to feed point	51.5Ω+ 3.52jΩ
Return Loss	- 28.5dB

##### General Antenna Parameters and Design

Electrical Delay (one direction)	1.042 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. 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: 2024-11-21

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 3700 MHz; Type: D3700V2; Serial: D3700V2 - SN: 1057**

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

Medium parameters used:  $f = 3700$  MHz;  $\sigma = 3.032$  S/m;  $\epsilon_r = 36.89$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7517; ConvF(6.56, 6.56, 6.56) @ 3700 MHz; Calibrated: 2024-02-21
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1588; Calibrated: 2024-09-13
- 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=3700 MHz/Zoom Scan,**

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

Reference Value = 69.51 V/m; Power Drift = -0.05 dB

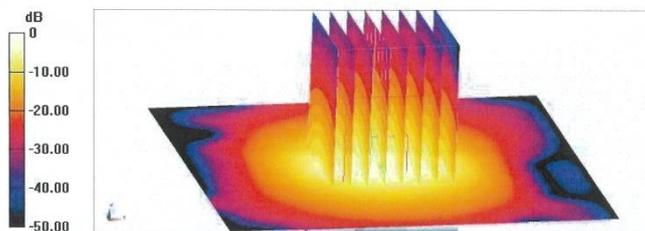
Peak SAR (extrapolated) = 18.1 W/kg

**SAR(1 g) = 6.74 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 = 75.4%

Maximum value of SAR (measured) = 12.9 W/kg



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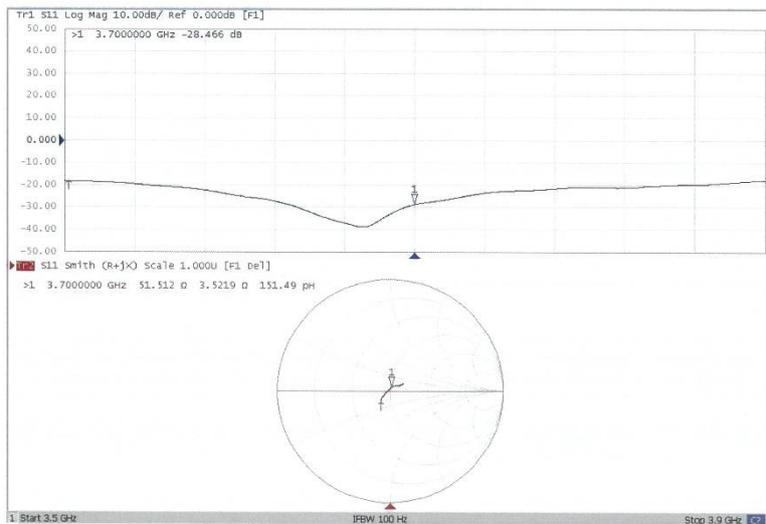
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**Impedance Measurement Plot for Head TSL**



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CNAS L0570



Client **SGS**

Certificate No: **24J02Z000933**

## CALIBRATION CERTIFICATE

Object **D3900V2 - SN: 1032**

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

Calibration date: **November 22, 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 7517	21-Feb-24(CTTL-SPEAG, No. 24J02Z80008)	Feb-25
DAE4	SN 1588	13-Sep-24(CTTL-SPEAG, No. 24J02Z000713)	Sep-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

	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 27, 2024

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**Glossary:**

TSL tissue simulating liquid  
 ConvF sensitivity in TSL / NORM<sub>x,y,z</sub>  
 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	3900 MHz ± 1 MHz 4100 MHz ± 1 MHz	

**Head TSL parameters at 3900MHz**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	37.5	3.32 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.4 ± 6 %	3.35 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	---	---

**SAR result with Head TSL at 3900MHz**

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	6.70 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	66.9 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.32 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.2 W/kg ± 24.2 % (k=2)

**Head TSL parameters at 4100MHz**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	37.2	3.53 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.9 ± 6 %	3.54 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	---	---

**SAR result with Head TSL at 4100MHz**

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	6.81 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	67.9 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.33 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.3 W/kg ± 24.2 % (k=2)

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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	46.1Ω- 5.60jΩ
Return Loss	- 23.0dB

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

Impedance, transformed to feed point	59.3Ω+ 1.21jΩ
Return Loss	- 21.3dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.011 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: 2024-11-22

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 3900 MHz; Type: D3900V2; Serial: D3900V2 - SN: 1032**

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

Medium parameters used:  $f = 3900 \text{ MHz}$ ;  $\sigma = 3.35 \text{ S/m}$ ;  $\epsilon_r = 37.39$ ;  $\rho = 1000 \text{ kg/m}^3$

Medium parameters used:  $f = 4100 \text{ MHz}$ ;  $\sigma = 3.54 \text{ S/m}$ ;  $\epsilon_r = 36.87$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7517; ConvF(6.4, 6.4, 6.4) @ 3900 MHz; ConvF(6.43, 6.43, 6.43) @ 4100 MHz; Calibrated: 2024-02-21
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1588; Calibrated: 2024-09-13
- 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 = 66.32 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 19.3 W/kg

**SAR(1 g) = 6.7 W/kg; SAR(10 g) = 2.32 W/kg**

Smallest distance from peaks to all points 3 dB below = 7.6 mm

Ratio of SAR at M2 to SAR at M1 = 73.3%

Maximum value of SAR (measured) = 13.2 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 = 65.43 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 20.6 W/kg

**SAR(1 g) = 6.81 W/kg; SAR(10 g) = 2.33 W/kg**

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

Ratio of SAR at M2 to SAR at M1 = 72.1%

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

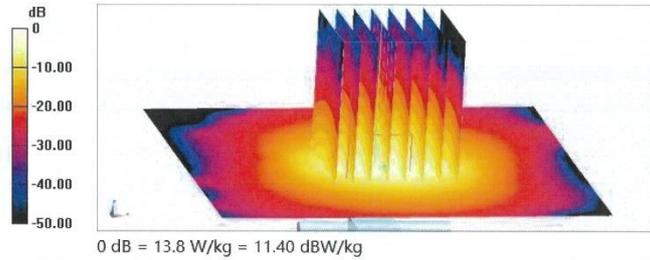
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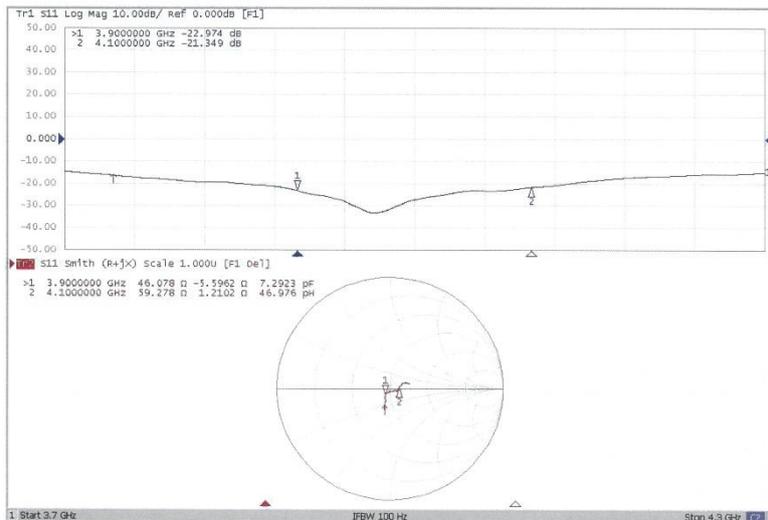
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### Impedance Measurement Plot for Head TSL



**- End of report -**

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