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S Schweizerischer Kalibrierdienst
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Accreditation No.: **SCS 108**

Client **Huawei (Auden)**

Certificate No: **D2600V2-1021_Nov11**

CALIBRATION CERTIFICATE

Object D2600V2 - SN: 1021

Calibration procedure(s) QA CAL-05.v8
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: November 22, 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	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5086 (20g)	29-Mar-11 (No. 217-01368)	Apr-12
Type-N mismatch combination	SN: 5047.2 / 06327	29-Mar-11 (No. 217-01371)	Apr-12
Reference Probe ES3DV3	SN: 3205	29-Apr-11 (No. ES3-3205_Apr11)	Apr-12
DAE4	SN: 601	04-Jul-11 (No. DAE4-601_Jul11)	Jul-12

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: November 22, 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	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2600 MHz ± 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 ± 0.2) °C	37.2 ± 6 %	2.00 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	15.0 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**58.8 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.69 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**26.4 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	52.5	2.16 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	50.4 ± 6 %	2.18 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	14.1 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**55.6 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.28 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**24.9 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.7 Ω - 3.6 jΩ
Return Loss	- 28.9 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.3 Ω - 2.4 jΩ
Return Loss	- 28.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.147 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	May 13, 2008

Date: 22.11.2011

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1021

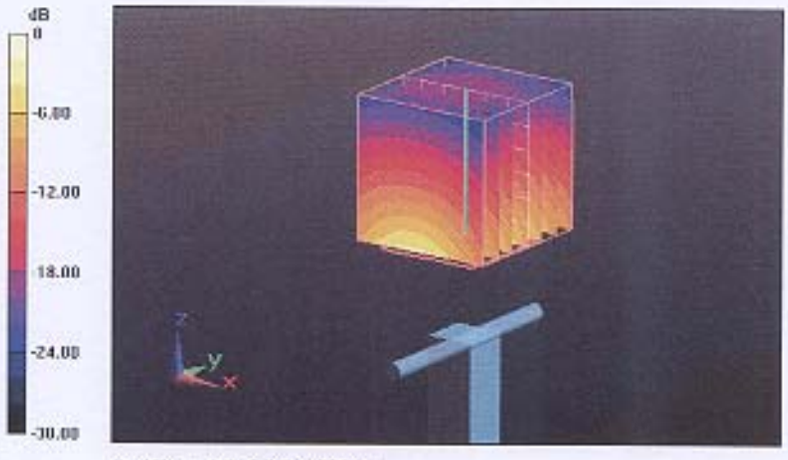
Communication System: CW; Frequency: 2600 MHz
Medium parameters used: f = 2600 MHz; σ = 2 mho/m; ε_r = 37.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.39, 4.39, 4.39); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

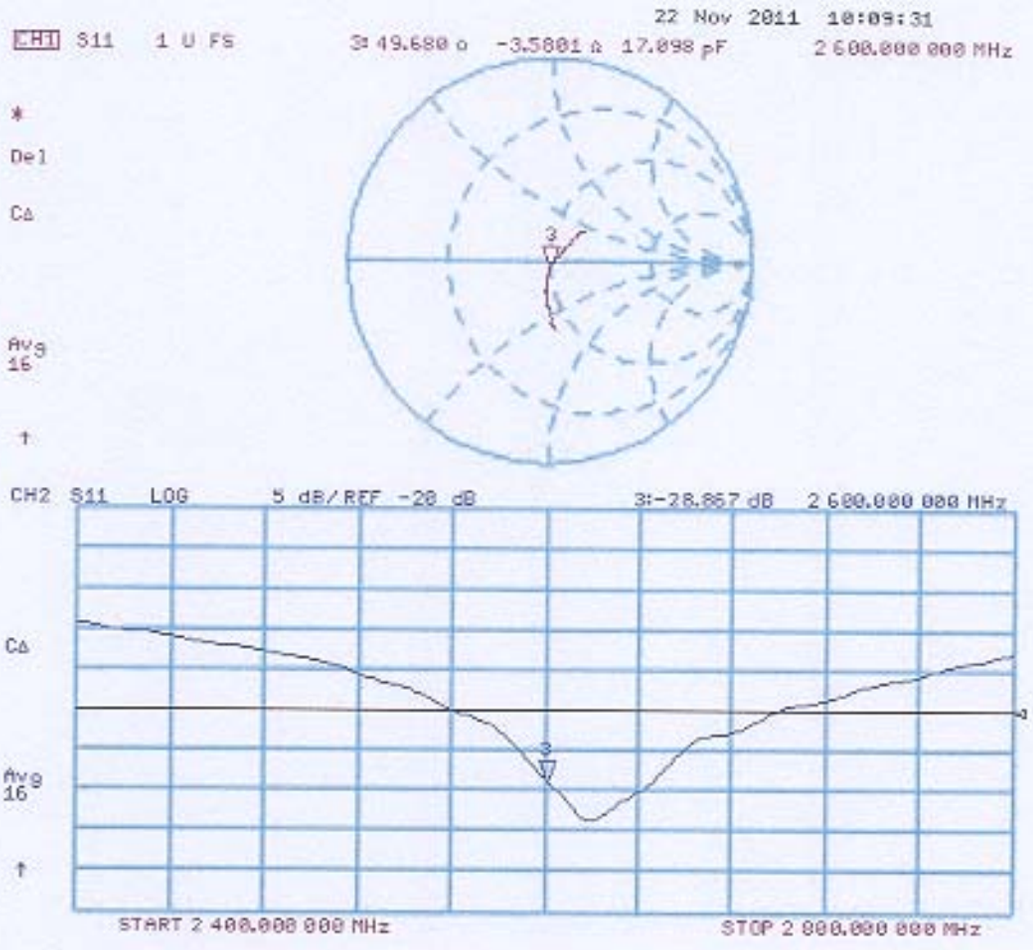
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 103.0 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 32.425 W/kg
SAR(1 g) = 15 mW/g; SAR(10 g) = 6.69 mW/g
Maximum value of SAR (measured) = 19.393 mW/g



