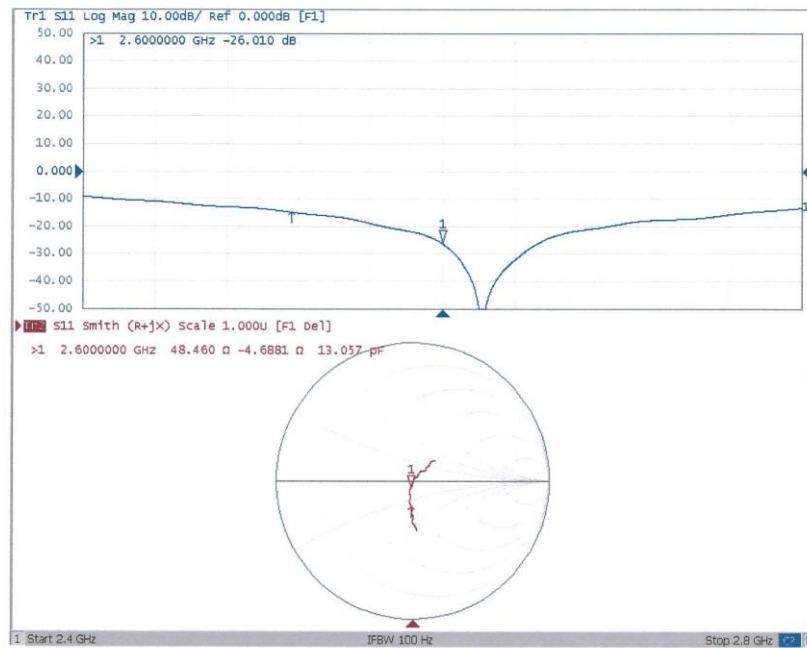




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Impedance Measurement Plot for Head TSL





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DASY5 Validation Report for Body TSL

Date: 11.01.2018

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1031

Communication System: UID 0, CW; Frequency: 2600 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2600$ MHz; $\sigma = 2.206$ S/m; $\epsilon_r = 52.65$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7514; ConvF(7.06, 7.06, 7.06) @ 2600 MHz; Calibrated: 8/27/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; Calibrated: 8/20/2018
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

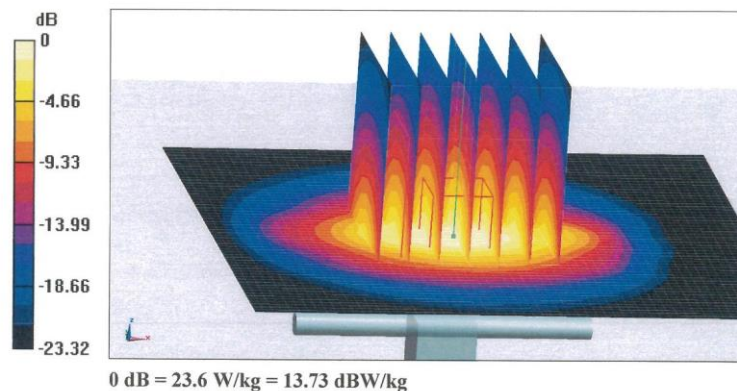
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.99 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 30.0 W/kg

