



In Collaboration with
s p e a g
 CALIBRATION LABORATORY

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 Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
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 CALIBRATION
 CNAS L0570

Client

Sporton

Certificate No: Z21-60550

CALIBRATION CERTIFICATE

Object

D750V3 - SN: 1099

Calibration Procedure(s)

FF-Z11-003-01

Calibration Procedures for dipole validation kits

Calibration date:

December 15, 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 | 24-Sep-21 (CTTL, No.J21X08326) | Sep-22 |
| Power sensor NRP8S | 104291 | 24-Sep-21 (CTTL, No.J21X08326) | Sep-22 |
| Reference Probe EX3DV4 | SN 7307 | 26-May-21(SPEAG, No.EX3-7307_May21) | May-22 |
| DAE4 | SN 1556 | 15-Jan-21(SPEAG, No.DAE4-1556_Jan21) | 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 |

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

Issued: December 24, 2021

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Glossary:

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

Calibration is Performed According to the Following Standards:

- 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%.



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Measurement Conditions

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

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

Head TSL parameters

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|--|---------------------|----------------|----------------------|
| Nominal Head TSL parameters | 22.0 °C | 42.0 | 0.90 mho/m |
| Measured Head TSL parameters | (22.0 \pm 0.2) °C | 41.1 \pm 6 % | 0.90 mho/m \pm 6 % |
| Head TSL temperature change during test | <1.0 °C | ---- | ---- |

SAR result with Head TSL

| | | |
|--|--------------------|------------------------------|
| SAR averaged over 1 cm^3 (1 g) of Head TSL | Condition | |
| SAR measured | 250 mW input power | 2.17 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 8.54 W/kg \pm 18.8 % (k=2) |
| SAR averaged over 10 cm^3 (10 g) of Head TSL | Condition | |
| SAR measured | 250 mW input power | 1.43 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 5.65 W/kg \pm 18.7 % (k=2) |



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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

| | |
|--------------------------------------|---------------|
| Impedance, transformed to feed point | 55.0Ω+ 0.78jΩ |
| Return Loss | - 26.4dB |

General Antenna Parameters and Design

| | |
|----------------------------------|----------|
| Electrical Delay (one direction) | 0.942 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

Test Laboratory: CTTL, Beijing, China

Date: 2021-12-15

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1099

Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 750$ MHz; $\sigma = 0.904$ S/m; $\epsilon_r = 41.1$; $\rho = 1000$ kg/m³

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7307; ConvF(10.31, 10.31, 10.31) @ 750 MHz; Calibrated: 2021-05-26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2021-01-15
- 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 = 56.18 V/m; Power Drift = -0.01 dB

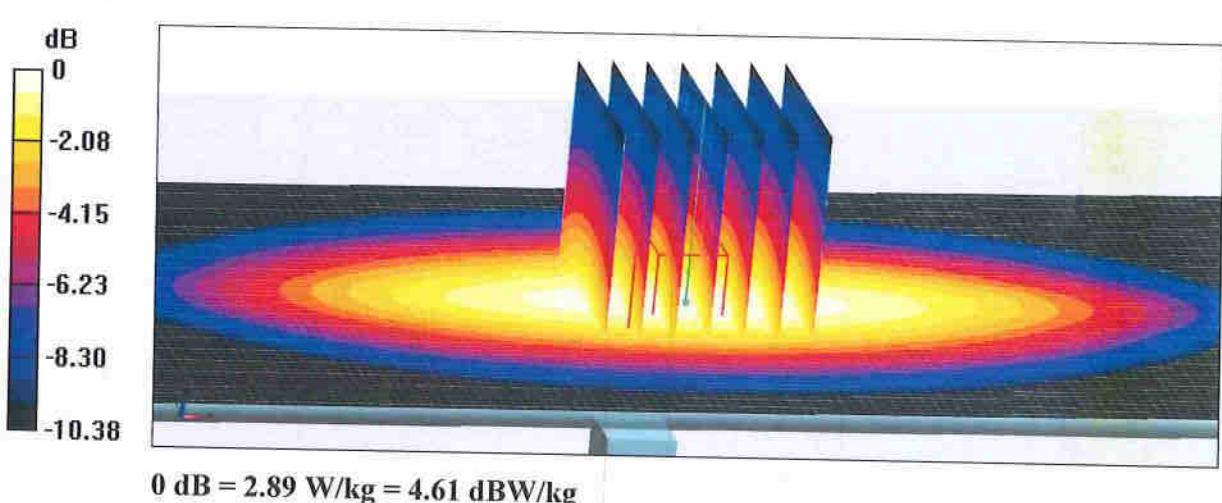
Peak SAR (extrapolated) = 3.25 W/kg

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

Smallest distance from peaks to all points 3 dB below: Larger than measurement grid (> 15 mm)

Ratio of SAR at M2 to SAR at M1 = 66.5%

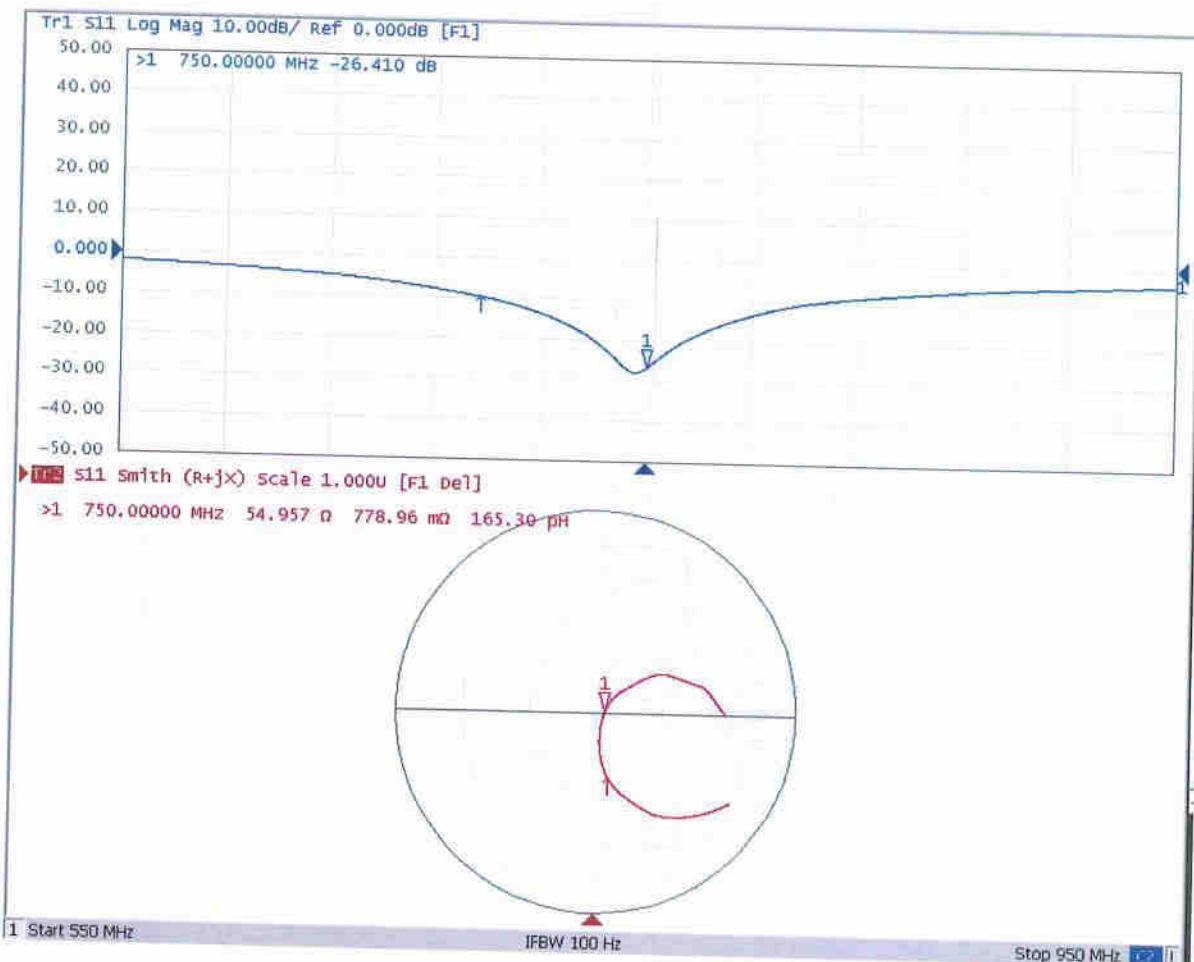
Maximum value of SAR (measured) = 2.89 W/kg





