



In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY



中国认可  
国际互认  
校准  
CALIBRATION  
CNAS L0570

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, Chi  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com http://www.chinattl.cn

Client **BACL**

Certificate No: **Z21-60314**

## CALIBRATION CERTIFICATE

Object **D835V2 - SN: 453**

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

Calibration date: **August 31, 2021**

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        | 106277     | 23-Sep-20 (CTTL, No.J20X08336)            | Sep-21                |
| Power sensor NRP8S      | 104291     | 23-Sep-20 (CTTL, No.J20X08336)            | Sep-21                |
| Reference Probe EX3DV4  | SN 7517    | 03-Feb-21(CTTL-SPEAG,No.Z21-60001)        | Feb-22                |
| DAE3                    | SN 536     | 06-Nov-20(CTTL-SPEAG,No.Z20-60452)        | Nov-21                |
| Secondary Standards     | ID #       | Cal Date (Calibrated by, Certificate No.) | Scheduled Calibration |
| Signal Generator E4438C | MY49071430 | 01-Feb-21 (CTTL, No.J21X00593)            | Jan-22                |
| NetworkAnalyzer E5071C  | MY46110673 | 14-Jan-21 (CTTL, No.J21X00232)            | Jan-22                |

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

Issued: September 6, 2021

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



In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com http://www.chinattl.cn

#### 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:

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

#### Additional Documentation:

- DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

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

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



In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com http://www.chinattl.cn

### Measurement Conditions

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

|                              |                          |             |
|------------------------------|--------------------------|-------------|
| DASY Version                 | DASY52                   | V52.10.4    |
| Extrapolation                | Advanced Extrapolation   |             |
| Phantom                      | Triple Flat Phantom 5.1C |             |
| Distance Dipole Center - TSL | 15 mm                    | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm        |             |
| Frequency                    | 835 MHz $\pm$ 1 MHz      |             |

### Head TSL parameters

The following parameters and calculations were applied.

|   | Temperature         | Permittivity   | Conductivity         |
|---|---------------------|----------------|----------------------|
| Nominal Head TSL parameters             | 22.0 °C             | 41.5           | 0.90 mho/m           |
| Measured Head TSL parameters            | (22.0 $\pm$ 0.2) °C | 41.7 $\pm$ 6 % | 0.88 mho/m $\pm$ 6 % |
| Head TSL temperature change during test | <1.0 °C             | ----           | ----                 |

### SAR result with Head TSL

|  |                    |                                  |
|--|--------------------|----------------------------------|
| SAR averaged over 1 $cm^3$ (1 g) of Head TSL   | Condition          |                                  |
| SAR measured                                   | 250 mW input power | 2.30 W/kg                        |
| SAR for nominal Head TSL parameters            | normalized to 1W   | 9.33 W/kg $\pm$ 18.8 % ( $k=2$ ) |
| SAR averaged over 10 $cm^3$ (10 g) of Head TSL | Condition          |                                  |
| SAR measured                                   | 250 mW input power | 1.49 W/kg                        |
| SAR for nominal Head TSL parameters            | normalized to 1W   | 6.03 W/kg $\pm$ 18.7 % ( $k=2$ ) |



In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com http://www.chinattl.cn

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

##### Antenna Parameters with Head TSL

|                                      |               |
|--------------------------------------|---------------|
| Impedance, transformed to feed point | 56.2Ω- 6.72jΩ |
| Return Loss                          | - 21.3dB      |

##### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.300 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 |
|-----------------|-------|





In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com http://www.chinattl.cn

# **DASY5 Validation Report for Head TSL**

Date: 08.31.2021

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 453**

Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.884$  S/m;  $\epsilon_r = 41.66$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7517; ConvF(9.81, 9.81, 9.81) @ 835 MHz; Calibrated: 2021-02-03
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn536; Calibrated: 2020-11-06
- Phantom: MFP\_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

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

Reference Value = 57.46 V/m; Power Drift = 0.07 dB

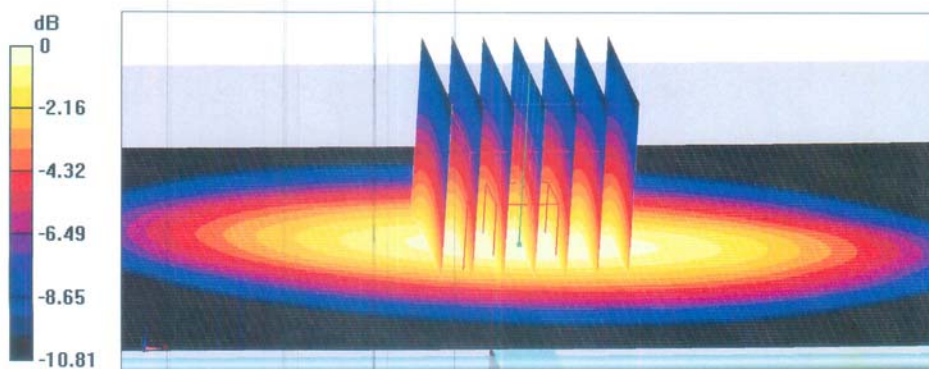
Peak SAR (extrapolated) = 3.64 W/kg

**SAR(1 g) = 2.3 W/kg; SAR(10 g) = 1.49 W/kg**

Smallest distance from peaks to all points 3 dB below = 17.5 mm

Ratio of SAR at M2 to SAR at M1 = 63.4%

Maximum value of SAR (measured) = 3.16 W/kg



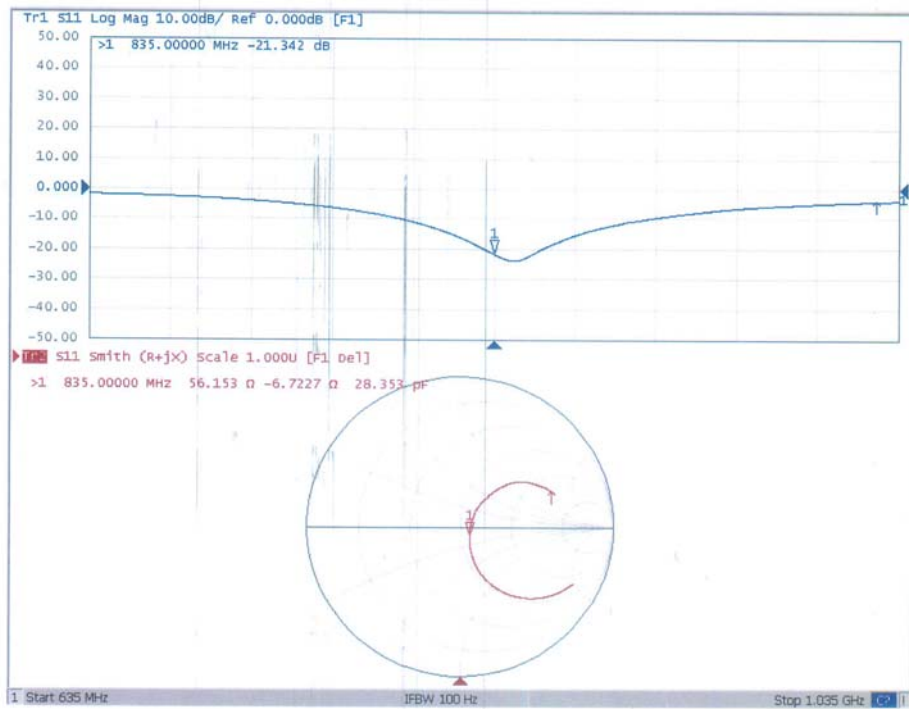
0 dB = 3.16 W/kg = 5.00 dBW/kg



In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com http://www.chinattl.cn

### Impedance Measurement Plot for Head TSL



## D835V2 - SN:453 Extended Dipole Calibrations

Referring to KDB865664 D01, if dipoles are verified in return loss(< -20dB, within 20% of prior calibration), and in impedance(within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

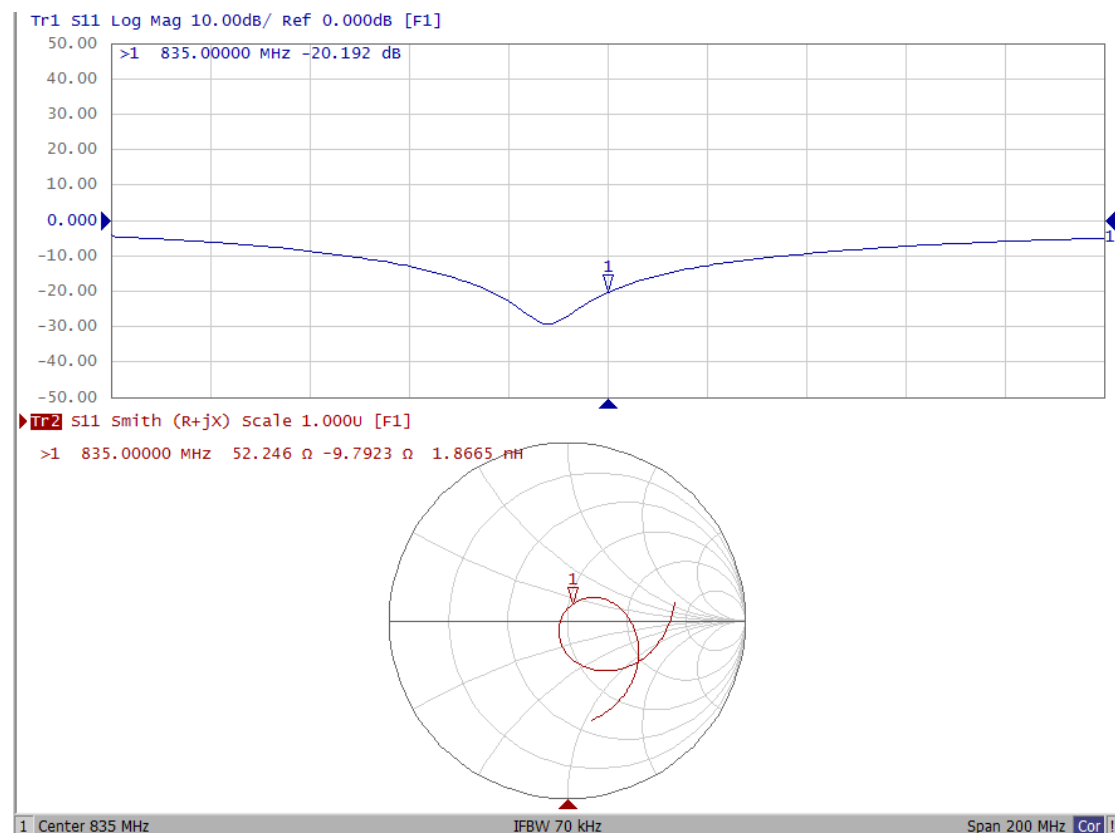
### Justification of the extended calibration

| D835V2 - SN:453            |                  |           |                      |             |                           |             |
|----------------------------|------------------|-----------|----------------------|-------------|---------------------------|-------------|
| 835MHz Head                |                  |           |                      |             |                           |             |
| Date of Measurement        | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (ohm) | Delta (ohm) |
| 2021/8/31<br>(Cal. Report) | -21.342          | /         | 56.153               | /           | -6.7227                   | /           |
| 2022/8/30<br>(Extended)    | -20.192          | -5.39     | 52.246               | -3.91       | -9.7923                   | -3.07       |
| 2023/8/30<br>(Extended)    | -20.110          | -5.77     | 53.060               | -3.09       | -9.1625                   | -2.44       |