SAR(1 g) = 13.7 W/kg; SAR(10 g) = 6.06 W/kg

Maximum value of SAR (measured) = 23.6 W/kg

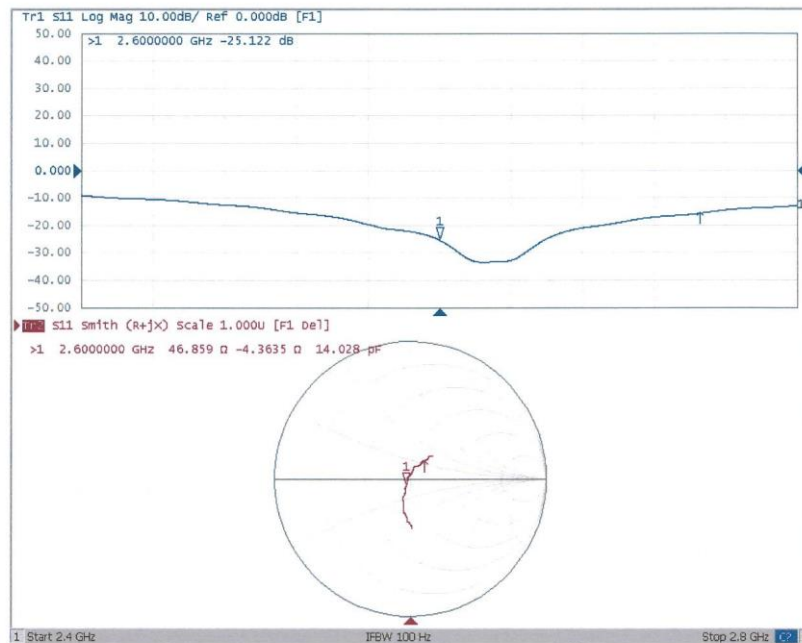




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Impedance Measurement Plot for Body TSL





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CNAS L0570

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Client

ECIT

Certificate No: Z18-60042

CALIBRATION CERTIFICATE

Object: D5GHzV2 - SN: 1172

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




Calibration date: March 30, 2018

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 | 102083 | 01-Nov-17 (CTTL, No.J17X08756) | Oct-18 |
| Power sensor NRP-Z91 | 100542 | 01-Nov-17 (CTTL, No.J17X08756) | Oct-18 |
| ReferenceProbe EX3DV4 | SN 7464 | 12-Sep-17(SPEAG,No.EX3-7464_Sep17) | Sep-18 |
| DAE4 | SN 1525 | 02-Oct-17(SPEAG,No.DAE4-1525_Oct17) | Oct-18 |
| Secondary Standards | ID # | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
| Signal Generator E4438C | MY49071430 | 23-Jan-18 (CTTL, No.J18X00560) | Jan-19 |
| NetworkAnalyzerE5071C | MY46110673 | 24-Jan-18 (CTTL, No.J18X00561) | Jan-19 |

| | 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: April 2, 2018

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

Certificate No: Z18-60042

Page 1 of 16



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Glossary:

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

Calibration is Performed According to the Following Standards:

- 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 | 52.10.0.1446 |
| Extrapolation | Advanced Extrapolation | |
| Phantom | Triple Flat Phantom 5.1C | |
| Distance Dipole Center - TSL | 10 mm | with Spacer |
| Zoom Scan Resolution | dx, dy = 4 mm, dz = 1.4 mm | Graded Ratio = 1.4 (Z direction) |
| Frequency | 5200 MHz \pm 1 MHz 5300 MHz \pm 1 MHz 5500 MHz \pm 1 MHz 5600 MHz \pm 1 MHz 5800 MHz \pm 1 MHz | |

Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|---------------------|----------------|----------------------|
| Nominal Head TSL parameters | 22.0 °C | 36.0 | 4.66 mho/m |
| Measured Head TSL parameters | (22.0 \pm 0.2) °C | 36.2 \pm 6 % | 4.70 mho/m \pm 6 % |
| Head TSL temperature change during test | <1.0 °C | ---- | ---- |

SAR result with Head TSL at 5200 MHz

| | | |
|---|--------------------|--------------------------------|
| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
| SAR measured | 100 mW input power | 7.48 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 74.9 mW / g \pm 24.4 % (k=2) |
| SAR averaged over 10 cm ³ (10 g) of Head TSL | Condition | |
| SAR measured | 100 mW input power | 2.14 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 21.4 mW / g \pm 24.2 % (k=2) |



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Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters | 22.0 °C | 35.9 | 4.76 mho/m |
| Measured Head TSL parameters | (22.0 ± 0.2) °C | 36.7 ± 6 % | 4.77 mho/m ± 6 % |
| Head TSL temperature change during test | <1.0 °C | ---- | ---- |

SAR result with Head TSL at 5300 MHz

| | | |
|---|--------------------|----------------------------|
| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
| SAR measured | 100 mW input power | 7.54 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 75.8 mW / g ± 24.4 % (k=2) |
| SAR averaged over 10 cm ³ (10 g) of Head TSL | Condition | |
| SAR measured | 100 mW input power | 2.11 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 21.2 mW / g ± 24.2 % (k=2) |

Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters | 22.0 °C | 35.6 | 4.96 mho/m |
| Measured Head TSL parameters | (22.0 ± 0.2) °C | 35.8 ± 6 % | 4.97 mho/m ± 6 % |
| Head TSL temperature change during test | <1.0 °C | ---- | ---- |

SAR result with Head TSL at 5500 MHz

| | | |
|---|--------------------|----------------------------|
| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
| SAR measured | 100 mW input power | 7.99 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 80.0 mW / g ± 24.4 % (k=2) |
| SAR averaged over 10 cm ³ (10 g) of Head TSL | Condition | |
| SAR measured | 100 mW input power | 2.26 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 22.6 mW / g ± 24.2 % (k=2) |



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Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters | 22.0 °C | 35.5 | 5.07 mho/m |
| Measured Head TSL parameters | (22.0 ± 0.2) °C | 35.8 ± 6 % | 5.10 mho/m ± 6 % |
| Head TSL temperature change during test | <1.0 °C | ---- | ---- |

SAR result with Head TSL at 5600 MHz

| | | |
|---|--------------------|----------------------------|
| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
| SAR measured | 100 mW input power | 7.91 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 79.3 mW / g ± 24.4 % (k=2) |
| SAR averaged over 10 cm ³ (10 g) of Head TSL | Condition | |
| SAR measured | 100 mW input power | 2.21 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 22.2 mW / g ± 24.2 % (k=2) |

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters | 22.0 °C | 35.3 | 5.27 mho/m |
| Measured Head TSL parameters | (22.0 ± 0.2) °C | 35.6 ± 6 % | 5.28 mho/m ± 6 % |
| Head TSL temperature change during test | <1.0 °C | ---- | ---- |

SAR result with Head TSL at 5800 MHz

| | | |
|---|--------------------|----------------------------|
| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
| SAR measured | 100 mW input power | 7.36 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 73.7 mW / g ± 24.4 % (k=2) |
| SAR averaged over 10 cm ³ (10 g) of Head TSL | Condition | |
| SAR measured | 100 mW input power | 2.06 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 20.7 mW / g ± 24.2 % (k=2) |



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Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|-----------------|--------------|------------------|
| Nominal Body TSL parameters | 22.0 °C | 49.0 | 5.30 mho/m |
| Measured Body TSL parameters | (22.0 ± 0.2) °C | 48.9 ± 6 % | 5.29 mho/m ± 6 % |
| Body TSL temperature change during test | <1.0 °C | ---- | ---- |

SAR result with Body TSL at 5200 MHz

| SAR averaged over 1 cm ³ (1 g) of Body TSL | Condition | |
|---|--------------------|----------------------------|
| SAR measured | 100 mW input power | 7.09 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 70.9 mW / g ± 24.4 % (k=2) |
| SAR averaged over 10 cm ³ (10 g) of Body TSL | Condition | |
| SAR measured | 100 mW input power | 1.98 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 19.8 mW / g ± 24.2 % (k=2) |

Body TSL parameters at 5300 MHz

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|-----------------|--------------|------------------|
| Nominal Body TSL parameters | 22.0 °C | 48.9 | 5.42 mho/m |
| Measured Body TSL parameters | (22.0 ± 0.2) °C | 48.7 ± 6 % | 5.40 mho/m ± 6 % |
| Body TSL temperature change during test | <1.0 °C | ---- | ---- |

SAR result with Body TSL at 5300 MHz

| SAR averaged over 1 cm ³ (1 g) of Body TSL | Condition | |
|---|--------------------|----------------------------|
| SAR measured | 100 mW input power | 7.12 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 71.1 mW / g ± 24.4 % (k=2) |
| SAR averaged over 10 cm ³ (10 g) of Body TSL | Condition | |
| SAR measured | 100 mW input power | 1.98 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 19.8 mW / g ± 24.2 % (k=2) |



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Body TSL parameters at 5500 MHz

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|-----------------|--------------|------------------|
| Nominal Body TSL parameters | 22.0 °C | 48.6 | 5.65 mho/m |
| Measured Body TSL parameters | (22.0 ± 0.2) °C | 48.2 ± 6 % | 5.67 mho/m ± 6 % |
| Body TSL temperature change during test | <1.0 °C | ---- | ---- |