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Impedance Measurement Plot for Head TSL





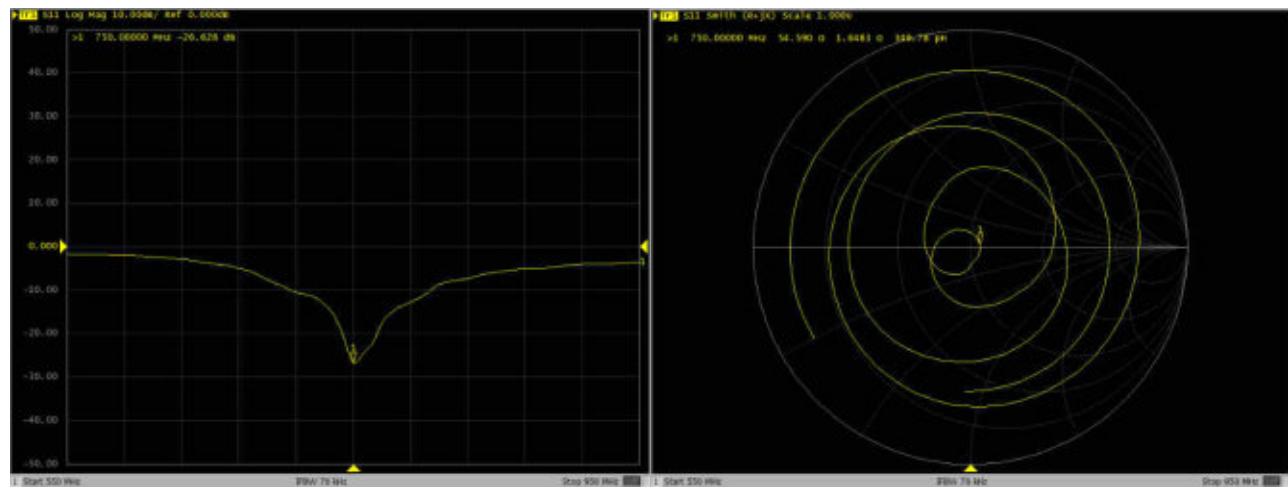
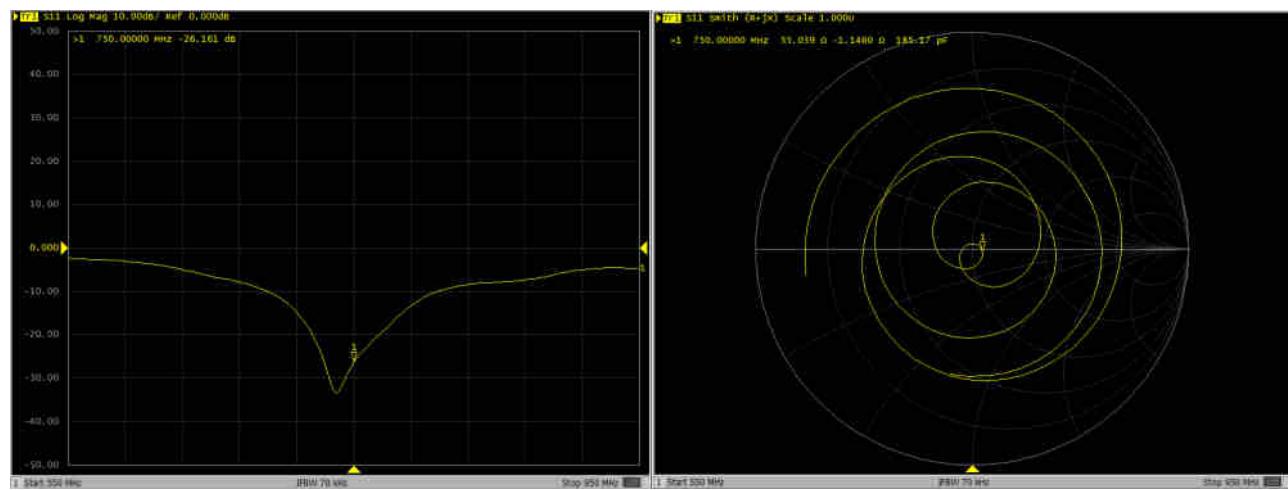
D750V3, Serial No. 1099 Extended Dipole Calibrations

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.

| D750V3 – serial no. 1099 | | | | | | |
|--------------------------|------------------|-----------|----------------------|-------------|---------------------------|-------------|
| | 750 Head | | | | | |
| Date of Measurement | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (ohm) | Delta (ohm) |
| 2021.12.15 | -26.4 | | 55 | | 0.78 | |
| 2022.12.14 | -26.6 | 0.9% | 54.6 | 0.4 | 1.6 | -0.82 |
| 2023.12.14 | -26.2 | -0.9% | 55.04 | -0.04 | -1.15 | 1.93 |

<Justification of the extended calibration>

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 > D750V3, serial no. 1099****750MHz – Head----2022.12.14****750MHz – Head----2023.12.14**



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 CALIBRATION
 CNAS L0570

Client

Sporton

Certificate No: Z21-60551

CALIBRATION CERTIFICATE

Object D835V2 - SN: 4d162

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

Calibration date: December 17, 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 | 24-Sep-21 (CTTL, No.J21X08326) | Sep-22 |
| Power sensor NRP8S | 104291 | 24-Sep-21 (CTTL, No.J21X08326) | Sep-22 |
| Reference Probe EX3DV4 | SN 7307 | 26-May-21(SPEAG, No.EX3-7307_May21) | May-22 |
| DAE4 | SN 1556 | 15-Jan-21(SPEAG, No.DAE4-1556_Jan21) | 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 |

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

Issued: December 24, 2021

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Glossary:

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

Calibration is Performed According to the Following Standards:

- 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%.



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Measurement Conditions

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

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

Head TSL parameters

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|--|---------------------|----------------|----------------------|
| Nominal Head TSL parameters | 22.0 °C | 41.5 | 0.90 mho/m |
| Measured Head TSL parameters | (22.0 \pm 0.2) °C | 40.8 \pm 6 % | 0.91 mho/m \pm 6 % |
| Head TSL temperature change during test | <1.0 °C | ---- | ---- |

SAR result with Head TSL

| | | |
|--|--------------------|------------------------------|
| SAR averaged over 1 cm^3 (1 g) of Head TSL | Condition | |
| SAR measured | 250 mW input power | 2.44 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 9.64 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 | 1.58 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 6.26 W/kg \pm 18.7 % (k=2) |



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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

| | |
|--------------------------------------|---------------|
| Impedance, transformed to feed point | 53.7Ω- 2.20jΩ |
| Return Loss | - 27.7dB |

General Antenna Parameters and Design

| | |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.346 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

Test Laboratory: CTTL, Beijing, China

Date: 2021-12-17

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d162

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

Medium parameters used: $f = 835$ MHz; $\sigma = 0.91$ S/m; $\epsilon_r = 40.77$; $\rho = 1000$ kg/m³

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7307; ConvF(10.13, 10.13, 10.13) @ 835 MHz; Calibrated: 2021-05-26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2021-01-15
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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

