Appendix D
Performance Specifications

This appendix provides performance specifications for all models of the 37200A Series Vector Network Analyzers

Appendix D
Performance Specifications

SYSTEM PERFORMANCE

Signal Source Characteristics Range:
37211A, 22.5 MHz to 3 GHz
37217A, 22.5 MHz to 8.6 GHz
37225A, 40 MHz to 13.5 GHz
37247A, 40 MHz to 20 GHz
37269A, 40 MHz to 40 GHz
Frequency Resolution: 1 kHz (1 Hz optional)
Power Range:
37211A, +10 to –85 dBm
37217A, +10 to –85 dBm
37225A, +10 to –85 dBm
37247A, +10 to –85 dBm
37269A, +5 to –97 dBm
Harmonics: <–35 dBc at maximum rated power
High Level Noise:
<0.03 dB and <0.4° peak-to-peak variation in a 1 kHz IF bandwidth up to 20 GHz.
<0.08 dB and <0.5° peak-to-peak variation up to 40 GHz.
Test Port Characteristics:
Standard Connector Type: K (2.92 mm)
Impedance: 50 ohms
Default Port Power Level (dBm):
37211A: 0 dBm
37217A: 0 dBm
37225A: 0 dBm
37247A: 0 dBm
37269A: –15 dBm
Maximum Input Level: +20 dBm
DC Bias: 0.5 A maximum, 40 VDC maximum
Raw (Uncorrected) Source Match: 10 dB to 20 GHz
8 dB to 40 GHz

GENERAL

Front Panel Connectors and Controls:
Keyboard Input: An IBM-AT compatible keyboard can be connected to the front panel for navigating through front panel menus and disk directories, annotation of data files and display labels, printing displays and pausing instrument sweeps.
Bias Inputs: 0.5 A maximum, 40 Vdc maximum through BNC connectors.
Rear Panel Connectors and Controls:
CRT Intensity: Continuous control of CRT intensity.
CRT Degauss: Pushbutton control degausses CRT.
Printer: Centronics interface for an external printer.
VGA Out: Provides VGA output of 372XXA video display.
10 MHz Ref. In: Connects to external reference frequency standard, 10 MHz, +5 to –5 dBm, 50 ohms, BNC female.
10 MHz Ref. Out: Connects to internal reference frequency standard, 10 MHz, 0 dBm, 50Ω, BNC female.
External Analog Out: –10V to +10V with 5 mV resolution, varying in proportion to user-selected data (e.g., frequency, amplitude). BNC female.
External Trigger Control: External triggering for 372XXA measurement, ±1V trigger. 10 kΩ input impedance. BNC female.
External I/O: 25-pin DSUB connector with the following capabilities:
External Analog Out: –10V to +10V with 5 mV resolution, varying in proportion to user-selected data (e.g., frequency, amplitude).
External Trigger Control: External triggering for *372XXA* measurement, ±1V trigger. 10 kΩ input impedance.
Bias In, Ports 1 and 2: 0.5A, 40 Vdc maximum.
Limits Pass/Fail: 0 (pass) or +5V (fail) output for each channel's limit pass/fail status (4 lines); 0(all channels pass) or +5V (any one of 4 channels fail) output limit pass/fail status (1 line).
External Analog Input: ±50 Volt input for displaying external signals on the CRT in Diagnostics mode. BNC Female.
System Bus: Dedicated IEEE-488.2 controller interface for the plotter, external power meter, and other peripheral instruments.
GPIB: IEEE-488.2 interface
External SCSI: Provides SCSI-2 connector for external SCSI hard drive connection.

ENVIRONMENTAL CHARACTERISTICS

Temperature Range:
Operating: 0 to 50°C
Storage: –40 to 75°C
Power Requirements: 85–264V, 48–63 Hz, 400 VA maximum
Dimensions: 267H x 432W x 585D mm (10.5 x 17 x 23 in.)
Weight: 34 kg (75 lb)

MEASUREMENT CAPABILITIES

Number of Channels: Four measurement channels.
Parameters: S_{11}, S_{21}, S_{22}, S_{12}; or *non-ratioed*, complex input and output impedance; complex input or output admittance; and complex forward and reverse transmission.
Domains: Frequency Domain, CW Draw, and optional Time (Distance) Domain.
Formats: Log Magnitude, Phase, Log Magnitude and Phase, Smith Chart (impedance), Inverse Smith Chart (Admittance), Linear Polar, Log Polar, Group Delay, Linear Magnitude, Linear Magnitude and Phase, Real, Imaginary, Real and Imaginary, SWR.
Data Points:
Can be switched to a value of 1601, 801, 401, 201, 101, or 51 data (frequency) points without recalibration. In addition, the system accepts an arbitrary set of N discrete data points where: *2<N<1601.*
CW mode permits selection of a single point without recalibration.
Reference Delay:
Can be entered in time or in distance (when the dielectric constant is entered). Automatic reference delay feature adds the correct electrical length compensation at the push of a button. Software compensation for the electrical length difference between reference and test is always accurate and stable since measurement frequencies are always synthesized. In addition, the system compensates reference phase delay for dispersive transmission media, such as waveguide and microstrip.
Number of Markers: Six independent markers can be used to read out measurement data.
Delta Markers: In delta-reference marker mode, any one marker can be selected as the reference for the other five.
Marker to Maximum/Minimum: Markers can be directed automatically to the minimum or maximum of a data trace.
Enhanced Markers: Marker search for a level or bandwidth, displaying an active marker for each channel, and discrete or continuou (interpolated) markers.
Marker Sweep: Sweeps upward in frequency between any two markers. Recalibration is not required.
Segmented Limit Lines: Two limit lines per channel, composed of flat, sloped, or single point segments, to indicate test limits. Each limit line may be made from up to 10 segments.
Pass/Fail Indication: When trace exceeds a limit line segment a “PASS” or “FAIL” message is displayed on the screen. A GPIB Pass/Fail SRQ is enabled.
Limit Frequency: Identifies the ±X dB bandwidth of amplifiers, filters and other frequency sensitive devices. Interpolation algorithm determines the exact intersection frequencies of test data and limit lines.
Measurement Frequency Range: Frequency range of measurement can be narrowed within calibration range without recalibration. CW mode permits single frequency measurements, also without recalibration.
Tune Mode: Tune Mode optimizes sweep speed in tuning applications by updating forward S-parameters more frequently than reverse ones. This mode allows the user to select the ratio of forward sweeps to reverse sweeps after a full 12-term calibration. The ratio of forward sweeps to reverse sweeps can be set anywhere between 1:1 to 10,000:1.

DISPLAY CAPABILITIES

Display Channels: Four, each of which can display any S-parameter or user-defined parameter in any format with up to two traces per channel for a maximum of eight traces simultaneously. A single channel, two channels (1 and 3, or 2 and 4), overlaid channels (1 and 3, or 2 and 4), or all four channels can be displayed simultaneously.
CRT: Color, 7.5-inch diagonal, VGA display.
Trace Overlay: Displays two data traces on the active channel’s graticule simultaneously.
Trace Memory: A separate memory for each channel can be used to store measurement data for later display or subtraction, addition, multiplication or division with current measurement data.
Scale Resolution (minimum):
Log Magnitude: 0.001 dB/div
Linear Magnitude: 1 pU
Phase: 0.01 degrees/div
Group Delay: 0.001 ps
Time: 0.001 ms
Distance: 0.001 mm
SWR: 1 pU
Autoscale: Automatically sets Resolution and Offset to fully display measurement data.
Reference Position: Can be set at any graticule line.
Annotation: Type of measurement, vertical and horizontal scale resolution, start and stop frequencies, and reference position.