0 dB = 19.390mW/g

Impedance Measurement Plot for Head TSL



Date: 22.11.2011

Test Laboratory: SPEAG, Zurich, Switzerland

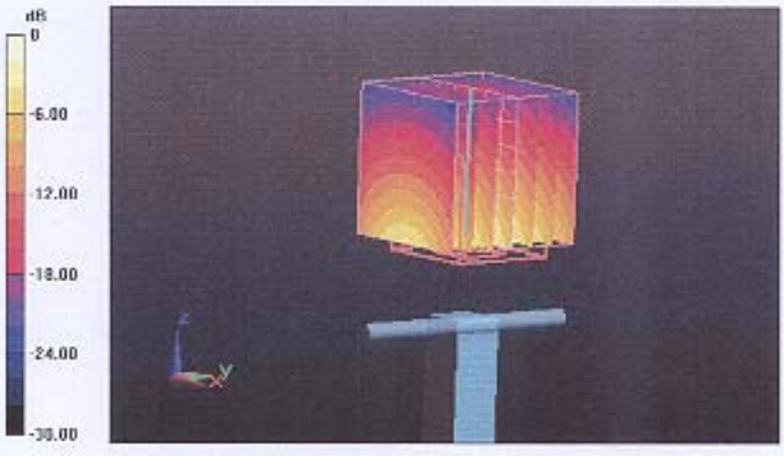
DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1021

Communication System: CW; Frequency: 2600 MHz
Medium parameters used: f = 2600 MHz; σ = 2.18 mho/m; ε_r = 50.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