Reference Value = 59.81 V/m; Power Drift = -0.01 dB

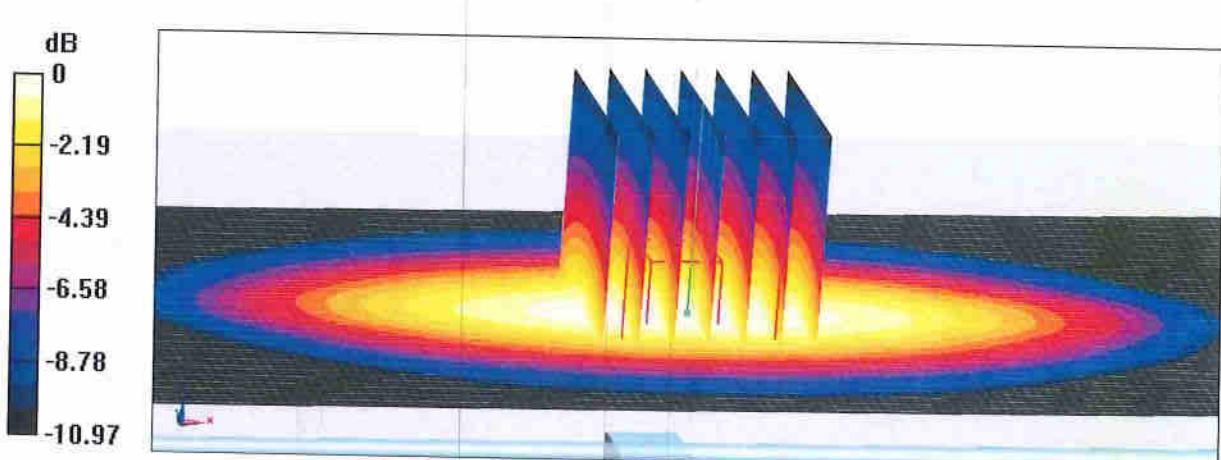
Peak SAR (extrapolated) = 3.70 W/kg

SAR(1 g) = 2.44 W/kg; SAR(10 g) = 1.58 W/kg

Smallest distance from peaks to all points 3 dB below = 20.5 mm

Ratio of SAR at M2 to SAR at M1 = 65.7%

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

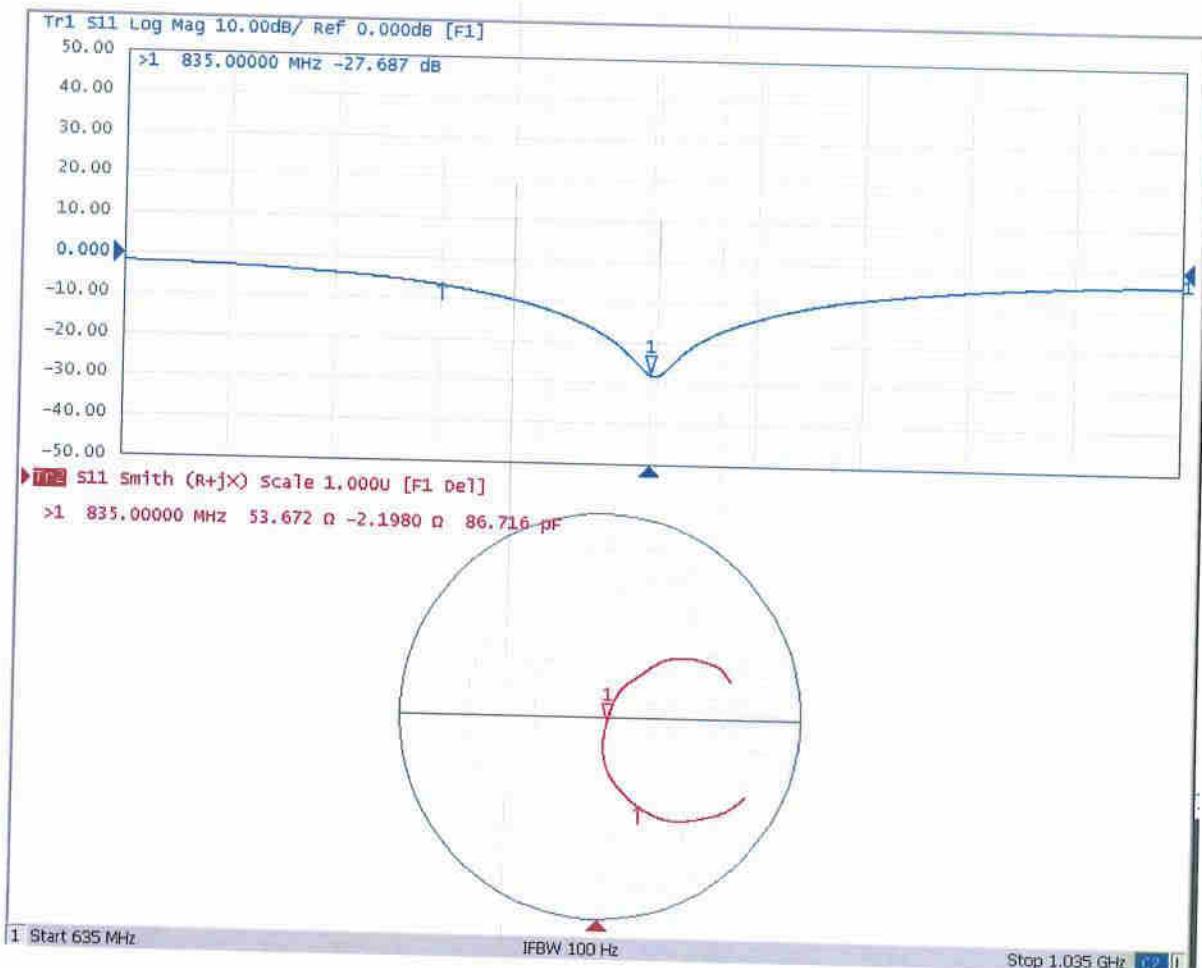




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Impedance Measurement Plot for Head TSL





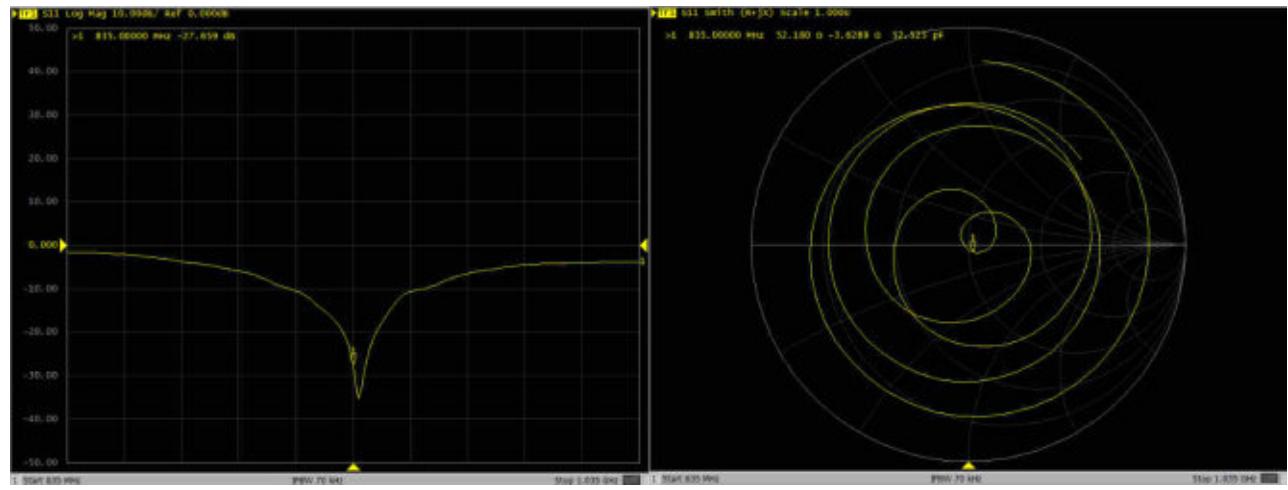
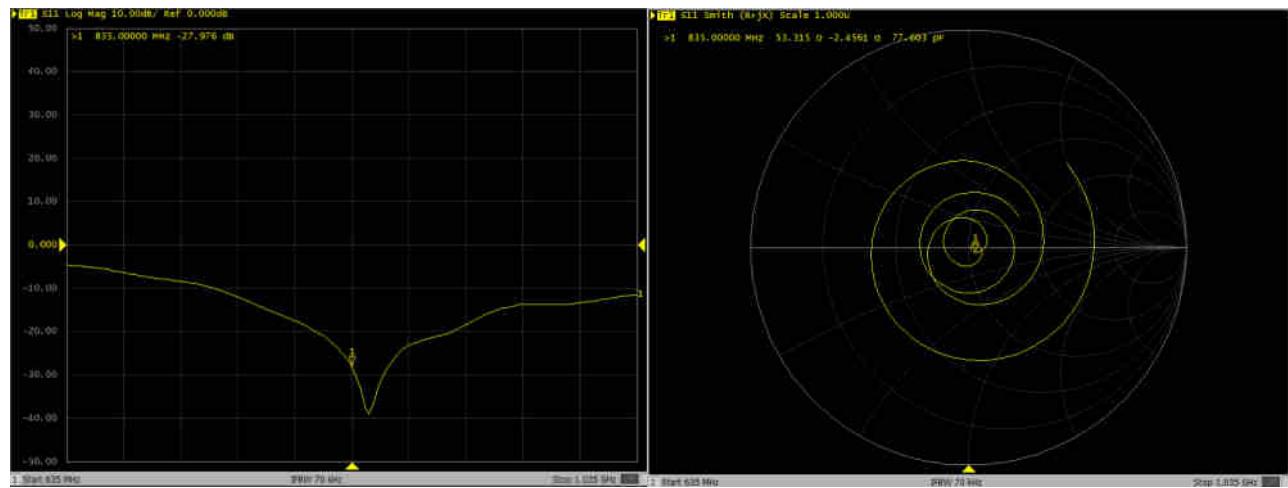
D835V2, Serial No. 4d162 Extended Dipole Calibrations