SAR result with Body TSL at 5500 MHz

| SAR averaged over 1 cm ³ (1 g) of Body TSL | Condition | |
|---|--------------------|----------------------------|
| SAR measured | 100 mW input power | 7.72 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 77.1 mW / g ± 24.4 % (k=2) |
| SAR averaged over 10 cm ³ (10 g) of Body TSL | Condition | |
| SAR measured | 100 mW input power | 2.14 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 21.4 mW / g ± 24.2 % (k=2) |

Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|-----------------|--------------|------------------|
| Nominal Body TSL parameters | 22.0 °C | 48.5 | 5.77 mho/m |
| Measured Body TSL parameters | (22.0 ± 0.2) °C | 48.1 ± 6 % | 5.81 mho/m ± 6 % |
| Body TSL temperature change during test | <1.0 °C | ---- | ---- |

SAR result with Body TSL at 5600 MHz

| SAR averaged over 1 cm ³ (1 g) of Body TSL | Condition | |
|---|--------------------|----------------------------|
| SAR measured | 100 mW input power | 7.52 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 75.1 mW / g ± 24.4 % (k=2) |
| SAR averaged over 10 cm ³ (10 g) of Body TSL | Condition | |
| SAR measured | 100 mW input power | 2.10 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 21.0 mW / g ± 24.2 % (k=2) |



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Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|-----------------|--------------|------------------|
| Nominal Body TSL parameters | 22.0 °C | 48.2 | 6.00 mho/m |
| Measured Body TSL parameters | (22.0 ± 0.2) °C | 47.7 ± 6 % | 6.09 mho/m ± 6 % |
| Body TSL temperature change during test | <1.0 °C | ---- | ---- |

SAR result with Body TSL at 5800 MHz

| | | |
|---|--------------------|----------------------------|
| SAR averaged over 1 cm ³ (1 g) of Body TSL | Condition | |
| SAR measured | 100 mW input power | 7.27 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 72.6 mW / g ± 24.4 % (k=2) |
| SAR averaged over 10 cm ³ (10 g) of Body TSL | Condition | |
| SAR measured | 100 mW input power | 2.02 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 20.2 mW / g ± 24.2 % (k=2) |



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Appendix (Additional assessments outside the scope of CNAS L0570)**Antenna Parameters with Head TSL at 5200 MHz**

| | |
|--------------------------------------|----------------|
| Impedance, transformed to feed point | 53.1Ω - 8.16jΩ |
| Return Loss | - 21.5dB |

Antenna Parameters with Head TSL at 5300 MHz

| | |
|--------------------------------------|----------------|
| Impedance, transformed to feed point | 49.8Ω - 5.65jΩ |
| Return Loss | - 25.0dB |

Antenna Parameters with Head TSL at 5500 MHz

| | |
|--------------------------------------|----------------|
| Impedance, transformed to feed point | 53.2Ω - 6.65jΩ |
| Return Loss | - 22.9dB |

Antenna Parameters with Head TSL at 5600 MHz

| | |
|--------------------------------------|----------------|
| Impedance, transformed to feed point | 58.6Ω - 2.98jΩ |
| Return Loss | - 21.6dB |

Antenna Parameters with Head TSL at 5800 MHz

| | |
|--------------------------------------|----------------|
| Impedance, transformed to feed point | 55.0Ω - 3.20jΩ |
| Return Loss | - 24.9dB |

Antenna Parameters with Body TSL at 5200 MHz

| | |
|--------------------------------------|----------------|
| Impedance, transformed to feed point | 50.5Ω - 9.39jΩ |
| Return Loss | - 20.6dB |

Antenna Parameters with Body TSL at 5300 MHz

| | |
|--------------------------------------|----------------|
| Impedance, transformed to feed point | 51.0Ω - 4.11jΩ |
| Return Loss | - 27.6dB |



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Antenna Parameters with Body TSL at 5500 MHz

| | |
|--------------------------------------|----------------|
| Impedance, transformed to feed point | 50.3Ω - 4.72jΩ |
| Return Loss | - 26.5dB |

Antenna Parameters with Body TSL at 5600 MHz

| | |
|--------------------------------------|----------------|
| Impedance, transformed to feed point | 57.0Ω - 5.31jΩ |
| Return Loss | - 21.7dB |