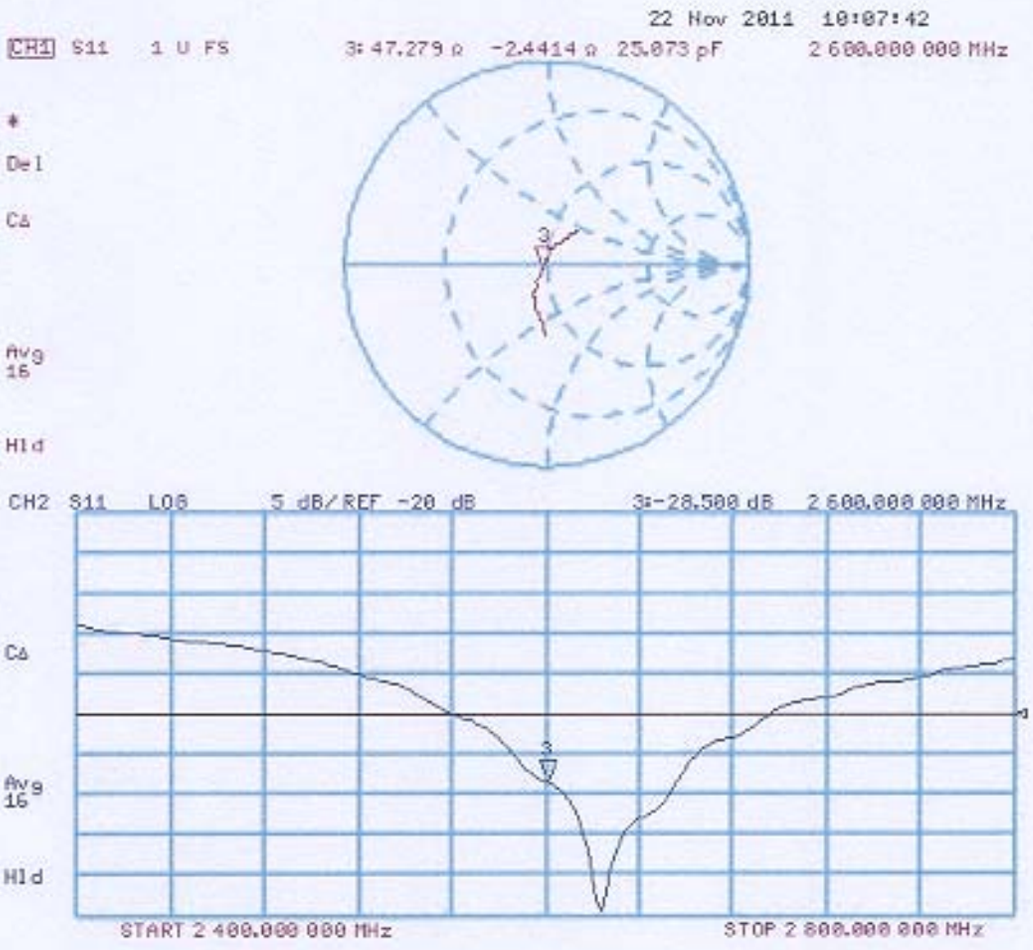
- Probe: ES3DV3 - SN3205; ConvF(4.16, 4.16, 4.16); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 97.494 V/m; Power Drift = -5.5e-006 dB
Peak SAR (extrapolated) = 29.549 W/kg
SAR(1 g) = 14.1 mW/g; SAR(10 g) = 6.28 mW/g
Maximum value of SAR (measured) = 18.869 mW/g