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.

| D835V2 – serial no. 4d162 | | | | | | |
|---------------------------|------------------|-----------|----------------------|-------------|---------------------------|-------------|
| | 835 Head | | | | | |
| Date of Measurement | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (ohm) | Delta (ohm) |
| 2021.12.17 | -27.7 | | 53.7 | | -2.2 | |
| 2022.12.16 | -27.7 | 0.0% | 52.2 | 1.5 | -3.6 | 1.4 |
| 2023.12.16 | -27.9 | 0.7% | 53.3 | 0.4 | -2.5 | 0.3 |

<Justification of the extended calibration>

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> 835V2, serial no. 4d162****835MHz - Head---2022.12.16****835MHz - Head---2023.12.16**

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



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

Accredited by the Swiss Accreditation Service (SAS)

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

Client **Sporton**

Accreditation No.: **SCS 0108**

Certificate No: **D1750V2-1090_Feb22**

CALIBRATION CERTIFICATE

Object **D1750V2 - SN:1090**

Calibration procedure(s) **QA CAL-05.v11**
 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz

Calibration date: **February 24, 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 (Certificate No.) | Scheduled Calibration |
|---------------------------------|--------------------|-----------------------------------|------------------------|
| Power meter NRP | SN: 104778 | 09-Apr-21 (No. 217-03291/03292) | Apr-22 |
| Power sensor NRP-Z91 | SN: 103244 | 09-Apr-21 (No. 217-03291) | Apr-22 |
| Power sensor NRP-Z91 | SN: 103245 | 09-Apr-21 (No. 217-03292) | Apr-22 |
| Reference 20 dB Attenuator | SN: BH9394 (20k) | 09-Apr-21 (No. 217-03343) | Apr-22 |
| Type-N mismatch combination | SN: 310982 / 06327 | 09-Apr-21 (No. 217-03344) | Apr-22 |
| Reference Probe EX3DV4 | SN: 7349 | 31-Dec-21 (No. EX3-7349_Dec21) | Dec-22 |
| DAE4 | SN: 601 | 01-Nov-21 (No. DAE4-601_Nov21) | Nov-22 |
| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
| Power meter E4419B | SN: GB39512475 | 30-Oct-14 (in house check Oct-20) | In house check: Oct-22 |
| Power sensor HP 8481A | SN: US37292783 | 07-Oct-15 (in house check Oct-20) | In house check: Oct-22 |
| Power sensor HP 8481A | SN: MY41093315 | 07-Oct-15 (in house check Oct-20) | In house check: Oct-22 |
| RF generator R&S SMT-06 | SN: 100972 | 15-Jun-15 (in house check Oct-20) | In house check: Oct-22 |
| Network Analyzer Agilent E8358A | SN: US41080477 | 31-Mar-14 (in house check Oct-20) | In house check: Oct-22 |

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

Signature

Approved by: Name **Niels Kuster** Function **Quality Manager**

Issued: March 3, 2022

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Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland



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S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)

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

Glossary:

| | |
|-------|--------------------------------|
| TS | tissue simulating liquid |
| ConvF | sensitivity in TS / 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 TS:* 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 TS parameters:* The measured TS parameters are used to calculate the nominal SAR result.

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

Measurement Conditions

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

| | | |
|------------------------------|------------------------|-------------|
| DASY Version | 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 | 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 | 40.4 \pm 6 % | 1.35 mho/m \pm 6 % |
| Head TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Head TSL

| | | |
|---|--------------------|------------------------------|
| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
| SAR measured | 250 mW input power | 9.14 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 37.0 W/kg \pm 17.0 % (k=2) |

| | | |
|---|--------------------|------------------------------|
| SAR averaged over 10 cm ³ (10 g) of Head TSL | condition | |
| SAR measured | 250 mW input power | 4.84 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 19.5 W/kg \pm 16.5 % (k=2) |

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

| | |
|--------------------------------------|-------------------------------|
| Impedance, transformed to feed point | 49.9 Ω - 1.4 $j\Omega$ |
| Return Loss | - 37.1 dB |

General Antenna Parameters and Design

| | |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.221 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: 24.02.2022

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1090

Communication System: UID 0 - CW; Frequency: 1750 MHz

Medium parameters used: $f = 1750$ MHz; $\sigma = 1.35$ S/m; $\epsilon_r = 40.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.67, 8.67, 8.67) @ 1750 MHz; Calibrated: 31.12.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 01.11.2021
- 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: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 106.9 V/m; Power Drift = 0.03 dB

