

24_LTE Band 7_20M_QPSK_100RB_0Offset_Bottom side_10mm_Ch21100

Communication System: UID 0, LTE-FDD (0); Frequency: 2535 MHz; Duty Cycle: 1:1

Medium: HSL_2600 Medium parameters used: $f = 2535$ MHz; $\sigma = 1.955$ S/m; $\epsilon_r = 38.185$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.2 °C ; Liquid Temperature : 22.7 °C

DASY5 Configuration:

- Probe: ES3DV3-SN3293; ConvF(4.44, 4.44, 4.44); Calibrated: 2018.10.25
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2018.10.22
- Phantom: SAM1; Type: SAM; Serial: TP-1842
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Ch21100/Area Scan (51x71x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 1.42 W/kg

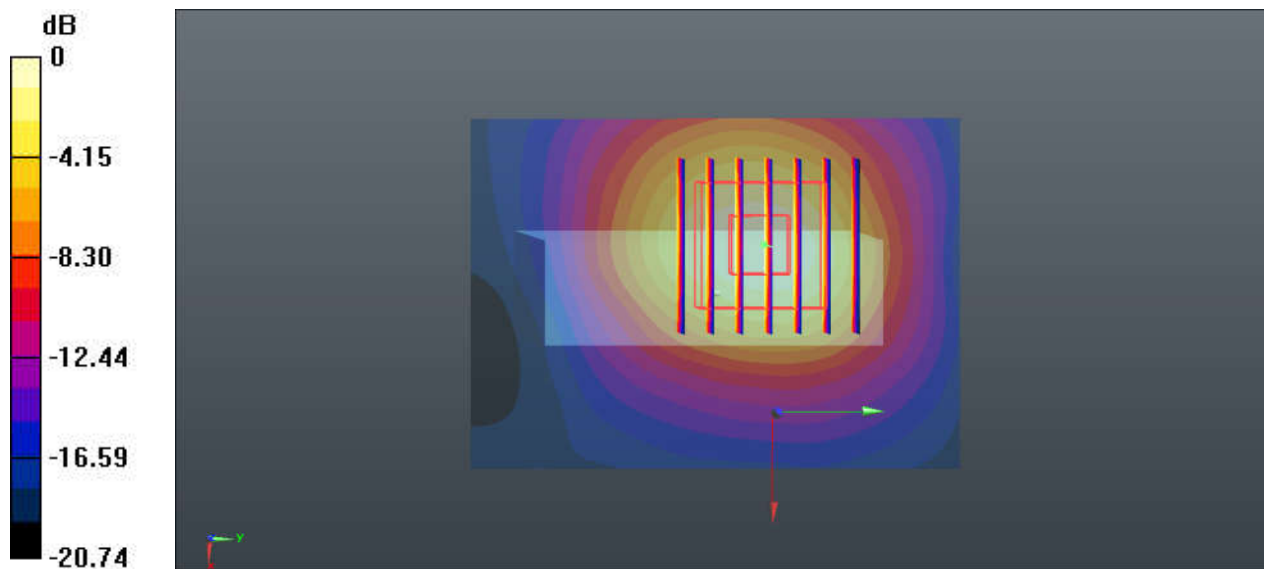
Ch21100/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 20.07 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 2.16 W/kg

SAR(1 g) = 1.06 W/kg; SAR(10 g) = 0.499 W/kg

Maximum value of SAR (measured) = 1.39 W/kg



0 dB = 1.39 W/kg = 1.43 dBW/kg

25_WLAN2.4GHz_802.11b 1Mbps_Right Side_10mm_Ch6

Communication System: UID 0, 802.11b (0); Frequency: 2437 MHz; Duty Cycle: 1:1.025

Medium: HSL_2450 Medium parameters used: $f = 2437$ MHz; $\sigma = 1.843$ S/m; $\epsilon_r = 40.326$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.3 °C ; Liquid Temperature : 22.8 °C

DASY5 Configuration:

- Probe: ES3DV3-SN3293; ConvF(4.53, 4.53, 4.53); Calibrated: 2018.10.25
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2018.10.22
- Phantom: SAM1; Type: SAM; Serial: TP-1842
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Ch6/Area Scan (61x81x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 0.312 W/kg

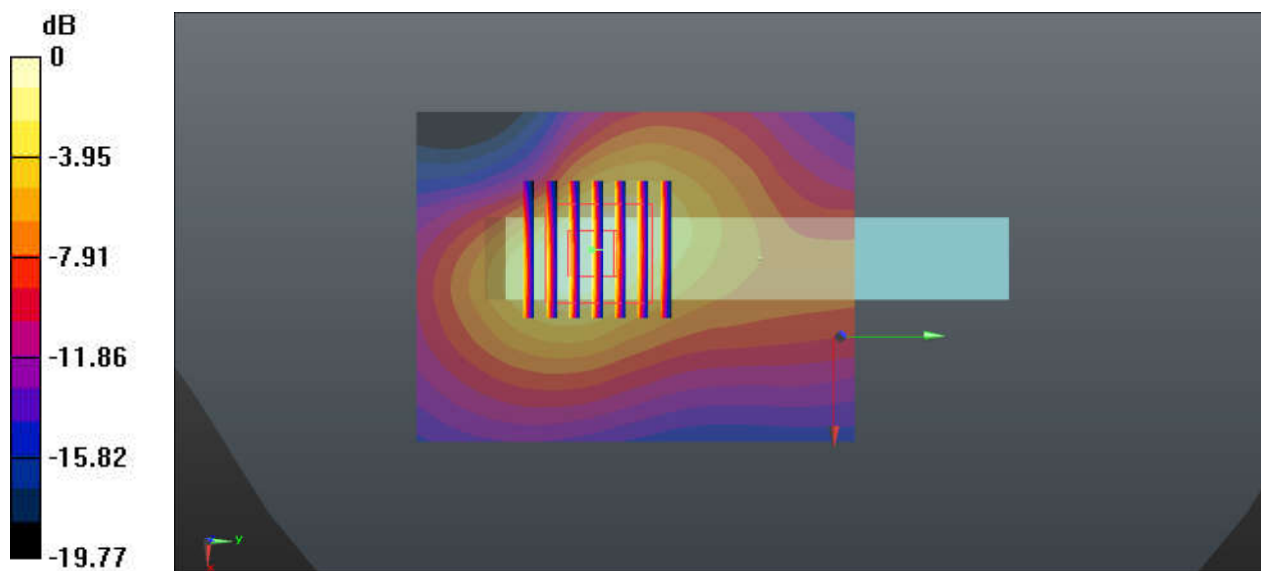
Ch6/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.420 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 0.472 W/kg

SAR(1 g) = 0.235 W/kg; SAR(10 g) = 0.115 W/kg

Maximum value of SAR (measured) = 0.307 W/kg



0 dB = 0.307 W/kg = -5.13 dBW/kg

26_Bluetooth_1Mbps_Right Side_10mm_Ch39

Communication System: UID 0, Bluetooth (0); Frequency: 2441 MHz; Duty Cycle: 1:1.294

Medium: HSL_2450 Medium parameters used: $f = 2441$ MHz; $\sigma = 1.848$ S/m; $\epsilon_r = 40.306$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.3 °C ; Liquid Temperature : 22.8 °C

DASY5 Configuration:

- Probe: ES3DV3-SN3293; ConvF(4.53, 4.53, 4.53); Calibrated: 2018.10.25
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2018.10.22
- Phantom: SAM1; Type: SAM; Serial: TP-1842
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Ch39/Area Scan (61x81x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 0.0443 W/kg

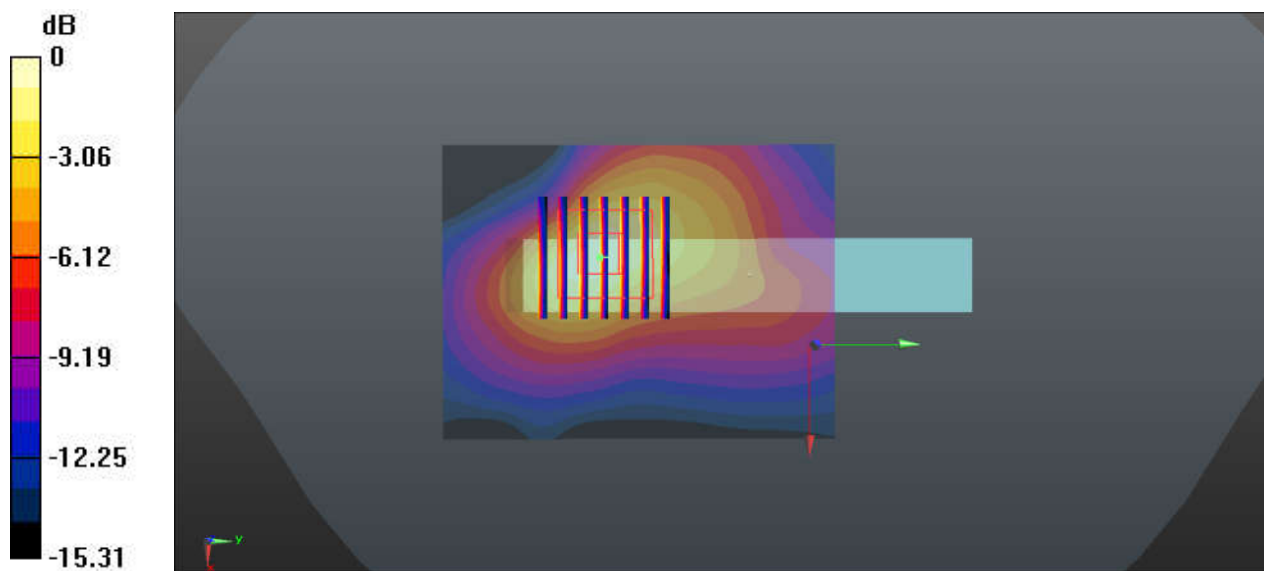
Ch39/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 2.390 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 0.0720 W/kg

SAR(1 g) = 0.035 W/kg; SAR(10 g) = 0.017 W/kg

Maximum value of SAR (measured) = 0.0457 W/kg



0 dB = 0.0457 W/kg = -13.40 dBW/kg

27_GSM 850_GPRS 4 Tx slots_Back_15mm_Ch251

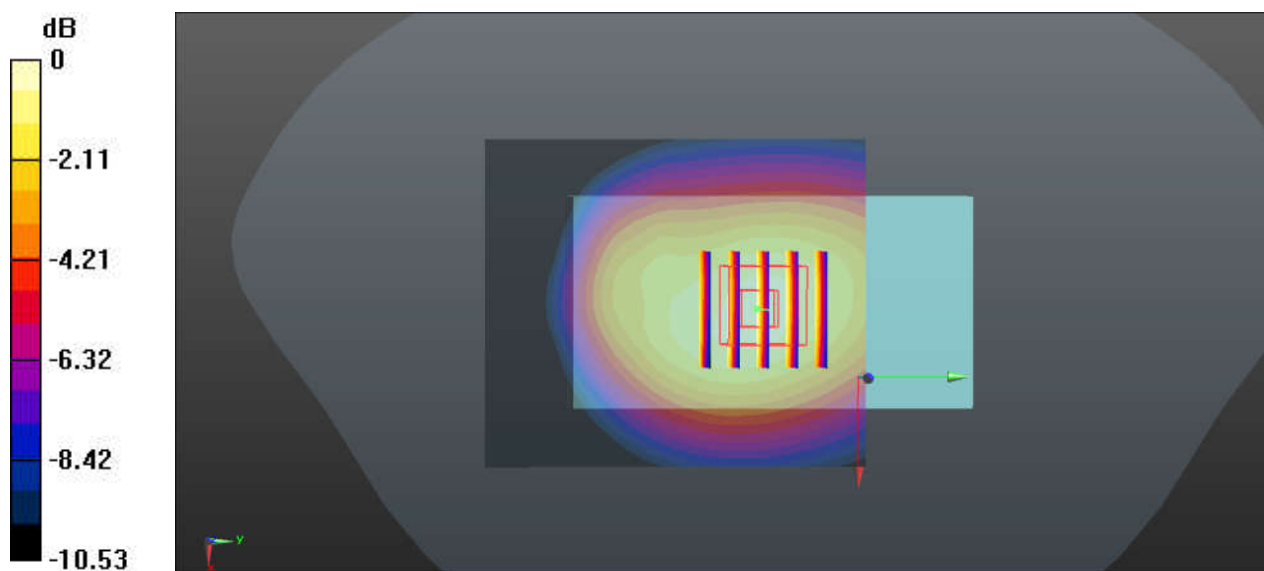
Communication System: UID 0, GSM850 (0); Frequency: 848.8 MHz; Duty Cycle: 1:2.08
Medium: HSL_835 Medium parameters used: $f = 849$ MHz; $\sigma = 0.919$ S/m; $\epsilon_r = 41.146$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.2 °C ; Liquid Temperature : 22.8 °C

DASY5 Configuration:

- Probe: ES3DV3-SN3293; ConvF(6.47, 6.47, 6.47); Calibrated: 2018.10.25
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2018.10.22
- Phantom: SAM1; Type: SAM; Serial: TP-1842
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Ch251/Area Scan (61x71x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.838 W/kg

Ch251/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 30.78 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 1.03 W/kg
SAR(1 g) = 0.782 W/kg; SAR(10 g) = 0.554 W/kg
Maximum value of SAR (measured) = 0.893 W/kg



0 dB = 0.893 W/kg = -0.49 dBW/kg

28_GSM 1900_GPRS 4 Tx slots_Back_15mm_Ch512

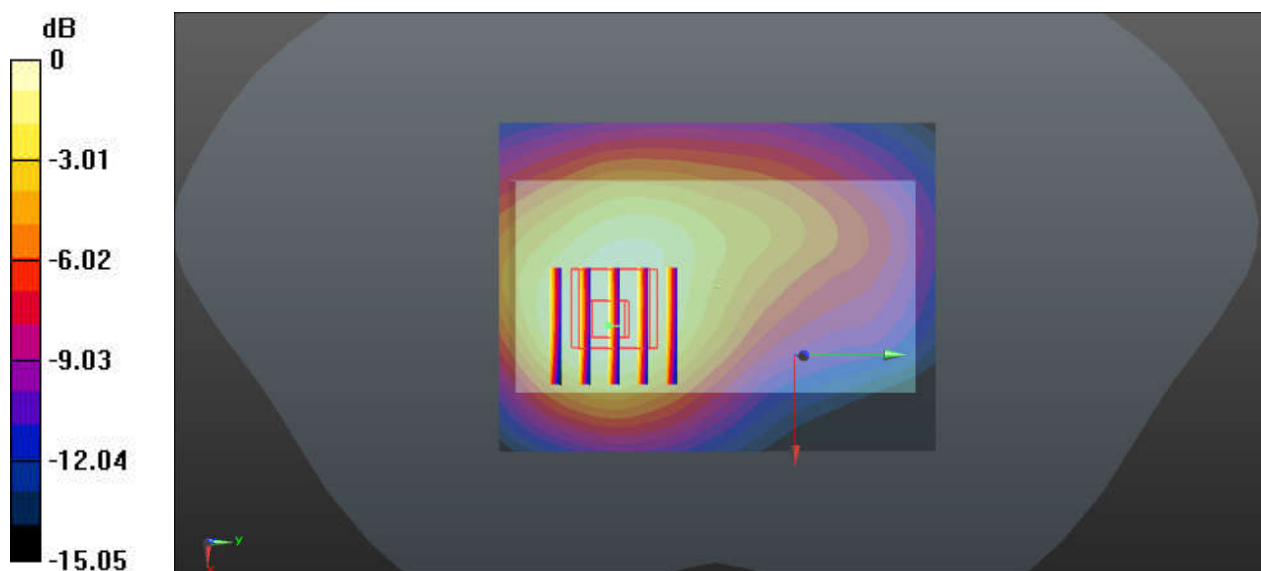
Communication System: UID 0, PCS (0); Frequency: 1850.2 MHz; Duty Cycle: 1:2.08
Medium: HSL_1900 Medium parameters used: $f = 1850.2$ MHz; $\sigma = 1.352$ S/m; $\epsilon_r = 39.299$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.2 °C ; Liquid Temperature : 22.8 °C

DASY5 Configuration:

- Probe: ES3DV3-SN3293; ConvF(5.19, 5.19, 5.19); Calibrated: 2018.10.25
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2018.10.22
- Phantom: SAM1; Type: SAM; Serial: TP-1842
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Ch512/Area Scan (61x81x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm
Maximum value of SAR (interpolated) = 0.789 W/kg

