

Antenna Parameters with Body TSL at 5750 MHz

Impedance, transformed to feed point	58.2 Ω - 1.6 j Ω
Return Loss	- 22.3 dB

Antenna Parameters with Body TSL at 5850 MHz

Impedance, transformed to feed point	56.3 Ω - 6.3 j Ω
Return Loss	- 21.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.127 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
Manufactured on	September 20, 2012

DASY5 Validation Report for Head TSL

Date: 06.06.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1155

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5400 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz, Frequency: 5850 MHz

Medium parameters used: $f = 5250$ MHz; $\sigma = 4.57$ S/m; $\epsilon_r = 36.2$; $\rho = 1000$ kg/m³

Medium parameters used: $f = 5400$ MHz; $\sigma = 4.73$ S/m; $\epsilon_r = 35.9$; $\rho = 1000$ kg/m³

Medium parameters used: $f = 5600$ MHz; $\sigma = 4.94$ S/m; $\epsilon_r = 35.7$; $\rho = 1000$ kg/m³

Medium parameters used: $f = 5750$ MHz; $\sigma = 5.09$ S/m; $\epsilon_r = 35.4$; $\rho = 1000$ kg/m³

Medium parameters used: $f = 5850$ MHz; $\sigma = 5.2$ S/m; $\epsilon_r = 35.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.51, 5.51, 5.51) @ 5250 MHz, ConvF(5.5, 5.5, 5.5) @ 5400 MHz, ConvF(5.05, 5.05, 5.05) @ 5600 MHz, ConvF(4.98, 4.98, 4.98) @ 5750 MHz, ConvF(4.94, 4.94, 4.94) @ 5850 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601 (5GHz); Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 76.63 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 28.2 W/kg

SAR(1 g) = 8.14 W/kg; SAR(10 g) = 2.35 W/kg

Maximum value of SAR (measured) = 18.4 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5400 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 75.16 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 31.4 W/kg

SAR(1 g) = 8.33 W/kg; SAR(10 g) = 2.39 W/kg

Maximum value of SAR (measured) = 19.4 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 75.94 V/m; Power Drift = -0.09 dB

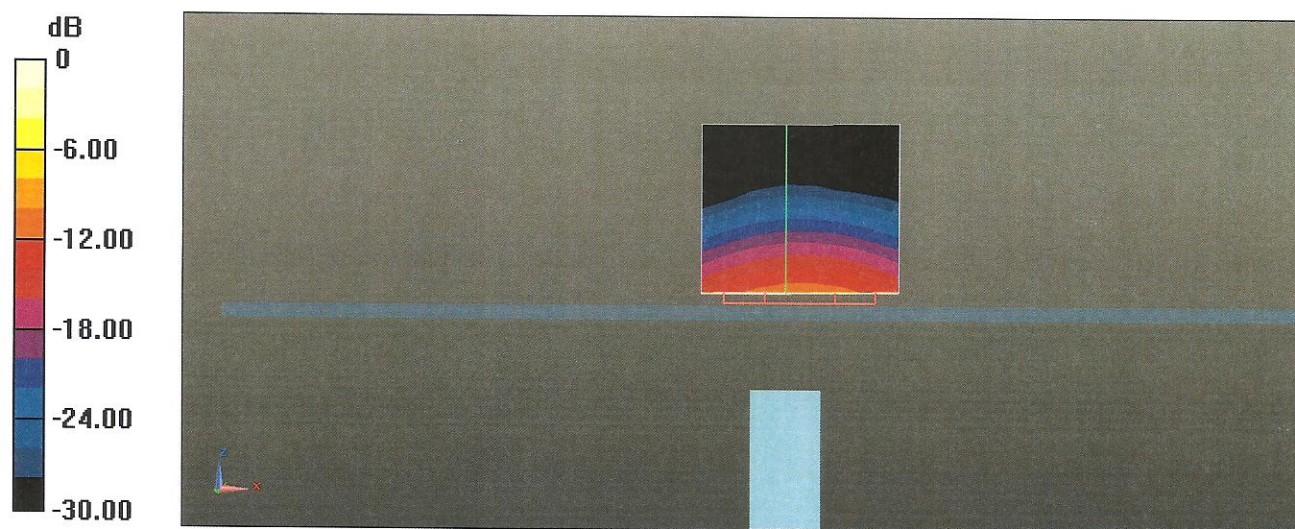
Peak SAR (extrapolated) = 32.5 W/kg

SAR(1 g) = 8.52 W/kg; SAR(10 g) = 2.43 W/kg

Maximum value of SAR (measured) = 20.1 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 72.32 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 30.9 W/kg
SAR(1 g) = 7.85 W/kg; SAR(10 g) = 2.23 W/kg
Maximum value of SAR (measured) = 18.7 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5850 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 73.54 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 36.0 W/kg
SAR(1 g) = 8.5 W/kg; SAR(10 g) = 2.41 W/kg
Maximum value of SAR (measured) = 20.7 W/kg