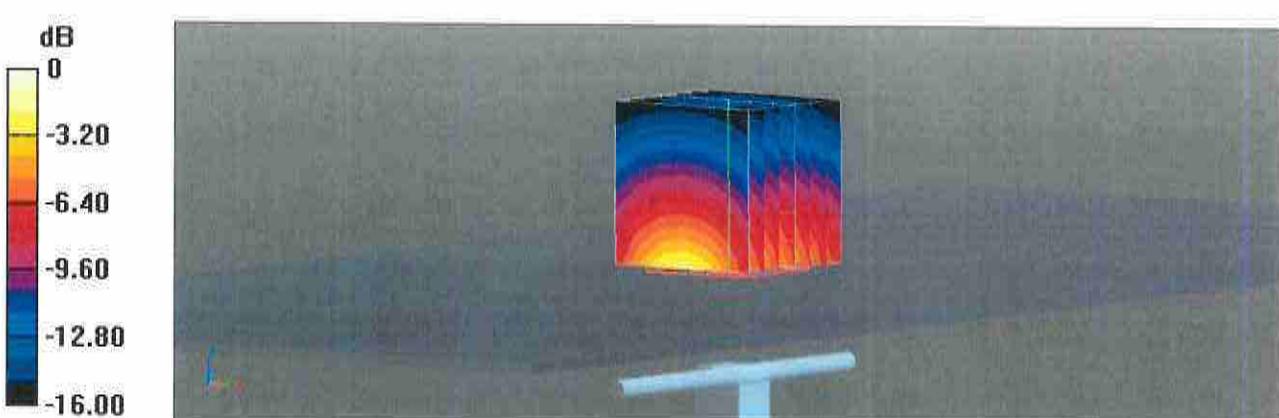
Peak SAR (extrapolated) = 16.7 W/kg

SAR(1 g) = 9.14 W/kg; SAR(10 g) = 4.84 W/kg

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

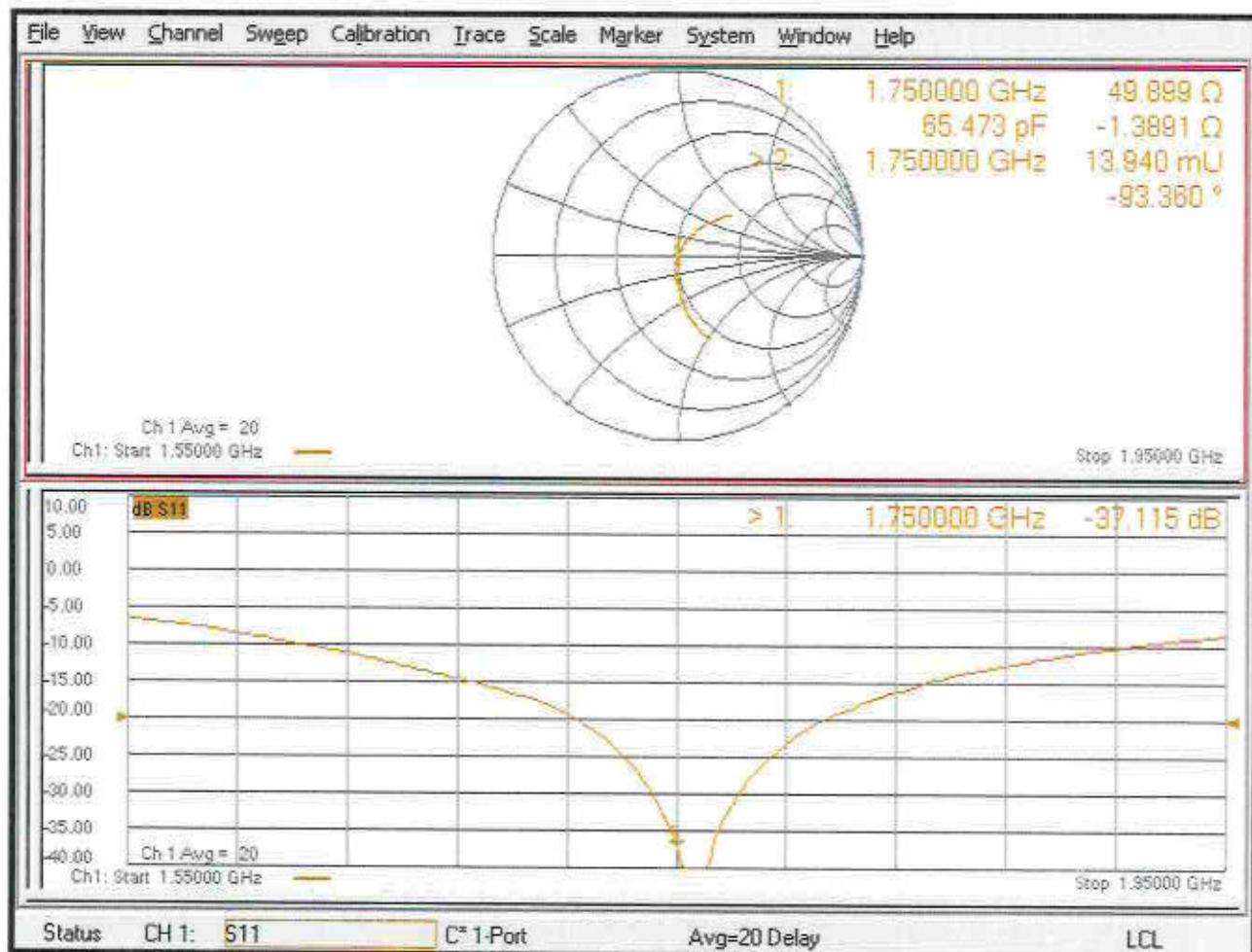
Ratio of SAR at M2 to SAR at M1 = 55%

Maximum value of SAR (measured) = 14.1 W/kg



0 dB = 14.1 W/kg = 11.50 dBW/kg

Impedance Measurement Plot for Head TSL



D1750V2, Serial No. 1090 Extended Dipole Calibrations

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.

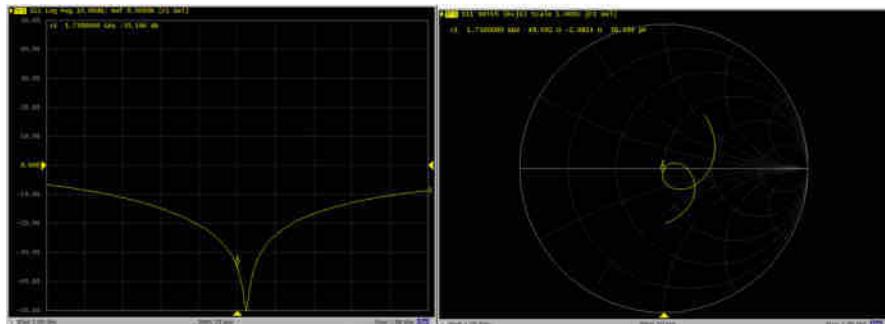
| D1750V2 – serial no. 1090 | | | | | | |
|---------------------------|------------------|-----------|----------------------|-------------|---------------------------|-------------|
| 1750 Head | | | | | | |
| Date of Measurement | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (ohm) | Delta (ohm) |
| 2022.2.24 | -37.115 | | 49.899 | | -1.3891 | |
| 2023.2.23 | -35.184 | -5.2 | 49.092 | 0.807 | -2.9814 | 1.5923 |
| 2024.2.23 | -36.717 | -1.07 | 50.143 | -0.244 | -1.4581 | 0.069 |

<Justification of the extended calibration>

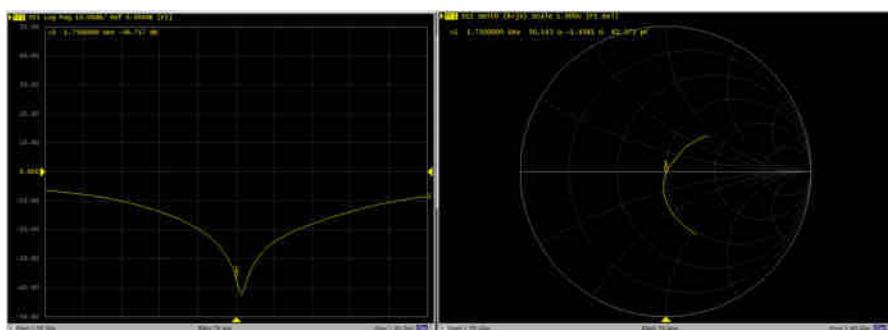
The return loss is < -20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data> D1750V2, serial no. 1090

1750MHz – Head - 2023-2-23



1750MHz – Head - 2024-2-23





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Client

Sporton

Certificate No: Z21-60553

CALIBRATION CERTIFICATE

Object D1900V2 - SN: 5d182

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

Calibration date: December 20, 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 | 24-Sep-21 (CTTL, No.J21X08326) | Sep-22 |
| Power sensor NRP8S | 104291 | 24-Sep-21 (CTTL, No.J21X08326) | Sep-22 |
| Reference Probe EX3DV4 | SN 7307 | 26-May-21(SPEAG, No.EX3-7307_May21) | May-22 |
| DAE4 | SN 1556 | 15-Jan-21(SPEAG, No.DAE4-1556_Jan21) | 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 |

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

Issued: December 27, 2021

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lossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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



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Measurement Conditions

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

| | | |
|-------------------------------------|--------------------------|-------------|
| DASY Version | DASY52 | V52.10.4 |
| Extrapolation | Advanced Extrapolation | |
| Phantom | Triple Flat Phantom 5.1C | |
| Distance Dipole Center - TSL | 10 mm | with Spacer |
| Zoom Scan Resolution | dx, dy, dz = 5 mm | |
| Frequency | 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 | 39.4 \pm 6 % | 1.41 mho/m \pm 6 % |
| Head TSL temperature change during test | <1.0 °C | ---- | ---- |

SAR result with Head TSL

| | | |
|---|--------------------|------------------------------|
| SAR averaged over 1 cm³ (1 g) of Head TSL | Condition | |
| SAR measured | 250 mW input power | 10.0 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 39.6 W/kg \pm 18.8 % (k=2) |
| SAR averaged over 10 cm³ (10 g) of Head TSL | Condition | |
| SAR measured | 250 mW input power | 5.07 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 20.2 W/kg \pm 18.7 % (k=2) |



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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

| | |
|--------------------------------------|---------------|
| Impedance, transformed to feed point | 54.3Ω+ 6.57jΩ |
| Return Loss | - 22.5dB |

General Antenna Parameters and Design

| | |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.112 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: 2021-12-20

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d182

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

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.414$ S/m; $\epsilon_r = 39.36$; $\rho = 1000$ kg/m³