The return loss is <-20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

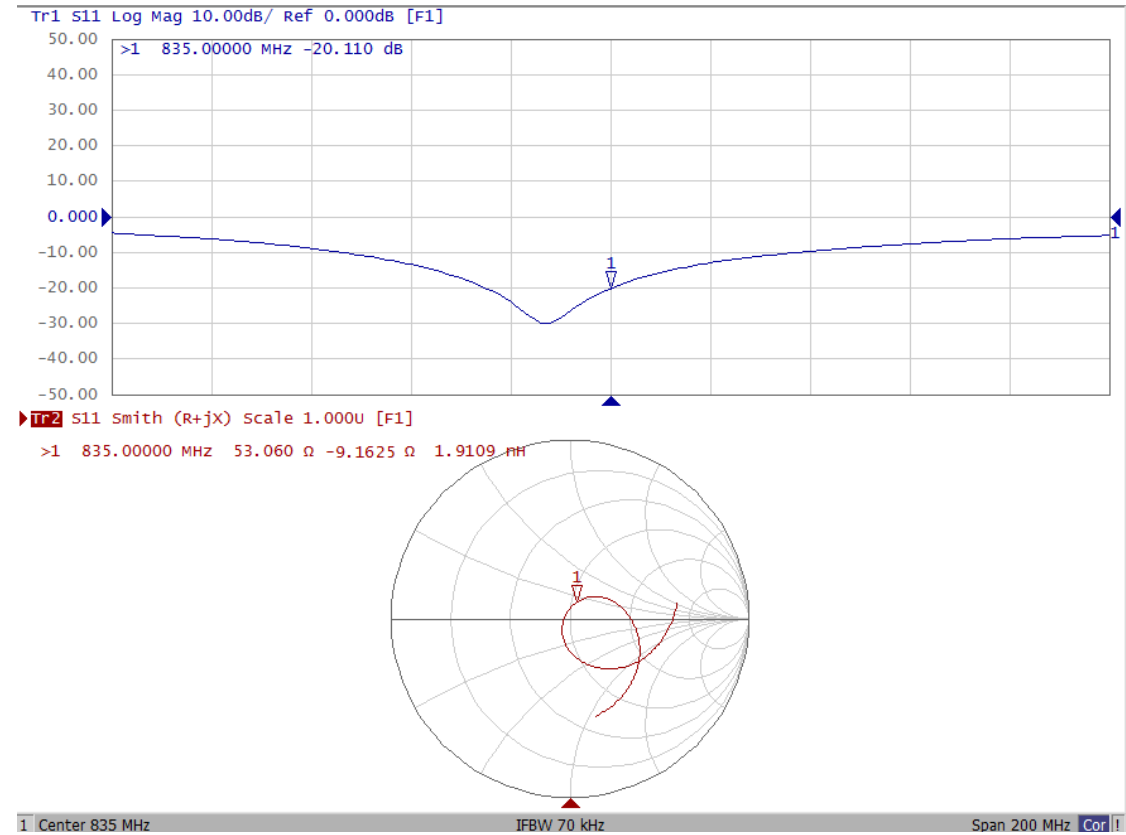
### Dipole Verification Data> D835V2 - SN:453 (Date of Measurement: 2022/8/30)

#### 835MHz - Head



**Dipole Verification Data> D835V2 - SN:453 (Date of Measurement: 2023/8/30)**

**835MHz - Head**



|             | Name      | Title        | Signature |
|-------------|-----------|--------------|-----------|
| Measure By: | Mark Dong | SAR Engineer | Mark Dong |





In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY



中国认可  
国际互认  
校准  
CALIBRATION  
CNAS L0570

Add: No.52 Hua YuanBei Road, Haidian District, Beijing, 100191, Ch  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com http://www.chinattl.cn

Client **BACL**

Certificate No: **Z21-60258**

## CALIBRATION CERTIFICATE

Object **D1750V2 - SN: 1141**

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

Calibration date: **June 29, 2021**

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        | 106277     | 23-Sep-20 (CTTL, No.J20X08336)            | Sep-21                |
| Power sensor NRP8S      | 104291     | 23-Sep-20 (CTTL, No.J20X08336)            | Sep-21                |
| Reference Probe EX3DV4  | SN 3846    | 26-Apr-21(CTTL-SPEAG,No.Z21-60084)        | Apr-22                |
| DAE4                    | SN 549     | 08-Jan-21(CTTL-SPEAG,No.Z21-60002)        | Jan-22                |
| Secondary Standards     | ID #       | Cal Date (Calibrated by, Certificate No.) | Scheduled Calibration |
| Signal Generator E4438C | MY49071430 | 01-Feb-21 (CTTL, No.J21X00593)            | Jan-22                |
| NetworkAnalyzer E5071C  | MY46110673 | 14-Jan-21 (CTTL, No.J21X00232)            | Jan-22                |

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

Issued: July 2, 2021

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



In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com http://www.chinattl.cn

#### 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:

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

#### Additional Documentation:

- DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

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

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



In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com http://www.chinattl.cn

### Measurement Conditions

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

|                              |                          |             |
|------------------------------|--------------------------|-------------|
| DASY Version                 | DASY52                   | V52.10.4    |
| Extrapolation                | Advanced Extrapolation   |             |
| Phantom                      | Triple Flat Phantom 5.1C |             |
| Distance Dipole Center - TSL | 10 mm                    | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm        |             |
| Frequency                    | 1750 MHz $\pm$ 1 MHz     |             |

### Head TSL parameters

The following parameters and calculations were applied.

|   | Temperature         | Permittivity   | Conductivity         |
|---|---------------------|----------------|----------------------|
| Nominal Head TSL parameters             | 22.0 °C             | 40.1           | 1.37 mho/m           |
| Measured Head TSL parameters            | (22.0 $\pm$ 0.2) °C | 39.9 $\pm$ 6 % | 1.36 mho/m $\pm$ 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 | 9.01 W/kg                                      |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | <b>36.1 W/kg <math>\pm</math> 18.8 % (k=2)</b> |
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | Condition          |  |
| SAR measured  | 250 mW input power | 4.66 W/kg                                      |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | <b>18.7 W/kg <math>\pm</math> 18.7 % (k=2)</b> |





In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com http://www.chinattl.cn

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

##### Antenna Parameters with Head TSL

|                                      |               |
|--------------------------------------|---------------|
| Impedance, transformed to feed point | 51.6Ω- 2.23jΩ |
| Return Loss                          | - 31.3 dB     |

##### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.120 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 |
|-----------------|-------|

**DASY5 Validation Report for Head TSL**

Date: 06.29.2021

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1141**

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

Medium parameters used:  $f = 1750$  MHz;  $\sigma = 1.362$  S/m;  $\epsilon_r = 39.93$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3846; ConvF(8.22, 8.22, 8.22) @ 1750 MHz; Calibrated: 2021-04-26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn549; Calibrated: 2021-01-08
- Phantom: MFP\_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