Antenna Parameters with Body TSL at 5800 MHz

| | |
|--------------------------------------|----------------|
| Impedance, transformed to feed point | 58.8Ω - 0.73jΩ |
| Return Loss | - 21.9dB |

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 |
|-----------------|-------|



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DASY5 Validation Report for Head TSL

Date: 03.30.2018

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1172

Communication System: CW; Frequency: 5200 MHz, Frequency: 5300 MHz,
Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz,
Medium parameters used: $f = 5200$ MHz; $\sigma = 4.704$ mho/m; $\epsilon_r = 36.22$; $\rho = 1000$
kg/m³, Medium parameters used: $f = 5300$ MHz; $\sigma = 4.77$ mho/m; $\epsilon_r = 36.74$; $\rho =$
1000 kg/m³, Medium parameters used: $f = 5500$ MHz; $\sigma = 4.966$ mho/m; $\epsilon_r = 35.76$;
 $\rho = 1000$ kg/m³, Medium parameters used: $f = 5600$ MHz; $\sigma = 5.104$ mho/m; $\epsilon_r =$
35.78; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5800$ MHz; $\sigma = 5.281$ mho/m;
 $\epsilon_r = 35.62$; $\rho = 1000$ kg/m³,

Phantom section: Left Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(5.82, 5.82, 5.82); Calibrated: 9/12/2017,
ConvF(5.53,5.53,5.53); Calibrated: 9/12/2017,ConvF(5.21,5.21,5.21);
Calibrated: 9/12/2017, ConvF(4.98,4.98,4.98); Calibrated: 9/12/2017,
ConvF(5.11,5.11,5.11); Calibrated: 9/12/2017,
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1525; Calibrated: 2017-10-02
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/3
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10
(7417)

Dipole Calibration /Pin=100mW, d=10mm, f=5200 MHz/Zoom Scan,
dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 60.30 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 32.5 W/kg
SAR(1 g) = 7.48 W/kg; SAR(10 g) = 2.14 W/kg
Maximum value of SAR (measured) = 18.7 W/kg

Dipole Calibration /Pin=100mW, d=10mm, f=5300 MHz/Zoom Scan,
dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 66.18 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 34.1 W/kg
SAR(1 g) = 7.54 W/kg; SAR(10 g) = 2.11 W/kg
Maximum value of SAR (measured) = 18.7 W/kg

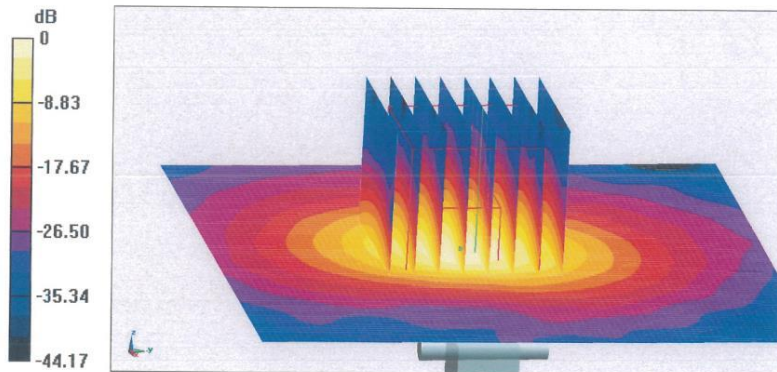


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Dipole Calibration /Pin=100mW, d=10mm, f=5500 MHz/Zoom Scan,
dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 62.80 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 35.7 W/kg
SAR(1 g) = 7.99 W/kg; SAR(10 g) = 2.26 W/kg
Maximum value of SAR (measured) = 19.3 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 = 61.90 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 37.2 W/kg
SAR(1 g) = 7.91 W/kg; SAR(10 g) = 2.21 W/kg
Maximum value of SAR (measured) = 19.7 W/kg

Dipole Calibration /Pin=100mW, d=10mm, f=5800 MHz/Zoom Scan,
dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 60.37 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 37.1 W/kg
SAR(1 g) = 7.36 W/kg; SAR(10 g) = 2.06 W/kg
Maximum value of SAR (measured) = 19.0 W/kg