Ch512/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm
Reference Value = 16.51 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 0.974 W/kg
SAR(1 g) = 0.626 W/kg; SAR(10 g) = 0.394 W/kg
Maximum value of SAR (measured) = 0.744 W/kg



29_WCDMA V_RMC 12.2Kbps_Back_15mm_Ch4132

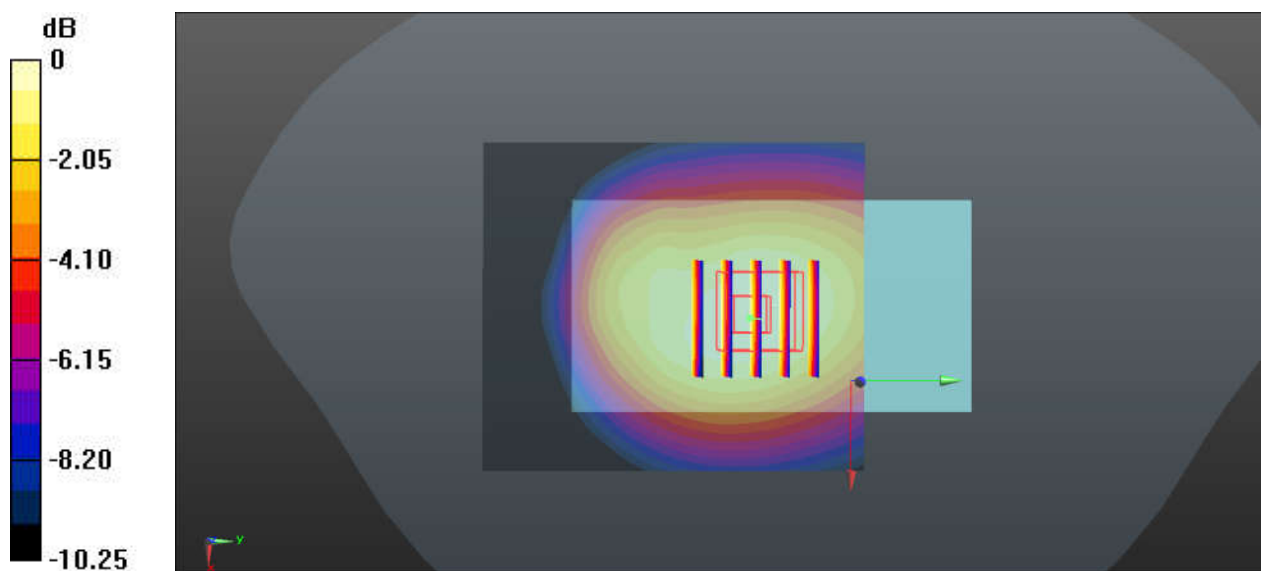
Communication System: UID 0, WCDMA (0); Frequency: 826.4 MHz; Duty Cycle: 1:1
Medium: HSL_835 Medium parameters used: $f = 826.4$ MHz; $\sigma = 0.897$ S/m; $\epsilon_r = 41.425$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.2 °C ; Liquid Temperature : 22.8 °C

DASY5 Configuration:

- Probe: ES3DV3-SN3293; ConvF(6.47, 6.47, 6.47); Calibrated: 2018.10.25
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2018.10.22
- Phantom: SAM1; Type: SAM; Serial: TP-1842
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Ch4132/Area Scan (61x71x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.995 W/kg

Ch4132/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 33.92 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 1.16 W/kg
SAR(1 g) = 0.887 W/kg; SAR(10 g) = 0.635 W/kg
Maximum value of SAR (measured) = 0.995 W/kg



0 dB = 0.995 W/kg = -0.02 dBW/kg

30_WCDMA IV_RMC 12.2Kbps_Back_15mm_Ch1413

Communication System: UID 0, WCDMA (0); Frequency: 1732.6 MHz; Duty Cycle: 1:1
Medium: HSL_1750 Medium parameters used: $f = 1733$ MHz; $\sigma = 1.363$ S/m; $\epsilon_r = 39.781$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.2 °C; Liquid Temperature : 22.6 °C

DASY5 Configuration:

- Probe: EX3DV4-SN3843; ConvF(7.95, 7.95, 7.95) ; Calibrated: 2019.9.26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn690; Calibrated: 2019.1.23
- Phantom: SAM1; Type: SAM; Serial: TP-1842
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Ch1413/Area Scan (71x91x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.722 W/kg

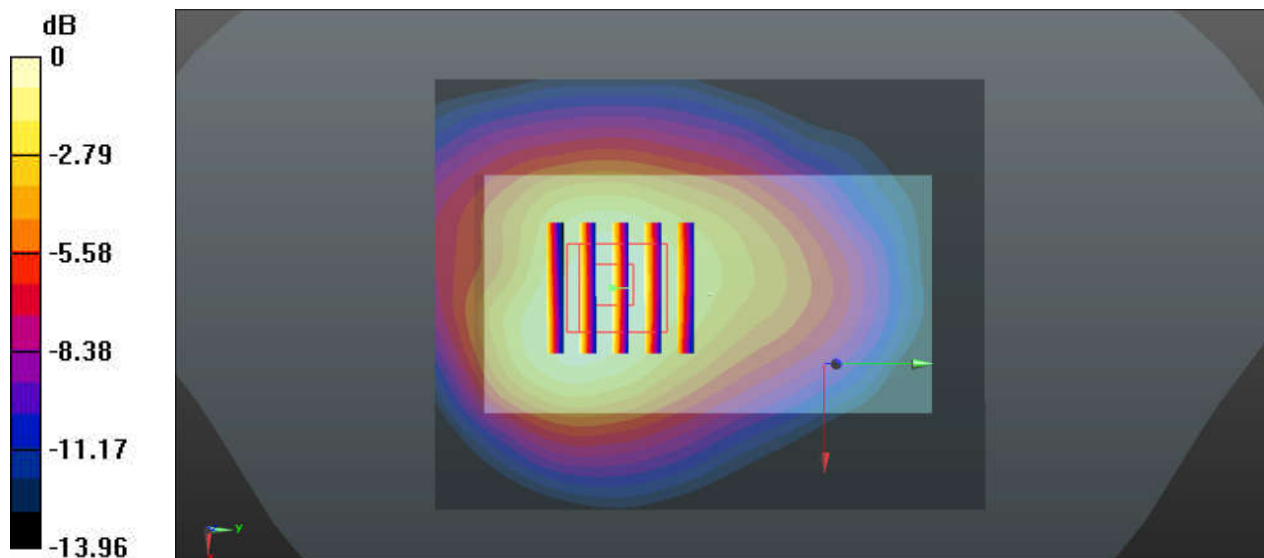
Ch1413/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 17.70 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 0.841 W/kg

SAR(1 g) = 0.532 W/kg; SAR(10 g) = 0.339 W/kg

Maximum value of SAR (measured) = 0.722 W/kg



0 dB = 0.722 W/kg = -1.41 dBW/kg

31_WCDMA II_RMC 12.2Kbps_Back_15mm_Ch9538

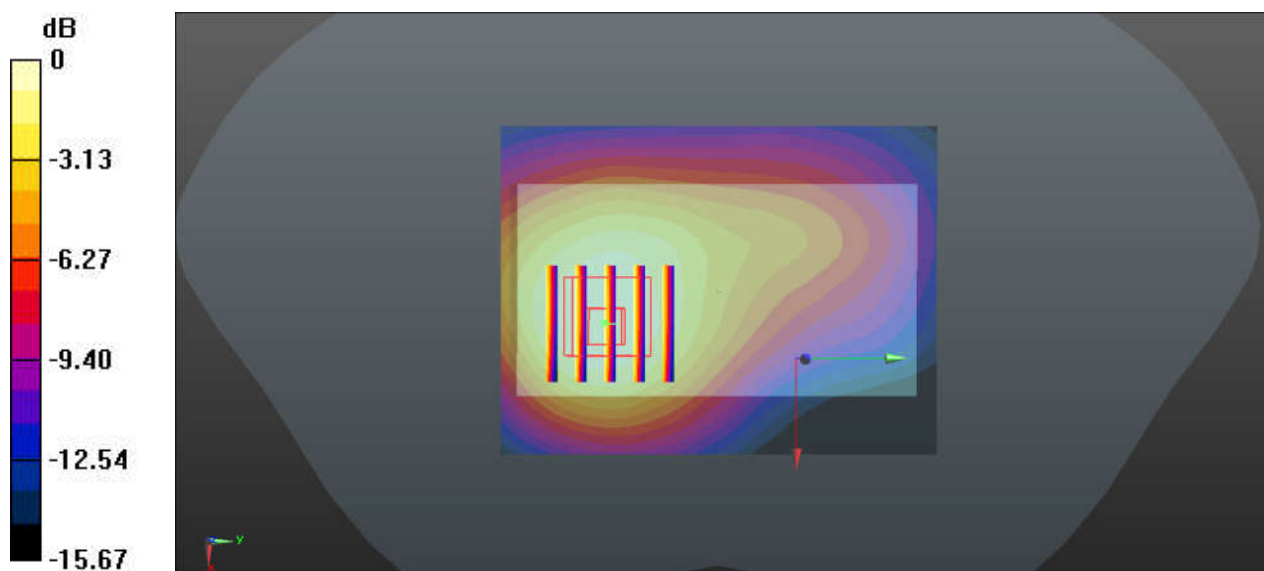
Communication System: UID 0, WCDMA (0); Frequency: 1907.6 MHz; Duty Cycle: 1:1
Medium: HSL_1900 Medium parameters used: $f = 1908$ MHz; $\sigma = 1.411$ S/m; $\epsilon_r = 39.055$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.2 °C ; Liquid Temperature : 22.8 °C

DASY5 Configuration:

- Probe: ES3DV3-SN3293; ConvF(5.19, 5.19, 5.19); Calibrated: 2018.10.25
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2018.10.22
- Phantom: SAM1; Type: SAM; Serial: TP-1842
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Ch9538/Area Scan (61x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.14 W/kg

Ch9538/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 18.12 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 1.47 W/kg
SAR(1 g) = 0.908 W/kg; SAR(10 g) = 0.563 W/kg
Maximum value of SAR (measured) = 1.08 W/kg



0 dB = 1.08 W/kg = 0.33 dBW/kg

32_LTE Band 12_10M_QPSK_1RB_49Offset_Back_15mm_Ch23095

Communication System: UID 0, LTE-FDD (0); Frequency: 707.5 MHz; Duty Cycle: 1:1
Medium: HSL_750 Medium parameters used: $f = 707.5$ MHz; $\sigma = 0.853$ S/m; $\epsilon_r = 42.316$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.3 °C; Liquid Temperature : 22.8 °C

DASY5 Configuration:

-Probe: ES3DV3-SN3293; ConvF(6.78, 6.78, 6.78); Calibrated: 2019.10.25
-Sensor-Surface: 3mm (Mechanical Surface Detection)
-Electronics: DAE4 Sn1279; Calibrated: 2018.10.22
-Phantom: SAM1; Type: SAM; Serial: TP-1842
-Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Ch23095/Area Scan (61x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.310 W/kg

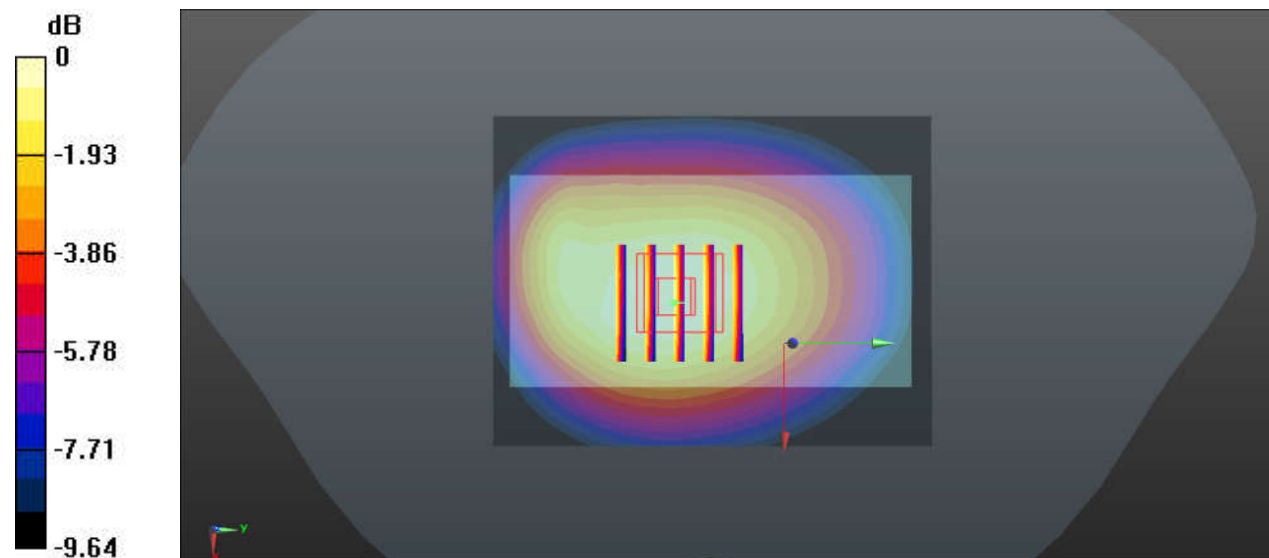
Ch23095/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 19.13 V/m; Power Drift = -0.10 dB

Peak SAR (extrapolated) = 0.363 W/kg

SAR(1 g) = 0.283 W/kg; SAR(10 g) = 0.207 W/kg

Maximum value of SAR (measured) = 0.315 W/kg



0 dB = 0.315 W/kg = -5.02 dBW/kg

33_LTE Band 13_10M_QPSK_1RB_0Offset_Back_15mm_Ch23230

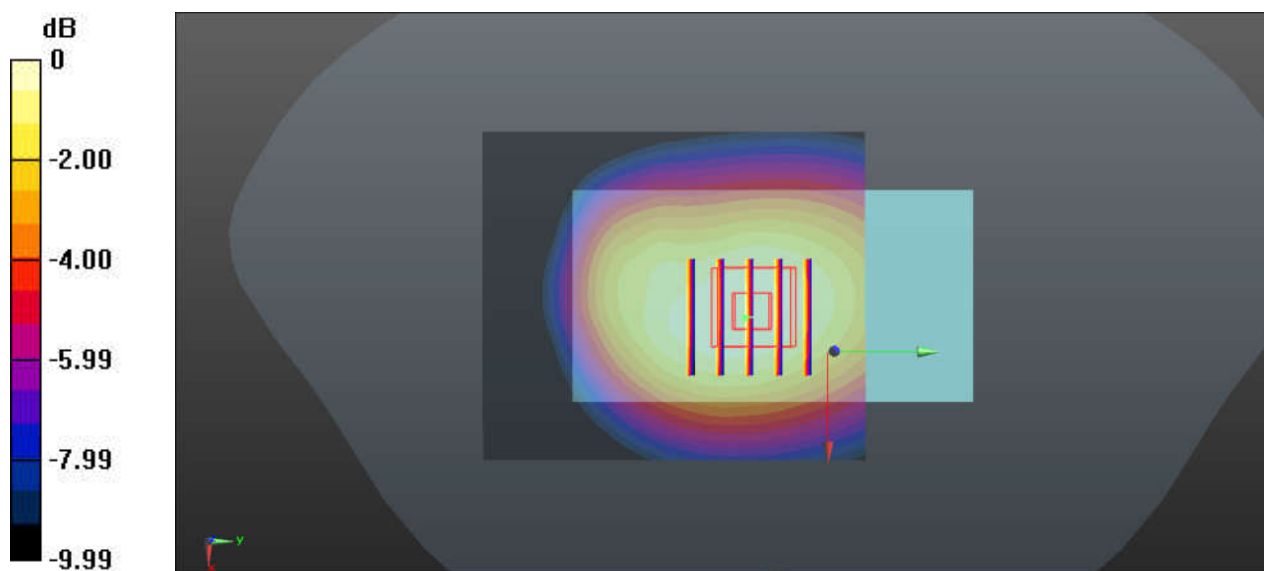
Communication System: UID 0, LTE-FDD (0); Frequency: 782 MHz; Duty Cycle: 1:1
Medium: HSL_750 Medium parameters used: $f = 782$ MHz; $\sigma = 0.924$ S/m; $\epsilon_r = 41.333$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.3 °C ; Liquid Temperature : 22.8 °C