MEASUREMENT ENHANCEMENT

Vector Error Correction: There are four methods of calibration:

1) OSL (standard) calibration method using short circuits, open circuits, and terminations (fixed or sliding)
2) Offset-Short calibration
3) LRL (Line-Reflect-Line) calibration
4) LRM Line-Reflect-Match calibration

There are five vector error correction models available:

1) Full 12-Term
2) One Path/Two Port (Forward or Reverse)
3) Frequency Response (Forward or Reverse or both)
4) Frequency Response with Isolation
5) Reflection Only (Port 1 or Port 2 or both)

Full 12-term can always be used, if desired, since all 372XXA series models automatically reverse the test signal. A front-panel button selects whether calibration is applied and an LED lights when error correction is applied.

Calibration Standards: User selects SMA, GPC-3.5, GPC-7, Type N, 2.4 mm, TNC, or K Connector from the calibration menu. Use of fixed or sliding load can be selected for each connector type. Open circuit capacitance coefficients can be modified. In general, all calibration parameters may be modified manually or through the GPIB interface.

Reference Impedance: Modify the reference impedance of the measurement to other than 50 ohms (but not 0).

LRL/LRM Calibration Capability: The LRL calibration technique uses the charactersitic impedance of a length of transmission line as the calibration standard. A full LRL calibration consists merely of two transmission line measurements, a high reflection measurement, and an isolation measurement. The LRM calibration technique is a variation of the LRL technique that utilizes a precision termination rather that a second length of transmission line. A third optional standard, either Line or Match, may be measured in order to extend the frequency range of the calibration. This extended calibration is achieved by mathematically concatenating either two LRL, two LRM, or one LRL and one LRM calibration(s). Using these techniques, full 12-term error correction can be performed on the 372XXA VNA.

Dispersion Compensation: Selectable as Coaxial (non-dispersive), Waveguide, or Microstrip (dispersive).

Reference Plane: Selectable as Middle of line 1 or Ends of line 1.

Corrected Impedance: Determined by Calibration Standards.

Data Averaging: Averaging of 1 to 4096 averages can be selected. Averaging can be toggled on/off with front panel button. A front panel button turns data averaging on/off, and a front panel LED indicates when averaging is active.

Video IF Bandwidth: Front panel button selects four levels of video IF bandwidth. MAXIMUM (10 kHz), NORMAL (1 kHz), REDUCED (100 Hz) and MINIMUM (10 Hz).

Trace Smoothing: Functions similarly to Data Averaging but computes an average over a percentage range of the data trace. The percentage of trace to be smoothed can be selected from 0 to 20% of trace. Front panel button turns smoothing on/off, and front panel LED indicates when smoothing is active.

SOURCE CONTROL

Frequency Resolution: 1 kHz (1 Hz optional)

Test Port Power Level: The level at Port 1 may be controlled in fine increments of 0.1 dB or in 10 dB steps by using the internal 0 to 70 dB step attenuator.

Power Accuracy: ±0.5 dB at 2 GHz at default power.

Level Test Port Power: The power, at all sweep frequencies, is leveled to within ±2 dB (±3 dB for 20–40 GHz).

Flatness Correction: Further improves the test port power flatness using an external power meter to measure and correct for level variations.

Dual Source Control: Allows a user to separately control the frequency of both the internal and an external signal source and the receiver without the need for an external controller.

Sweep Type: Linear, CW, Marker, or N-Discrete point sweep.

Frequency Accuracy, Standard Time Base:

Aging: <1 x 10^{-6}/year

Stability: <1 x 10^{-6} over +15 to +50°C range

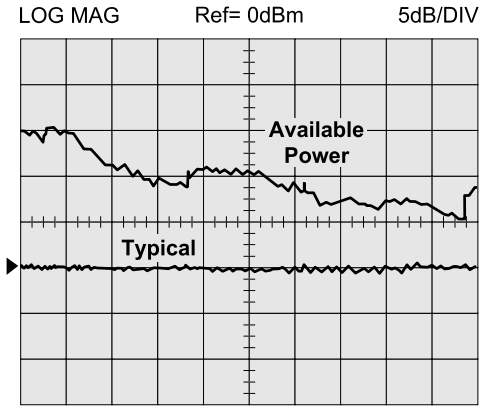
Frequency Accuracy, High Stability Time Base (Opt 10):

Aging: <1 x 10^{-9}/day

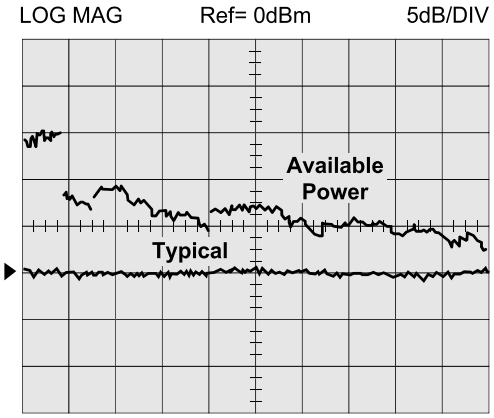
Stability: <1 x 10^{-9} over 0 to +55°C range

Power Range:

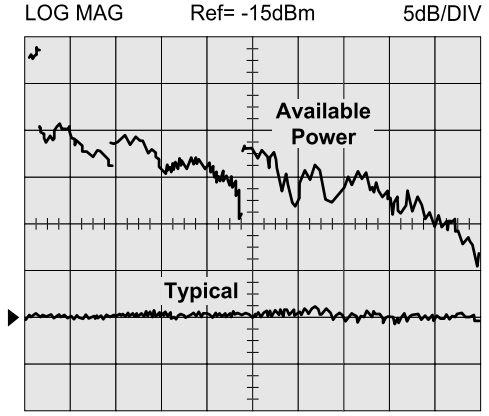
Model	Rated Power (dBm)	Minimum Power (dBm)	Resolution (dB)	Flatness (dB)
37211A	0	–85	0.1	±1.5
37217A	0	–85	0.1	±1.5
37225A	0	–85	0.1	±1.5
37247A	0	–85	0.1	±2
37269A	–15	–97	0.1	±3



Model 37211A and 37217A Port 1 Power



Model 37225A and 37247A Port 1 Power



Model 37269A Port 1 Power

GROUP DELAY CHARACTERISTICS

Group Delay is measured by computing the phase change in degrees across a frequency step by applying the formula:

$$\tau_g = -\frac{1}{360}\frac{d\Phi}{df}$$

Aperture: Defined as the frequency span over which the phase change is computed at a given frequency point. The aperture can be changed without recalibration. The minimum aperture is the frequency range divided by the number of points in calibration and can be increased to 20% of the frequency range without recalibration. The frequency width of the aperture and the percent of the frequency range are displayed automatically.

Range: The maximum delay range is limited to measuring no more than ±180 degrees of phase change within the aperture set by the number of frequency points. A frequency step size of 100 kHz corresponds to 10 ms.