**System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:**

dx=5mm, dy=5mm, dz=5mm

Reference Value = 98.30 V/m; Power Drift = -0.03 dB

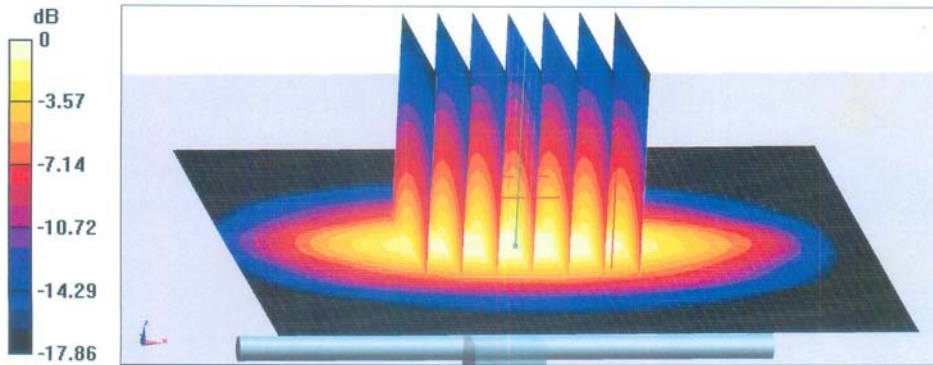
Peak SAR (extrapolated) = 17.7 W/kg

**SAR(1 g) = 9.01 W/kg; SAR(10 g) = 4.66 W/kg**

Smallest distance from peaks to all points 3 dB below = 10.8 mm

Ratio of SAR at M2 to SAR at M1 = 51%

Maximum value of SAR (measured) = 14.4 W/kg



0 dB = 14.4 W/kg = 11.58 dBW/kg

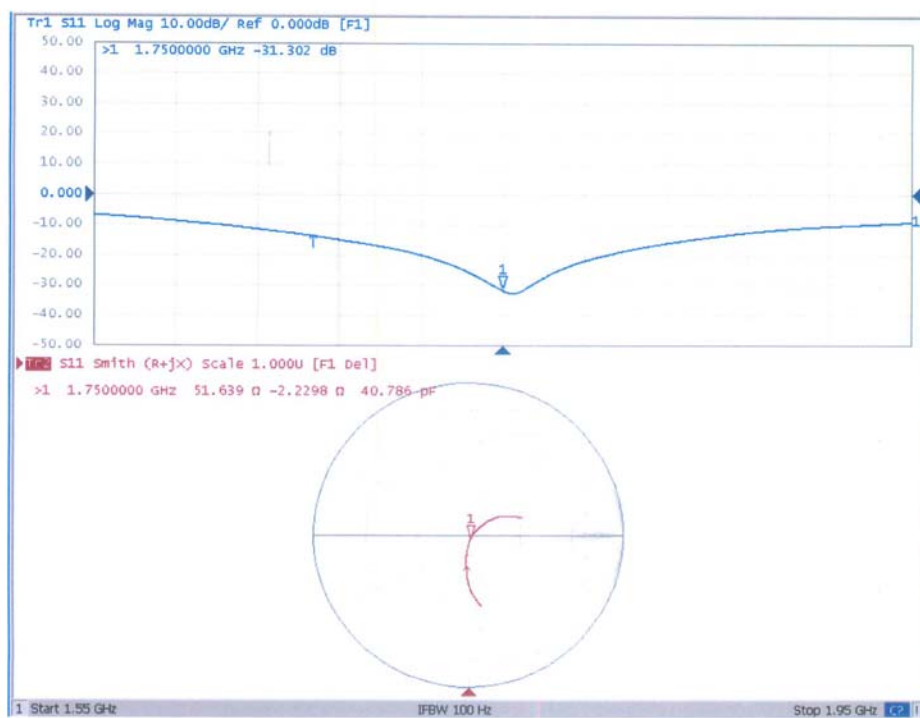




In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com http://www.chinattl.cn

### Impedance Measurement Plot for Head TSL



## D1750V2 - SN:1141 Extended Dipole Calibrations

Referring to KDB865664 D01, if dipoles are verified in return loss(< -20dB, within 20% of prior calibration), and in impedance(within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

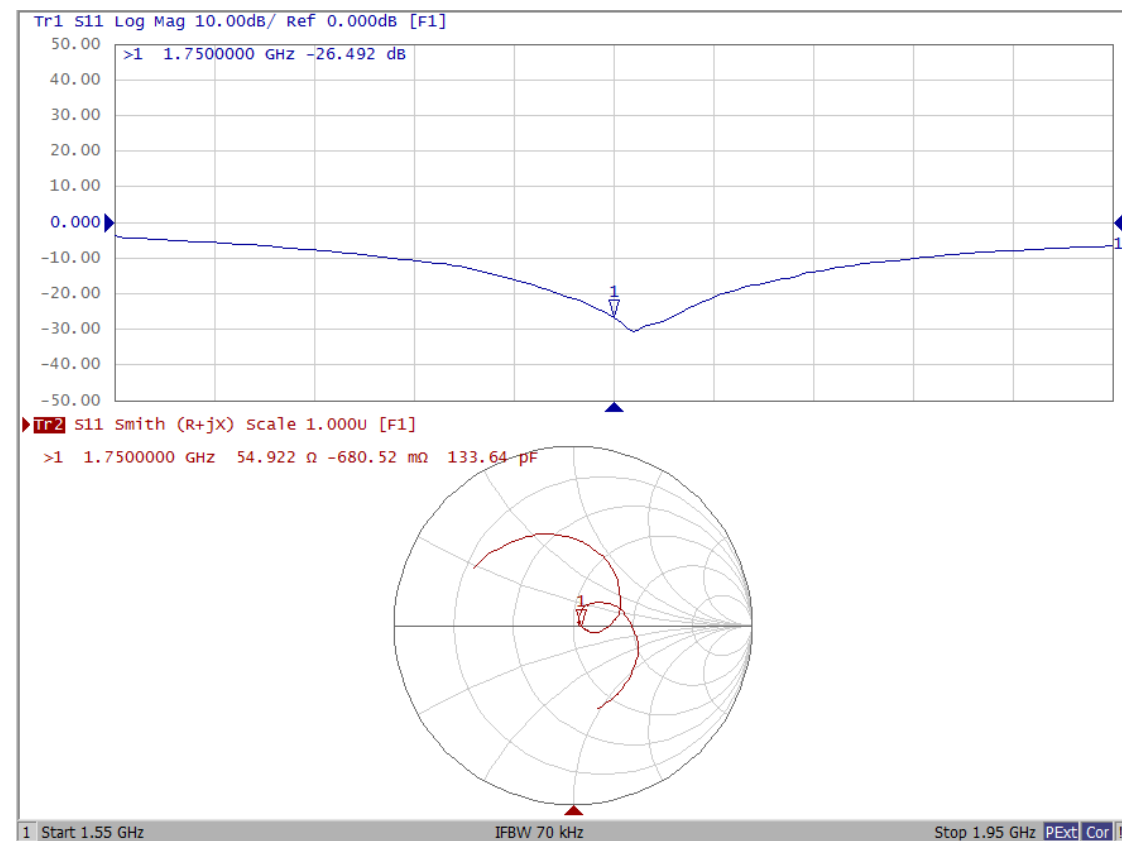
### Justification of the extended calibration

| D1750V2 - SN:1141          |                  |           |                      |             |                           |             |
|----------------------------|------------------|-----------|----------------------|-------------|---------------------------|-------------|
| 1750MHz Head               |                  |           |                      |             |                           |             |
| Date of Measurement        | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (ohm) | Delta (ohm) |
| 2021/6/29<br>(Cal. Report) | -31.302          | /         | 51.639               | /           | -2.2298                   | /           |
| 2022/6/28<br>(Extended)    | -26.492          | -15.37    | 54.922               | 3.283       | -0.68052                  | 1.54928     |
| 2023/6/28<br>(Extended)    | -28.470          | -9.05     | 53.955               | 2.316       | -0.17559                  | 2.05421     |

The return loss is <-20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

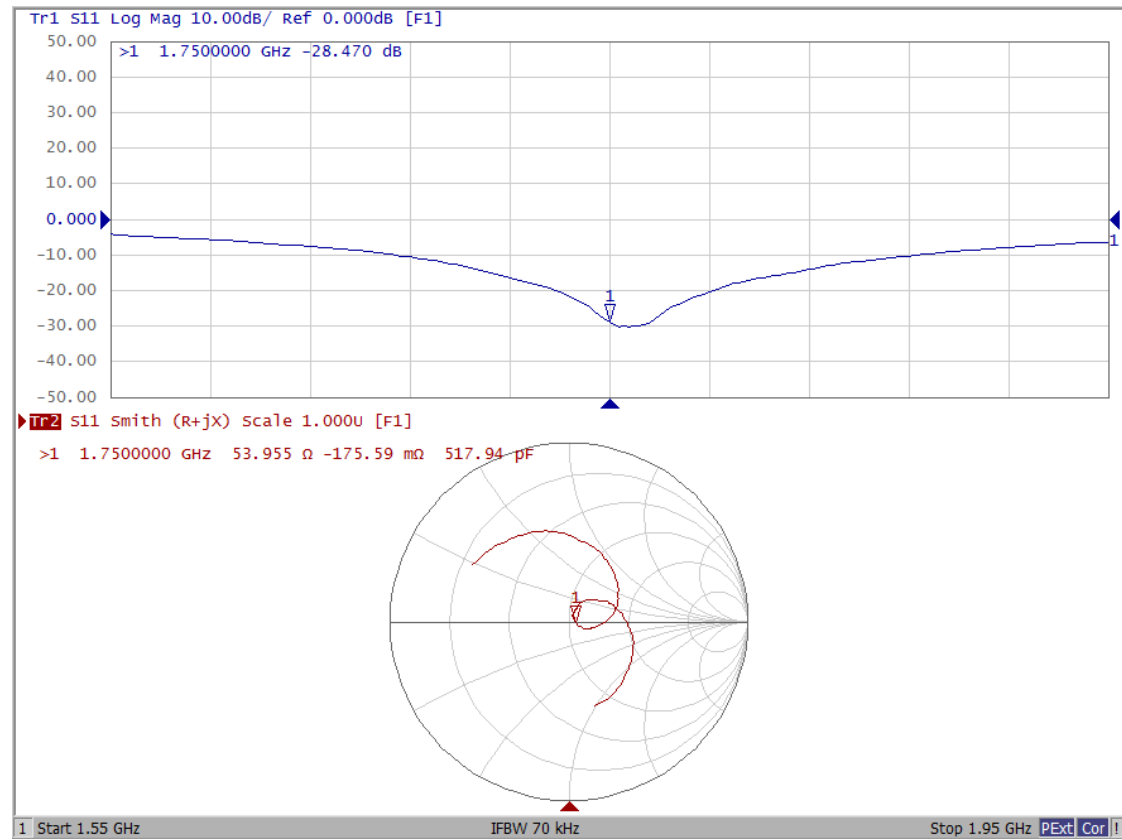
### Dipole Verification Data> D1750V2 - SN:1141 (Date of Measurement: 2022/6/28)

#### 1750MHz - Head



Dipole Verification Data> D1750V2 - SN:1141 (Date of Measurement: 2023/6/28)

1750MHz - Head



|             | Name      | Title        | Signature |
|-------------|-----------|--------------|-----------|
| Measure By: | Mark Dong | SAR Engineer | Mark Dong |



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



中国认可  
国际互认  
校准  
CALIBRATION  
CNAS L0570



Client **BACL**

Certificate No: **Z22-60478**

## CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 543**

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

Calibration date: **November 2, 2022**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards       | ID #       | Cal Date (Calibrated by, Certificate No.) | Scheduled Calibration |
|-------------------------|------------|---|-----------------------|
| Power Meter NRP2        | 106276     | 10-May-22 (CTTL, No.J22X03103)            | May-23                |
| Power sensor NRP6A      | 101369     | 10-May-22 (CTTL, No.J22X03103)            | May-23                |
| Reference Probe EX3DV4  | SN 7464    | 26-Jan-22(SPEAG,No.EX3-7464_Jan22)        | Jan-23                |
| DAE4                    | SN 1556    | 12-Jan-22(CTTL-SPEAG,No.Z22-60007)        | Jan-23                |
| Secondary Standards     | ID #       | Cal Date (Calibrated by, Certificate No.) | Scheduled Calibration |
| Signal Generator E4438C | MY49071430 | 13-Jan-22 (CTTL, No.J22X00409)            | Jan-23                |
| Network Analyzer E5071C | MY46110673 | 14-Jan-22 (CTTL, No.J22X00406)            | Jan-23                |