DASY5 Configuration:

- Probe: ES3DV3-SN3293; ConvF(6.78, 6.78, 6.78); Calibrated: 2019.10.25
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2018.10.22
- Phantom: SAM1; Type: SAM; Serial: TP-1842
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Ch23230/Area Scan (61x71x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.910 W/kg

Ch23230/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 31.95 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 1.03 W/kg
SAR(1 g) = 0.803 W/kg; SAR(10 g) = 0.580 W/kg
Maximum value of SAR (measured) = 0.896 W/kg



0 dB = 0.896 W/kg = -0.48 dBW/kg

34_LTE Band 5_10M_QPSK_1RB_0Offset_Back_15mm_Ch20525

Communication System: UID 0, LTE-FDD (0); Frequency: 836.5 MHz; Duty Cycle: 1:1
Medium: HSL_835 Medium parameters used: $f = 836.5$ MHz; $\sigma = 0.906$ S/m; $\epsilon_r = 41.297$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.2 °C; Liquid Temperature : 22.8 °C

DASY5 Configuration:

-Probe: ES3DV3-SN3293; ConvF(6.47, 6.47, 6.47); Calibrated: 2018.10.25
-Sensor-Surface: 3mm (Mechanical Surface Detection)
-Electronics: DAE4 Sn1279; Calibrated: 2018.10.22
-Phantom: SAM1; Type: SAM; Serial: TP-1842
-Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Ch20525/Area Scan (61x71x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 1.10 W/kg

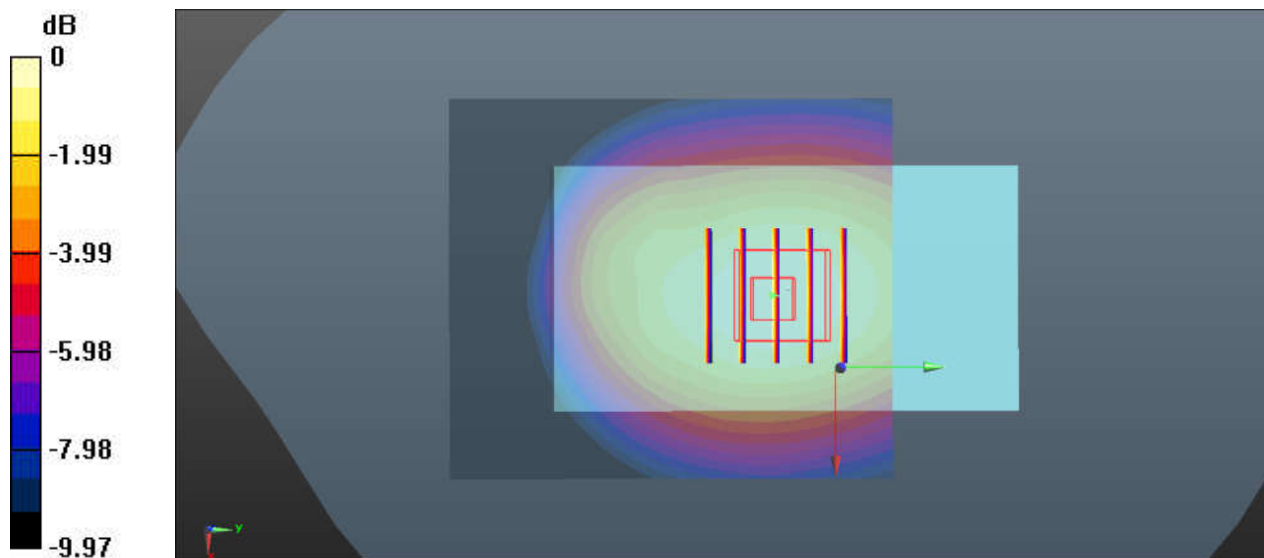
Ch20525/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 34.99 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 1.24 W/kg

SAR(1 g) = 0.968 W/kg; SAR(10 g) = 0.700 W/kg

Maximum value of SAR (measured) = 1.09 W/kg



0 dB = 1.09 W/kg = 0.37 dBW/kg

35_LTE Band 66_20M_QPSK_1RB_0Offset_Back_15mm_Ch132072

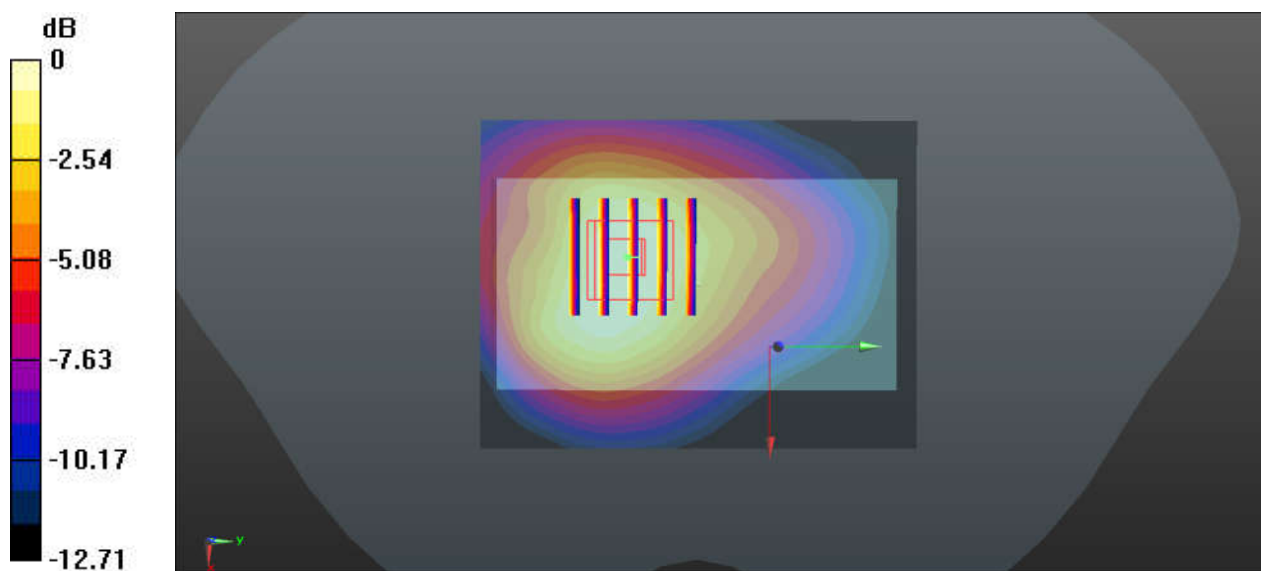
Communication System: UID 0, LTE-FDD (0); Frequency: 1720 MHz; Duty Cycle: 1:1
Medium: HSL_1750 Medium parameters used: $f = 1720$ MHz; $\sigma = 1.33$ S/m; $\epsilon_r = 39.176$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.2 °C ; Liquid Temperature : 22.8 °C

DASY5 Configuration:

- Probe: ES3DV3-SN3293; ConvF(5.40, 5.40, 5.40); Calibrated: 2018.10.25
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2018.10.22
- Phantom: SAM1; Type: SAM; Serial: TP-1842
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Ch132072/Area Scan (61x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.835 W/kg

Ch132072/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.04 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 1.04 W/kg
SAR(1 g) = 0.729 W/kg; SAR(10 g) = 0.476 W/kg
Maximum value of SAR (measured) = 0.840 W/kg



0 dB = 0.840 W/kg = -0.76 dBW/kg

36_LTE Band 2_20M_QPSK_1RB_0Offset_Back_15mm_Ch19100

Communication System: UID 0, LTE-FDD (0); Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: HSL_1900 Medium parameters used: $f = 1900$ MHz; $\sigma = 1.403$ S/m; $\epsilon_r = 39.091$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.2 °C ; Liquid Temperature : 22.8 °C

DASY5 Configuration:

- Probe: ES3DV3-SN3293; ConvF(5.19, 5.19, 5.19); Calibrated: 2018.10.25
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2018.10.22
- Phantom: SAM1; Type: SAM; Serial: TP-1842
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Ch19100/Area Scan (61x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 1.07 W/kg

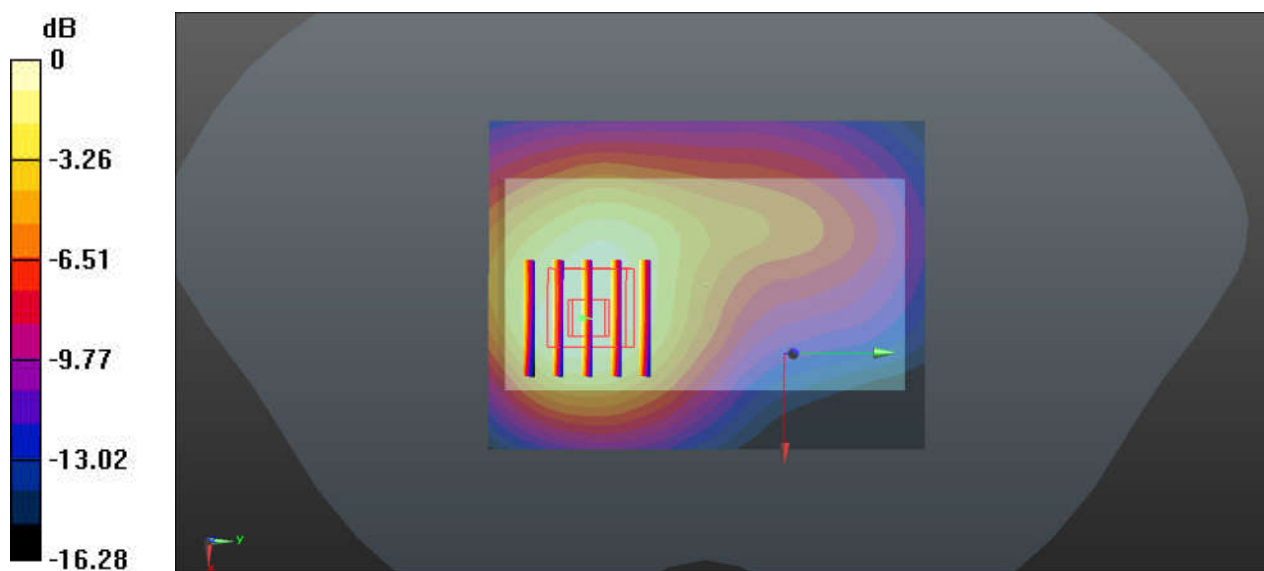
Ch19100/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 15.40 V/m; Power Drift = 0.19 dB

Peak SAR (extrapolated) = 1.38 W/kg

SAR(1 g) = 0.857 W/kg; SAR(10 g) = 0.528 W/kg

Maximum value of SAR (measured) = 1.02 W/kg



0 dB = 1.02 W/kg = 0.09 dBW/kg

37_LTE Band 7_20M_QPSK_1RB_49Offset_Back_15mm_Ch21100

Communication System: UID 0, LTE-FDD (0); Frequency: 2535 MHz; Duty Cycle: 1:1

Medium: HSL_2600 Medium parameters used: $f = 2535$ MHz; $\sigma = 1.955$ S/m; $\epsilon_r = 38.185$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.2 °C ; Liquid Temperature : 22.7 °C

DASY5 Configuration:

- Probe: E3DV3-SN3293; ConvF(4.44, 4.44, 4.44); Calibrated: 2018.10.25
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2018.10.22
- Phantom: SAM1; Type: SAM; Serial: TP-1842
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Ch21100/Area Scan (71x81x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 1.32 W/kg

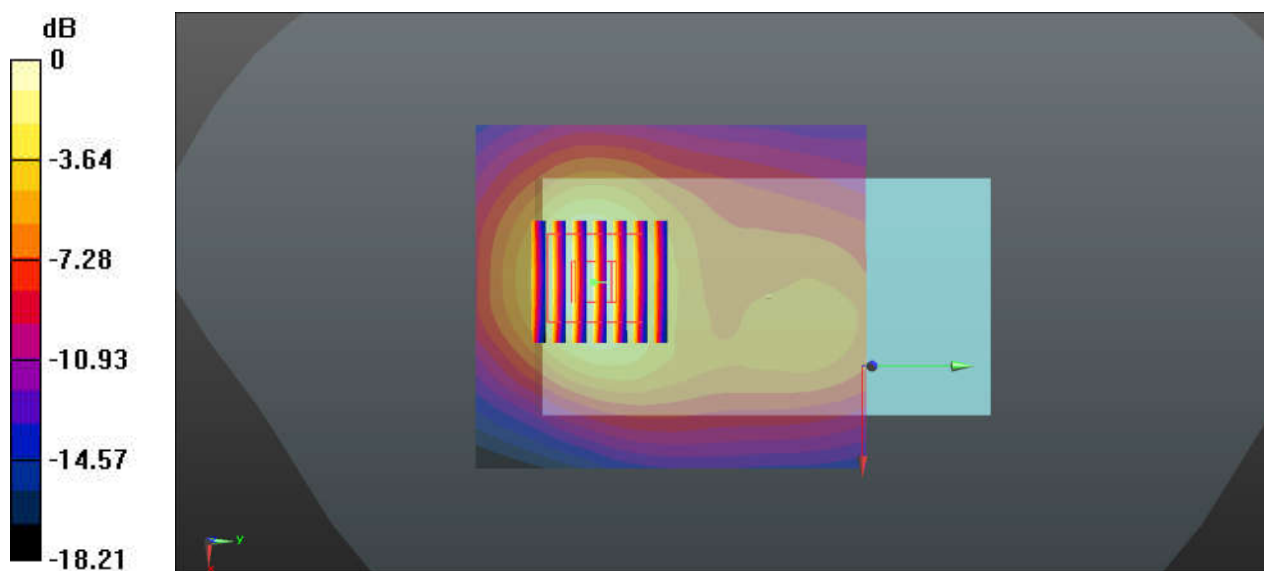
Ch21100/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 13.14 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 1.87 W/kg

SAR(1 g) = 1.01 W/kg; SAR(10 g) = 0.534 W/kg

Maximum value of SAR (measured) = 1.28 W/kg



0 dB = 1.28 W/kg = 1.07 dBW/kg

38_WLAN2.4GHz_802.11b 1Mbps_Front_15mm_Ch6

Communication System: UID 0, 802.11b (0); Frequency: 2437 MHz; Duty Cycle: 1:1.025
Medium: HSL_2450 Medium parameters used: $f = 2437$ MHz; $\sigma = 1.843$ S/m; $\epsilon_r = 40.326$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.3 °C; Liquid Temperature : 22.8 °C

DASY5 Configuration:

- Probe: ES3DV3-SN3293; ConvF(4.53, 4.53, 4.53); Calibrated: 2018.10.25
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2018.10.22
- Phantom: SAM1; Type: SAM; Serial: TP-1842
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Ch6/Area Scan (71x111x1): Interpolated grid: $dx=1.200$ mm, $dy=1.200$ mm

Maximum value of SAR (interpolated) = 0.106 W/kg

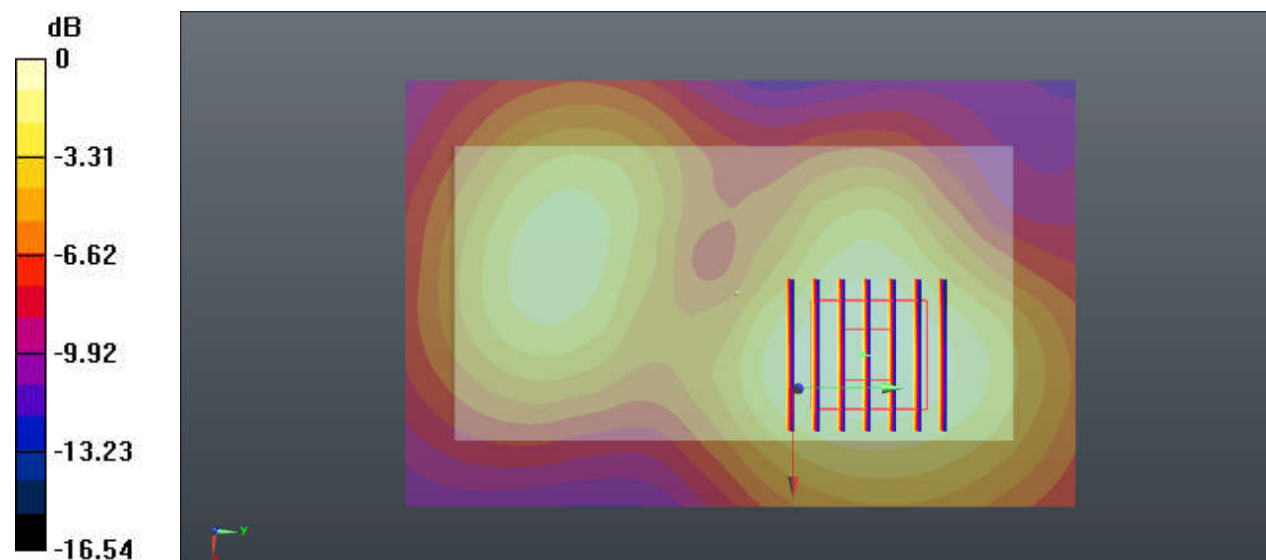
Ch6/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 4.422 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 0.146 W/kg

SAR(1 g) = 0.082 W/kg; SAR(10 g) = 0.046 W/kg

Maximum value of SAR (measured) = 0.100 W/kg



0 dB = 0.100 W/kg = -10.00 dBW/kg



Appendix C. DASY Calibration Certificate

The DASY calibration certificates are shown as follows.



