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

**S** Schweizerischer Kalibrierdienst
**C** Service suisse d'étalonnage
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**S** Swiss Calibration Service

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Accreditation No.: **SCS 108**

Client **Huawei Shenzhen (Auden)**

Certificate No: **D1800V2-2d184_Mar11**

# CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | D1800V2 - SN: 2d184 |
| Calibration procedure(s) | QA CAL-05.v8<br>Calibration procedure for dipole validation kits |
| Calibration date: | March 08, 2011 |

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Certificate No.) | Scheduled Calibration |
|---|---|---|---|
| Power meter EPM-442A | GB37480704 | 06-Oct-10 (No. 217-01266) | Oct-11 |
| Power sensor HP 8481A | US37292783 | 06-Oct-10 (No. 217-01266) | Oct-11 |
| Reference 20 dB Attenuator | SN: 5086 (20g) | 30-Mar-10 (No. 217-01158) | Mar-11 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 30-Mar-10 (No. 217-01162) | Mar-11 |
| Reference Probe ES3DV3 | SN: 3205 | 30-Apr-10 (No. ES3-3205_Apr10) | Apr-11 |
| DAE4 | SN: 601 | 10-Jun-10 (No. DAE4-601_Jun10) | Jun-11 |

| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
|---|---|---|---|
| Power sensor HP 8481A | MY41092317 | 18-Oct-02 (in house check Oct-09) | In house check: Oct-11 |
| RF generator R&S SMT-06 | 100005 | 4-Aug-99 (in house check Oct-09) | In house check: Oct-11 |
| Network Analyzer HP 8753E | US37390585 S4206 | 18-Oct-01 (in house check Oct-10) | In house check: Oct-11 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Dimce Iliev | Laboratory Technician | D. Iliev |
| Approved by: | Katja Pokovic | Technical Manager | |

Issued: March 9, 2011

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

## Glossary:

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

## Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

## Additional Documentation:

d) 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.

## Measurement Conditions

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

| | | |
|---|---|---|
| **DASY Version** | DASY5 | V52.6.2 |
| **Extrapolation** | Advanced Extrapolation | |
| **Phantom** | Modular Flat Phantom V5.0 | |
| **Distance Dipole Center - TSL** | 10 mm | with Spacer |
| **Zoom Scan Resolution** | dx, dy, dz = 5 mm | |
| **Frequency** | 1800 MHz ± 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 ± 0.2) °C | 39.4 ± 6 % | 1.35 mho/m ± 6 % |
| **Head TSL temperature during test** | (21.0 ± 0.2) °C | ---- | ---- |

## SAR result with Head TSL

| **SAR averaged over 1 $cm^3$ (1 g) of Head TSL** | Condition | |
|---|---|---|
| SAR measured | 250 mW input power | 9.57 mW / g |
| SAR normalized | normalized to 1W | 38.3 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | **39.1 mW /g ± 17.0 % (k=2)** |

| **SAR averaged over 10 $cm^3$ (10 g) of Head TSL** | condition | |
|---|---|---|
| SAR measured | 250 mW input power | 5.03 mW / g |
| SAR normalized | normalized to 1W | 20.2 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | **20.3 mW /g ± 16.5 % (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 ± 0.2) °C | 52.2 ± 6 % | 1.45 mho/m ± 6 % |
| **Body TSL temperature during test** | (21.0 ± 0.2) °C | ---- | ---- |

## SAR result with Body TSL

| **SAR averaged over 1 $cm^3$ (1 g) of Body TSL** | Condition | |
|---|---|---|
| SAR measured | 250 mW input power | 9.46 mW / g |
| SAR normalized | normalized to 1W | 37.8 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | **38.8 mW / g ± 17.0 % (k=2)** |

| **SAR averaged over 10 $cm^3$ (10 g) of Body TSL** | condition | |
|---|---|---|
| SAR measured | 250 mW input power | 5.03 mW / g |
| SAR normalized | normalized to 1W | 20.1 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | **20.4 mW / g ± 16.5 % (k=2)** |

## Appendix

### Antenna Parameters with Head TSL

| | |
|---|---|
| Impedance, transformed to feed point | 49.7 Ω - 2.3 jΩ |
| Return Loss | - 32.8 dB |

### Antenna Parameters with Body TSL

| | |
|---|---|
| Impedance, transformed to feed point | 45.3 Ω - 2.3 jΩ |
| Return Loss | - 25.2 dB |