Measurement Repeatability (sweep to sweep): For continuous measurement of a through connection, RSS fluctuations due to phase and FM noise are:

$$\frac{1.41\ [\,(\,Phase\ Noise\ in\ deg)^2 + (\,\tau_g \times Residual\ FM\ Noise\ in\ Hz\,)^2\,] \times 0.5}{360\,(\,Aperture\ \ in\ \ Hz\,)}$$

Accuracy:

$$Error\ \ in\ \ \tau_g = \frac{Error\ in\ Phase}{360} + [\,\tau_g \times\ Aperture\ \ Freq\ \ Error\ \ (Hz)\,]$$
$$Aperture\,(Hz)$$

HARD COPY

Hardcopy Output Selection: Menu selects printer type, graphical or tabular data output, and plotter type, which allows portrait or landscape format. The number of data points of tabular data can be selected as well as data at markers only.

Compatible Printers:

- HP ThinkJet
- HP QuietJet
- HP DeskJet (b/w) (310/320, 500)
- HP LaserJet II & III Series
- Epson FX80

Compatible GPIB Plotters:

- HP Models 7440A,7470A, 7475A, and 7550A
- Tektronix Model HC100 plotters. The plotter is connected to the dedicated system GPIB bus.

Performance: After selecting the Start Print button, front panel operation and measurement capability is restored to the user within 2 seconds.

STORAGE

Internal Memory: Up to 10 front panel states can be stored and recalled from non-volatile memory locations. The current front panel setup is automatically stored in non-volatile memory at instrument power-down. When power is applied, the instrument returns to its last front panel setup (with no calibration data applied).
Internal Hard Disk Drive: A hard-disk drive is used to store and recall measurement and calibration data and front-panel setups.
External SCSI Interface: Option 4 deletes the internal hard disk drive and adds a SCSI Interface connector to the rear panel for connecting a SCSI-2 formatted hard disk drive.
Internal Disk Drive: A 3.5-inch microdiskette drive with 1.44 Mbytes formatted capacity is used to load measurement programs and to store and recall measurement and calibration data and front-panel setups.
Disk Storage Format: All files are MS-DOS Compatible. User-defined file names may be 1 to 8 characters long.
Data File Size:

Measurement: 20.5K bytes per 401 point S-parameter trace.
Calibration: 48.8K bytes per 401 point (12-term cal+setup). Trace Memory: 3.2Kbytes per 401 point data trace.

REMOTE PROGRAMMING

Interface: GPIB (IEEE-488.2)
Addressing: Address can be set from the front panel and can range from 0 to 30. Defaults to address 6.
Transfer Formats: ASCII, 32-bit floating point, or 64-bit floating point.
Speed: 40K bytes/s
Interface Function Codes: SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP1, DT1, DC0, C0.

MEASUREMENT ACCURACY

The graphs shown on pages C-8 through C-14 give measurement accuracy after 12-term vector error correction. These errors include the contributions of residual directivity, load and source match, frequency response, isolation, network analyzer dynamic accuracy, and connector repeatability. In preparing the following graphs, 100 Hz IF bandwidth and averaging of 1024 points were used. Changes in the video IF bandwidth or averaging can result in variations at low levels.

DYNAMIC RANGE SUMMARY

Dynamic range (Table C-1) is given in two manners. “Receiver Dynamic Range” is defined as the ratio of the maximum signal level at Port 2 for 0.1 dB compression to the noise floor at Port 2. “System Dynamic Range” is defined as the ratio of the power incident on Port 2 in a through line connection to the noise floor at Port 2 (forward measurements only). In preparing the Dynamic Range specifications, 100 Hz IF bandwidth and 1024 averages were used during calibration and measurement.

TEST PORT CHARACTERISTICS

The Test Port specifications (Table C-2) apply when the proper Model 34U or 34Y Universal Adapters are connected, with or without phase-equal insertables, to the test set ports and calibrated with the appropriate Wiltron or other designated calibration kit at 23°C ± 3°C using the OSL calibration method with a sliding load to achieve 12-term error correction. A 90 Minute minimum warm-up time is assumed.

TIME (DISTANCE) DOMAIN MEASUREMENT CAPABILITY (OPTION 2)

Option 2, Time (Distance) Domain software allows the conversion of reflection or transmission measurements from the frequency domain to the time domain. Measured S-parameter data is converted to the time domain by application of a Fast Fourier Transform (FFT) using the Chirp Z-Transform technique. Prior to conversion any one of several selectable windowing functions may be applied. Once the data is converted to the time domain, a gating function may be applied to select the data of interest. The processed data may then be displayed in the time domain with display start and stop times selected by the user, or in the distance domain with display start and stop distance selected by the user. The data may also be converted back to the frequency domain with a time gate to view the frequency response of the gated data.
Lowpass Mode: This mode displays a response equivalent to the classic (Time Domain Reflectometer) response of the device under test. Lowpass response may be displayed in either the impulse or step mode. This type of processing requires a sweep over a harmonic series of frequencies and an extrapolated or user-entered dc value.
Bandpass Mode: This mode displays a response equivalent to the time response of the device under test to a band limited impulse. This type of processing may be used with any arbitrary frequency sweep range, limited only by the test set range or device-under-test response.
Phasor Impulse Mode: This mode displays a response similar to the Lowpass impulse response, using data taken over an arbitrary (band limited) sweep range. Detailed information, similar to that contained in the lowpass impulse response, may be used to identify the nature of impedance discontinuities in the device under test. Now, with Phasor Impulse, it is possible to characterize complex impedances on band-limited devices.
Windowing: Any one of four window functions may be applied to the initial frequency data, to counteract the ef-

fects of processing data with a finite bandwidth. These windows provide a range of tradeoffs of main-lobe width vs. sidelobe level (ringing). The general type of function used is the Blackman-Harris window, with the number of terms being varied from one to four. Typical performance is shown below:

Type of Window (Number of Terms)	First Side Lobe Relative to Peak	Impulse Width[1]
Rectangular (1)	–13 dB	1.2W
Nominal-Hamming (2)	–43 dB	1.8W
Low Side Lobe Blackman-Harris (3)	–67 dB	2.1W
Minimum Side Lobe Blackman-Harris (4)	–67 dB	2.7W

1 W(Bin Width)=½ Δf sweep width

Gating: A selective gating function may be applied to the time domain data to remove the responses of all but one desired time range. This gating function may be chosen as the convolution of any of the above window types with a rectangular gate of user-defined position and width. The gate may be specified by entering start and stop times or center and span. The gated data may be displayed in the time domain, or converted back to the frequency domain.

Time Domain Display: Data processed to time domain may be displayed as a function of time or as a function of distance, provided the dielectric constant of the transmission media is entered correctly. In the case of dispersive media such as waveguide or microstrip, the true distance to a discontinuity is displayed in the distance mode. The time display may be set to any arbitrary range by specifying either the start and stop times or the center time and span.

Frequency with Time Gate: Data that has been converted to time domain and selected by the application of gating function may be converted back to the frequency domain. This allows the display of the frequency response of a single element contained in the device under test. Frequency response accuracy is a function of window and gate type, and gate width. For a full reflection, minimum gate and window accuracy is within 0.2 dB of the ungated response over a 40 GHz range.

OTHER OPTIONS

Option 1 & 1A-Rack & Slide Mounting Options
Option 1 provides slide mounts and associated hardware to install the 372XXA in a user-supplied rack. Option 1A provides hardware for mounting the 372XXA in a user-supplied rack where there is proper bottom support for the instrument.

Option 3 — 1 Hz Frequency Resolution
Option 3 adds 1 Hz frequency resolution to all *microwave* models (1 kHz is standard). *(1 Hz frequency resolution is standard on Models 37211A and 37217A.)*

Option 4 — External SCSI Interface
Option 4 adds a rear panel connector for connection of an external SCSI-2 Hard Disk Drive for use in applications where removable media is a requirement. In this situation, the internal hard disk drive is not installed.