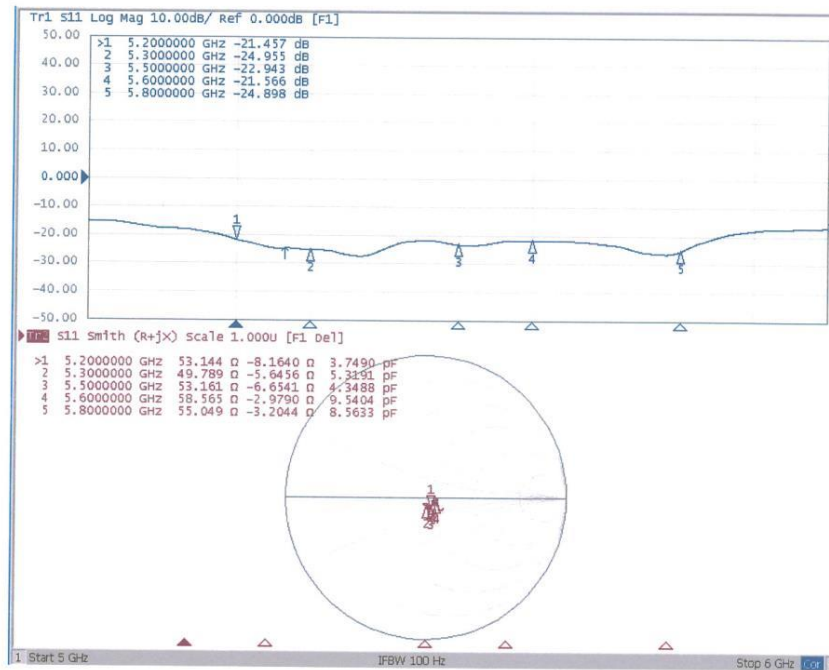


0 dB = 19.0 W/kg = 12.79 dBW/kg



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Impedance Measurement Plot for Head TSL





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DASY5 Validation Report for Body TSL

Date: 03.20.2018

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1172

Communication System: CW; Frequency: 5200 MHz, Frequency: 5300 MHz,
Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz,
Medium parameters used: $f = 5200$ MHz; $\sigma = 5.285$ mho/m; $\epsilon_r = 48.89$; $\rho = 1000$
kg/m³, Medium parameters used: $f = 5300$ MHz; $\sigma = 5.398$ mho/m; $\epsilon_r = 48.67$; $\rho =$
1000 kg/m³, Medium parameters used: $f = 5500$ MHz; $\sigma = 5.674$ mho/m; $\epsilon_r = 48.24$;
 $\rho = 1000$ kg/m³, Medium parameters used: $f = 5600$ MHz; $\sigma = 5.813$ mho/m; $\epsilon_r =$
48.05; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5800$ MHz; $\sigma = 6.093$ mho/m;
 $\epsilon_r = 47.65$; $\rho = 1000$ kg/m³,

Phantom section: Center Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(5.39, 5.39, 5.39); Calibrated: 9/12/2017,
ConvF(5.19, 5.19, 5.19); Calibrated: 9/12/2017, ConvF(4.61, 4.61, 4.61);
Calibrated: 9/12/2017, ConvF(4.5, 4.5, 4.5); Calibrated: 9/12/2017,
ConvF(4.67, 4.67, 4.67); Calibrated: 9/12/2017,
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1525; Calibrated: 2017-10-02
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/3
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10
(7417)

Dipole Calibration /Pin=100mW, d=10mm, f=5200 MHz/Zoom Scan,
dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 65.11 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 32.2 W/kg
SAR(1 g) = 7.09 W/kg; SAR(10 g) = 1.98 W/kg
Maximum value of SAR (measured) = 17.3 W/kg

Dipole Calibration /Pin=100mW, d=10mm, f=5300 MHz/Zoom Scan,
dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 62.15 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 33.3 W/kg
SAR(1 g) = 7.12 W/kg; SAR(10 g) = 1.98 W/kg
Maximum value of SAR (measured) = 17.5 W/kg