0 dB = 18.870mW/g

Impedance Measurement Plot for Body TSL

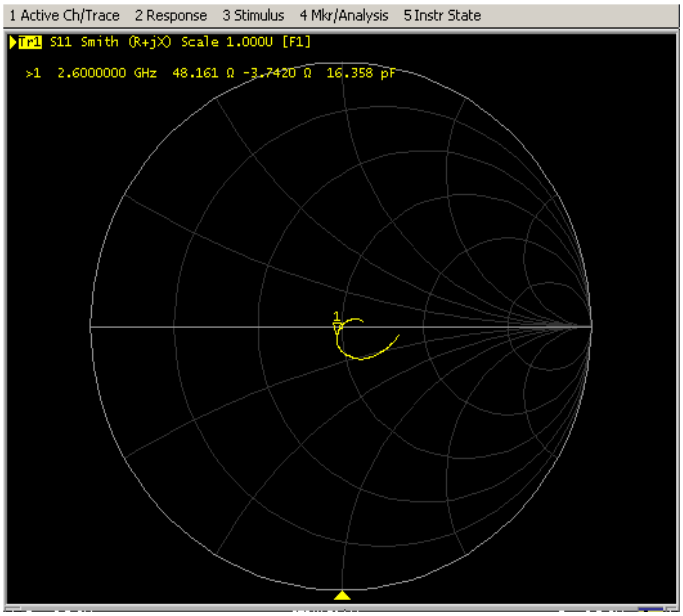


Justification of the extended calibration of Dipole D2600V2 SN:1021

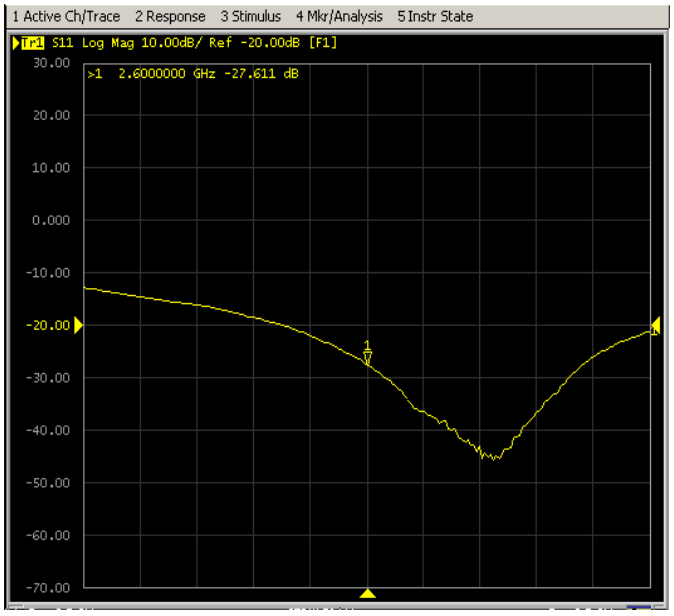
Per KDB 865664, we have Measured the Impedance and Return Loss as below, and the return loss is <-20dB, with 20% of prior calibration; the real or imaginary parts of the impedance is with 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole2600 Head TST	Target Value	Measured Value	Difference
Impedance transformed to feed point	49.7Ω-3.6jΩ	48.16Ω-3.74jΩ	R=-1.54Ω, X=-0.14Ω
Return Loss	-28.9dB	-27.61dB	4.46%
Dipole2600 Body TST	**Target Value**	**Measured Value**	**Difference**
Impedance transformed to feed point	47.3Ω-2.4jΩ	47.83Ω-2.66jΩ	R=0.53Ω, X=-0.26Ω
Return Loss	-28.5dB	-26.94dB	5.47%
Measured Date	2011-11-22	2013-09-12	-----

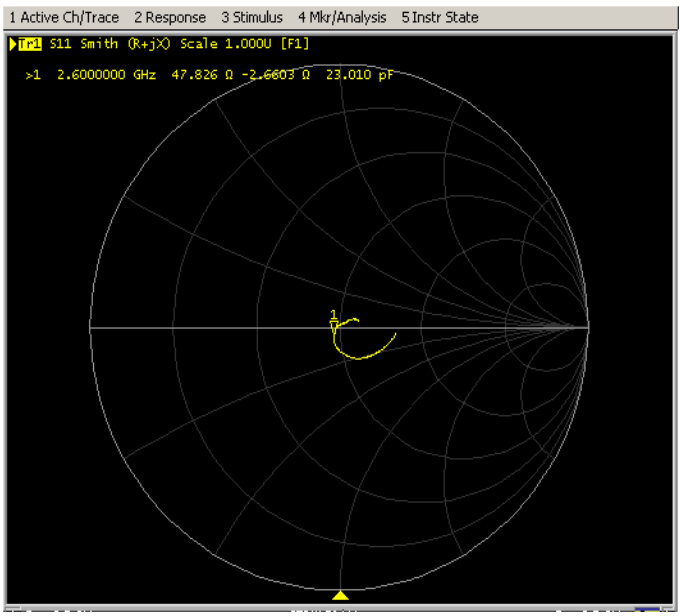
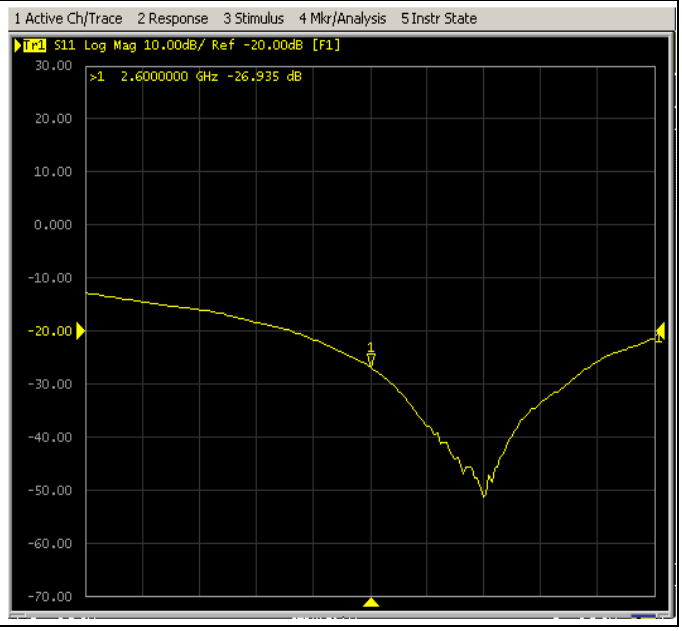
Impedance Test-Head



Return Loss Test-Head



Impedance Test-Body



Return Loss Test-Body