Option 6 — Port 2 Test Step Attenuator
Option 6 adds a 0 to 70 dB step attenuator in the Forward Transmission signal path to allow for device output power of up to +30 dBm (1 Watt) into Port 2.

Option 7 — Test Port Connector

7A: Replaces Universal K connector with Universal GPC-7 connector

7N Replaces Universal K connector with Universal N male connector

7NF Replaces Universal K connector with Universal N female connector

Option 10 — Ovenized Timebase
Option 10 replaces the standard temperature compensated crystal oscillator (with a temperature stability of 1ppm over a +15 to 55°C range) with an ovenized crystal oscillator (aging stability of x 10^{-9}/day and temperature stability ± x 10^{-9} over 0 to 55°C range).

Option 11 — Reference Loop Extension Cables
Option 11 add extension to both Reference A and Reference B Sampler RF inputs allowing the user direct access to these channels.

MEASUREMENT SPEED SUMMARY

Measurement times will be on a per sweep basis including retrace, with a 12-term RF calibration applied, no averaging, 10 kHz IF bandwidth and two channels with one display trace each. The measurement times are as follows:
401 pts, .01-20 GHz sweep = 1.1 seconds
101 pts, .01-20 GHz sweep = .35 seconds
401 pts, 1 GHz sweep width = 1.0 seconds
101 pts, 1 GHz sweep width = .26 seconds

UNCERTAINTY CURVES (measured @23 ±3 deg C)

Uncertainty curves are provided on the following pages.

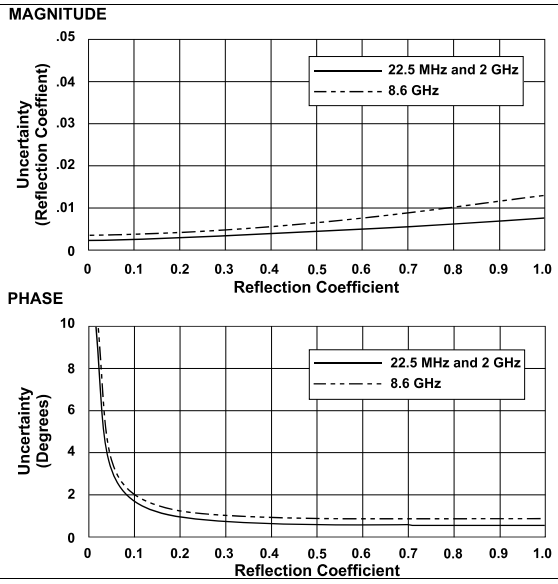
Table D-1. *Dynamic Range Summary*

Model	Freq (GHz)	Max Signal Into Port 2 (dBm)	Noise Floor (dBm)	Receiver Dynamic Range	Port 1 Power (dBm)	System Dynamic Range
37211A.	0.0225	+30	–95	125	0	95
	2	+30	–98	130	0	98
	3	+30	–98	130	0	98
37217A	0.0225	+30	–95	125	0	95
	2	+30	–98	130	0	98
	8.6	+30	–98	128	0	98
37225A	0.04	+30	–70	100	0	70
	2	+30	–98	128	0	98
	13.5	+30	–98	128	0	96
37247A	0.04	+30	–70	100	0	70
	2	+30	–98	128	0	98
	20	+30	–96	126	0	96
37269A	0.04	+30	–70	100	0	70
	2	+30	–98	128	0	98
	20	+30	–95	125	–5	90
	40	+30	–93	123	–15	78

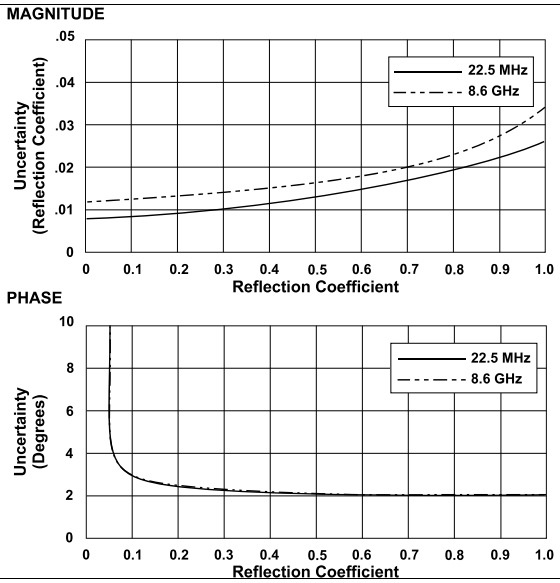
Table D-2. *Test Port Characteristics*

Connector	Frequency (GHz)	Directivity	Source Match	Load Match	Reflection Frequency Tracking	Transmission Frequency Tracking	Isolation
GPC-7	0.04	>52	>44	>52	±0.003	±0.004	>105
	1.0	>52	>44	>52	±0.003	±0.004	>115
	8.6	>52	>42	>52	±0.004	±0.012	>112
	18	>52	>42	>52	±0.004	±0.012	>112
GPC-7 LRL Calibration	2.0	>60	>60	>60	±0.001	±0.001	>115
	8.6	>60	>60	>60	±0.001	±0.001	>112
	18	>60	>60	>60	±0.001	±0.001	>112
3.5 mm	0.04	>44	>40	>44	±0.006	±0.006	>105
	1.0	>44	>40	>44	±0.006	±0.006	>115
	8.6	>44	>38	>44	±0.006	±0.050	>110
	20	>44	>38	>44	±0.015	±0.020	>110
	26.5	>44	>34	>44	±0.020	±0.030	>102
K	0.04	>42	>40	>42	±0.006	±0.006	>105
	1.0	>42	>40	>42	±0.006	±0.006	>115
	8.6	>42	>38	>42	±0.006	±0.070	>110
	20	>42	>38	>42	±0.015	±0.020	>110
	40	>38	>38	>38	±0.020	±0.030	>100

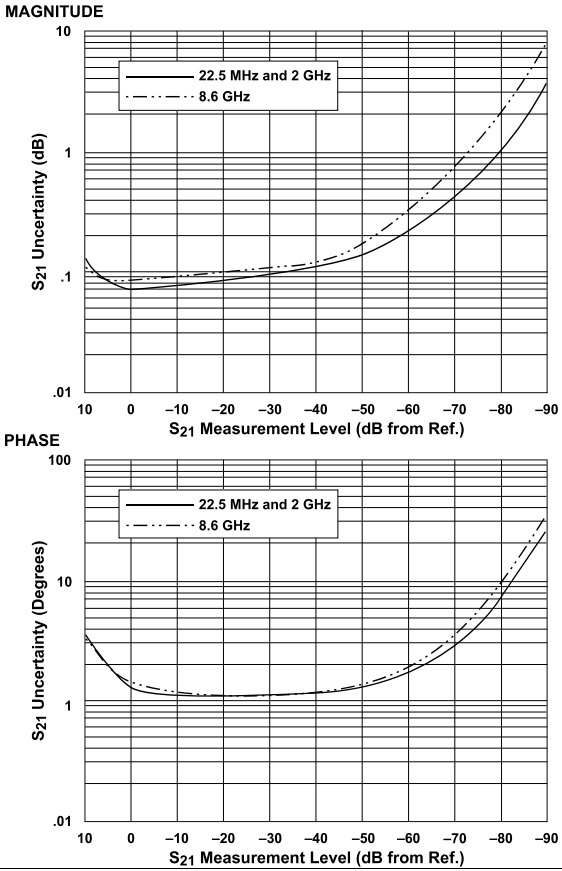
Models 37211A and 37217A (GPC-7 Connectors), Reflection Measurements