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.51 Xueyuan 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

Client

Sporton

Certificate No: **Z19-60081**

CALIBRATION CERTIFICATE

Object

D750V3 - SN: 1087

Calibration Procedure(s)

FF-Z11-003-01

Calibration Procedures for dipole validation kits

Calibration date:

March 27, 2019

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	20-Aug-18 (CTTL, No.J18X06862)	Aug-19
Power sensor NRP8S	104291	20-Aug-18 (CTTL, No.J18X06862)	Aug-19
Reference Probe EX3DV4	SN 3617	31-Jan-19(SPEAG,No.EX3-3617_Jan19)	Jan-20
DAE4	SN 1331	06-Feb-19(SPEAG,No.DAE4-1331_Feb19)	Feb-20
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	23-Jan-19 (CTTL, No.J19X00336)	Jan-20
NetworkAnalyzer E5071C	MY46110673	24-Jan-19 (CTTL, No.J19X00547)	Jan-20

	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: March 29, 2019

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Add: No.51 Xueyuan 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 _{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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Add: No.51 Xueyuan 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	52.10.2.1495
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	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	43.0 $\pm$ 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	2.10 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.36 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	1.42 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.65 W/kg $\pm$ 18.7 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	56.9 $\pm$ 6 %	0.94 mho/m $\pm$ 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.09 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	8.58 W/kg $\pm$ 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.41 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	5.75 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	52.4Ω- 2.59jΩ
Return Loss	- 29.3dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	51.6Ω- 3.86jΩ
Return Loss	- 27.7dB

General Antenna Parameters and Design

Electrical Delay (one direction)	0.898 ns
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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

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DASY5 Validation Report for Head TSL

Date: 03.26.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1087

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

Medium parameters used: $f = 750$ MHz; $\sigma = 0.903$ S/m; $\epsilon_r = 43.01$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(10.03, 10.03, 10.03) @ 750 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2/6/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

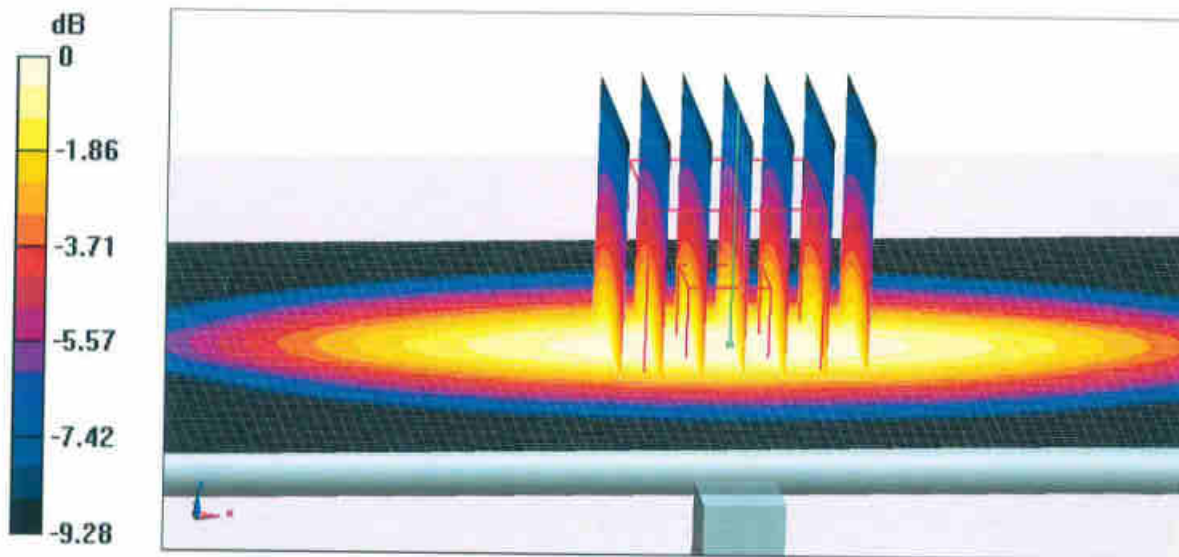
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 55.05 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.00 W/kg

SAR(1 g) = 2.1 W/kg; SAR(10 g) = 1.42 W/kg

Maximum value of SAR (measured) = 2.72 W/kg



0 dB = 2.72 W/kg = 4.35 dBW/kg

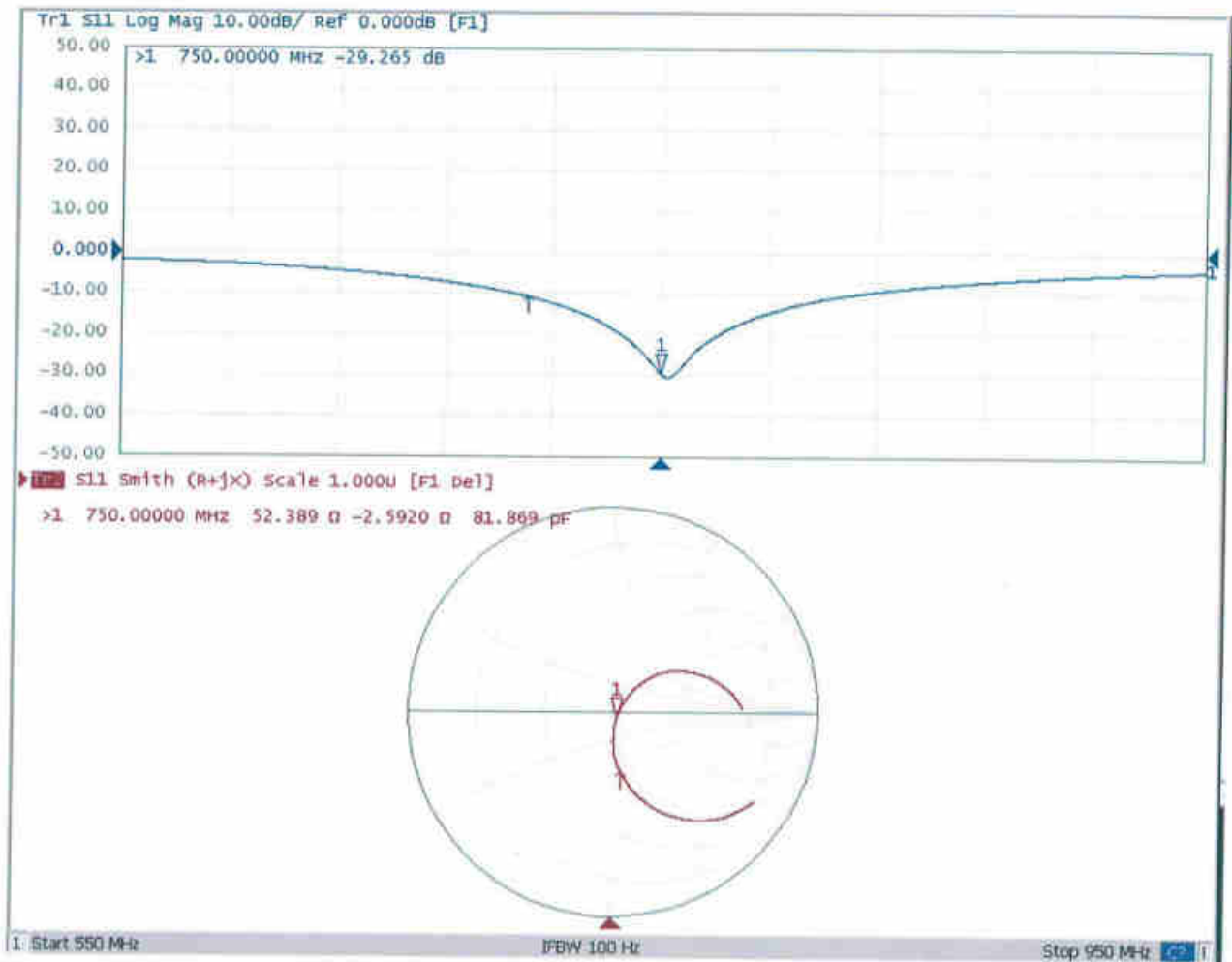


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Impedance Measurement Plot for Head TSL





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DASY5 Validation Report for Body TSL

Date: 03.26.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1087

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

Medium parameters used: $f = 750$ MHz; $\sigma = 0.935$ S/m; $\epsilon_r = 56.85$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(9.85, 9.85, 9.85) @ 750 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2/6/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

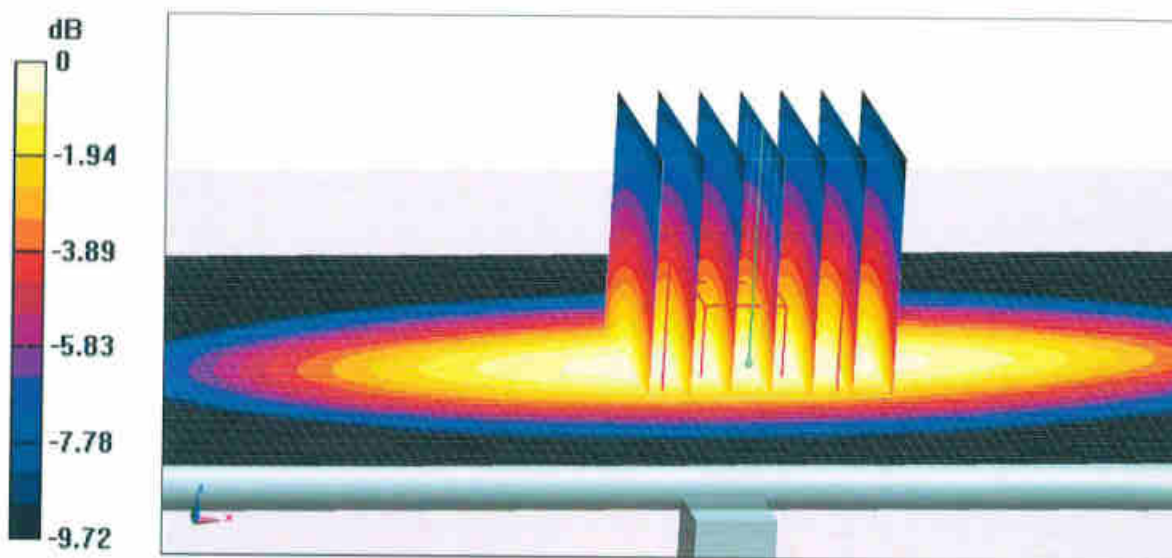
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 53.71 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.08 W/kg

SAR(1 g) = 2.09 W/kg; SAR(10 g) = 1.41 W/kg

Maximum value of SAR (measured) = 2.75 W/kg



0 dB = 2.75 W/kg = 4.39 dBW/kg

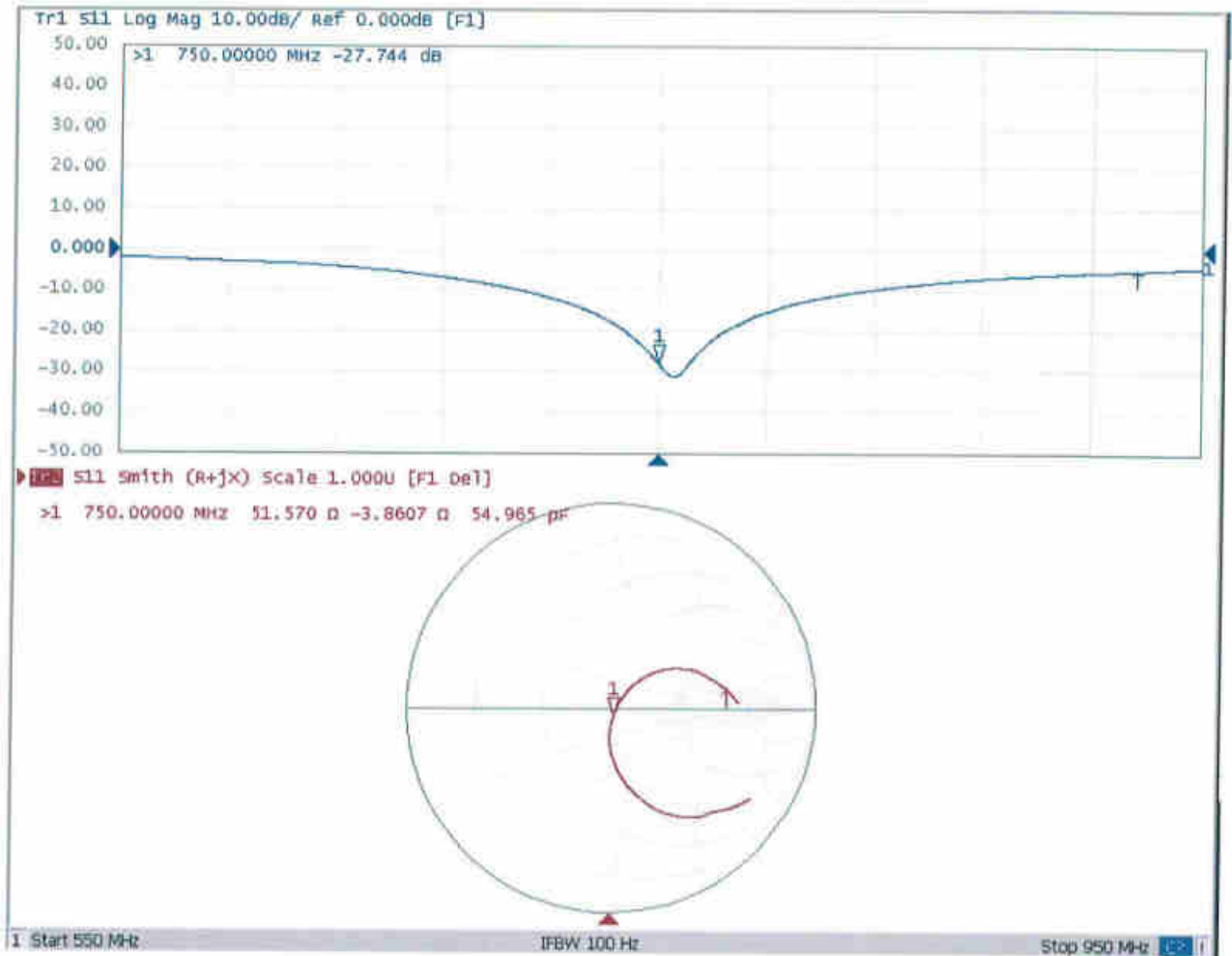


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Impedance Measurement Plot for Body TSL





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Client **Sporton**

Certificate No: **Z19-60082**

CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d151**

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

Calibration date: **March 27, 2019**

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	20-Aug-18 (CTTL, No.J18X06862)	Aug-19
Power sensor NRP8S	104291	20-Aug-18 (CTTL, No.J18X06862)	Aug-19
Reference Probe EX3DV4	SN 3617	31-Jan-19(SPEAG,No.EX3-3617_Jan19)	Jan-20
DAE4	SN 1331	06-Feb-19(SPEAG,No.DAE4-1331_Feb19)	Feb-20
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	23-Jan-19 (CTTL, No.J19X00336)	Jan-20
NetworkAnalyzer E5071C	MY46110673	24-Jan-19 (CTTL, No.J19X00547)	Jan-20

	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: March 30, 2019

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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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Tel: +86-10-62304633-2079