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

Issued: November 7, 2022

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

**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%.



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

### Measurement Conditions

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

|                              |                          |             |
|------------------------------|--------------------------|-------------|
| DASY Version                 | DASY52                   | 52.10.4     |
| Extrapolation                | Advanced Extrapolation   |             |
| Phantom                      | Triple Flat Phantom 5.1C |             |
| Distance Dipole Center - TSL | 10 mm                    | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm        |             |
| Frequency                    | 1900 MHz $\pm$ 1 MHz     |             |

### Head TSL parameters

The following parameters and calculations were applied.

|   | Temperature         | Permittivity   | Conductivity         |
|---|---------------------|----------------|----------------------|
| Nominal Head TSL parameters             | 22.0 °C             | 40.0           | 1.40 mho/m           |
| Measured Head TSL parameters            | (22.0 $\pm$ 0.2) °C | 40.5 $\pm$ 6 % | 1.39 mho/m $\pm$ 6 % |
| Head TSL temperature change during test | <1.0 °C             | —              | —                    |

### SAR result with Head TSL

|  |                    |                              |
|--|--------------------|------------------------------|
| SAR averaged over 1 $cm^3$ (1 g) of Head TSL   | Condition          |                              |
| SAR measured                                   | 250 mW input power | 9.96 W/kg                    |
| SAR for nominal Head TSL parameters            | normalized to 1W   | 40.2 W/kg $\pm$ 18.8 % (k=2) |
| SAR averaged over 10 $cm^3$ (10 g) of Head TSL | Condition          |                              |
| SAR measured                                   | 250 mW input power | 5.20 W/kg                    |
| SAR for nominal Head TSL parameters            | normalized to 1W   | 20.9 W/kg $\pm$ 18.7 % (k=2) |

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

### Antenna Parameters with Head TSL

|                                      |               |
|--------------------------------------|---------------|
| Impedance, transformed to feed point | 49.9Ω+ 3.89jΩ |
| Return Loss                          | - 28.2dB      |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.107 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 |
|-----------------|-------|

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

**DASY5 Validation Report for Head TSL**

Date: 2022-11-02

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 543**

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.388$  S/m;  $\epsilon_r = 40.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(8.18, 8.18, 8.18) @ 1900 MHz; Calibrated: 2022-01-26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2022-01-12
- Phantom: MFP\_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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

Reference Value = 100.4 V/m; Power Drift = 0.05 dB

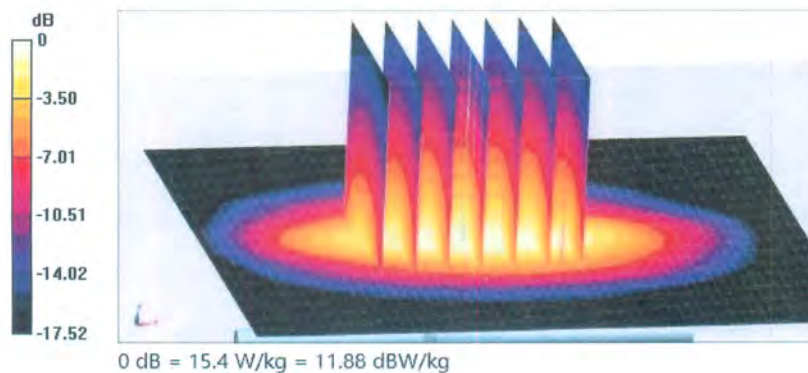
Peak SAR (extrapolated) = 18.5 W/kg

**SAR(1 g) = 9.96 W/kg; SAR(10 g) = 5.2 W/kg**

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

Ratio of SAR at M2 to SAR at M1 = 54.6%

Maximum value of SAR (measured) = 15.4 W/kg



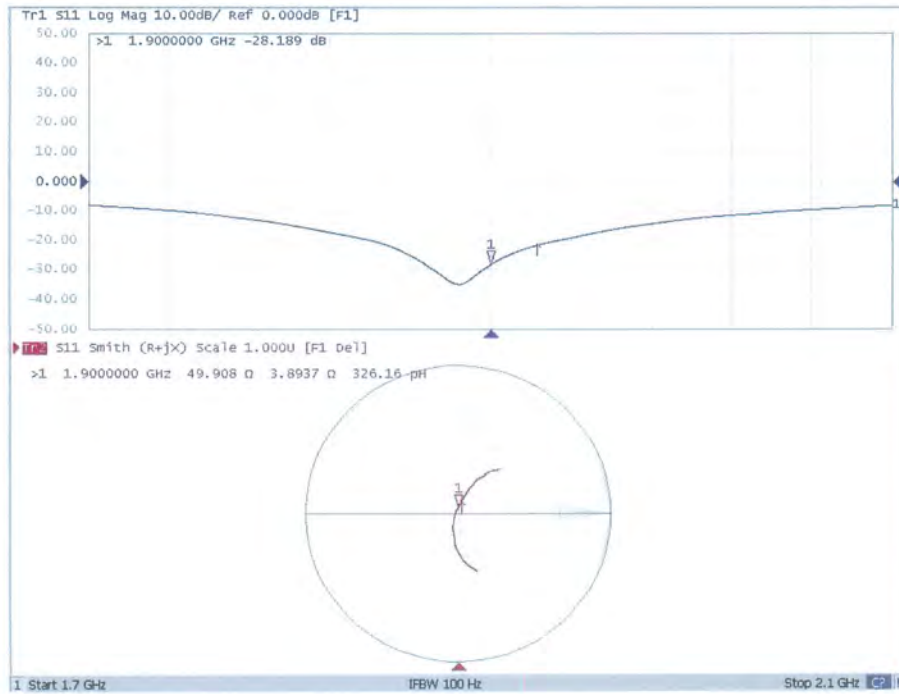


In Collaboration with  
**speag**  
CALIBRATION LABORATORY



Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2117  
E-mail: [ctl@chinattl.com](mailto:ctl@chinattl.com) <http://www.caict.ac.cn>

### Impedance Measurement Plot for Head TSL



## D1900V2 - SN:543 Extended Dipole Calibrations

Referring to KDB865664 D01, if dipoles are verified in return loss(< -20dB, within 20% of prior calibration), and in impedance(within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

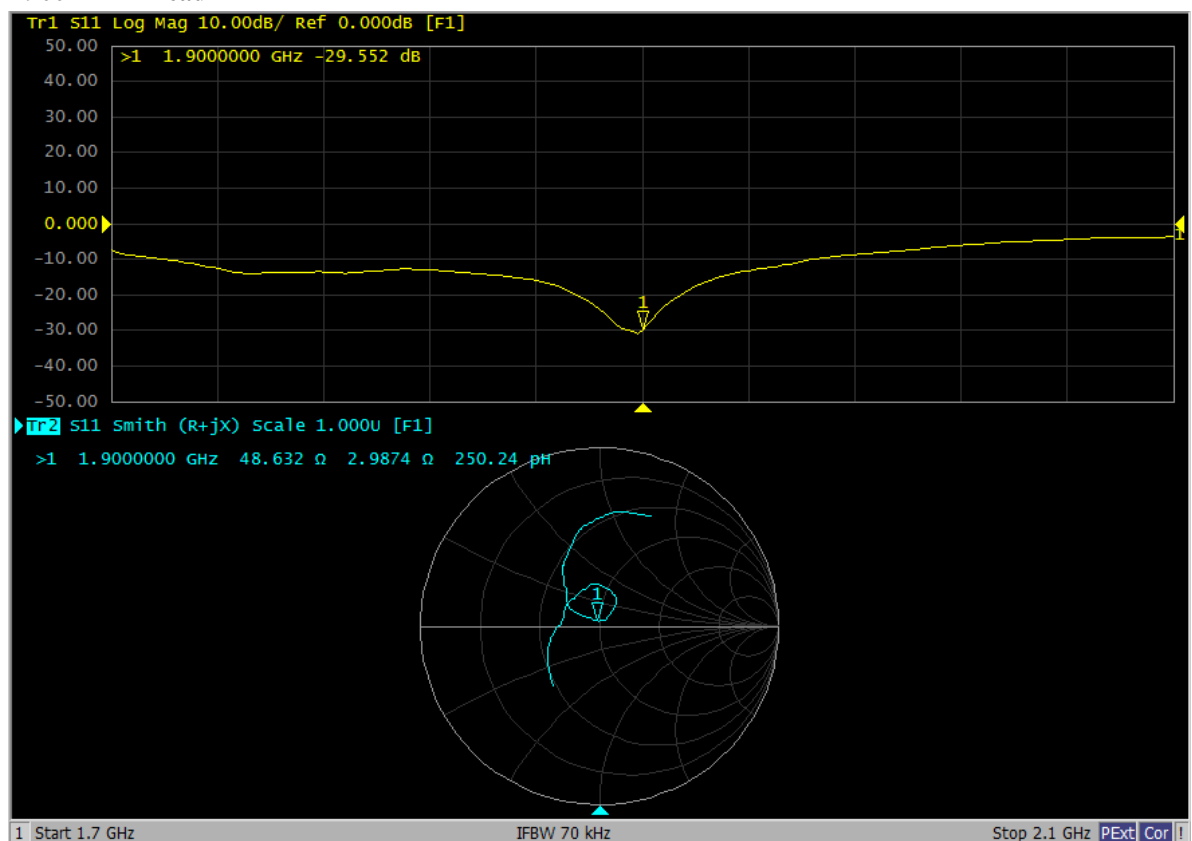
### Justification of the extended calibration

| D1900V2 - SN:543        |                  |           |                      |             |                           |             |
|-------------------------|------------------|-----------|----------------------|-------------|---------------------------|-------------|
| 1900MHz Head            |                  |           |                      |             |                           |             |
| Date of Measurement     | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (ohm) | Delta (ohm) |
| 2022/11/2 (Cal. Report) | -28.189          | /         | 49.908               | /           | 3.8937                    | /           |
| 2023/11/1 (Extended)    | -29.552          | 4.84      | 48.632               | -1.276      | 2.9874                    | -0.9063     |