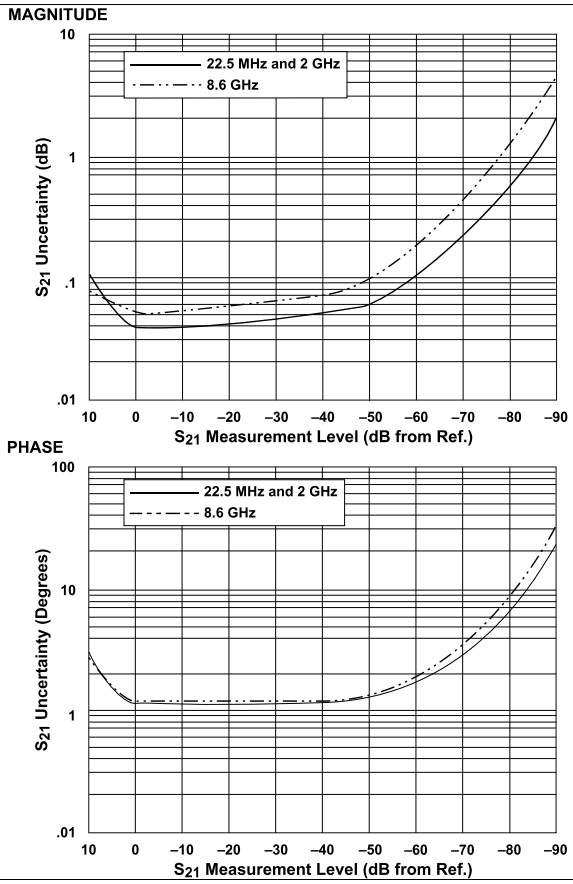
Models 37211A and 37217A (Type N Connectors) Reflection Measurements



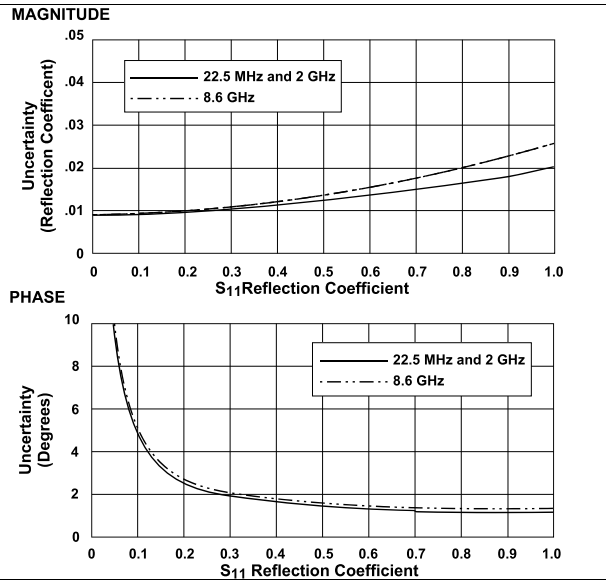
Models 37211A and 37217A (GPC-7 Connectors), Transmission Measurements



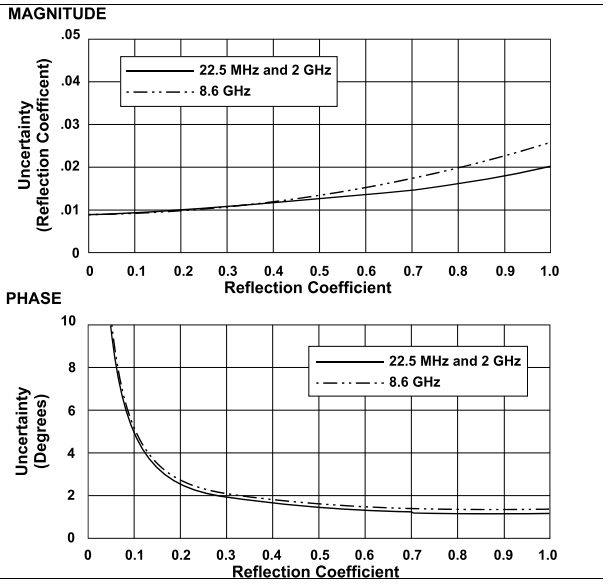
Models 37211A and 37217A (Type N Connectors) Transmission Measurements



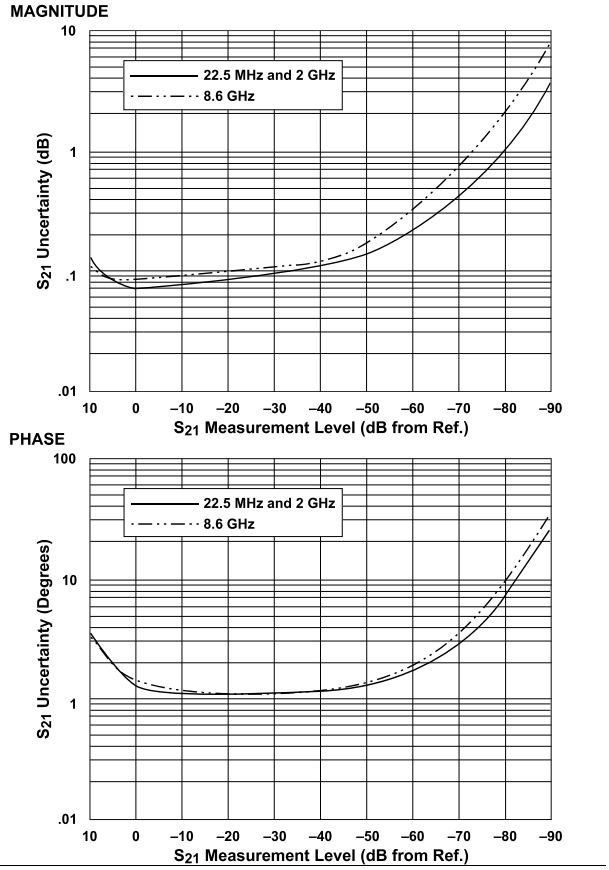
Models 37211A and 37217A (3.5mm Connectors),



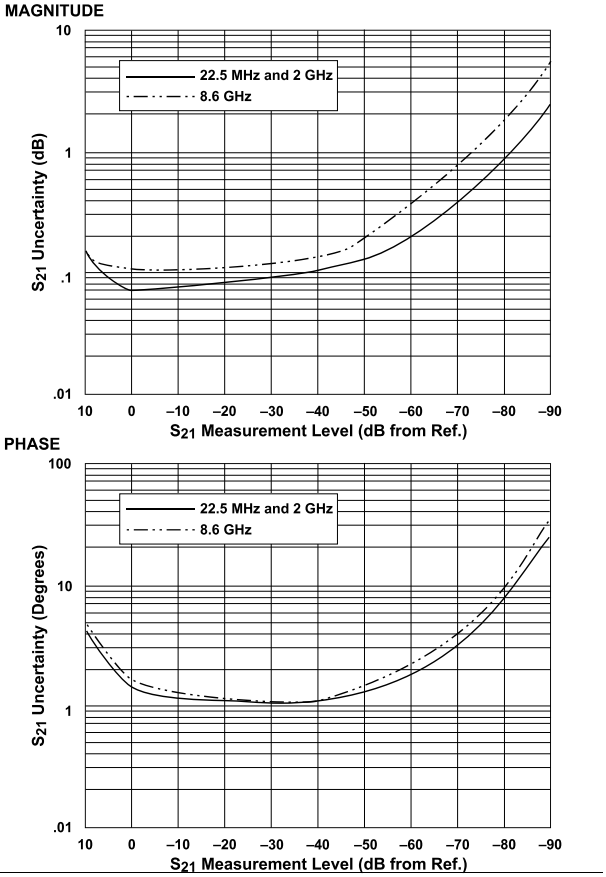
Models 37211A and 37217A (K Connectors)