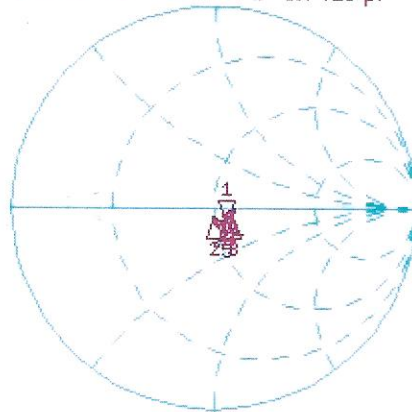
0 dB = 18.4 W/kg = 12.65 dBW/kg

Impedance Measurement Plot for Head TSL

6 Jun 2018 14:02:18

CH1 S11 1 U FS 1: 55.273 Ω -8.0996 Ω 3.7428 pF 5 250.000 000 MHz

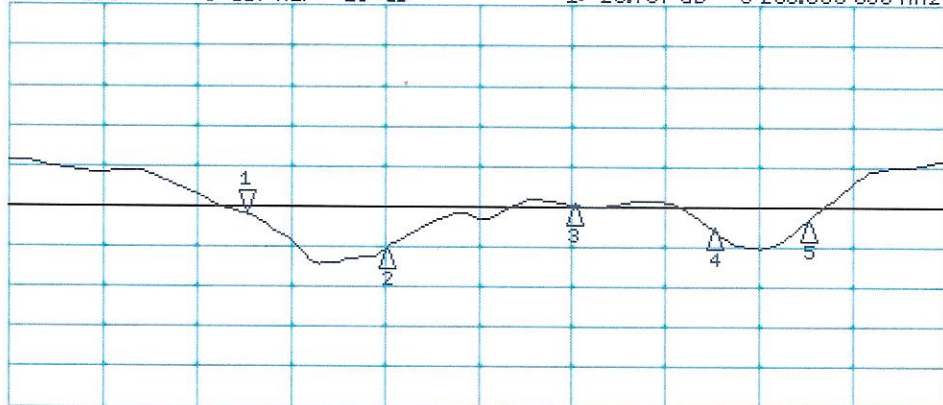
*
Del
Cor
Avg
16
H1d



CH1 Markers
2: 49.549 Ω
-5.4258 Ω
5.40000 GHz
3: 59.207 Ω
-6.2539 Ω
5.60000 GHz
4: 57.252 Ω
-2.8379 Ω
5.75000 GHz
5: 55.438 Ω
-6.6934 Ω
5.85000 GHz

CH2 S11 LOG 5 dB/REF -20 dB 1: -20.767 dB 5 250.000 000 MHz

Cor
Avg
16
H1d



CH2 Markers
2: -25.254 dB
5.40000 GHz
3: -19.850 dB
5.60000 GHz
4: -22.785 dB
5.75000 GHz
5: -21.762 dB
5.85000 GHz

START 5 000.000 000 MHz

STOP 5 000.000 000 MHz

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1155

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5400 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz, Frequency: 5850 MHz

Medium parameters used: $f = 5250$ MHz; $\sigma = 5.51$ S/m; $\epsilon_r = 46.9$; $\rho = 1000$ kg/m³

Medium parameters used: $f = 5400$ MHz; $\sigma = 5.71$ S/m; $\epsilon_r = 46.7$; $\rho = 1000$ kg/m³

Medium parameters used: $f = 5600$ MHz; $\sigma = 5.99$ S/m; $\epsilon_r = 46.3$; $\rho = 1000$ kg/m³

Medium parameters used: $f = 5750$ MHz; $\sigma = 6.19$ S/m; $\epsilon_r = 46$; $\rho = 1000$ kg/m³