The return loss is <-20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

### Dipole Verification Data> D1900V2 - SN:543 (Date of Measurement: 2023/11/1)

#### 1900MHz - Head



|             | Name      | Title        | Signature |
|-------------|-----------|--------------|-----------|
| Measure By: | Mark Dong | SAR Engineer | Mark Dong |





In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY



中国认可  
国际互认  
校准  
CALIBRATION  
CNAS L0570

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, Chi  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com http://www.chinattl.cn

Client

BACL

Certificate No: Z21-60260

## CALIBRATION CERTIFICATE

Object: D2450V2 - SN: 971

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

Calibration date: June 28, 2021

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        | 106277     | 23-Sep-20 (CTTL, No.J20X08336)            | Sep-21                |
| Power sensor NRP8S      | 104291     | 23-Sep-20 (CTTL, No.J20X08336)            | Sep-21                |
| Reference Probe EX3DV4  | SN 3846    | 26-Apr-21(CTTL-SPEAG,No.Z21-60084)        | Apr-22                |
| DAE4                    | SN 549     | 08-Jan-21(CTTL-SPEAG,No.Z21-60002)        | Jan-22                |
| Secondary Standards     | ID #       | Cal Date (Calibrated by, Certificate No.) | Scheduled Calibration |
| Signal Generator E4438C | MY49071430 | 01-Feb-21 (CTTL, No.J21X00593)            | Jan-22                |
| NetworkAnalyzer E5071C  | MY46110673 | 14-Jan-21 (CTTL, No.J21X00232)            | Jan-22                |

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

Signature

Issued: July 2, 2021

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

Certificate No: Z21-60260

Page 1 of 6



In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: [ettl@chinattl.com](mailto:ettl@chinattl.com) <http://www.chinattl.cn>

#### 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:

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

#### Additional Documentation:

- DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

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

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



In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com http://www.chinattl.cn

#### Measurement Conditions

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

|                              |                          |             |
|------------------------------|--------------------------|-------------|
| DASY Version                 | DASY52                   | V52.10.4    |
| Extrapolation                | Advanced Extrapolation   |             |
| Phantom                      | Triple Flat Phantom 5.1C |             |
| Distance Dipole Center - TSL | 10 mm                    | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm        |             |
| Frequency                    | 2450 MHz $\pm$ 1 MHz     |             |

#### Head TSL parameters

The following parameters and calculations were applied.

|   | Temperature         | Permittivity   | Conductivity         |
|---|---------------------|----------------|----------------------|
| Nominal Head TSL parameters             | 22.0 °C             | 39.2           | 1.80 mho/m           |
| Measured Head TSL parameters            | (22.0 $\pm$ 0.2) °C | 39.1 $\pm$ 6 % | 1.78 mho/m $\pm$ 6 % |
| Head TSL temperature change during test | <1.0 °C             | ----           | ----                 |

#### SAR result with Head TSL

|  |                    |                              |
|--|--------------------|------------------------------|
| SAR averaged over 1 $cm^3$ (1 g) of Head TSL   | Condition          |                              |
| SAR measured                                   | 250 mW input power | 13.3 W/kg                    |
| SAR for nominal Head TSL parameters            | normalized to 1W   | 53.5 W/kg $\pm$ 18.8 % (k=2) |
| SAR averaged over 10 $cm^3$ (10 g) of Head TSL | Condition          |                              |
| SAR measured                                   | 250 mW input power | 6.04 W/kg                    |
| SAR for nominal Head TSL parameters            | normalized to 1W   | 24.2 W/kg $\pm$ 18.7 % (k=2) |





In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com http://www.chinattl.cn

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

##### Antenna Parameters with Head TSL

|                                      |               |
|--------------------------------------|---------------|
| Impedance, transformed to feed point | 55.7Ω+ 4.06jΩ |
| Return Loss                          | - 23.6dB      |

##### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.071 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 |
|-----------------|-------|



In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com http://www.chinattl.cn

# **DASY5 Validation Report for Head TSL**

Date: 06.28.2021

Test Laboratory: CTTTL, Beijing, China

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 971**

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.779$  S/m;  $\epsilon_r = 39.12$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3846; ConvF(7.45, 7.45, 7.45) @ 2450 MHz; Calibrated: 2021-04-26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn549; Calibrated: 2021-01-08
- Phantom: MFP\_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

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

Reference Value = 106.9 V/m; Power Drift = 0.02 dB

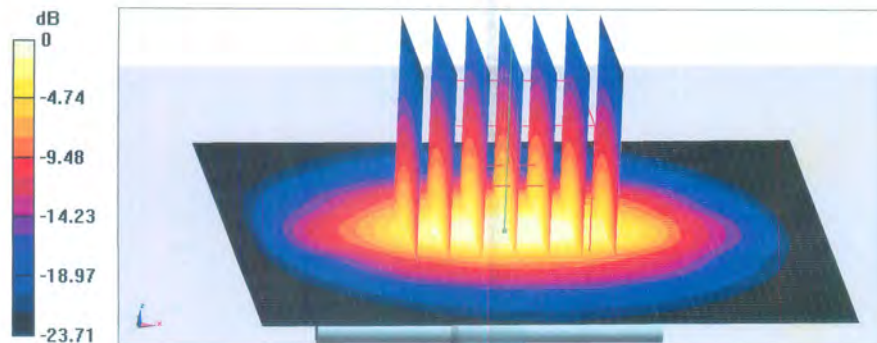
Peak SAR (extrapolated) = 28.8 W/kg

**SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.04 W/kg**

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

Ratio of SAR at M2 to SAR at M1 = 45.6%

Maximum value of SAR (measured) = 22.8 W/kg



0 dB = 22.8 W/kg = 13.58 dBW/kg

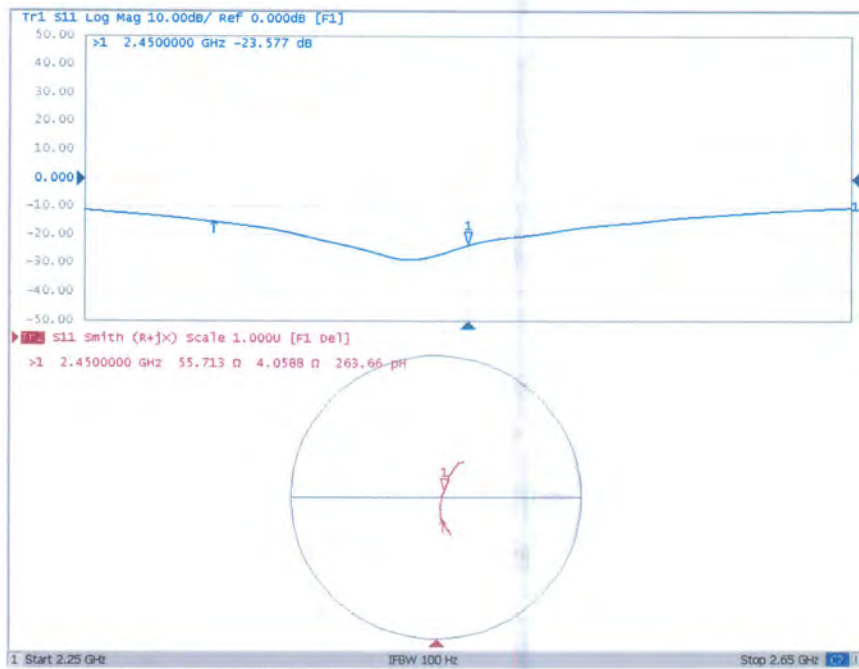




In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com http://www.chinattl.cn

### Impedance Measurement Plot for Head TSL



## D2450V2 - SN:971 Extended Dipole Calibrations

Referring to KDB865664 D01, if dipoles are verified in return loss(< -20dB, within 20% of prior calibration), and in impedance(within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

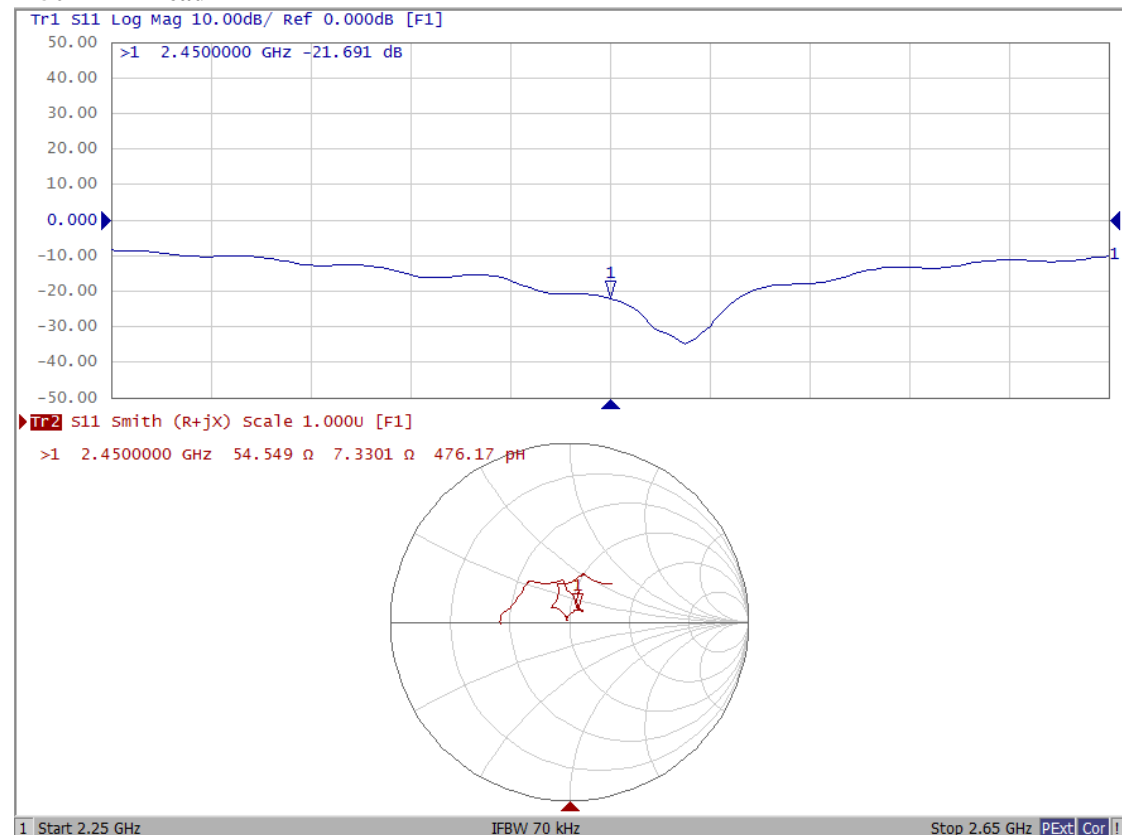
### Justification of the extended calibration