### General Antenna Parameters and Design

| | |
|---|---|
| Electrical Delay (one direction) | 1.213 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.
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 23, 2008 |

## DASY5 Validation Report for Head TSL

Date/Time: 07.03.2011 13:26:16

Test Laboratory: SPEAG, Zurich, Switzerland

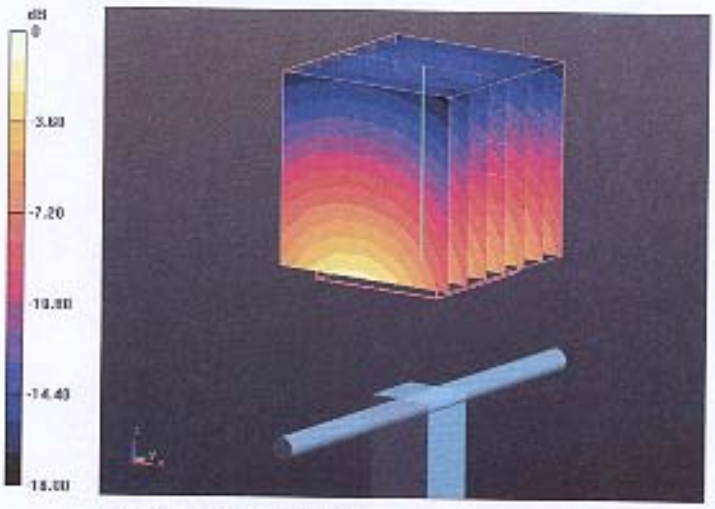
**DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN:2d184**

Communication System: CW; Frequency: 1800 MHz; Duty Cycle: 1:1
Medium: HSL U12 BB
Medium parameters used: f = 1800 MHz; $\sigma$ = 1.34 mho/m; $\varepsilon_r$ = 39.5; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

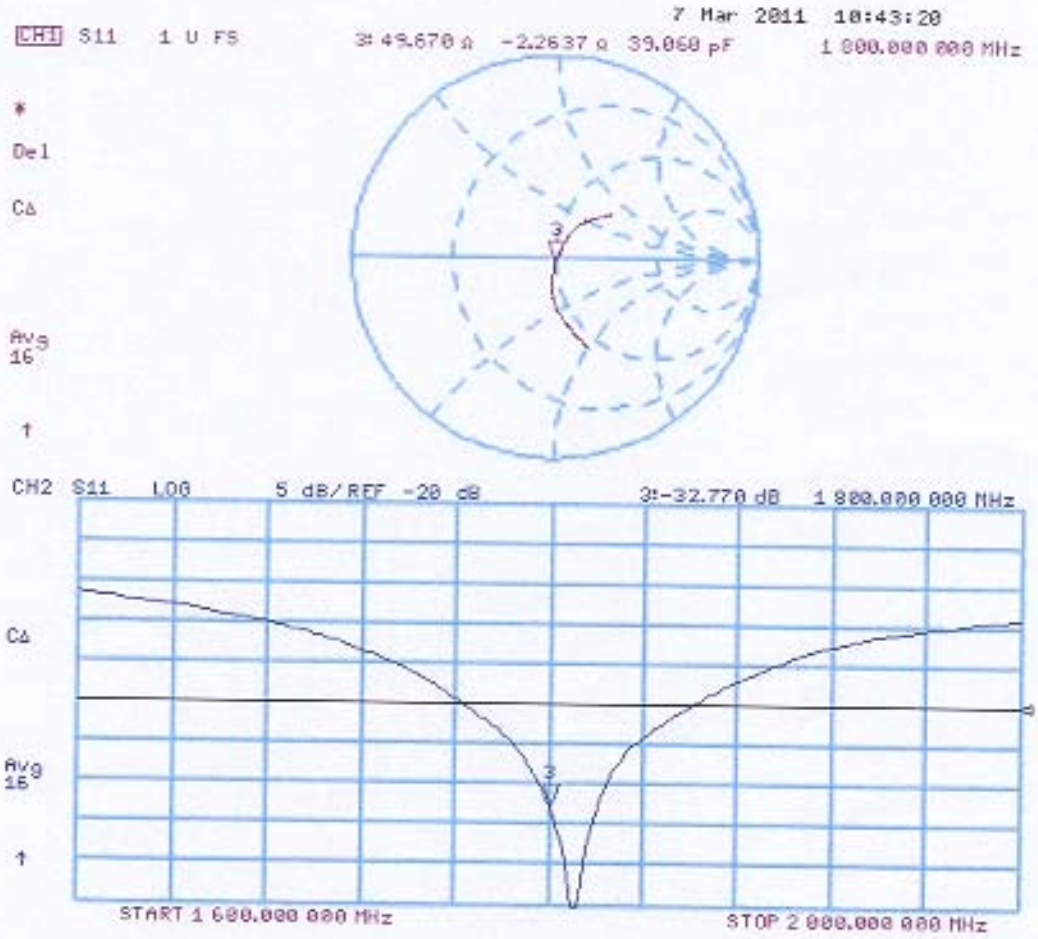
- Probe: ES3DV3 - SN3205; ConvF(5.05, 5.05, 5.05); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY52, V52.6.2 Build (424)
- Postprocessing SW: SEMCAD X, V14.4.4 Build (2829)

**Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 97.238 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 17.403 W/kg
**SAR(1 g) = 9.57 mW/g; SAR(10 g) = 5.03 mW/g**
Maximum value of SAR (measured) = 11.849 mW/g




0 dB = 11.850mW/g

## Impedance Measurement Plot for Head TSL



## DASY5 Validation Report for Body TSL

Date/Time: 08.03.2011 13:09:30

Test Laboratory: SPEAG, Zurich, Switzerland

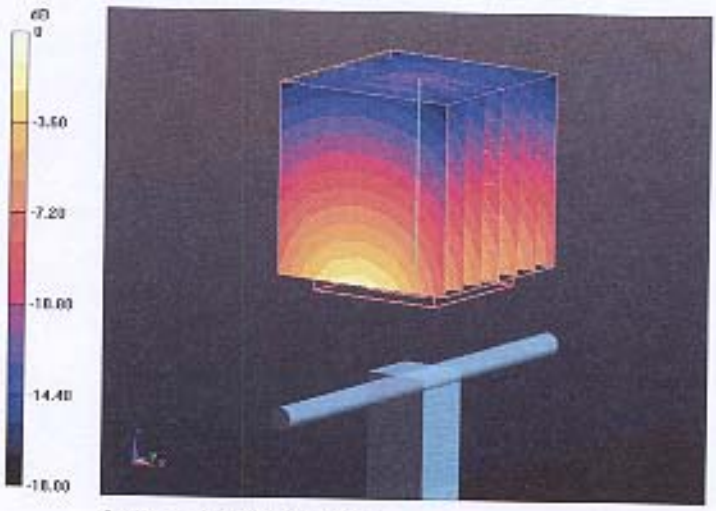
**DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN:2d184**

Communication System: CW; Frequency: 1800 MHz; Duty Cycle: 1:1
Medium: MSL U12 BB
Medium parameters used: f = 1800 MHz; $\sigma$ = 1.45 mho/m; $\varepsilon_r$ = 52.4; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