Medium parameters used: $f = 5850$ MHz; $\sigma = 6.33$ S/m; $\epsilon_r = 45.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.26, 5.26, 5.26) @ 5250 MHz, ConvF(4.7, 4.7, 4.7) @ 5400 MHz, ConvF(4.65, 4.65, 4.65) @ 5600 MHz, ConvF(4.57, 4.57, 4.57) @ 5750 MHz, ConvF(4.47, 4.47, 4.47) @ 5850 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601 (5GHz); Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 67.19 V/m; Power Drift = -0.06dB

Peak SAR (extrapolated) = 28.5 W/kg

SAR(1 g) = 7.53 W/kg; SAR(10 g) = 2.11 W/kg

Maximum value of SAR (measured) = 17.2 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5400 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 68.41 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 31.3 W/kg

SAR(1 g) = 7.93 W/kg; SAR(10 g) = 2.22 W/kg

Maximum value of SAR (measured) = 19.5 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 67.66 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 33.5 W/kg

SAR(1 g) = 8.02 W/kg; SAR(10 g) = 2.23 W/kg

Maximum value of SAR (measured) = 19.2 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:

Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 64.78 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 31.5 W/kg

SAR(1 g) = 7.39 W/kg; SAR(10 g) = 2.06 W/kg

Maximum value of SAR (measured) = 17.8 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5850 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:

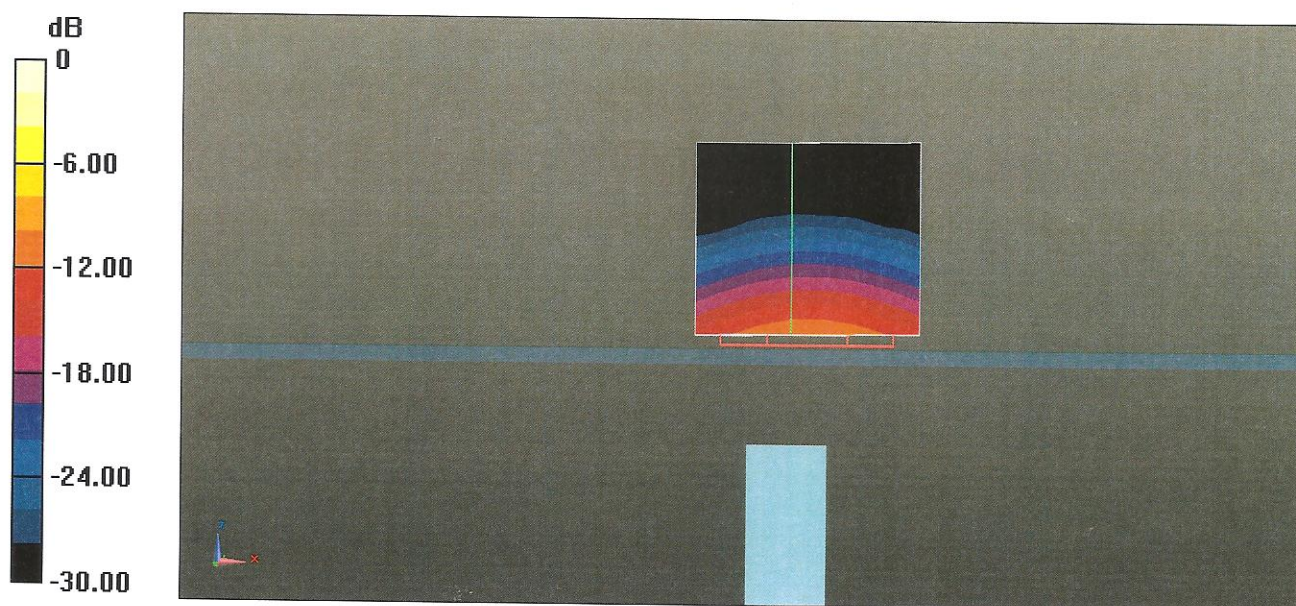
Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 65.90 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 34.8 W/kg