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7307; ConvF(8.32, 8.32, 8.32) @ 1900 MHz; Calibrated: 2021-05-26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2021-01-15
- 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)

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 101.3 V/m; Power Drift = -0.01 dB

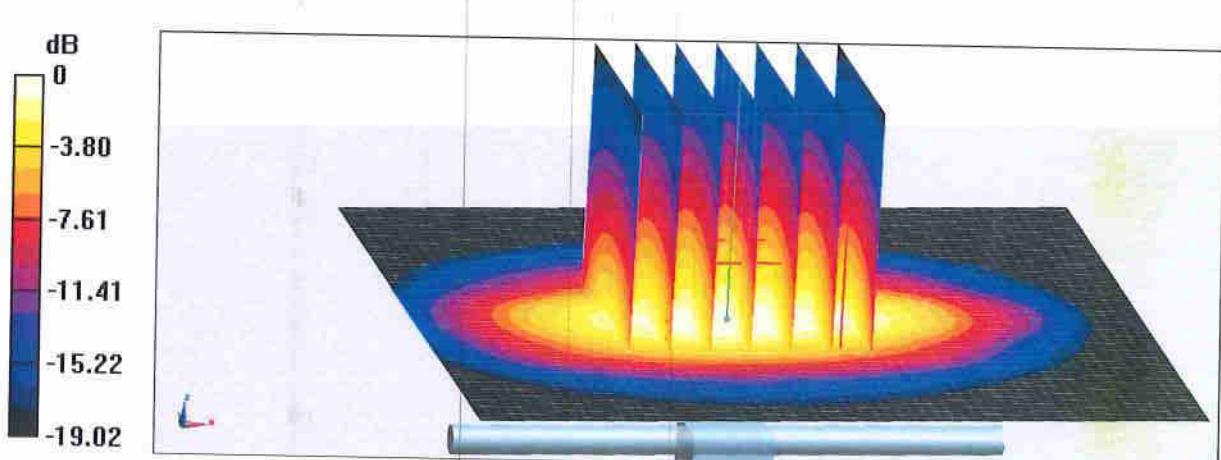
Peak SAR (extrapolated) = 19.6 W/kg

SAR(1 g) = 10 W/kg; SAR(10 g) = 5.07 W/kg

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

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

Maximum value of SAR (measured) = 15.9 W/kg

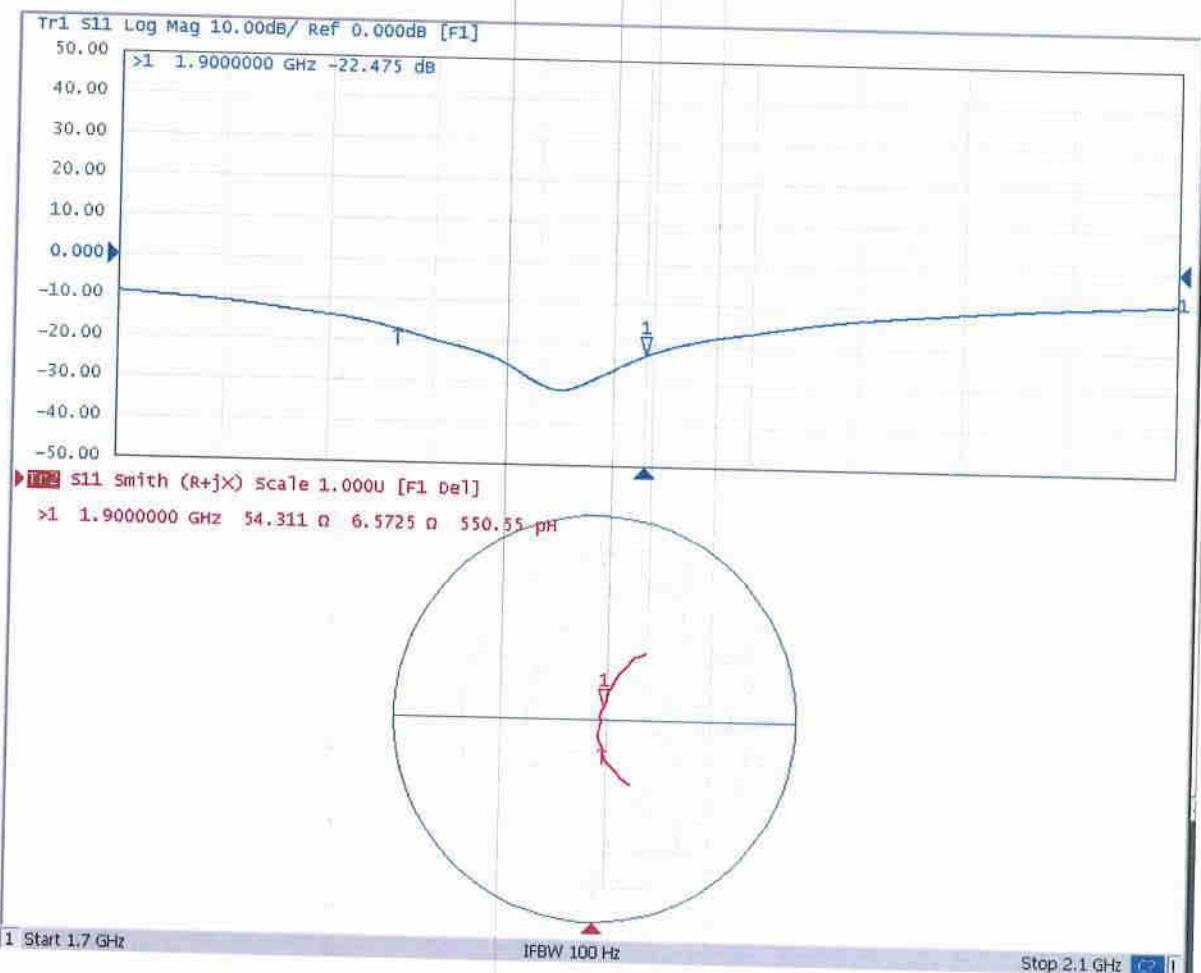




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Impedance Measurement Plot for Head TSL