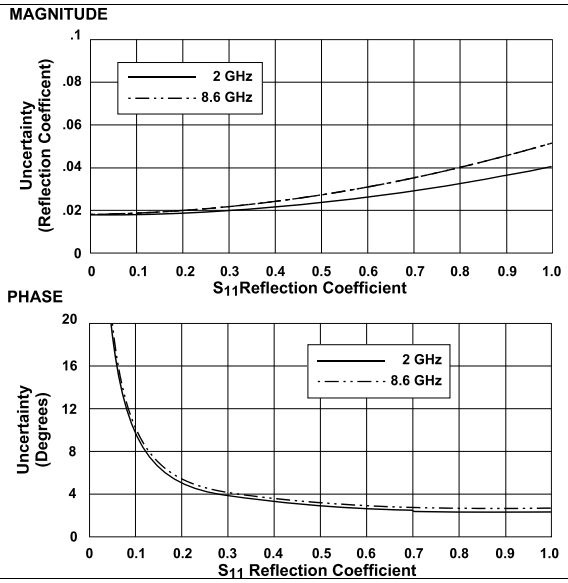
Models 37211A and 37217A (3.5mm Connectors), Transmission Measurements



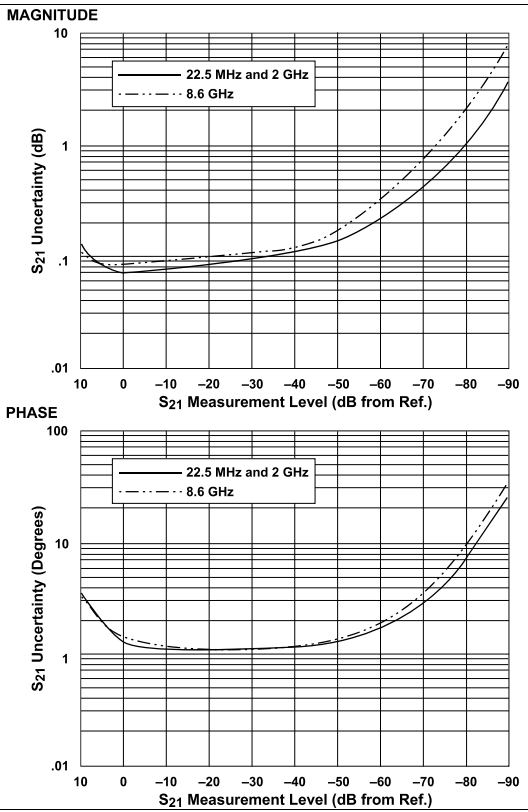
Models 37211A and 37217A (K Connectors) Transmission Measurements



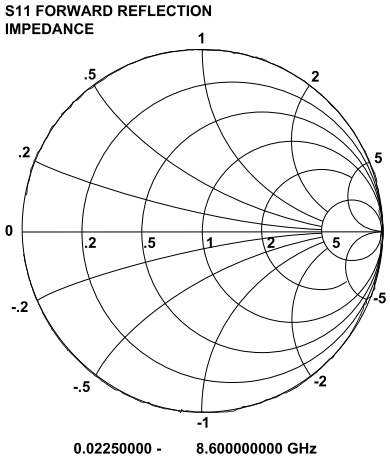
Model 37217A Universal Test Fixture (Model 3680K), Microstrip LRL Calibration (Model 36804-15, 15 mil Calibration Kit — Reflection Measurements



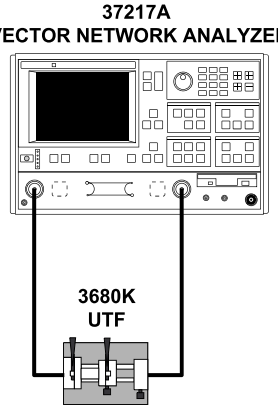
Model 37217A Universal Test Fixture (Model 3680K), Microstrip LRL Calibration (Model 36804-15, 15 mil Calibration Kit — Transmission Measurements



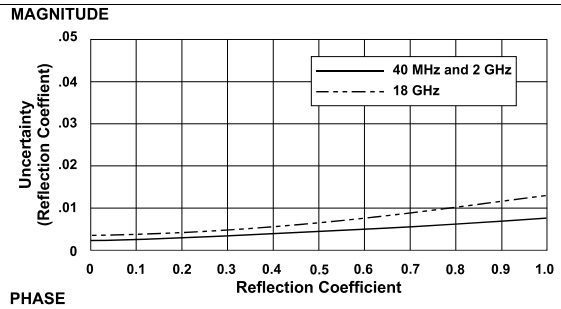
Model 37217A Universal Test Fixture (Model 3680K), Microstrip LRL Calibration (Model 36804-15, 15 mil Calibration Kit — LRLM Performance (typical)



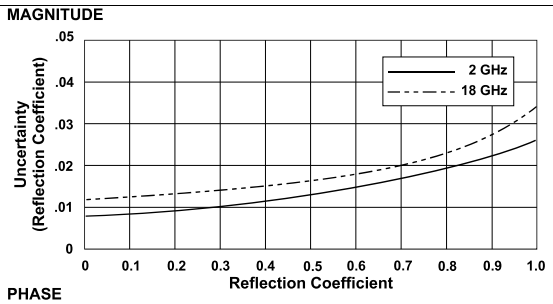
Measurement Setup



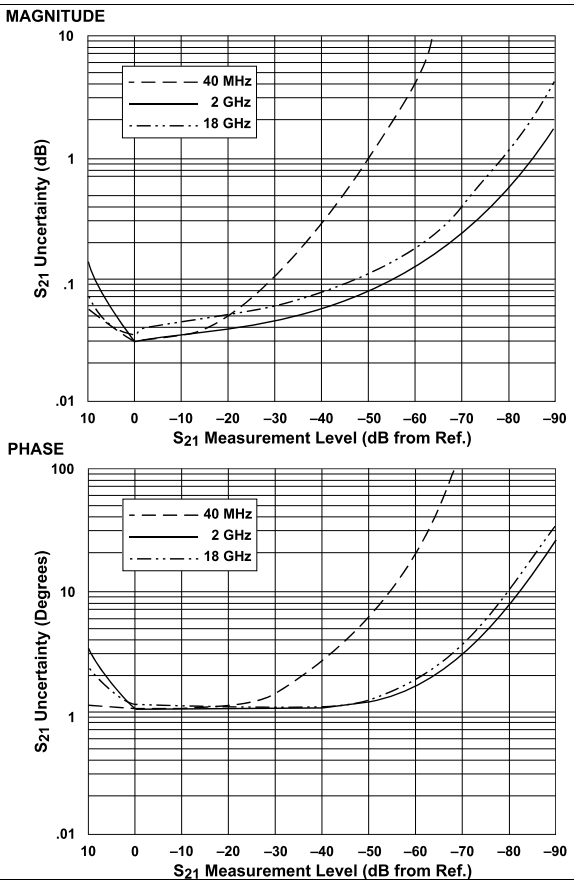
Models 37225A and 37247A (GPC-7 Connectors), Reflection Measurements