SAR(1 g) = 7.85 W/kg; SAR(10 g) = 2.18 W/kg

Maximum value of SAR (measured) = 19.1 W/kg



0 dB = 17.2 W/kg = 12.36 dBW/kg

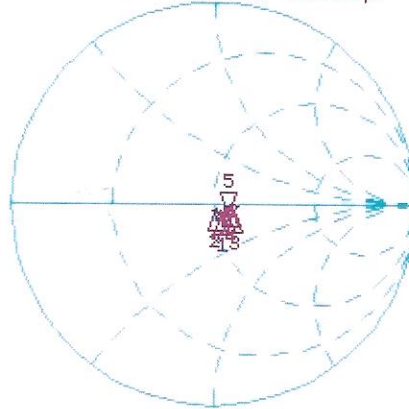
Impedance Measurement Plot for Body TSL

8 Jun 2018 17:23:01

CH1 S11 1 U FS

5: 56.309 Ω -6.2539 Ω 4.3502 pF 5.850.000 000 MHz

*
De1
Cor
Avg
16
H1d



CH1 Markers

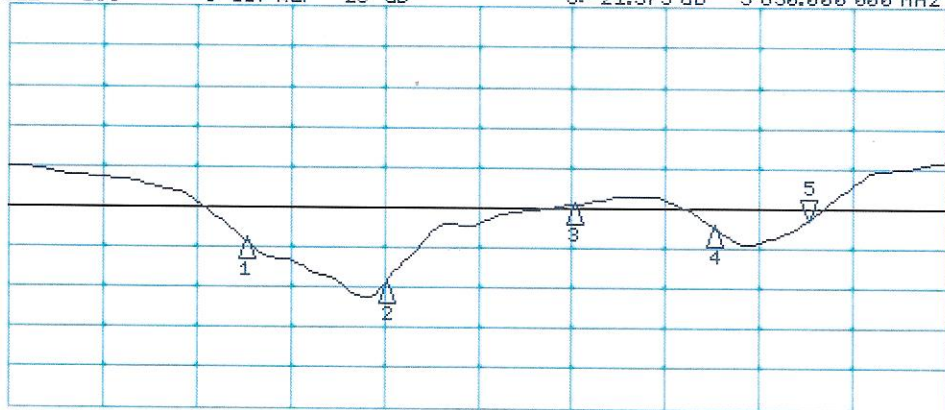
- 1: 53.424 Ω
-5.5078 Ω
5.25000 GHz
- 2: 49.893 Ω
-3.3242 Ω
5.40000 GHz
- 3: 60.596 Ω
-4.9629 Ω
5.60000 GHz
- 4: 58.160 Ω
-1.5859 Ω
5.75000 GHz

CH2 S11 LOG

5 dB/REF -20 dB

5: -21.575 dB 5.850.000 000 MHz

Cor
Avg
16
H1d



CH2 Markers

- 1: -24.061 dB
5.25000 GHz
- 2: -29.552 dB
5.40000 GHz
- 3: -19.521 dB
5.60000 GHz
- 4: -22.289 dB
5.75000 GHz