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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	52.10.2.1495
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	42.7 $\pm$ 6 %	0.93 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	2.36 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.30 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	1.56 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.16 W/kg $\pm$ 18.7 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	56.7 $\pm$ 6 %	0.94 mho/m $\pm$ 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.32 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	9.53 W /kg $\pm$ 18.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.52 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	6.20 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	50.8Ω- 3.28jΩ
Return Loss	- 29.5dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.7Ω- 3.98jΩ
Return Loss	- 25.5dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.253 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: 03.26.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d151

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

Medium parameters used: $f = 835$ MHz; $\sigma = 0.925$ S/m; $\epsilon_r = 42.68$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(9.75, 9.75, 9.75) @ 835 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2/6/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

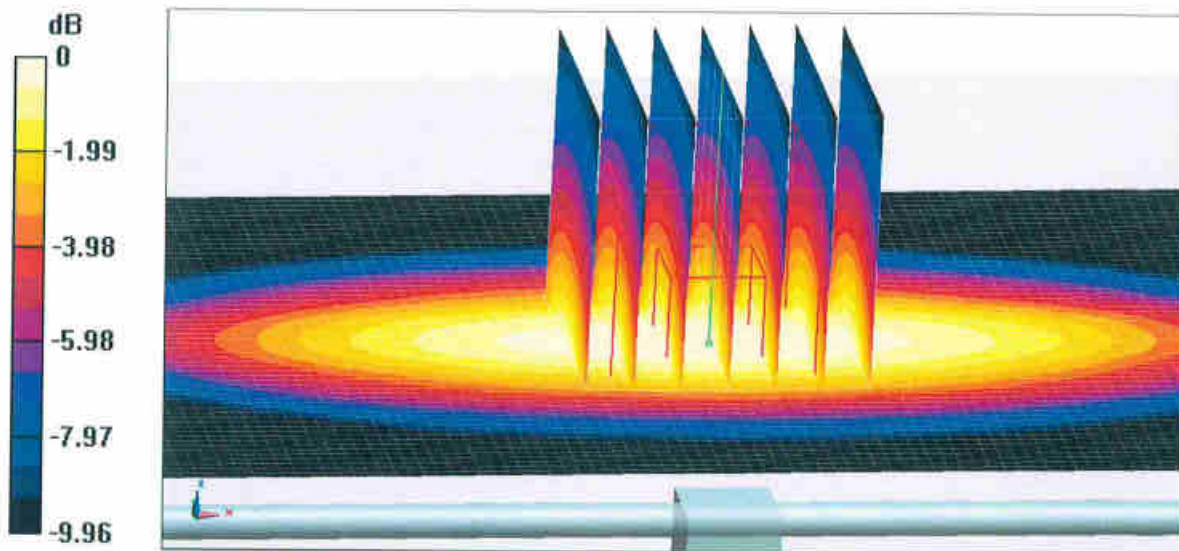
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 57.34 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 3.55 W/kg

SAR(1 g) = 2.36 W/kg; SAR(10 g) = 1.56 W/kg

Maximum value of SAR (measured) = 3.14 W/kg



0 dB = 3.14 W/kg = 4.97 dBW/kg

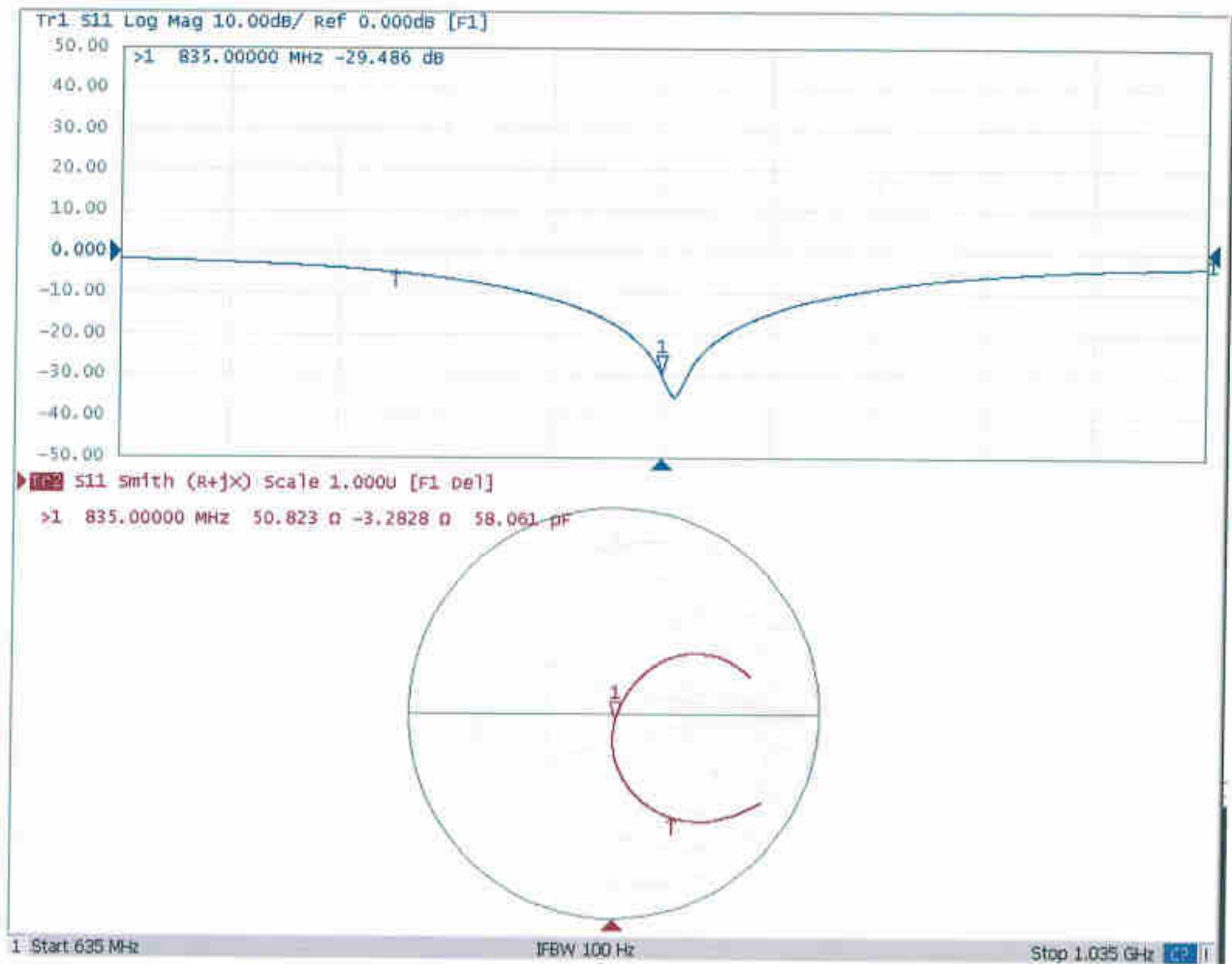


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Impedance Measurement Plot for Head TSL





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DASY5 Validation Report for Body TSL

Date: 03.26.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d151

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

Medium parameters used: $f = 835$ MHz; $\sigma = 0.944$ S/m; $\epsilon_r = 56.66$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(9.61, 9.61, 9.61) @ 835 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2/6/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

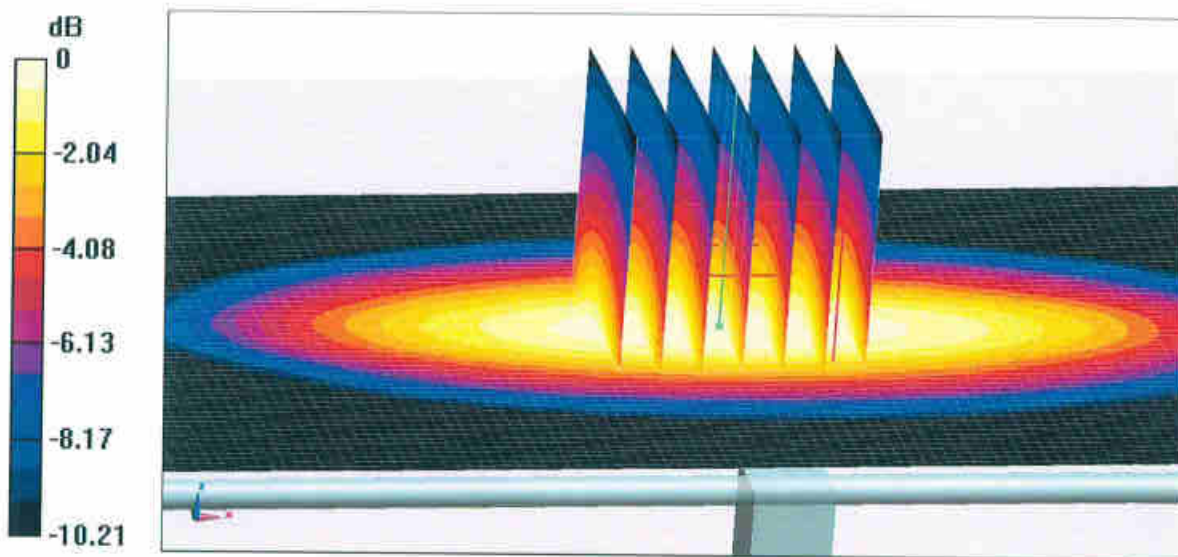
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 56.03 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 3.53 W/kg

SAR(1 g) = 2.32 W/kg; SAR(10 g) = 1.52 W/kg

Maximum value of SAR (measured) = 3.12 W/kg



0 dB = 3.12 W/kg = 4.94 dBW/kg

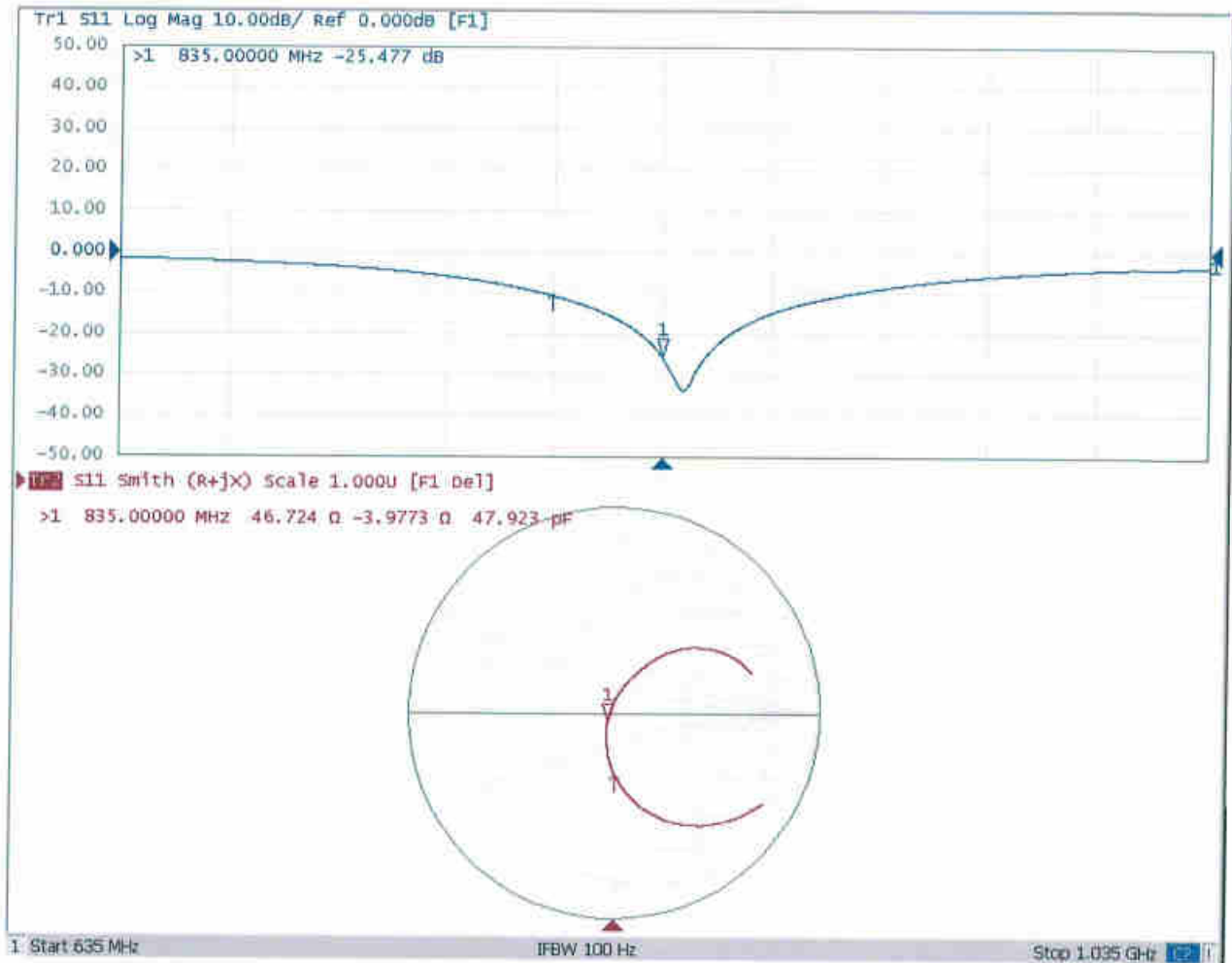


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Impedance Measurement Plot for Body TSL





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Client

Sporton

Certificate No:

Z19-60084

CALIBRATION CERTIFICATE

Object **D1750V2 - SN: 1090**

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

Calibration date: **March 27, 2019**

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)℃ 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	20-Aug-18 (CTTL, No.J18X06862)	Aug-19
Power sensor NRP8S	104291	20-Aug-18 (CTTL, No.J18X06862)	Aug-19
Reference Probe EX3DV4	SN 3617	31-Jan-19(SPEAG,No.EX3-3617_Jan19)	Jan-20
DAE4	SN 1331	06-Feb-19(SPEAG,No.DAE4-1331_Feb19)	Feb-20
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	23-Jan-19 (CTTL, No.J19X00336)	Jan-20
NetworkAnalyzer E5071C	MY46110673	24-Jan-19 (CTTL, No.J19X00547)	Jan-20

	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: March 29, 2019

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Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China

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E-mail: cttl@chinattl.com

http://www.chinattl.cn

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	52.10.2.1495
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	41.3 $\pm$ 6 %	1.37 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	9.04 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	36.4 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	4.79 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	19.2 W/kg $\pm$ 18.7 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	55.0 $\pm$ 6 %	1.45 mho/m $\pm$ 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.21 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	37.7 W/kg $\pm$ 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	4.89 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	19.9 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	47.5Ω- 2.34 jΩ
Return Loss	- 29.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	43.9Ω- 2.19 jΩ
Return Loss	- 23.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.085 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

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DASY5 Validation Report for Head TSL

Date: 03.26.2019

Test Laboratory: CTTL, Beijing, China

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

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

Medium parameters used: $f = 1750$ MHz; $\sigma = 1.37$ S/m; $\epsilon_r = 41.27$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(8.38, 8.38, 8.38) @ 1750 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2/6/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

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

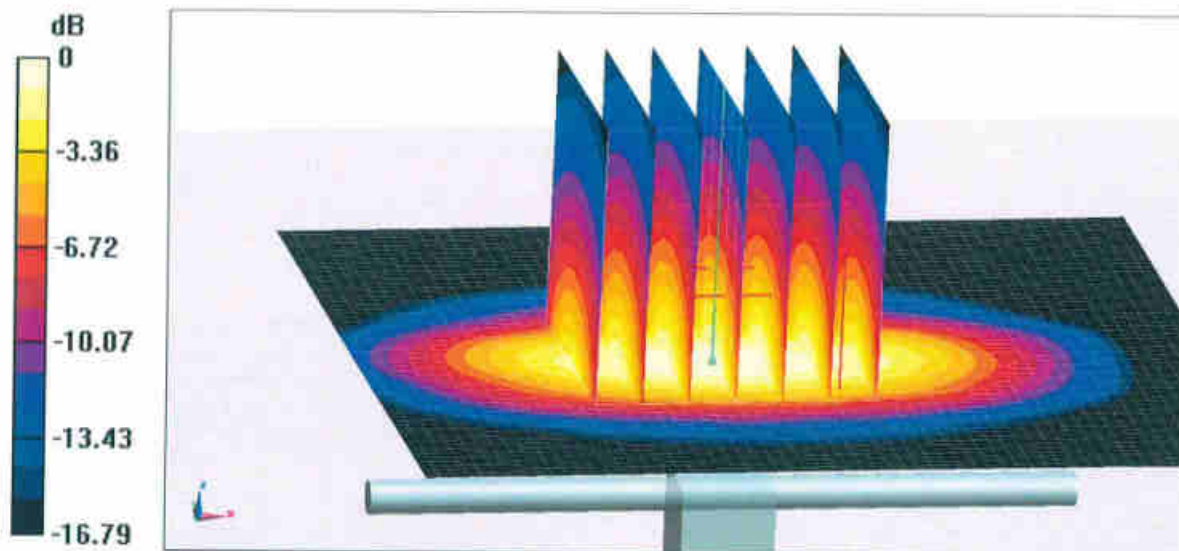
$dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 89.03 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 17.1 W/kg