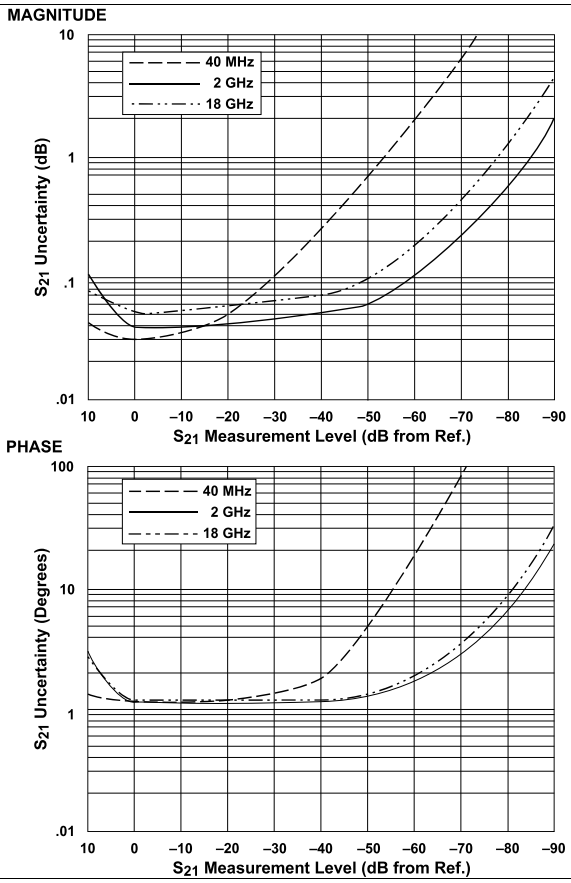
Models 37225A and 37247A (Type N Connectors), Reflection Measurements



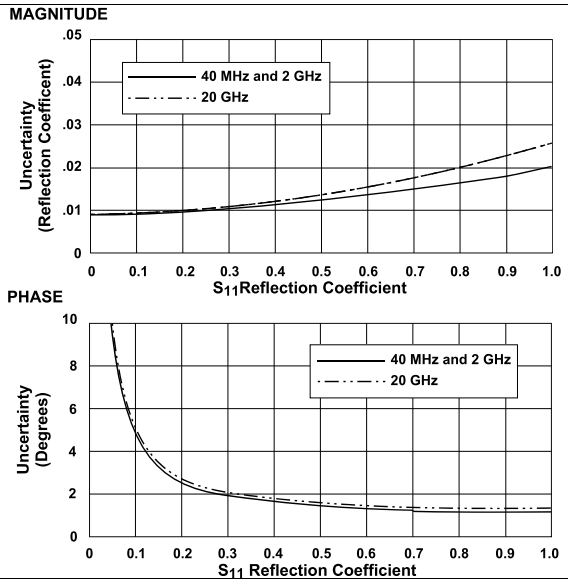
Models 37225A and 37247A (GPC-7 Connectors), Transmission Measurements



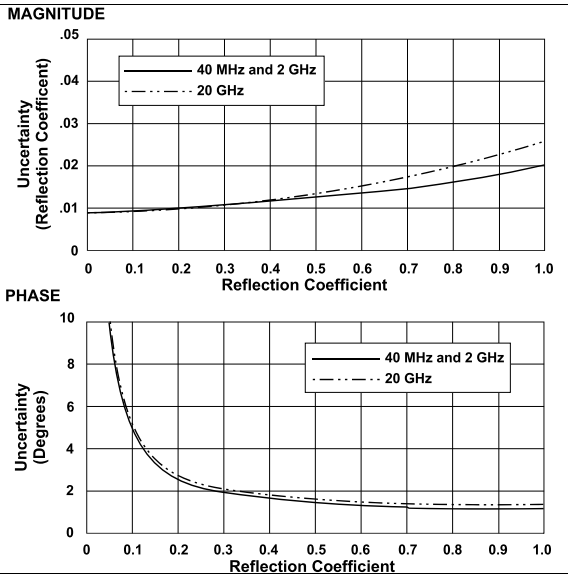
Models 37225A and 37247A (Type N Connectors), Transmission Measurements



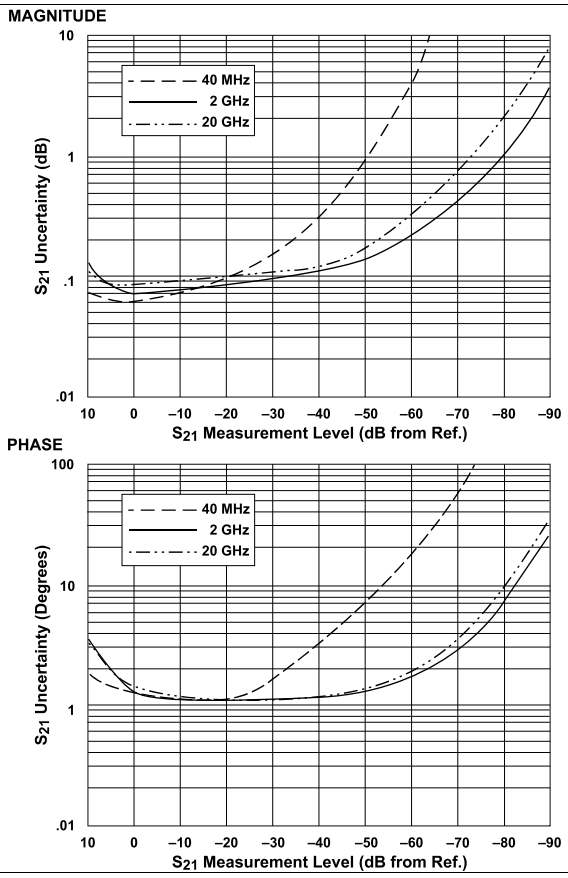
Models 37225A and 37247A (GPC-7 Connectors), Reflection Measurements



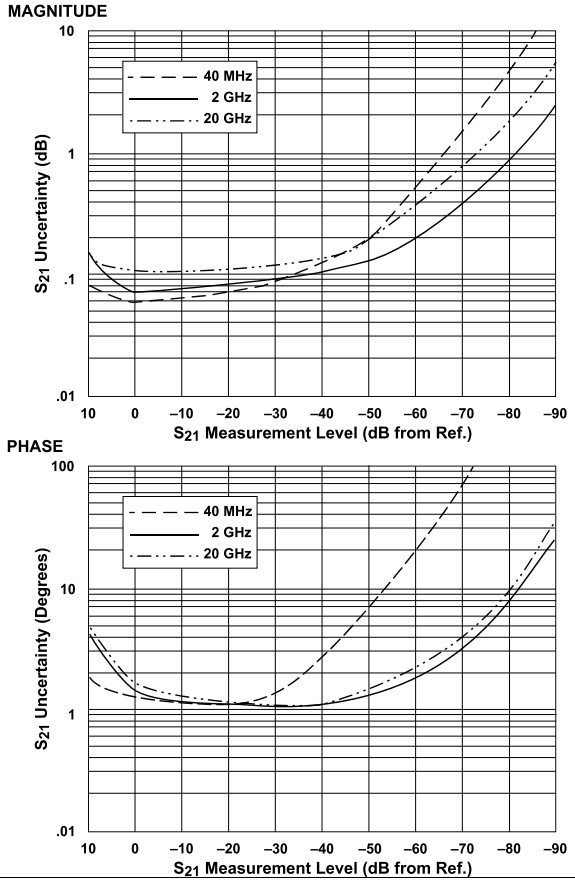
Models 37225A and 37247A (K Connectors), Reflection Measurements