| D2450V2 - SN:971        |                  |           |                      |             |                           |             |
|-------------------------|------------------|-----------|----------------------|-------------|---------------------------|-------------|
| 2450MHz Head            |                  |           |                      |             |                           |             |
| Date of Measurement     | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (ohm) | Delta (ohm) |
| 2021/6/28 (Cal. Report) | -23.577          | /         | 55.713               | /           | 4.0588                    | /           |
| 2022/6/27 (Extended)    | -21.691          | -8        | 54.549               | -1.164      | 7.3301                    | 3.2713      |
| 2023/6/27 (Extended)    | -21.918          | -7.04     | 54.157               | -1.556      | 7.2675                    | 3.2087      |

The return loss is <-20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

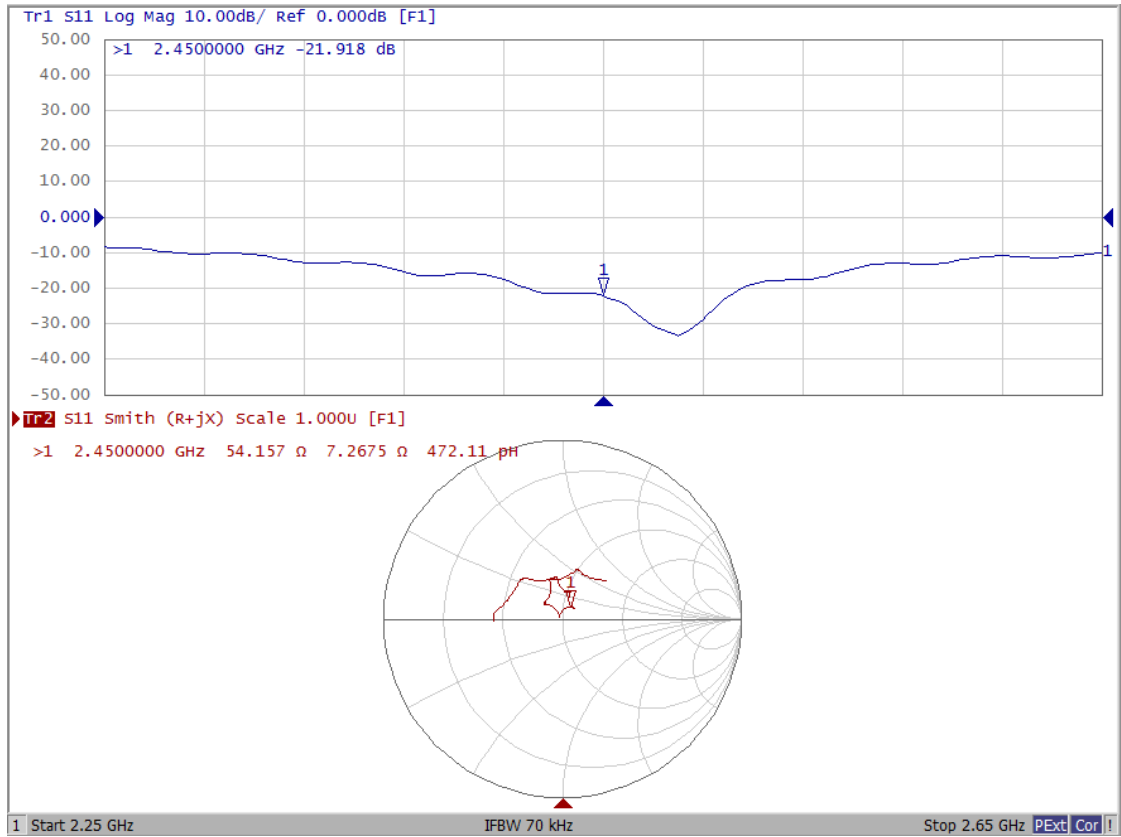
### Dipole Verification Data> D2450V2 - SN:971 (Date of Measurement: 2022/6/27)

#### 2450MHz - Head



Dipole Verification Data> D2450V2 - SN:971 (Date of Measurement: 2023/6/27)

2450MHz - Head



|             | Name      | Title        | Signature |
|-------------|-----------|--------------|-----------|
| Measure By: | Mark Dong | SAR Engineer | Mark Dong |



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



中国认可  
国际互认  
校准  
CALIBRATION  
CNAS L0570



Client **BACL**

Certificate No: **Z22-60479**

## CALIBRATION CERTIFICATE

Object **D2600V2 - SN: 1132**

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

Calibration date: **November 1, 2022**

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     | 10-May-22 (CTTL, No.J22X03103)            | May-23                |
| Power sensor NRP6A      | 101369     | 10-May-22 (CTTL, No.J22X03103)            | May-23                |
| Reference Probe EX3DV4  | SN 7464    | 26-Jan-22(SPEAG,No.EX3-7464_Jan22)        | Jan-23                |
| DAE4                    | SN 1556    | 12-Jan-22(CTTL-SPEAG,No.Z22-60007)        | Jan-23                |
| Secondary Standards     | ID #       | Cal Date (Calibrated by, Certificate No.) | Scheduled Calibration |
| Signal Generator E4438C | MY49071430 | 13-Jan-22 (CTTL, No.J22X00409)            | Jan-23                |
| Network Analyzer E5071C | MY46110673 | 14-Jan-22 (CTTL, No.J22X00406)            | Jan-23                |

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

Issued: November 7, 2022

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



In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY



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 / 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%.





In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY



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

### 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                    | 2600 MHz $\pm$ 1 MHz     |             |

### Head TSL parameters

The following parameters and calculations were applied.

|   | Temperature         | Permittivity   | Conductivity         |
|---|---------------------|----------------|----------------------|
| Nominal Head TSL parameters             | 22.0 °C             | 39.0           | 1.96 mho/m           |
| Measured Head TSL parameters            | (22.0 $\pm$ 0.2) °C | 39.0 $\pm$ 6 % | 1.97 mho/m $\pm$ 6 % |
| Head TSL temperature change during test | <1.0 °C             | ---            | ---                  |

### SAR result with Head TSL

|  |                    |                                  |
|--|--------------------|----------------------------------|
| SAR averaged over 1 $cm^3$ (1 g) of Head TSL   | Condition          |                                  |
| SAR measured                                   | 250 mW input power | 14.0 W/kg                        |
| SAR for nominal Head TSL parameters            | normalized to 1W   | 55.8 W/kg $\pm$ 18.8 % ( $k=2$ ) |
| SAR averaged over 10 $cm^3$ (10 g) of Head TSL | Condition          |                                  |
| SAR measured                                   | 250 mW input power | 6.35 W/kg                        |
| SAR for nominal Head TSL parameters            | normalized to 1W   | 25.4 W/kg $\pm$ 18.7 % ( $k=2$ ) |

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

### Antenna Parameters with Head TSL

|                                      |               |
|--------------------------------------|---------------|
| Impedance, transformed to feed point | 47.0Ω- 6.44jΩ |
| Return Loss                          | - 22.7dB      |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.058 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 |
|-----------------|-------|



In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY



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>

### DASY5 Validation Report for Head TSL

Date: 2022-11-01

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1132**

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

Medium parameters used:  $f = 2600$  MHz;  $\sigma = 1.974$  S/m;  $\epsilon_r = 39.04$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(7.64, 7.64, 7.64) @ 2600 MHz; Calibrated: 2022-01-26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2022-01-12
- 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 = 103.1 V/m; Power Drift = -0.04 dB

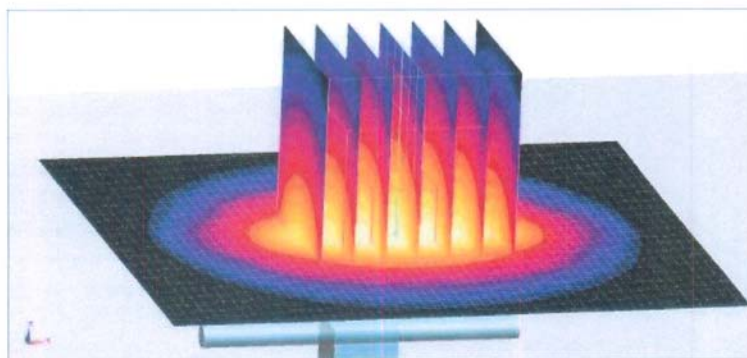
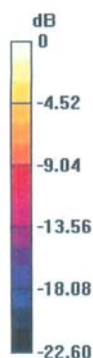
Peak SAR (extrapolated) = 29.2 W/kg