START 5 000.000 000 MHz

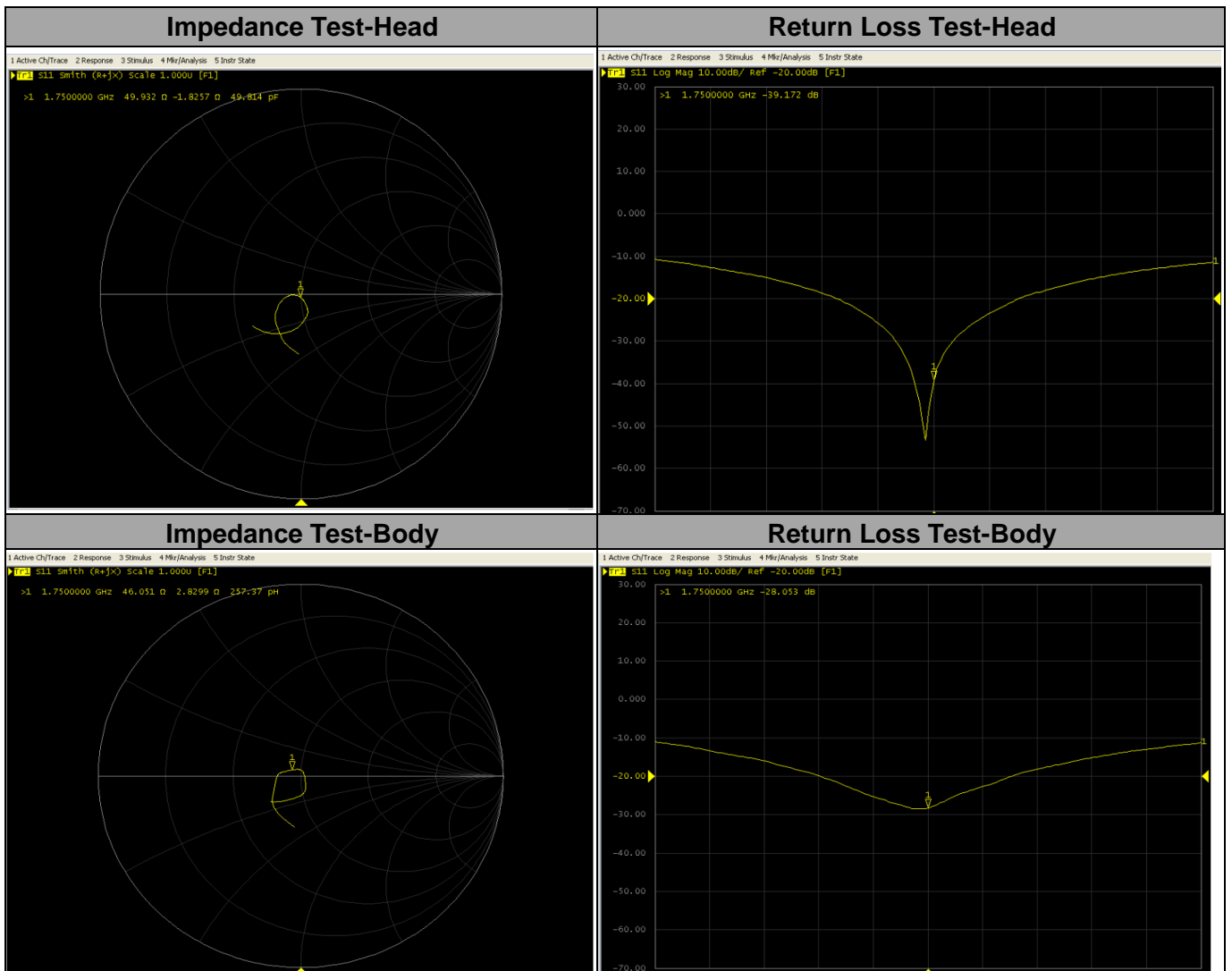
STOP 6 000.000 000 MHz

Justification of the extended calibration of Dipole D1750V2 SN:1123

Per KDB 865664, we have measured the Impedance and Return Loss as below.

- 1) The most recent return-loss result, measured at least annually, deviates by no more than 20% from the previous measurement.
- 2) The most recent measurement of the real or imaginary parts of the impedance, measured at least annually is within 5 ohm from the previous measurement.

Dipole 835 Head TST	Target Value	Measured Value	Difference
Impedance transformed to feed point	50.6Ω-0.8j Ω	49.93Ω-1.83j Ω	R=-0.67Ω,X=-1.03j Ω
Return Loss	-40.2dB	-39.17 dB	-2.56%
Dipole 835 Body TST	Target Value	Measured Value	Difference
Impedance transformed to feed point	46.9Ω-1.0j Ω	46.05Ω+2.83j Ω	R=-0.85Ω,X=3.83j Ω
Return Loss	-29.5 dB	-28.05 dB	-4.92%
Measured Date	2017-07-27	2018-07-17	-----



Justification of the extended calibration of Dipole D1900V2 SN:5d143

Per KDB 865664, we have measured the Impedance and Return Loss as below.

- 1) The most recent return-loss result, measured at least annually, deviates by no more than 20% from the previous measurement.
- 2) The most recent measurement of the real or imaginary parts of the impedance, measured at least annually is within 5 ohm from the previous measurement.

Dipole 1900 Head TST	Target Value	Measured Value	Difference
Impedance transformed to feed point	53.4Ω+4.3j Ω	49.75Ω+7.52j Ω	R=-3.65Ω,X=3.22Ω
Return Loss	-25.6dB	-25.32 dB	-1.09%
Dipole 1900 Body TST	Target Value	Measured Value	Difference
Impedance transformed to feed point	49.1Ω+5.9j Ω	46.18Ω+2.21j Ω	R=-2.92Ω,X=-3.69Ω
Return Loss	-24.4 dB	-24.5 dB	0.41%
Measured Date	2017-09-20	2018-09-20	-----