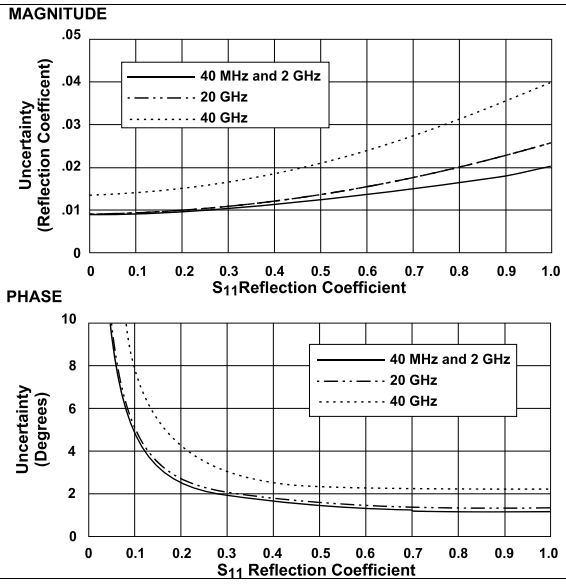
Models 37225A and 37247A (GPC-7 Connectors), Transmission Measurements



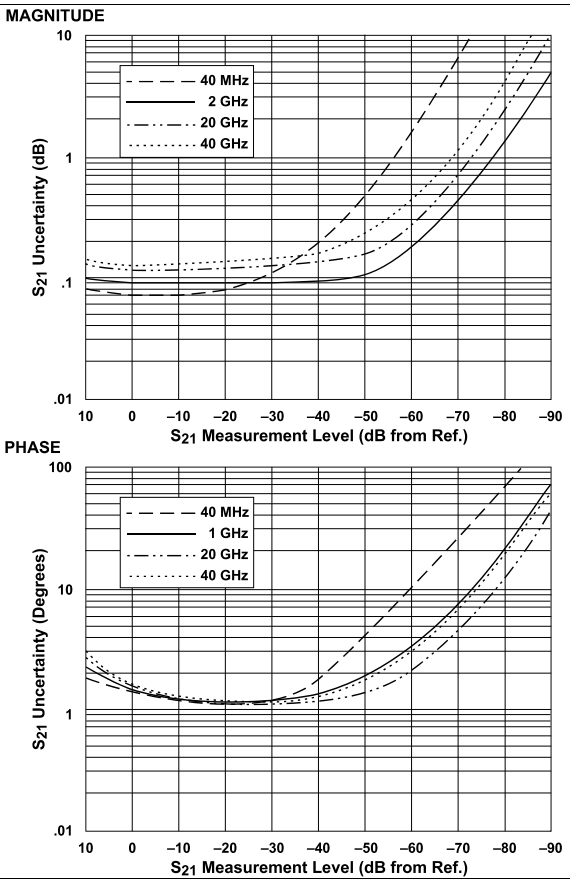
Models 37225A and 37247A (K Connectors), Transmission Measurements



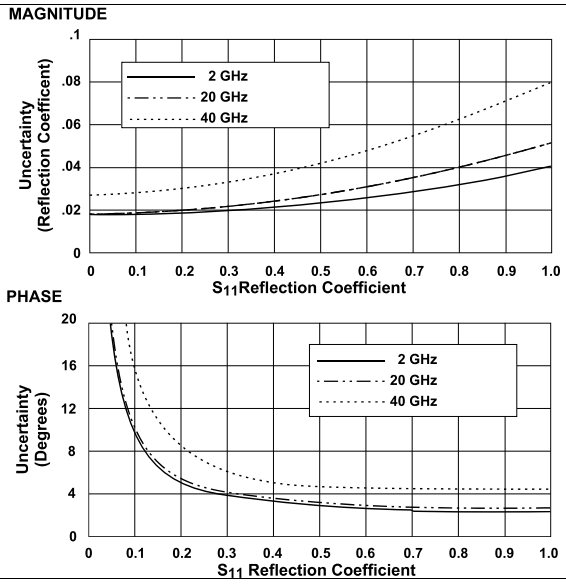
Model 37269A (K Connectors), Reflection Measurements



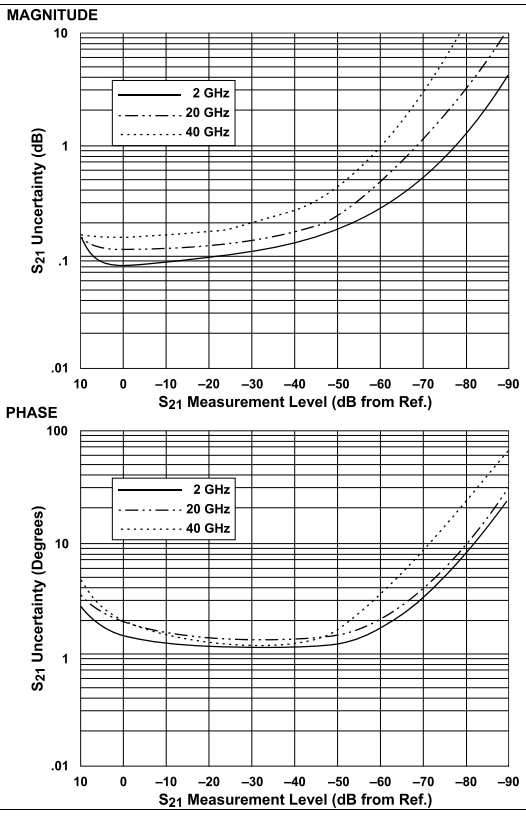
Model 37269A (K Connectors), Transmission Measurements



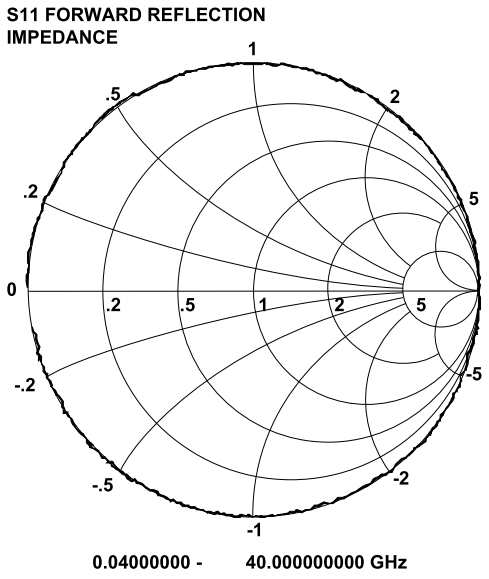
Model 37269A Universal Test Fixture (Model 3680K), Microstrip LRL Calibration (Model 36804-10, 10 mil Calibration Kit — Reflection Measurements



Model 37269A Universal Test Fixture (Model 3680K), Microstrip LRL Calibration (Model 36804-10, 10 mil Calibration Kit — Transmission Measurements



Model 37269A Universal Test Fixture (Model 3680K), Microstrip LRL Calibration (Model 36804-10, 10 mil Calibration Kit — LRLM Performance (typical)



Measurement Setup