SAR(1 g) = 9.04 W/kg; SAR(10 g) = 4.79 W/kg

Maximum value of SAR (measured) = 14.2 W/kg



0 dB = 14.2 W/kg = 11.52 dBW/kg



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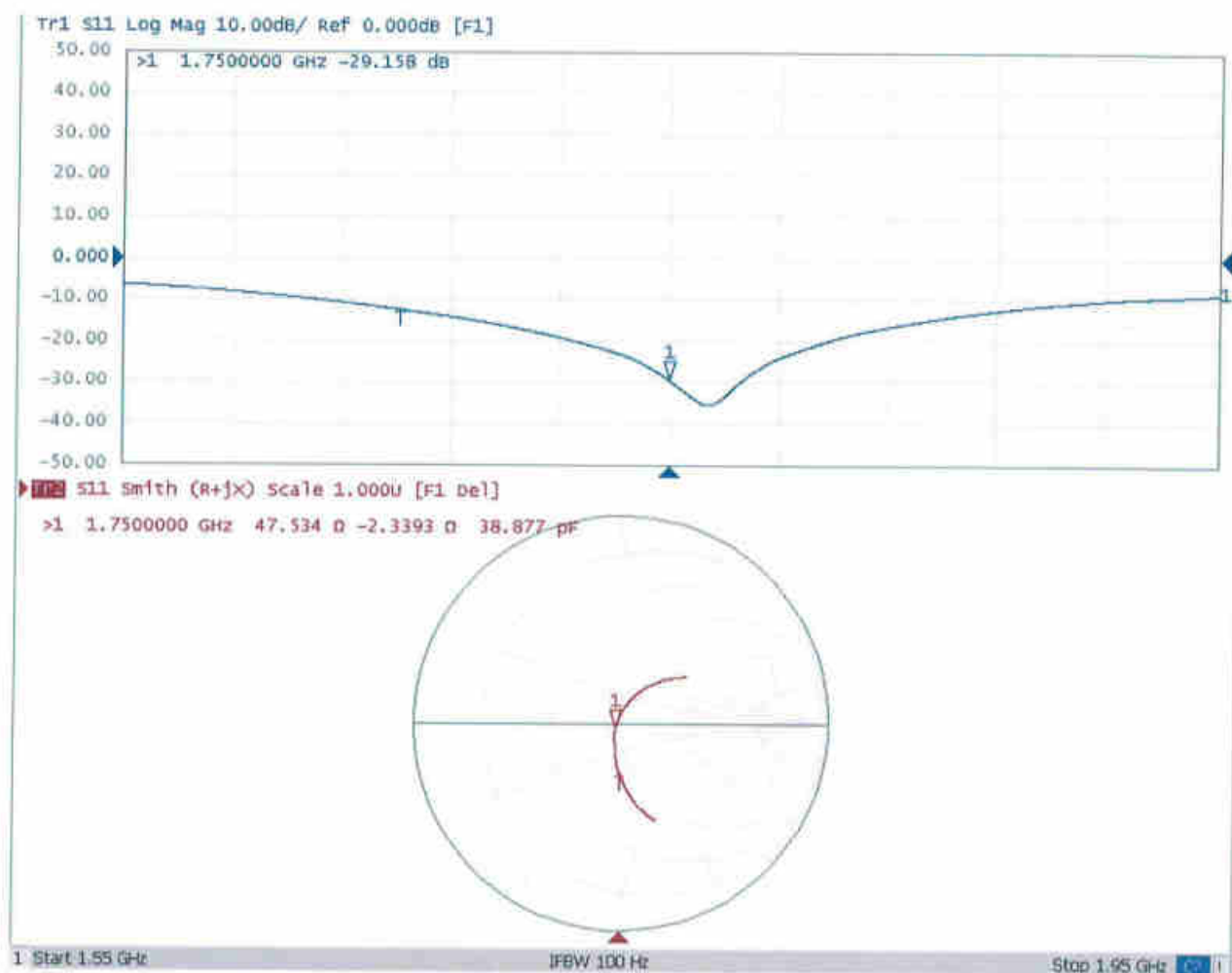
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Impedance Measurement Plot for Head TSL





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DASY5 Validation Report for Body TSL

Date: 03.26.2019

Test Laboratory: CTTL, Beijing, China

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

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

Medium parameters used: $f = 1750$ MHz; $\sigma = 1.449$ S/m; $\epsilon_r = 54.97$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(8.03, 8.03, 8.03) @ 1750 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2/6/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

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

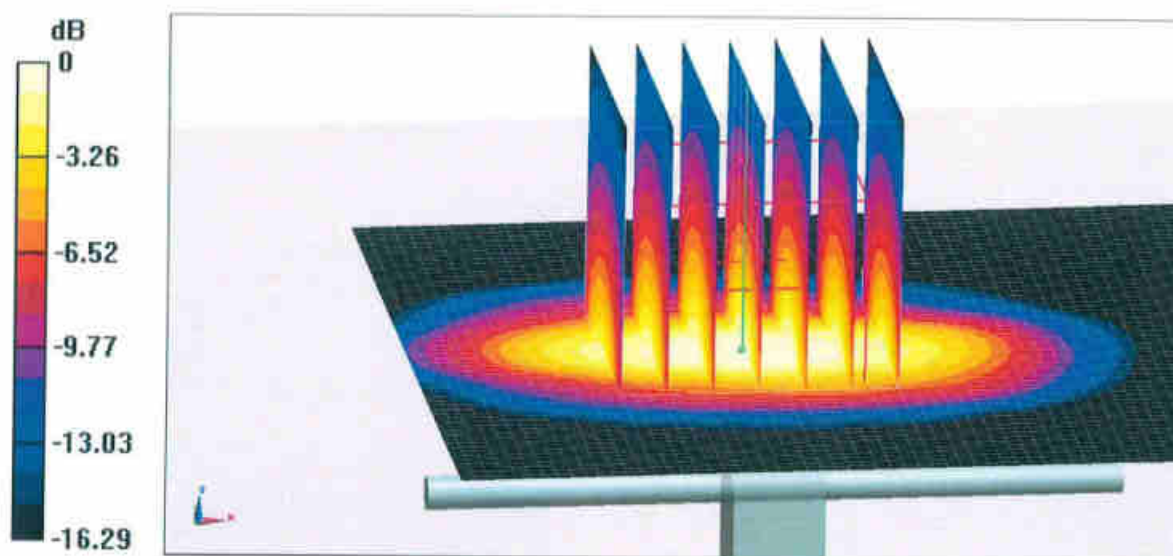
$dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 93.13 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 16.8 W/kg

SAR(1 g) = 9.21 W/kg; SAR(10 g) = 4.89 W/kg

Maximum value of SAR (measured) = 14.2 W/kg



0 dB = 14.2 W/kg = 11.52 dBW/kg



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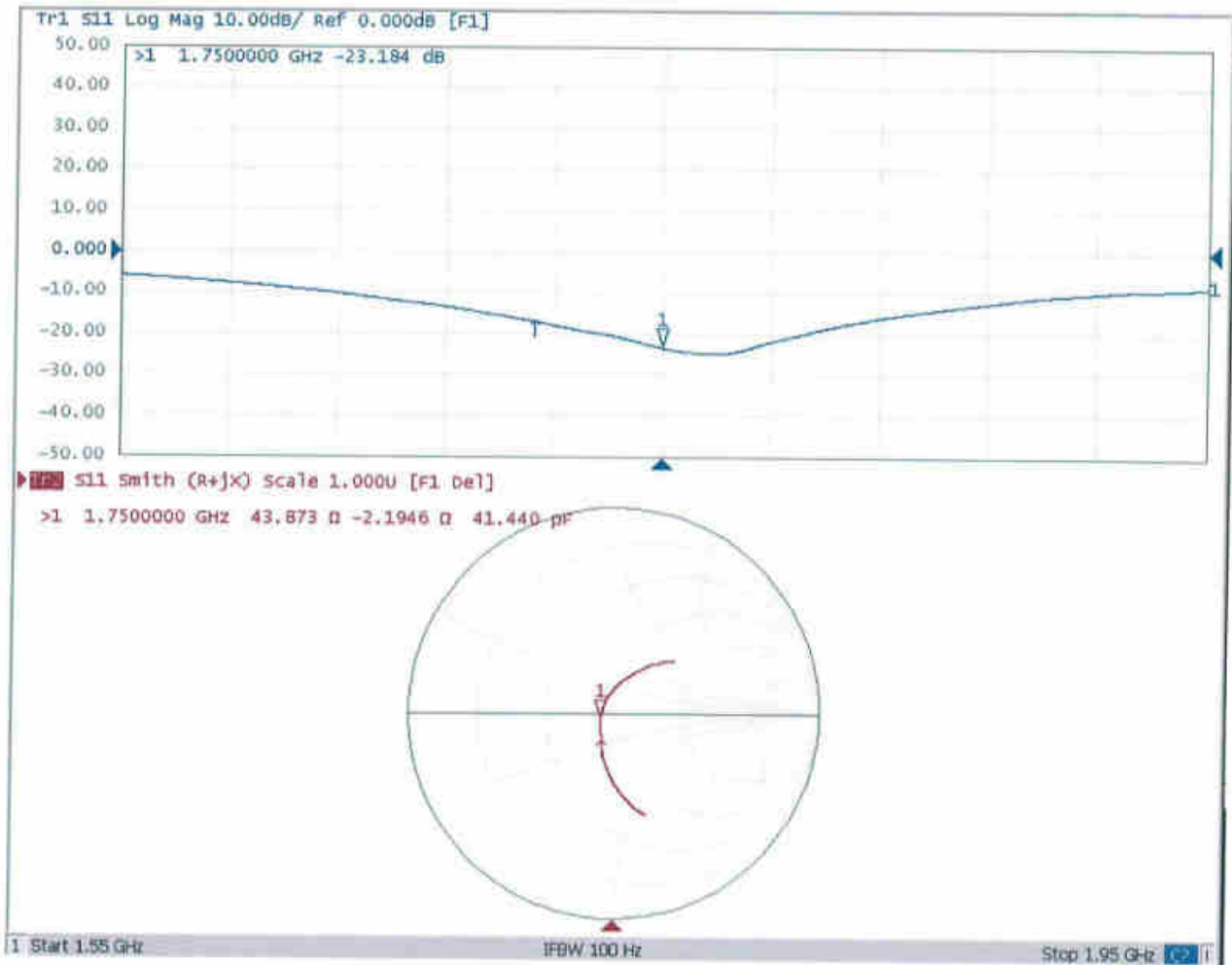
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Impedance Measurement Plot for Body TSL





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Client

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Certificate No: **Z19-60085**

CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d170**

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

Calibration date: **March 26, 2019**

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)℃ 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	20-Aug-18 (CTTL, No.J18X06862)	Aug-19
Power sensor NRP8S	104291	20-Aug-18 (CTTL, No.J18X06862)	Aug-19
Reference Probe EX3DV4	SN 3617	31-Jan-19(SPEAG,No.EX3-3617_Jan19)	Jan-20
DAE4	SN 1331	06-Feb-19(SPEAG,No.DAE4-1331_Feb19)	Feb-20
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	23-Jan-19 (CTTL, No.J19X00336)	Jan-20
NetworkAnalyzer E5071C	MY46110673	24-Jan-19 (CTTL, No.J19X00547)	Jan-20

	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: March 29, 2019

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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	52.10.2.1495
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 %	1.44 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	9.90 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	39.0 W/kg $\pm$ 18.8 % (k=2)
SAR averaged over 10 cm³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.12 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	20.3 W/kg $\pm$ 18.7 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	54.5 $\pm$ 6 %	1.56 mho/m $\pm$ 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	40.0 W/kg $\pm$ 18.8 % (k=2)
SAR averaged over 10 cm³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.28 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.0 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	$51.7\Omega + 6.73j\Omega$
Return Loss	- 23.3dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$47.8\Omega + 6.72j\Omega$
Return Loss	- 22.8dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.066 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

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DASY5 Validation Report for Head TSL

Date: 03.26.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d170

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

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.441$ S/m; $\epsilon_r = 40.48$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(8.14, 8.14, 8.14) @ 1900 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2/6/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

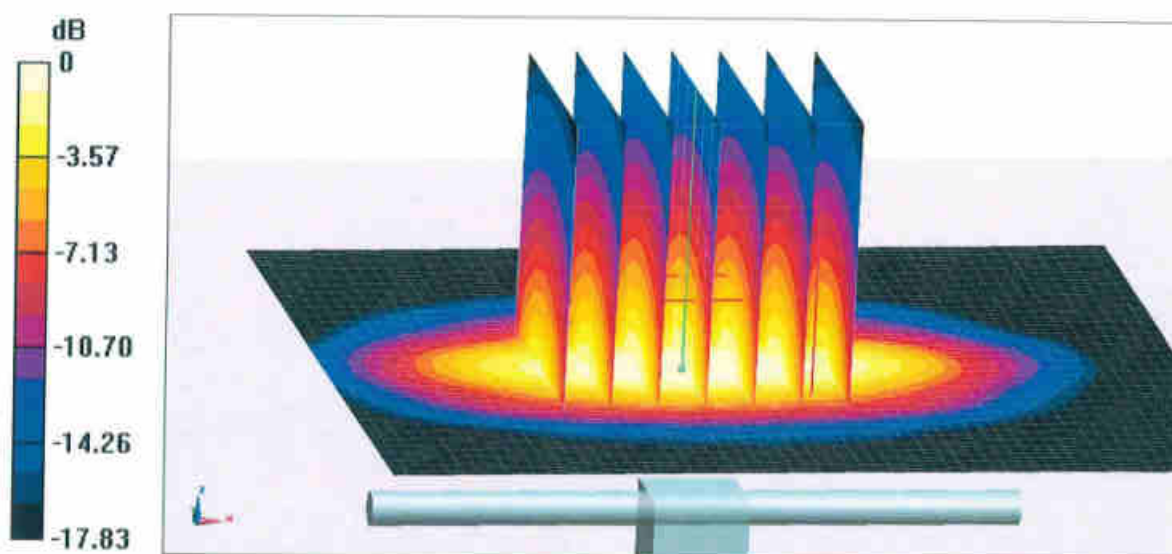
System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:
 $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 97.54 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 18.9 W/kg