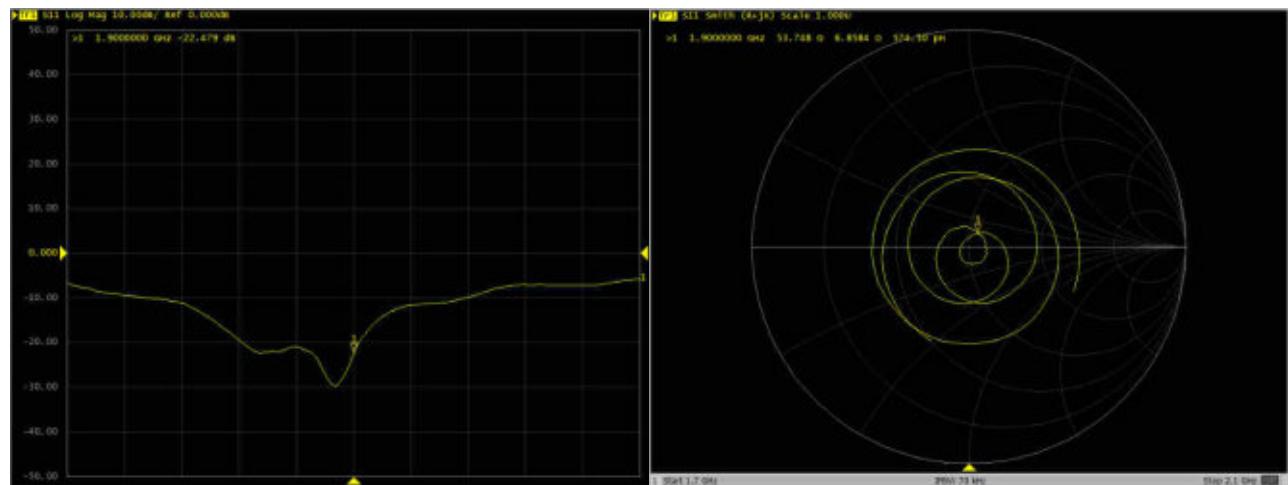
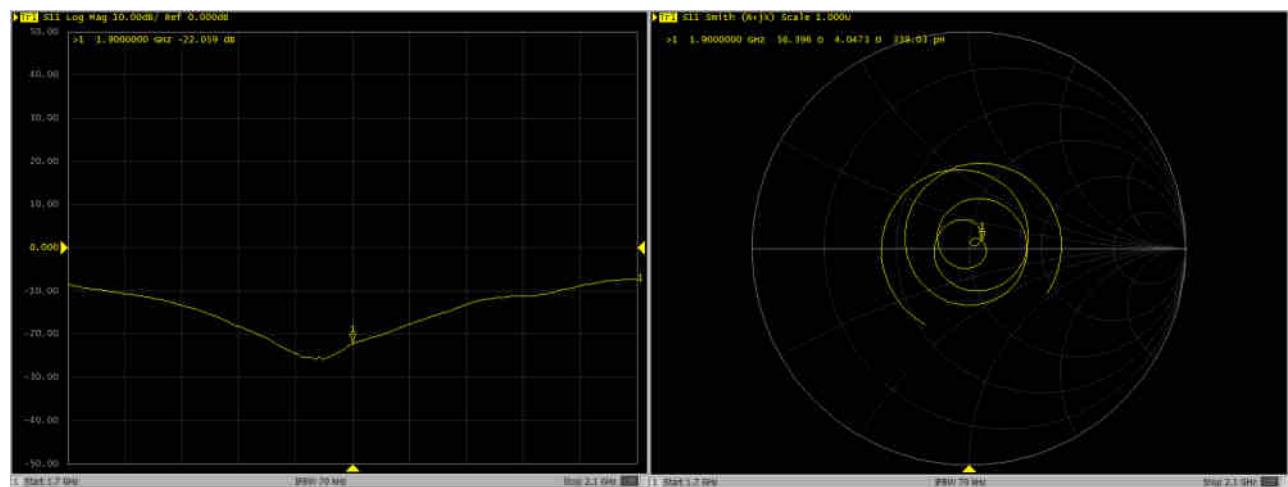
D1900V2, Serial No. 5d182 Extended Dipole Calibrations

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.

| D1900V2 – serial no. 5d182 | | | | | | |
|----------------------------|------------------|-----------|----------------------|-------------|---------------------------|-------------|
| | 1900 Head | | | | | |
| Date of Measurement | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (ohm) | Delta (ohm) |
| 2021.12.20 | -22.5 | | 54.3 | | 6.57 | |
| 2022.12.19 | -22.5 | 0.0% | 53.7 | 0.6 | 6.9 | -0.33 |
| 2023.12.19 | -22.1 | -1.8% | 56.4 | -2.1 | 4 | 2.57 |

<Justification of the extended calibration>

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, serial no. 5d182****1900MHz – Head----2022.12.19****1900MHz – Head----2023.12.19**

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Client Sporton

Certificate No: 23J02Z80115

CALIBRATION CERTIFICATE

Object D2450V2 - SN: 924

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

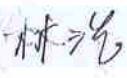
Calibration date: November 3, 2023

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Calibrated by, Certificate No.) | Scheduled Calibration |
|-------------------------|------------|---|-----------------------|
| Power Meter NRP2 | 106276 | 15-May-23 (CTTL, No.J23X04183) | May-24 |
| Power sensor NRP6A | 101369 | 15-May-23 (CTTL, No.J23X04183) | May-24 |
| Reference Probe EX3DV4 | SN 7464 | 19-Jan-23(CTTL-SPEAG, No.Z22-60565) | Jan-24 |
| DAE4 | SN 1556 | 11-Jan-23(CTTL-SPEAG, No.Z23-60034) | Jan-24 |
| Secondary Standards | ID # | Cal Date (Calibrated by, Certificate No.) | Scheduled Calibration |
| Signal Generator E4438C | MY49071430 | 05-Jan-23 (CTTL, No. J23X00107) | Jan-24 |
| NetworkAnalyzer E5071C | MY46110673 | 10-Jan-23 (CTTL, No. J23X00104) | Jan-24 |

| Calibrated by: | 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, 2023

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Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

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Measurement Conditions

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

| | | |
|-------------------------------------|--------------------------|-------------|
| DASY Version | DASY52 | 52.10.4 |
| Extrapolation | Advanced Extrapolation | |
| Phantom | Triple Flat Phantom 5.1C | |
| Distance Dipole Center - TSL | 10 mm | with Spacer |
| Zoom Scan Resolution | dx, dy, dz = 5 mm | |
| Frequency | 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 | 38.8 \pm 6 % | 1.83 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 | 13.2 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 52.3 W/kg \pm 18.8 % (k=2) |
| SAR averaged over 10 cm ³ (10 g) of Head TSL | Condition | |
| SAR measured | 250 mW input power | 6.17 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 24.5 W/kg \pm 18.7 % (k=2) |

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

| | |
|--------------------------------------|---------------|
| Impedance, transformed to feed point | 50.2Ω+ 7.23jΩ |
| Return Loss | - 22.9dB |

General Antenna Parameters and Design

| | |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.061 ns |
|----------------------------------|----------|

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feed-point may be damaged.

Additional EUT Data

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

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DASY5 Validation Report for Head TSL

Date: 2023-11-03

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 924

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

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.827$ S/m; $\epsilon_r = 38.76$; $\rho = 1000$ kg/m³

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(7.67, 7.67, 7.67) @ 2450 MHz; Calibrated: 2023-01-19
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2023-01-11
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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