**SAR(1 g) = 14 W/kg; SAR(10 g) = 6.35 W/kg**

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

Ratio of SAR at M2 to SAR at M1 = 48.5%

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



0 dB = 23.7 W/kg = 13.75 dBW/kg



In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY



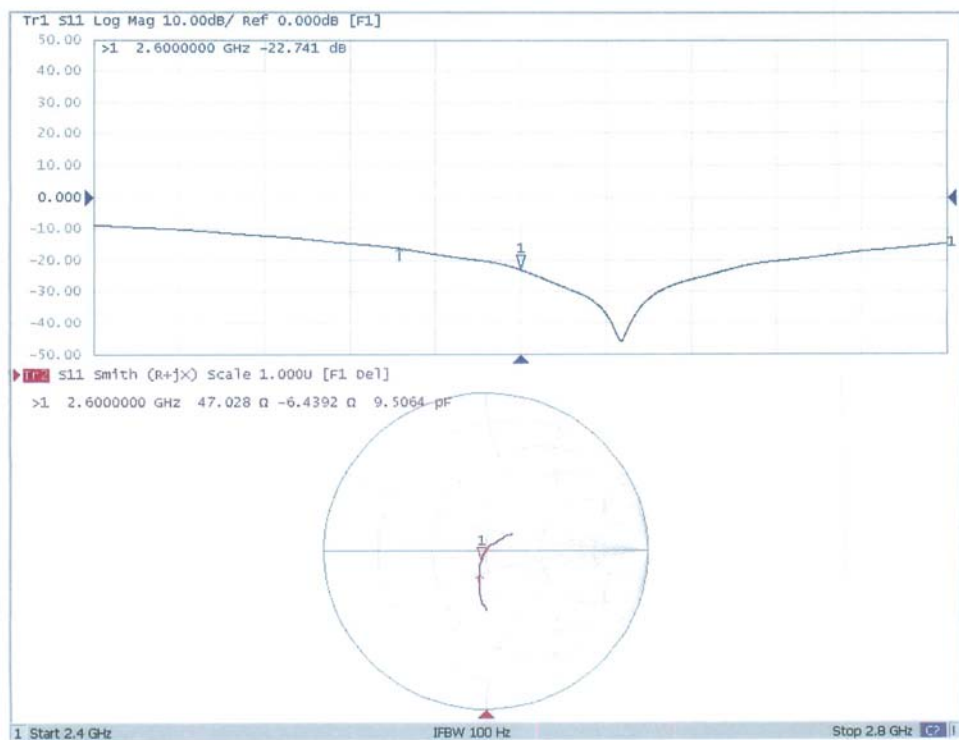
Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China

Tel: +86-10-62304633-2117

E-mail: emf@caict.ac.cn

<http://www.caict.ac.cn>

### Impedance Measurement Plot for Head TSL



## D2600V2 - SN:1132 Extended Dipole Calibrations

Referring to KDB 865664 D01, if dipoles are verified in return loss(< -20dB, within 20% of prior calibration), and in impedance(within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

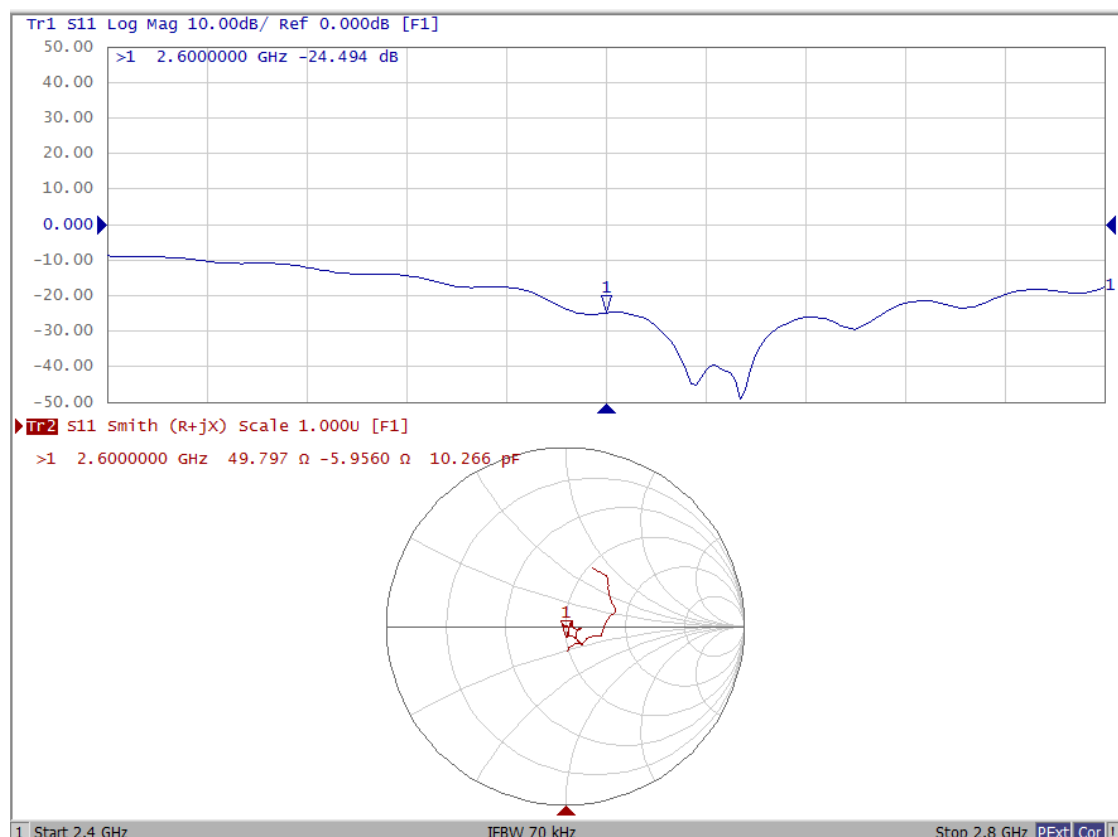
### Justification of the extended calibration

| D2600V2 - SN:1132          |                  |           |                      |             |                           |             |
|----------------------------|------------------|-----------|----------------------|-------------|---------------------------|-------------|
| 2600MHz Head               |                  |           |                      |             |                           |             |
| Date of Measurement        | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (ohm) | Delta (ohm) |
| 2022/11/1<br>(Cal. Report) | -22.741          | /         | 47.028               | /           | -6.4392                   | /           |
| 2023/10/31<br>(Extended)   | -24.494          | 7.71      | 49.797               | 2.769       | -5.9560                   | 0.4832      |

The return loss is <-20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

### Dipole Verification Data> D2600V2 - SN:1132 (Date of Measurement: 2023/10/31)

#### 2600MHz - Head



|             | Name      | Title        | Signature |
|-------------|-----------|--------------|-----------|
| Measure By: | Mark Dong | SAR Engineer | Mark Dong |





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



中国认可  
国际互认  
校准  
CALIBRATION  
CNAS L0570



Client

BACL

Certificate No: Z22-60480

## CALIBRATION CERTIFICATE

Object

D5GHzV2 - SN: 1246

Calibration Procedure(s)

FF-Z11-003-01

Calibration Procedures for dipole validation kits

Calibration date:

November 1, 2022

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     | 10-May-22 (CTTL, No.J22X03103)            | May-23                |
| Power sensor NRP6A      | 101369     | 10-May-22 (CTTL, No.J22X03103)            | May-23                |
| Reference Probe EX3DV4  | SN 7464    | 26-Jan-22(SPEAG,No.EX3-7464_Jan22)        | Jan-23                |
| DAE4                    | SN 1556    | 12-Jan-22(CTTL-SPEAG,No.Z22-60007)        | Jan-23                |
| Secondary Standards     | ID #       | Cal Date (Calibrated by, Certificate No.) | Scheduled Calibration |
| Signal Generator E4438C | MY49071430 | 13-Jan-22 (CTTL, No. J22X00409)           | Jan-23                |
| Network Analyzer E5071C | MY46110673 | 14-Jan-22 (CTTL, No.J22X00406)            | Jan-23                |

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

Issued: November 7, 2022

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



In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY



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

#### 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%.



In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY



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>

### 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 $\pm$ 1 MHz<br>5600 MHz $\pm$ 1 MHz<br>5750 MHz $\pm$ 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 $\pm$ 0.2) °C | 35.2 $\pm$ 6 % | 4.68 mho/m $\pm$ 6 % |
| Head TSL temperature change during test | <1.0 °C             | ---            | ---                  |

### SAR result with Head TSL at 5250MHz

|   |                    |                              |
|---|--------------------|------------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL   | Condition          |                              |
| SAR measured  | 100 mW input power | 7.78 W/kg                    |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 77.5 W/kg $\pm$ 24.4 % (k=2) |
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | Condition          |                              |
| SAR measured  | 100 mW input power | 2.21 W/kg                    |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 22.0 W/kg $\pm$ 24.2 % (k=2) |



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>

### 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 | 34.6 ± 6 %   | 5.05 mho/m ± 6 % |
| Head TSL temperature change during test | <1.0 °C         | ---          | ---              |

### SAR result with Head TSL at 5600MHz

|   |                    |                          |
|---|--------------------|--------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL   | Condition          |                          |
| SAR measured  | 100 mW input power | 8.11 W/kg                |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 80.7 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 | 2.30 W/kg                |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 22.8 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 | 34.4 ± 6 %   | 5.21 mho/m ± 6 % |
| Head TSL temperature change during test | <1.0 °C         | ---          | ---              |

### SAR result with Head TSL at 5750MHz

|   |                    |                          |
|---|--------------------|--------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL   | Condition          |                          |
| SAR measured  | 100 mW input power | 7.89 W/kg                |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 78.4 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 | 2.22 W/kg                |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 22.0 W/kg ± 24.2 % (k=2) |

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

### Antenna Parameters with Head TSL at 5250MHz

|                                      |               |
|--------------------------------------|---------------|
| Impedance, transformed to feed point | 49.1Ω- 3.09jΩ |
| Return Loss                          | - 29.8dB      |

### Antenna Parameters with Head TSL at 5600MHz

|                                      |               |
|--------------------------------------|---------------|
| Impedance, transformed to feed point | 52.0Ω+ 4.16jΩ |
| Return Loss                          | - 26.9dB      |

### Antenna Parameters with Head TSL at 5750MHz

|                                      |               |
|--------------------------------------|---------------|
| Impedance, transformed to feed point | 53.5Ω+ 2.47jΩ |
| Return Loss                          | - 27.6dB      |

### 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 |
|-----------------|-------|



**DASY5 Validation Report for Head TSL**

Date: 2022-11-01

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1246**

Communication System: CW; Frequency: 5250 MHz, Frequency: 5600 MHz,  
Frequency: 5750 MHz