SAR(1 g) = 9.9 W/kg; SAR(10 g) = 5.12 W/kg

Maximum value of SAR (measured) = 15.6 W/kg



0 dB = 15.6 W/kg = 11.93 dBW/kg

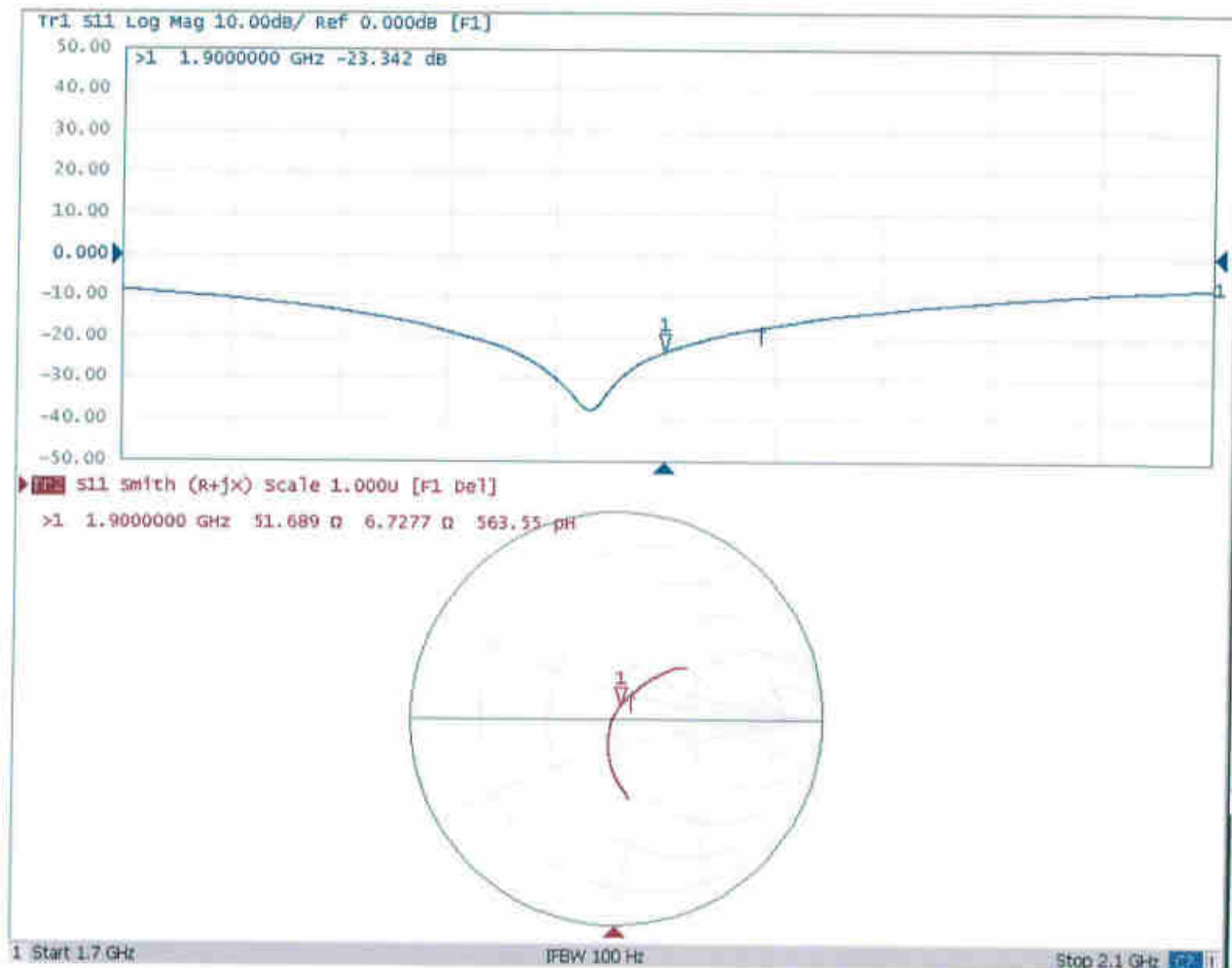


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Impedance Measurement Plot for Head TSL





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DASY5 Validation Report for Body TSL

Date: 03.26.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d170

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

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.56$ S/m; $\epsilon_r = 54.52$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(7.78, 7.78, 7.78) @ 1900 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2/6/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

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

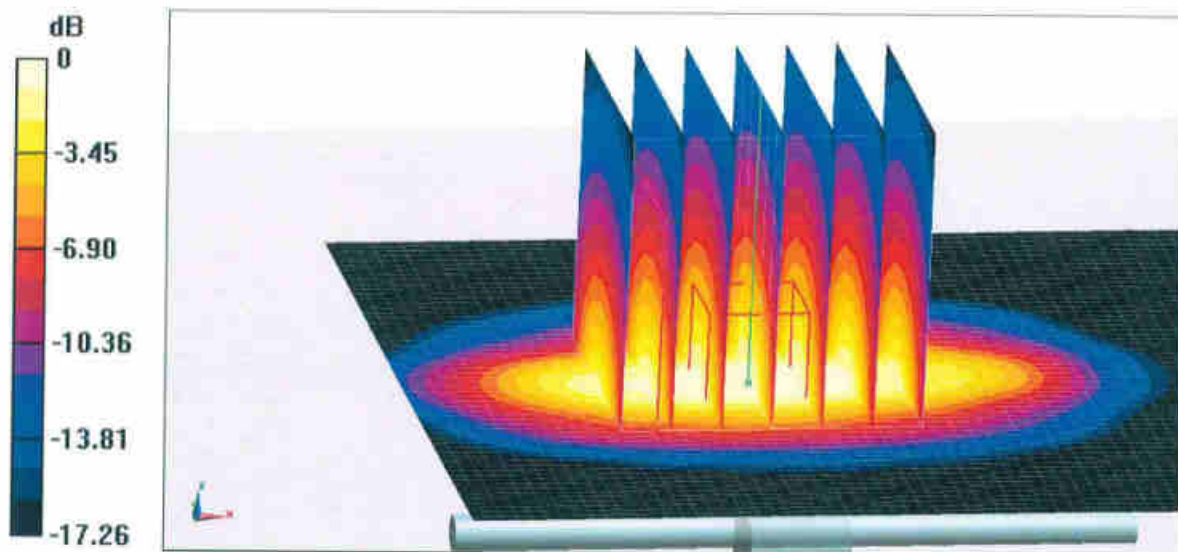
$dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 95.48 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 18.6 W/kg

SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.28 W/kg

Maximum value of SAR (measured) = 15.7 W/kg



0 dB = 15.7 W/kg = 11.96 dBW/kg

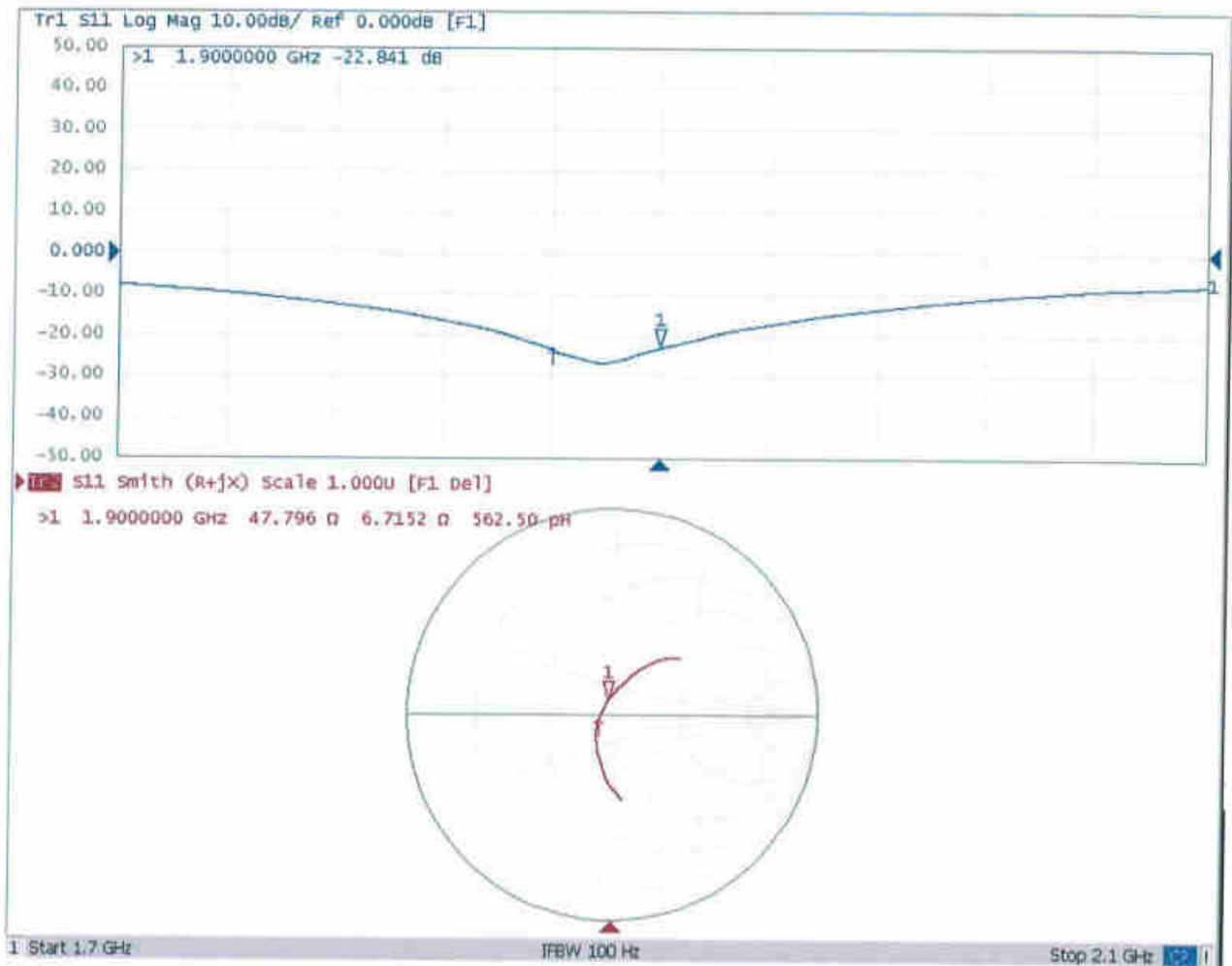


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Impedance Measurement Plot for Body TSL





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CNAS L0570

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Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com http://www.chinattl.cn

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Sporton

Certificate No: **Z19-60087**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 908**

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

Calibration date: **March 25, 2019**

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)℃ 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	20-Aug-18 (CTTL, No.J18X06862)	Aug-19
Power sensor NRP8S	104291	20-Aug-18 (CTTL, No.J18X06862)	Aug-19
Reference Probe EX3DV4	SN 3617	31-Jan-19(SPEAG,No.EX3-3617_Jan19)	Jan-20
DAE4	SN 1331	06-Feb-19(SPEAG,No.DAE4-1331_Feb19)	Feb-20
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	23-Jan-19 (CTTL, No.J19X00336)	Jan-20
NetworkAnalyzer E5071C	MY46110673	24-Jan-19 (CTTL, No.J19X00547)	Jan-20

	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: March 28, 2019

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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	52.10.2.1495
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	39.6 $\pm$ 6 %	1.84 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	52.8 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	6.07 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.2 W/kg $\pm$ 18.7 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	53.8 $\pm$ 6 %	2.00 mho/m $\pm$ 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.8 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	50.8 W/kg $\pm$ 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.91 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	23.6 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	$57.3\Omega + 5.18j\Omega$
Return Loss	- 21.6dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$52.6\Omega + 5.81j\Omega$
Return Loss	- 24.1dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.020 ns
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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

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DASY5 Validation Report for Head TSL

Date: 03.25.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 908

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

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.841$ S/m; $\epsilon_r = 39.63$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(7.62, 7.62, 7.62) @ 2450 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2/6/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

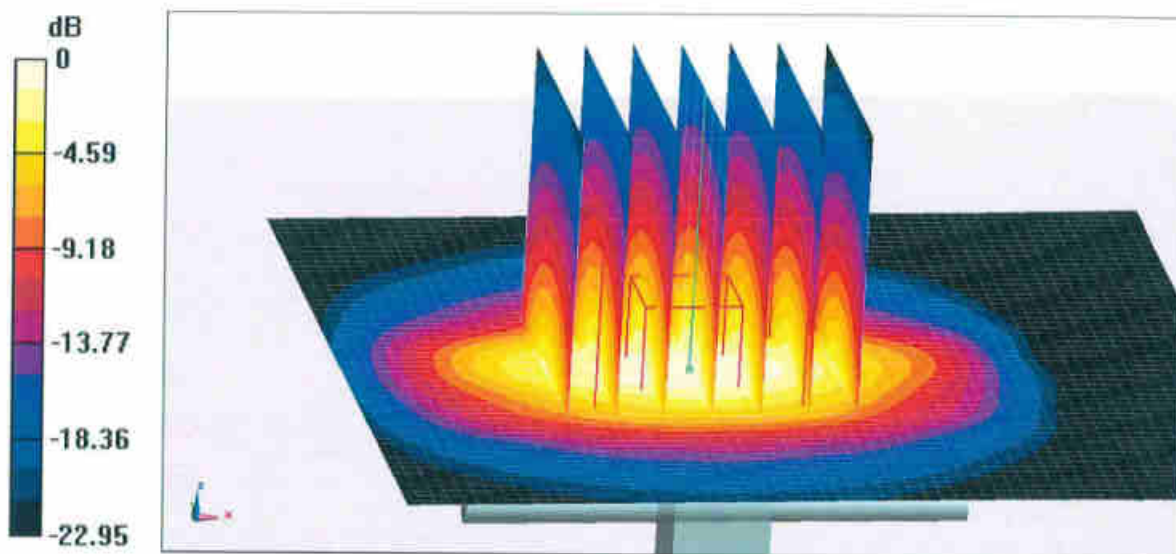
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.04 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 28.3 W/kg

SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.07 W/kg

Maximum value of SAR (measured) = 22.4 W/kg

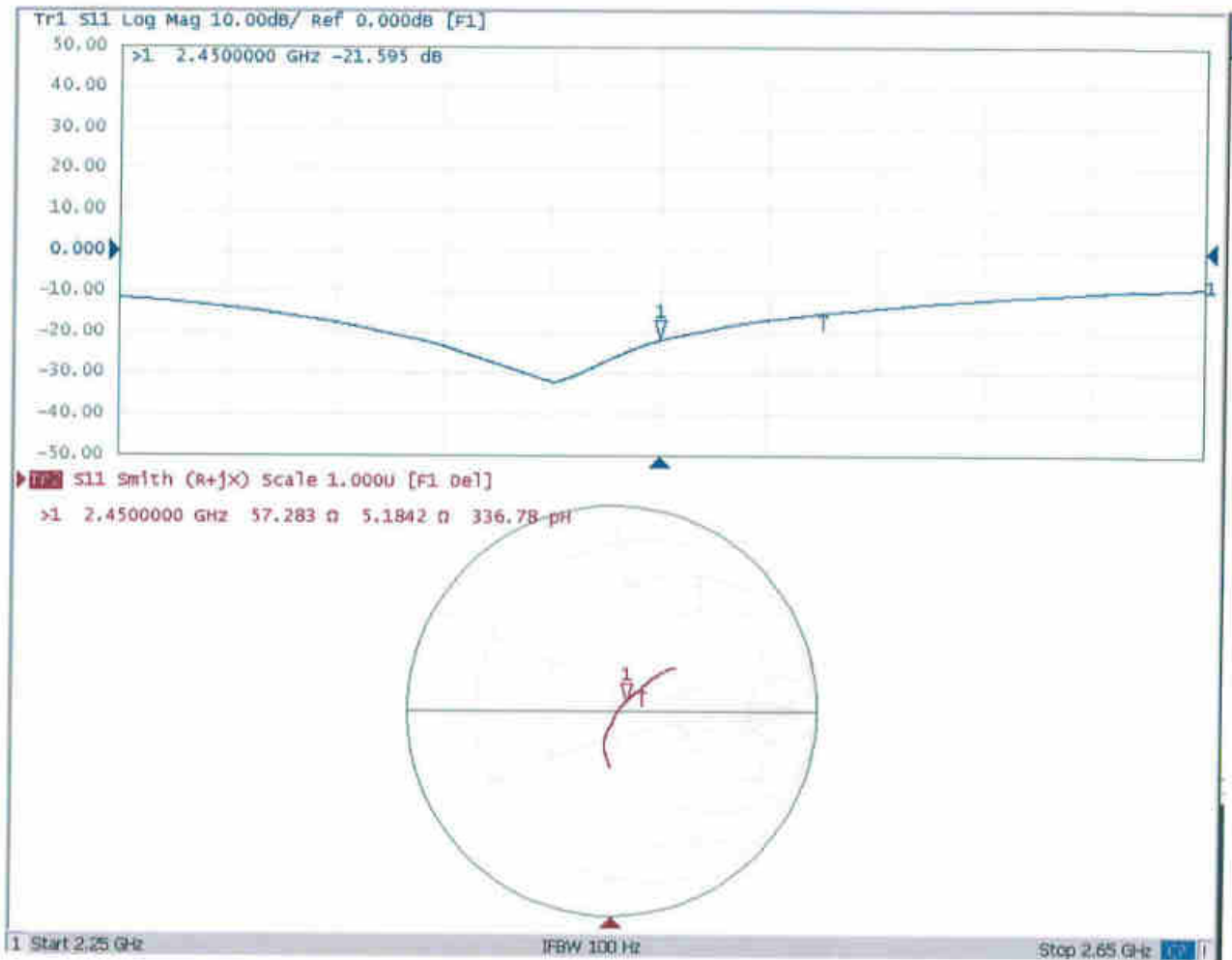


0 dB = 22.4 W/kg = 13.50 dBW/kg



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Impedance Measurement Plot for Head TSL





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DASY5 Validation Report for Body TSL

Date: 03.25.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 908

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

Medium parameters used: $f = 2450$ MHz; $\sigma = 2.003$ S/m; $\epsilon_r = 53.78$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(7.79, 7.79, 7.79) @ 2450 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2/6/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