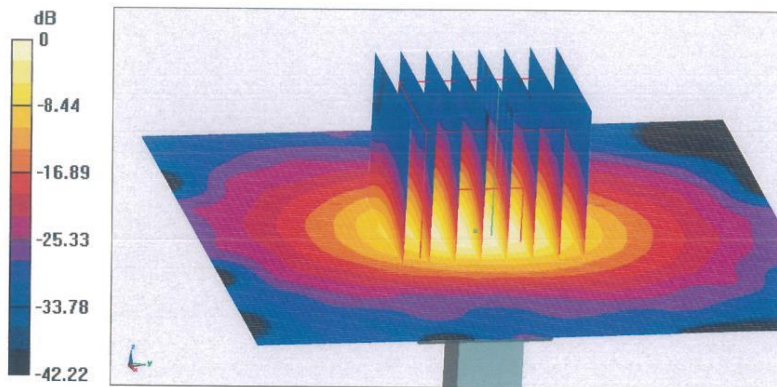


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Dipole Calibration /Pin=100mW, d=10mm, f=5500 MHz/Zoom Scan,
dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
 Reference Value = 65.49 V/m; Power Drift = 0.03 dB
 Peak SAR (extrapolated) = 37.5 W/kg
SAR(1 g) = 7.72 W/kg; SAR(10 g) = 2.14 W/kg
 Maximum value of SAR (measured) = 19.5 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 = 64.69 V/m; Power Drift = 0.00 dB
 Peak SAR (extrapolated) = 36.4 W/kg
SAR(1 g) = 7.52 W/kg; SAR(10 g) = 2.1 W/kg
 Maximum value of SAR (measured) = 18.5 W/kg

Dipole Calibration /Pin=100mW, d=10mm, f=5800 MHz/Zoom Scan,
dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
 Reference Value = 62.28 V/m; Power Drift = 0.00 dB
 Peak SAR (extrapolated) = 37.9 W/kg
SAR(1 g) = 7.27 W/kg; SAR(10 g) = 2.02 W/kg
 Maximum value of SAR (measured) = 18.5 W/kg

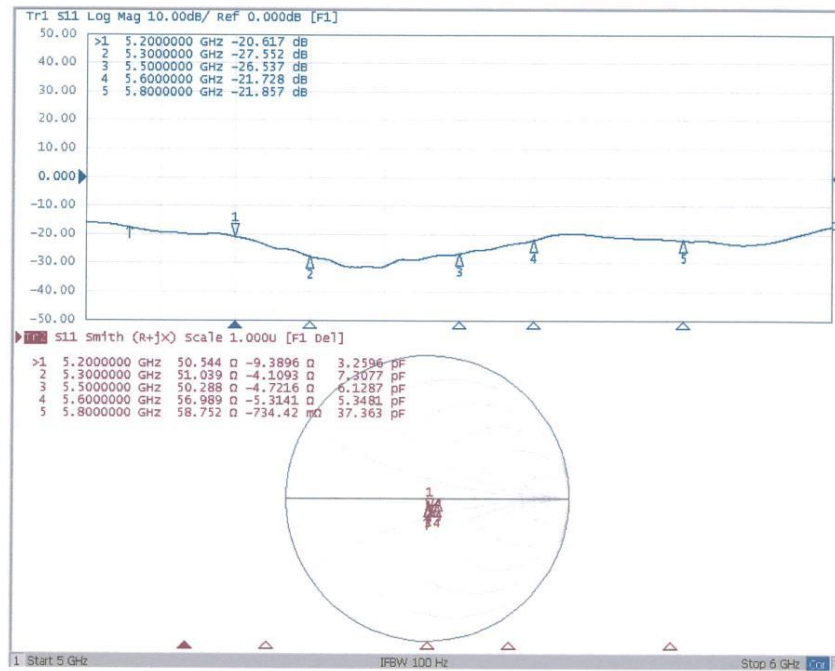


0 dB = 18.5 W/kg = 12.67 dBW/kg



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Impedance Measurement Plot for Body TSL





**Acceptable Conditions for SAR Measurements Using Probes and Dipoles
Calibrated under the SPEAG-TMC Dual-Logo Calibration Program to
Support FCC Equipment Certification**

The acceptable conditions for SAR measurements using probes, dipoles and DAEs calibrated by TMC (*Telecommunication Metrology Center of MITT in Beijing, China*), under the Dual-Logo Calibration Certificate program and quality assurance (QA) protocols established between SPEAG (*Schmid & Partner Engineering AG, Switzerland*) and TMC, to support FCC (*U.S. Federal Communications Commission*) equipment certification are defined and described in the following.