Reference Value = 101.5 V/m; Power Drift = -0.05 dB

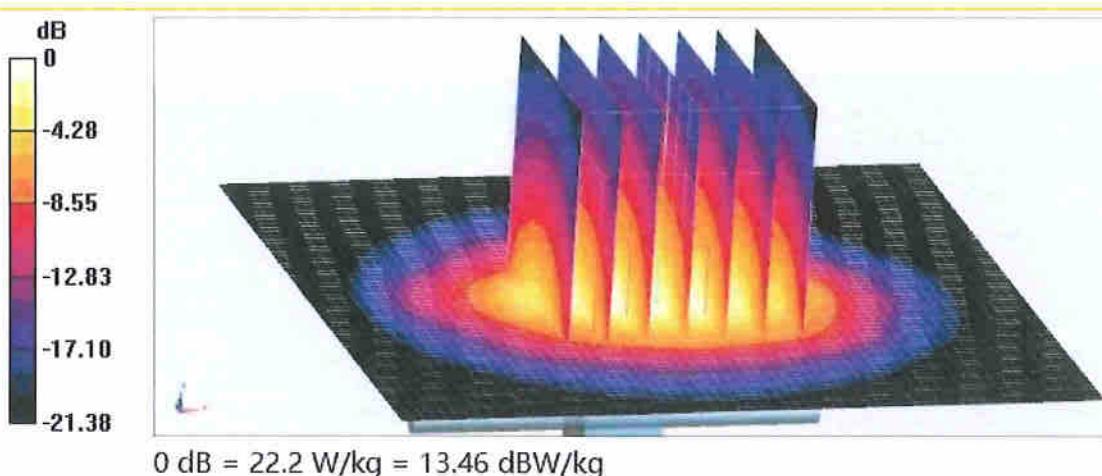
Peak SAR (extrapolated) = 27.3 W/kg

SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.17 W/kg

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

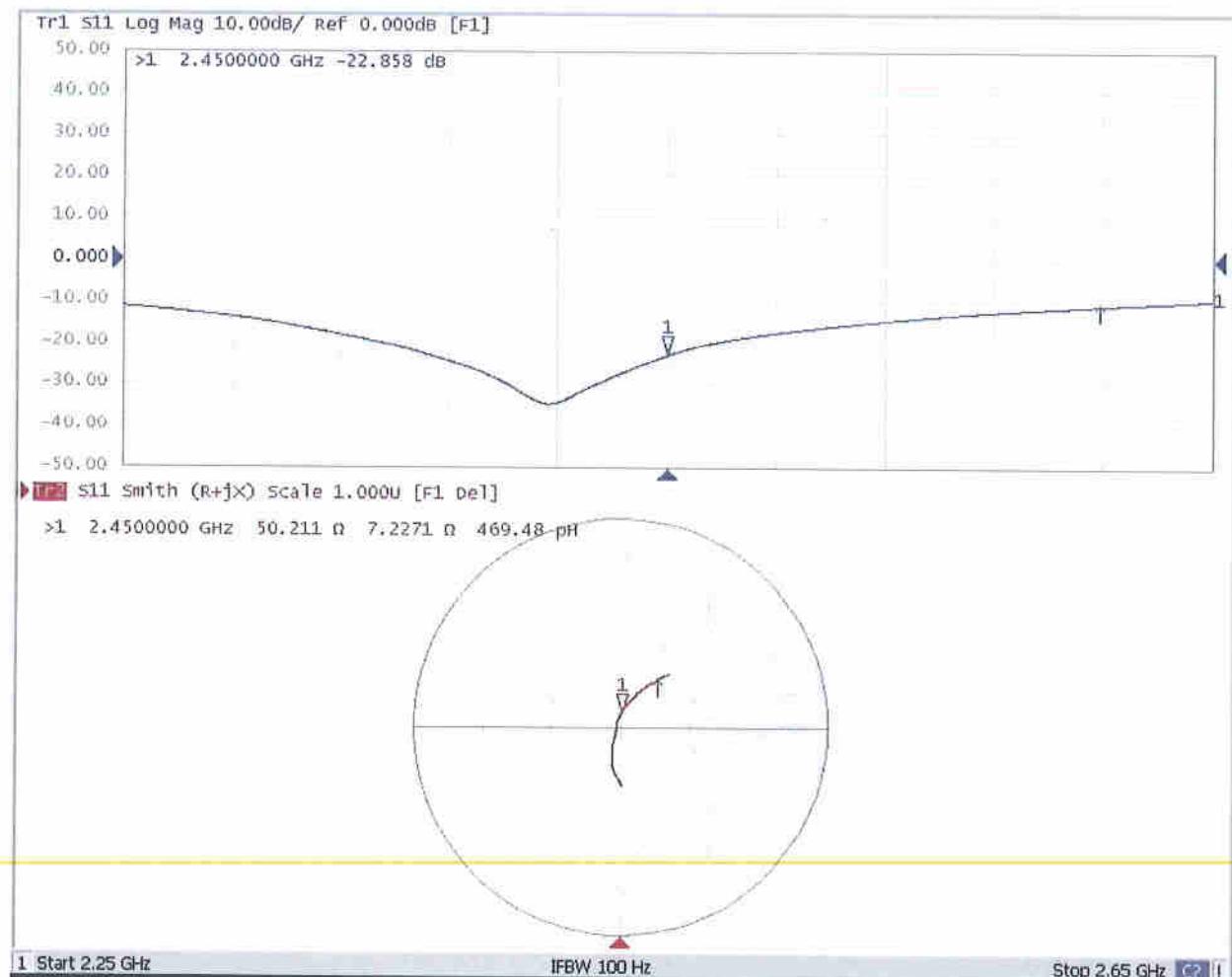
Ratio of SAR at M2 to SAR at M1 = 49.1%

Maximum value of SAR (measured) = 22.2 W/kg



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Impedance Measurement Plot for Head TSL





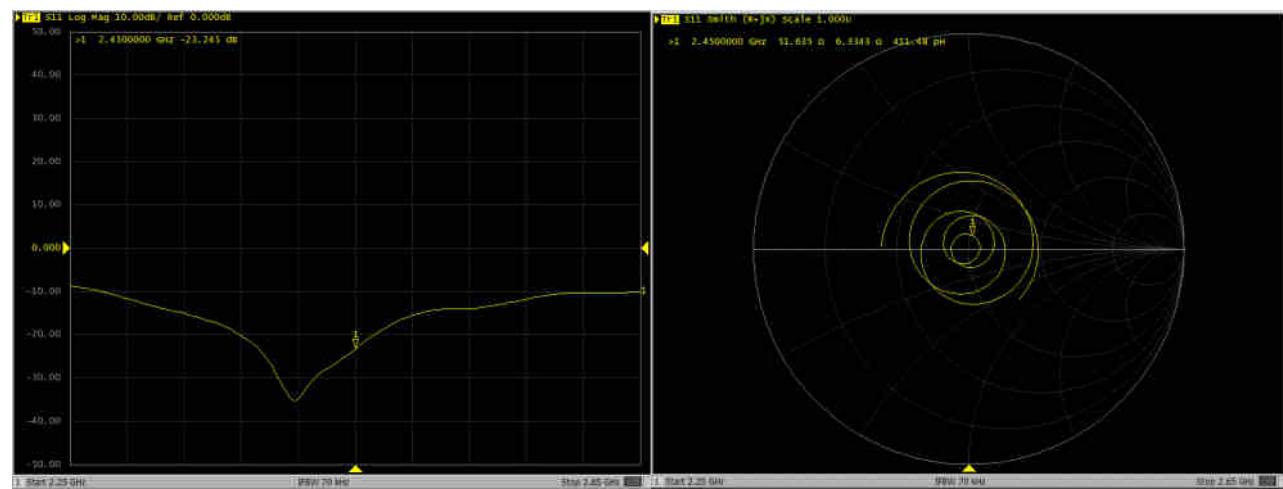
D2450V2, Serial No. 924 Extended Dipole Calibrations

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.

| D2450V2 – serial no. 924 | | | | | | |
|--------------------------|------------------|-----------|----------------------|-------------|---------------------------|-------------|
| | 2450 Head | | | | | |
| Date of Measurement | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (ohm) | Delta (ohm) |
| 2023.11.3 | -22.9 | | 50.2 | | 7.2 | |
| 2024.11.2 | -23.2 | 1.5% | 51.6 | -1.4 | 6.3 | 0.9 |
| | | | | | | |

<Justification of the extended calibration>

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 > 2450V2, serial no. 924****2450MHz - Head---2024.11.2**



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Client

Sportun

Certificate No: Z21-60554

CALIBRATION CERTIFICATE

Object D2600V2 - SN: 1070

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

Calibration date: December 20, 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 | 24-Sep-21 (CTTL, No.J21X08326) | Sep-22 |
| Power sensor NRP8S | 104291 | 24-Sep-21 (CTTL, No.J21X08326) | Sep-22 |
| Reference Probe EX3DV4 | SN 7307 | 26-May-21(SPEAG, No.EX3-7307_May21) | May-22 |
| DAE4 | SN 1556 | 15-Jan-21(SPEAG, No.DAE4-1556_Jan21) | 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 |
| Network Analyzer E5071C | MY46110673 | 14-Jan-21 (CTTL, No.J21X00232) | Jan-22 |

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

Issued: December 27, 2021

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



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Glossary:

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

Calibration is Performed According to the Following Standards:

- 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%.



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Measurement Conditions

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

| | | |
|-------------------------------------|--------------------------------------|-------------|
| DASY Version | DASY52 | V52.10.4 |
| Extrapolation | Advanced Extrapolation | |
| Phantom | Triple Flat Phantom 5.1C | |
| Distance Dipole Center - TSL | 10 mm | with Spacer |
| Zoom Scan Resolution | $dx, dy, dz = 5 \text{ mm}$ | |
| Frequency | $2600 \text{ MHz} \pm 1 \text{ MHz}$ | |

Head TSL parameters

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|--|-----------------------------|------------------------|--------------------------------------|
| Nominal Head TSL parameters | 22.0 °C | 39.0 | 1.96 mho/m |
| Measured Head TSL parameters | $(22.0 \pm 0.2) \text{ °C}$ | $40.1 \pm 6 \text{ %}$ | $1.97 \text{ mho/m} \pm 6 \text{ %}$ |
| Head TSL temperature change during test | $<1.0 \text{ °C}$ | --- | --- |

SAR result with Head TSL

| | | |
|---|--------------------|--|
| SAR averaged over 1 cm^3 (1 g) of Head TSL | Condition | |
| SAR measured | 250 mW input power | 14.0 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 56.2 W/kg $\pm 18.8 \text{ % (k=2)}$ |
| SAR averaged over 10 cm^3 (10 g) of Head TSL | Condition | |
| SAR measured | 250 mW input power | 6.14 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 24.6 W/kg $\pm 18.7 \text{ % (k=2)}$ |