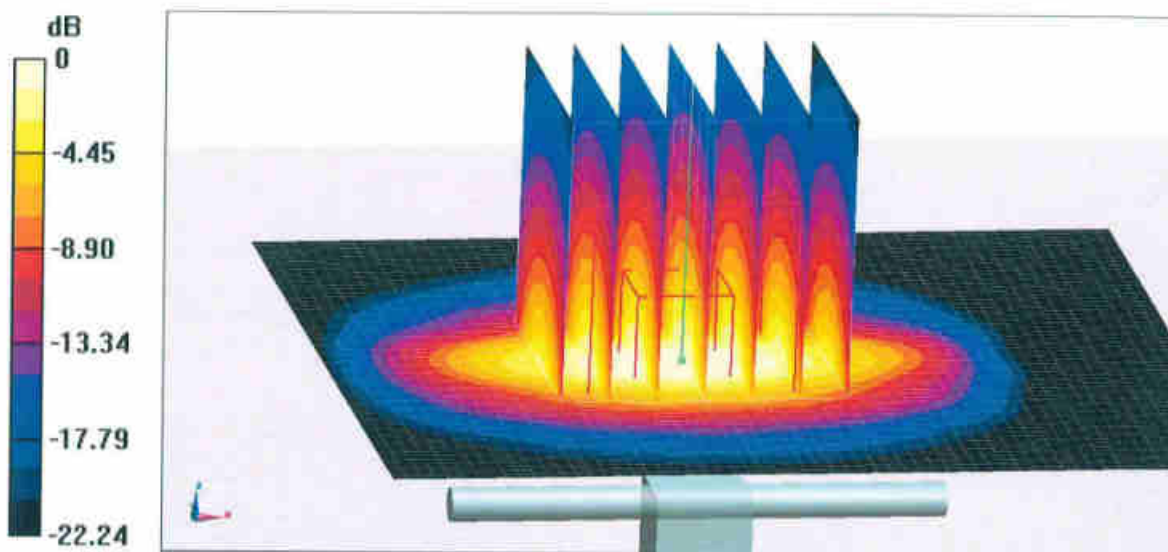
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.51 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 27.1 W/kg

SAR(1 g) = 12.8 W/kg; SAR(10 g) = 5.91 W/kg

Maximum value of SAR (measured) = 21.4 W/kg





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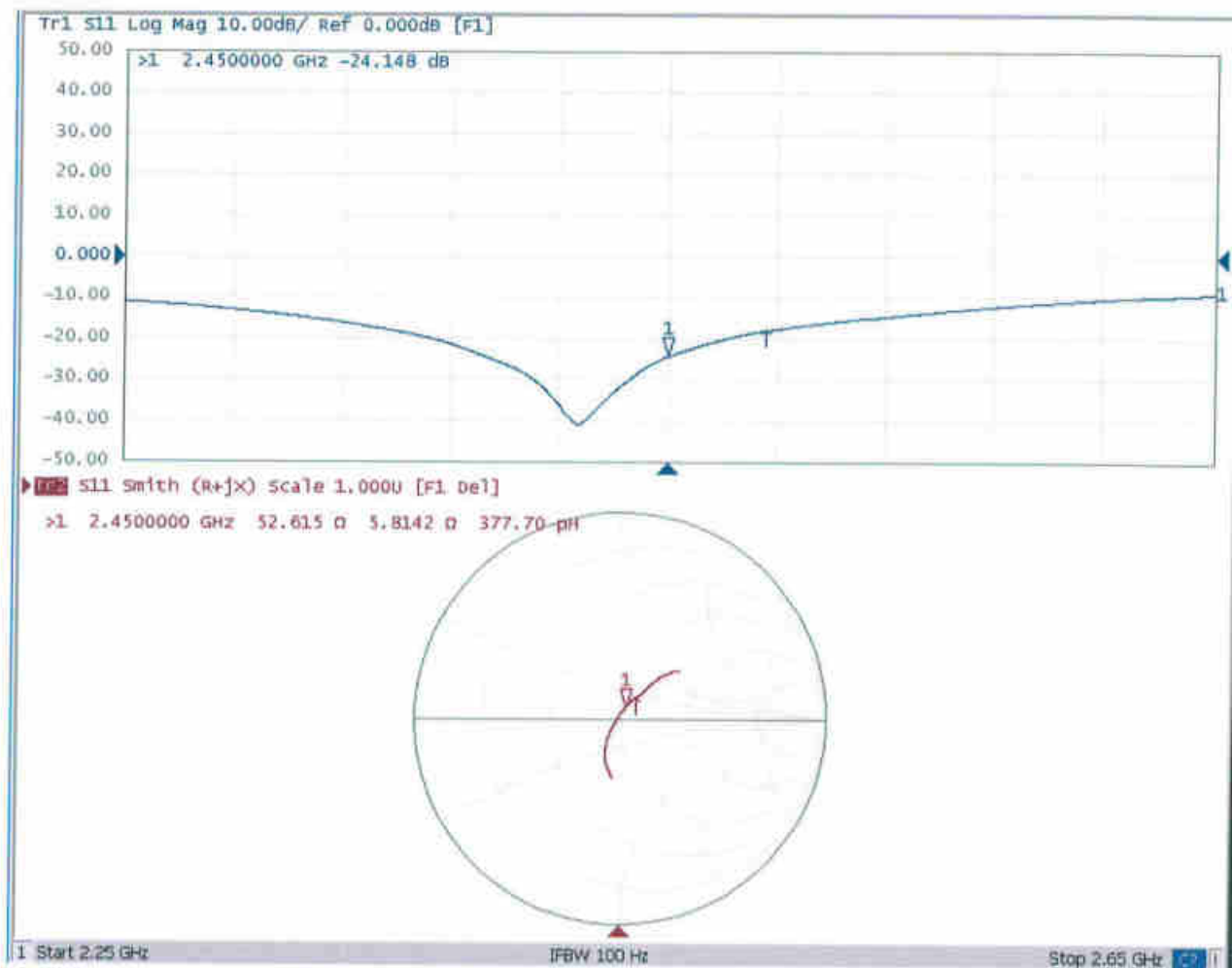
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Impedance Measurement Plot for Body TSL





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Client

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Certificate No: **Z18-60490**

CALIBRATION CERTIFICATE

Object **D2600V2 - SN: 1061**

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

Calibration date: **December 7, 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 NRVD	102196	07-Mar-18 (CTTL, No.J18X01510)	Mar-19
Power sensor NRV-Z5	100596	07-Mar-18 (CTTL, No.J18X01510)	Mar-19
Reference Probe EX3DV4	SN 7514	27-Aug-18(SPEAG,No.EX3-7514_Aug18)	Aug-19
DAE4	SN 1555	20-Aug-18(SPEAG,No.DAE4-1555_Aug18)	Aug-19
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	23-Jan-18 (CTTL, No.J18X00560)	Jan-19
Network Analyzer E5071C	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: December 10, 2018

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Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China

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Fax: +86-10-62304633-2504

E-mail: cttl@chinattl.com

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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%.



Measurement Conditions

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

DASY Version	DASY52	52.10.2.1495
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	39.1 $\pm$ 6 %	1.93 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	14.3 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	57.7 mW / g $\pm$ 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.45 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	25.9 mW / g $\pm$ 18.7 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.5	2.16 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	51.0 $\pm$ 6 %	2.18 mho/m $\pm$ 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.7 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	54.2 mW / g $\pm$ 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	6.11 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	24.3 mW / g $\pm$ 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	49.8Ω- 7.00jΩ
Return Loss	- 23.1dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.6Ω- 5.41jΩ
Return Loss	- 22.8dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.012 ns
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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: 12.06.2018

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1061

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

Medium parameters used: $f = 2600$ MHz; $\sigma = 1.926$ S/m; $\epsilon_r = 39.1$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7514; ConvF(6.92, 6.92, 6.92) @ 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)

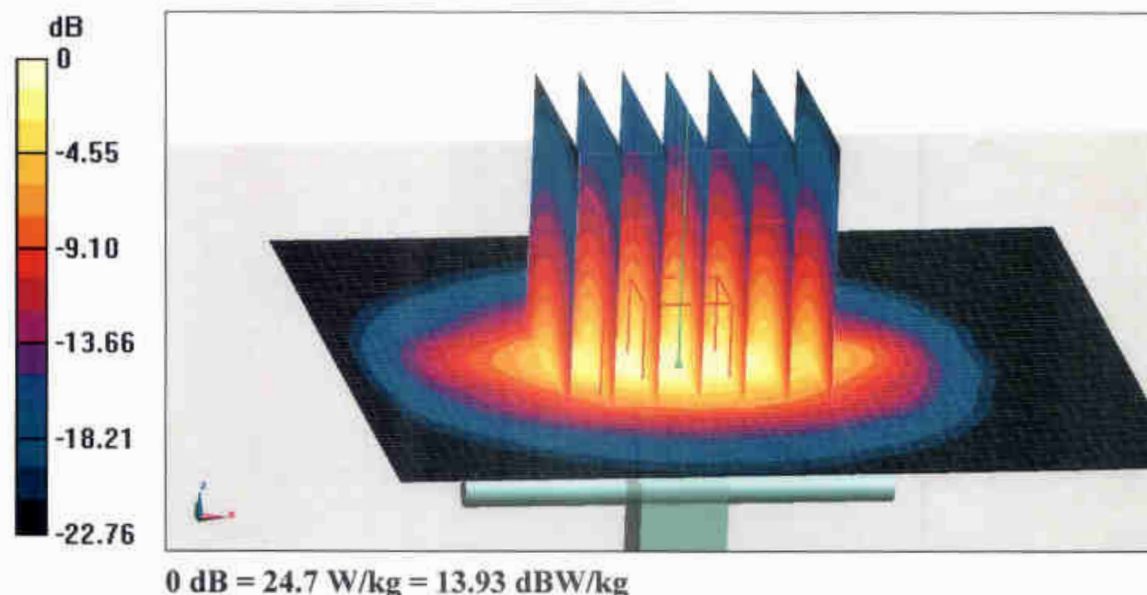
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 103.5 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 31.0 W/kg

SAR(1 g) = 14.3 W/kg; SAR(10 g) = 6.45 W/kg

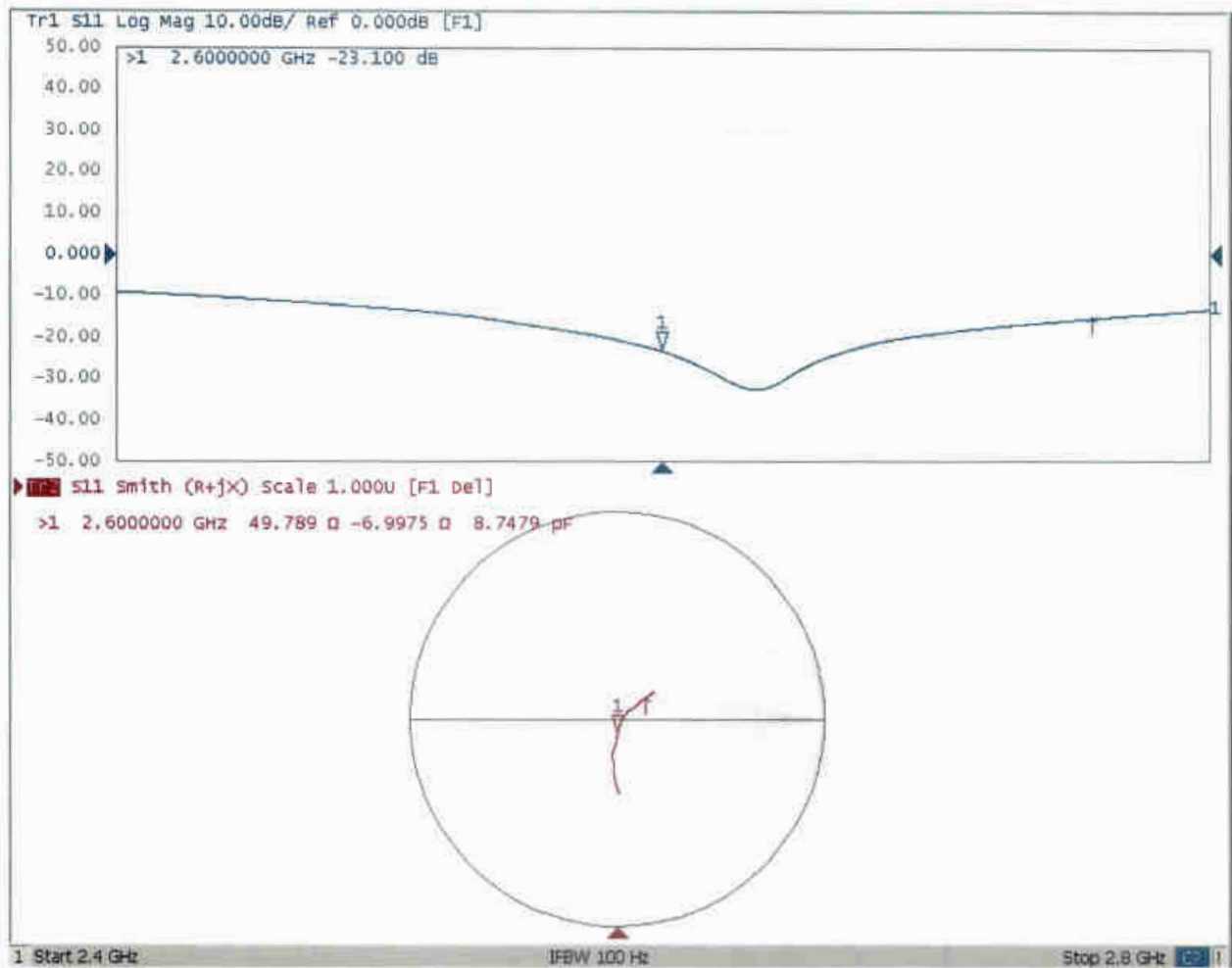
Maximum value of SAR (measured) = 24.7 W/kg





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Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 12.06.2018

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1061

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

Medium parameters used: $f = 2600$ MHz; $\sigma = 2.181$ S/m; $\epsilon_r = 51.03$; $\rho = 1000$ 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)

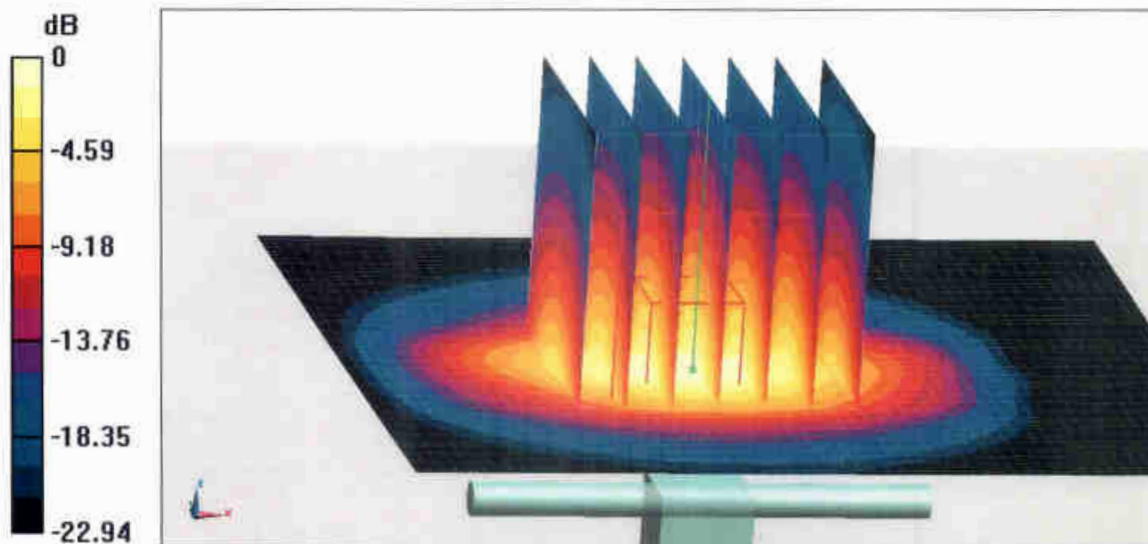
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 87.11 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 29.3 W/kg

SAR(1 g) = 13.7 W/kg; SAR(10 g) = 6.11 W/kg

Maximum value of SAR (measured) = 23.4 W/kg



0 dB = 23.4 W/kg = 13.69 dBW/kg



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Impedance Measurement Plot for Body TSL