Medium parameters used:  $f = 5250$  MHz;  $\sigma = 4.677$  S/m;  $\epsilon_r = 35.15$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Medium parameters used:  $f = 5600$  MHz;  $\sigma = 5.047$  S/m;  $\epsilon_r = 34.56$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Medium parameters used:  $f = 5750$  MHz;  $\sigma = 5.211$  S/m;  $\epsilon_r = 34.35$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(5.43, 5.43, 5.43) @ 5250 MHz;  
ConvF(4.91, 4.91, 4.91) @ 5600 MHz; ConvF(4.85, 4.85, 4.85) @ 5750  
MHz; Calibrated: 2022-01-26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2022-01-12
- 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 = 65.38 V/m; Power Drift = -0.05 dB  
Peak SAR (extrapolated) = 31.5 W/kg  
**SAR(1 g) = 7.78 W/kg; SAR(10 g) = 2.21 W/kg**  
Smallest distance from peaks to all points 3 dB below = 6.9 mm  
Ratio of SAR at M2 to SAR at M1 = 64.9%  
Maximum value of SAR (measured) = 17.9 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 = 65.26 V/m; Power Drift = -0.04 dB  
Peak SAR (extrapolated) = 35.8 W/kg  
**SAR(1 g) = 8.11 W/kg; SAR(10 g) = 2.3 W/kg**  
Smallest distance from peaks to all points 3 dB below = 7.2 mm  
Ratio of SAR at M2 to SAR at M1 = 62.3%  
Maximum value of SAR (measured) = 19.2 W/kg

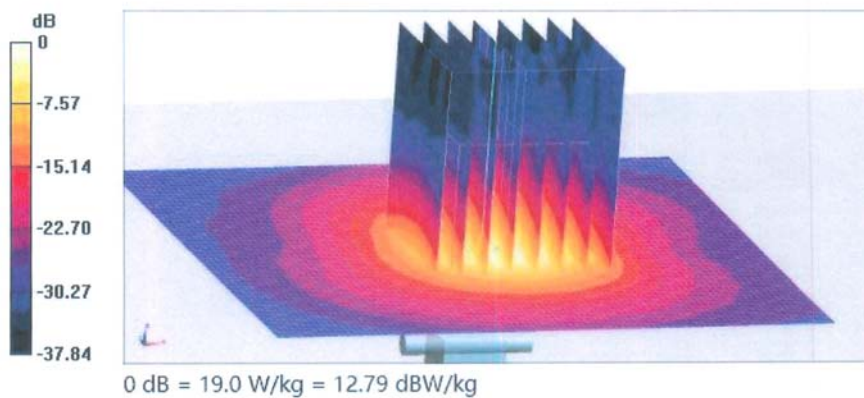


In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY



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

**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 = 63.56 V/m; Power Drift = -0.07 dB  
Peak SAR (extrapolated) = 36.7 W/kg  
**SAR(1 g) = 7.89 W/kg; SAR(10 g) = 2.22 W/kg**  
Smallest distance from peaks to all points 3 dB below = 7.2 mm  
Ratio of SAR at M2 to SAR at M1 = 60.9%  
Maximum value of SAR (measured) = 19.0 W/kg



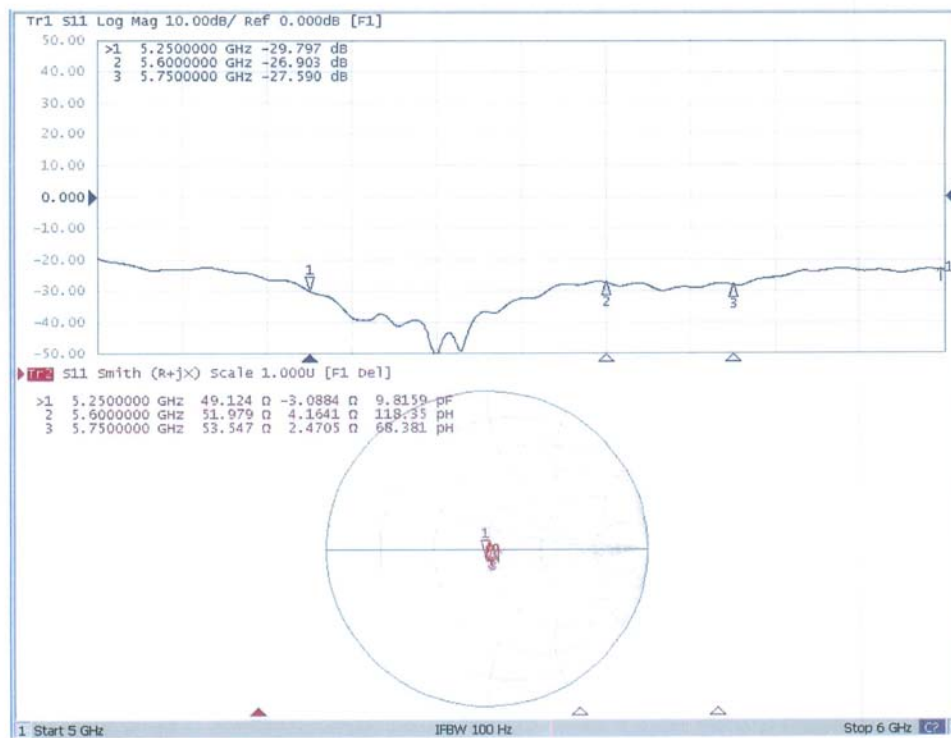


In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY



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

### Impedance Measurement Plot for Head TSL



**D5GHzV2 - SN:1246 Extended Dipole Calibrations**

Referring to KDB865664 D01, if dipoles are verified in return loss(< -20dB, within 20% of prior calibration), and in impedance(within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

**Justification of the extended calibration**

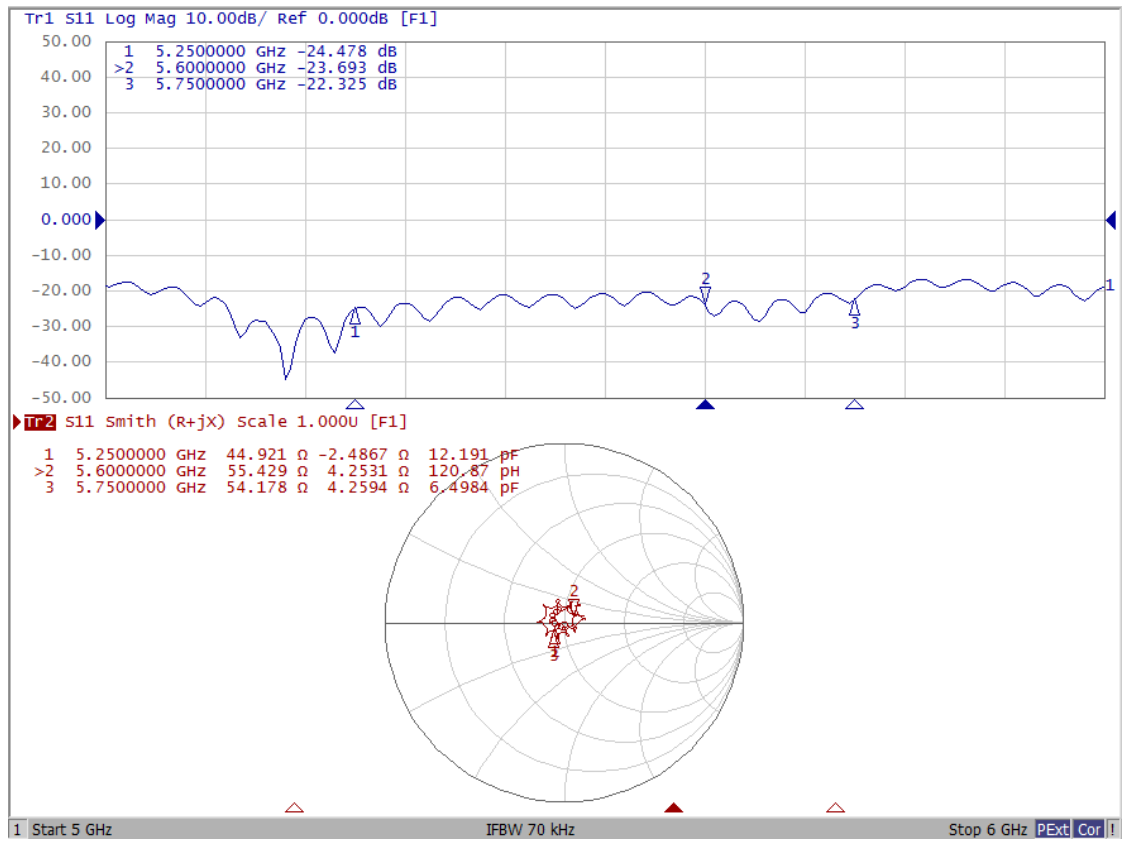
| <b>D5GHzV2 - SN:1246</b>   |                  |           |                      |             |                           |             |
|----------------------------|------------------|-----------|----------------------|-------------|---------------------------|-------------|
| <b>5250MHz Head</b>        |                  |           |                      |             |                           |             |
| Date of Measurement        | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (ohm) | Delta (ohm) |
| 2022/11/1<br>(Cal. Report) | -29.797          | /         | 49.124               | /           | -3.0884                   | /           |
| 2023/10/31<br>(Extended)   | -24.478          | -17.85    | 44.921               | -4.203      | -2.4867                   | 0.6017      |
| <b>5600MHz Head</b>        |                  |           |                      |             |                           |             |
| Date of Measurement        | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (ohm) | Delta (ohm) |
| 2022/11/1<br>(Cal. Report) | -26.903          | /         | 51.979               | /           | 4.1641                    | /           |
| 2023/10/31<br>(Extended)   | -23.693          | -11.93    | 55.429               | 3.45        | 4.2531                    | 0.089       |
| <b>5750MHz Head</b>        |                  |           |                      |             |                           |             |
| Date of Measurement        | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (ohm) | Delta (ohm) |
| 2022/11/1<br>(Cal. Report) | -27.590          | /         | 53.547               | /           | 2.4705                    | /           |
| 2023/10/31<br>(Extended)   | -22.325          | -19.08    | 54.178               | 0.631       | 4.2594                    | 1.7889      |

The return loss is <-20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.



**Dipole Verification Data> D5GHzV2 - SN:1246 (Date of Measurement: 2023/10/31)**

**5250MHz/5600MHz/5750MHz - Head**



|             | Name      | Title        | Signature |
|-------------|-----------|--------------|-----------|
| Measure By: | Mark Dong | SAR Engineer | Mark Dong |