- 1) The agreement established between SPEAG and TMC is only applicable to calibration services performed by TMC where its clients (companies and divisions of such companies) are headquartered in the Greater China Region, including Taiwan and Hong Kong. This agreement is subject to renewal at the end of each calendar year between SPEAG and TMC. TMC shall inform the FCC of any changes or early termination to the agreement.
- 2) Only a subset of the calibration services specified in the SPEAG-TMC agreement, while it remains valid, are applicable to SAR measurements performed using such equipment for supporting FCC equipment certification. These are identified in the following.
 - a) Calibration of dosimetric (SAR) probes EX3DVx, ET3DVx and ES3DVx.
 - i) Free-space E-field and H-field probes, including those used for HAC (hearing aid compatibility) evaluation, temperature probes, other probes or equipment not identified in this document, when calibrated by TMC, are excluded and cannot be used for measurements to support FCC equipment certification.
 - ii) Signal specific and bundled probe calibrations based on PMR (probe modulation response) characteristics are handled according to the requirements of KDB 865664; that is, "Until standardized procedures are available to make such determination, the applicability of a signal specific probe calibration for testing specific wireless modes and technologies is determined on a case-by-case basis through KDB inquiries, including SAR system verification requirements."
 - b) Calibration of SAR system validation dipoles, excluding HAC dipoles.
 - c) Calibration of data acquisition electronics DAE3Vx, DAE4Vx and DAEasyVx.
 - d) For FCC equipment certification purposes, the frequency range of SAR probe and dipole calibrations is limited to 700 MHz - 6 GHz and provided it is supported by the equipment identified in the TMC QA protocol (a separate attachment to this document).
 - e) The identical system and equipment setup, measurement configurations, hardware, evaluation algorithms, calibration and QA protocols, including the format of calibration certificates and reports used by SPEAG shall be applied by TMC.
 - f) The calibrated items are only applicable to SPEAG DASY 4 and DASY 5 or higher version systems.



- 3) The SPEAG-TMC agreement includes specific protocols identified in the following to ensure the quality of calibration services provided by TMC under this SPEAG-TMC Dual-Logo calibration agreement are equivalent to the calibration services provided by SPEAG. TMC shall, upon request, provide copies of documentation to the FCC to substantiate program implementation.
- a) The Inter-laboratory Calibration Evaluation (ILCE) stated in the TMC QA protocol shall be performed between SPEAG and TMC at least once every 12 months. The ILCE acceptance criteria defined in the TMC QA protocol shall be satisfied for the TMC, SPEAG and FCC agreements to remain valid.
 - b) Check of Calibration Certificate (CCC) shall be performed by SPEAG for all calibrations performed by TMC. Written confirmation from SPEAG is required for TMC to issue calibration certificates under the SPEAG-TMC Dual-Logo calibration program. Quarterly reports for all calibrations performed by TMC under the program are also issued by SPEAG.
 - c) The calibration equipment and measurement system used by TMC shall be verified before each calibration service according to the specific reference SAR probes, dipoles, and DAE calibrated by SPEAG. The results shall be reproducible and within the defined acceptance criteria specified in the TMC QA protocol before each actual calibration can commence. TMC shall maintain records of the measurement and calibration system verification results for all calibrations.
 - d) Quality Check of Calibration (QCC) certificates shall be performed by SPEAG at least once every 12 months. SPEAG shall visit TMC facilities to verify the laboratory, equipment, applied procedures and plausibility of randomly selected certificates.
- 4) A copy of this document, to be updated annually, shall be provided to TMC clients that accept calibration services according to the SPEAG-TMC Dual-Logo calibration program, which should be presented to a TCB (*Telecommunication Certification Body*), to facilitate FCC equipment approval.
- 5) TMC shall address any questions raised by its clients or TCBs relating to the SPEAG-TMC Dual-Logo calibration program and inform the FCC and SPEAG of any critical issues.

Change Note: Revised on June 26 to clarify the applicability of PMR and Bundled probe calibrations according to the requirements of KDB 865664.

ANNEX H. Accreditation Certificate



*****END OF REPORT*****