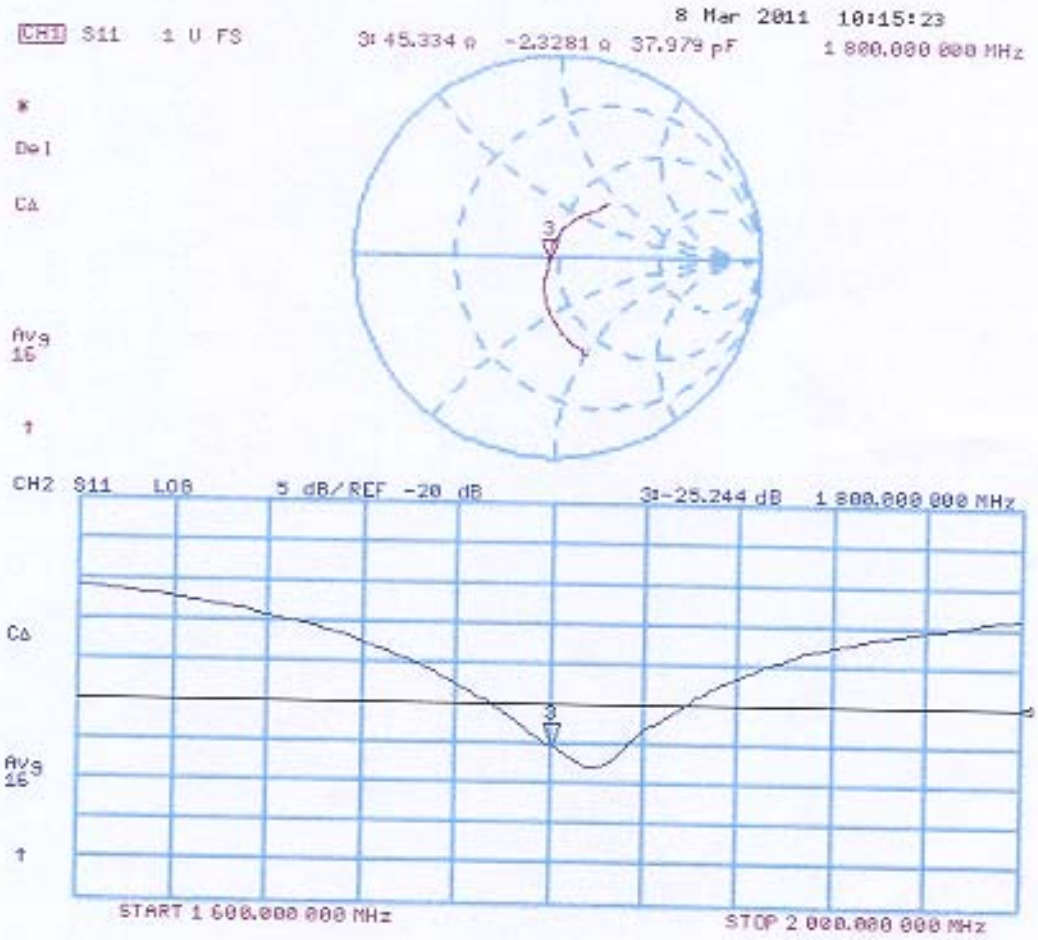
- Probe: ES3DV3 - SN3205; ConvF(4.74, 4.74, 4.74); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY52, V52.6.2 Build (424)
- Postprocessing SW: SEMCAD X, V14.4.4 Build (2829)

**Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 95.452 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 16.289 W/kg
**SAR(1 g) = 9.46 mW/g; SAR(10 g) = 5.03 mW/g**
Maximum value of SAR (measured) = 11.956 mW/g




0 dB = 11.960mW/g

## Impedance Measurement Plot for Body TSL

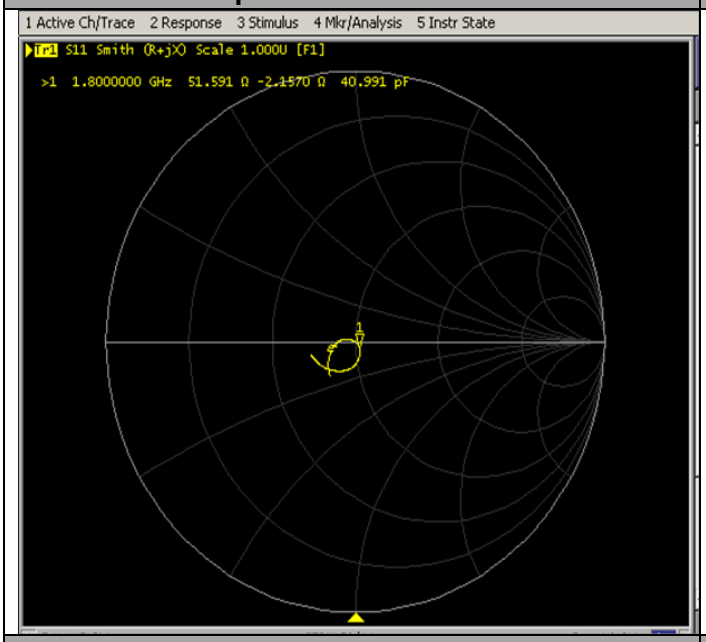


## Justification of the extended calibration of Dipole D1800V2 SN: 2d184

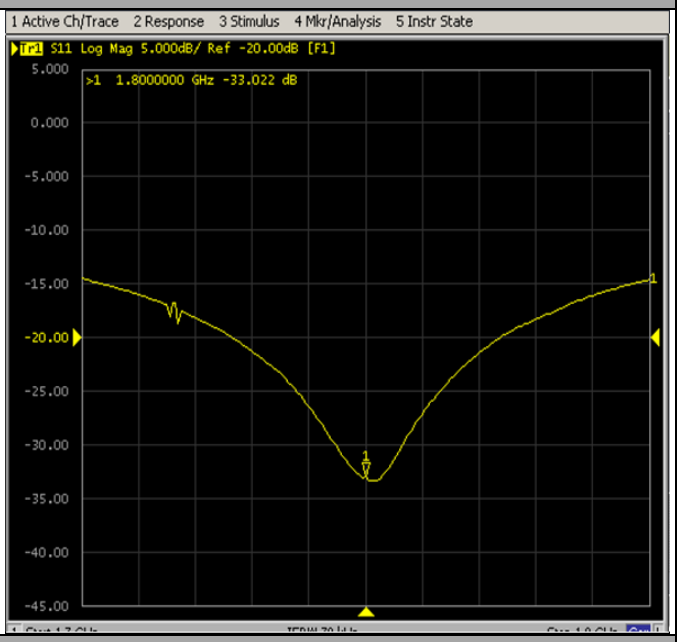
Per KDB 450824, we have Measured the Impedance and Return Loss as below, and the return loss is <-20dB, with 20% of prior calibration; the real or imaginary parts of the impedance is with 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

| Dipole1800 Head TST | Target Value | Measured Value | Difference |
|---|---|---|---|
| Impedance transformed to feed point | 49.7Ω-2.3jΩ | 51.59Ω-2.16jΩ | R=1.89Ω, X=0.14Ω |
| Return Loss | -32.8dB | -33.02dB | -0.67% |
| **Dipole1800 Body TST** | **Target Value** | **Measured Value** | **Difference** |
| Impedance transformed to feed point | 45.3Ω-2.3jΩ | 46.30Ω-2.57jΩ | R=1.0Ω, X=-0.47Ω |
| Return Loss | -25.2dB | -25.64dB | -1.75% |
| Measured Date | 2011-03-08 | 2012-03-07 | ----- |

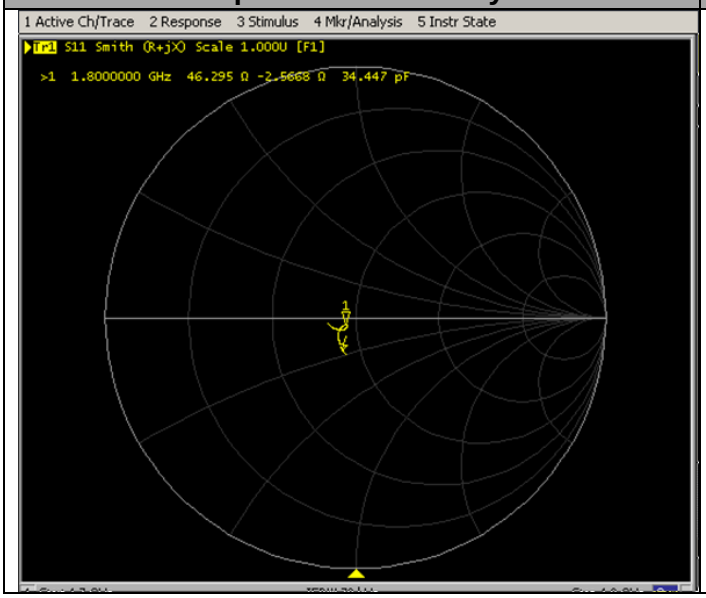
**Impedance Test-Head**

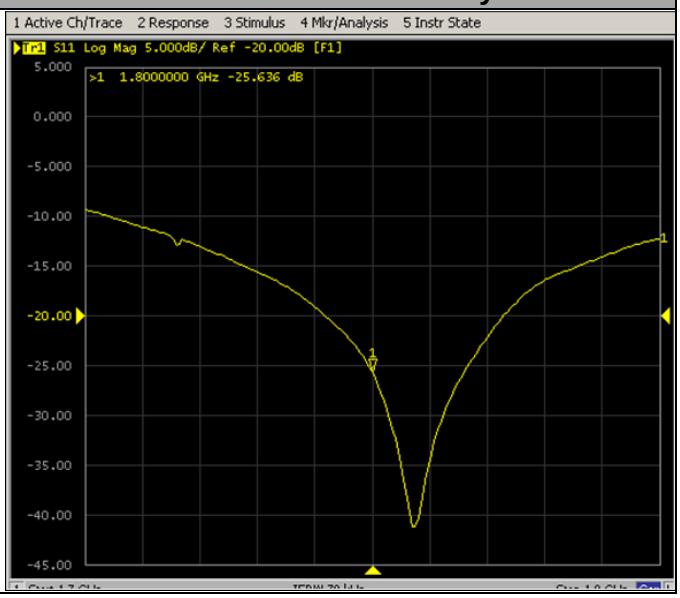



**Return Loss Test-Head**




**Impedance Test-Body**




**Return Loss Test-Body**