

## Chapter 3. Specifications

---

**This section consists of two parts:**

- System specifications
- General characteristics

### **Specifications**

Specifications describe the instrument's warranted performance over the temperature range 0° to 55°C (except where noted).

Switch repeatability and overall measurement uncertainty are verified by executing the Total System Uncertainty test, which uses the standards comparison method.<sup>1</sup> Verification is viable for 3.5 mm, 7 mm and type-N connector types.

Source specifications can be verified after measurement calibration by executing the Performance Tests.<sup>1</sup>

Measurement port specifications are factory-tested only. They are not field verifiable and are dependent upon calibration kit in use meeting its specifications.

## UNCORRECTED PERFORMANCE

The following table shows specified performance without accuracy enhancement.

*Table 3-1. Specified Performance without Accuracy Enhancement*

| HP 8719C and 8720C Standard        |                 |              |            |                          |
|------------------------------------|-----------------|--------------|------------|--------------------------|
|                                    | Frequency Range |              |            |                          |
|                                    | .050 to 0.5 GHz | 0.5 to 2 GHz | 2 to 8 GHz | 8 to 20 GHz <sup>1</sup> |
| Directivity <sup>2</sup>           | 30 dB           | 30 dB        | 21 dB      | 16 dB                    |
| Source Match                       | 16 dB           | 18 dB        | 14 dB      | 10 dB                    |
| Load Match (Fwd)                   | 26 dB           | 24 dB        | 15 dB      | 12 dB                    |
| Load Match (Rev)                   | 26 dB           | 24 dB        | 15 dB      | 12 dB                    |
| Reflection Tracking <sup>3</sup>   | ±2 dB           | ±2 dB        | ±2 dB      | ±3 dB                    |
| Transmission Tracking <sup>3</sup> | ±1 dB           | ±1 dB        | ±1 dB      | ±1 dB                    |
| Crosstalk                          | 80 dB           | 87 dB        | 87 dB      | 85 dB                    |
| HP 8719C and 8720C Option 006      |                 |              |            |                          |
|                                    | Frequency Range |              |            |                          |
|                                    | .050 to 0.5 GHz | 0.5 to 2 GHz | 2 to 8 GHz | 8 to 20 GHz <sup>1</sup> |
| Directivity <sup>2</sup>           | 30 dB           | 30 dB        | 21 dB      | 16 dB                    |
| Source Match                       | 10 dB           | 10 dB        | 10 dB      | 8 dB                     |
| Load Match (Fwd)                   | 22 dB           | 20 dB        | 15 dB      | 12 dB                    |
| Load Match (Rev)                   | 22 dB           | 20 dB        | 15 dB      | 12 dB                    |
| Reflection Tracking <sup>3</sup>   | ±2 dB           | ±2 dB        | ±2 dB      | ±3 dB                    |
| Transmission Tracking <sup>3</sup> | ±1 dB           | ±1 dB        | ±1 dB      | ±1 dB                    |
| Crosstalk                          | 80 dB           | 87 dB        | 87 dB      | 85 dB                    |

1. HP 8719C: to 13.5 GHz

2. Includes effect of HP 85131D cable set on test parts.

3. Excludes -1/+3 dB slope, typical, in magnitude response from 2.0 to 20 GHz and rolloff below 2 GHz, which is typically -4 dB at 1 GHz, -9 dB at 500 MHz, -20 dB at 130 MHz, and -28 at 50 MHz.

## SOURCE SPECIFICATIONS

### SOURCE FREQUENCY SPECIFICATIONS

*Table 3-2. Range*

|                   | HP 8719C  | HP 8720C  |
|-------------------|-----------|-----------|
| Minimum Frequency | 50 MHz    | 50 MHz    |
| Maximum Frequency | 13.51 GHz | 20.05 GHz |

|                                       |  |
|---------------------------------------|--|
| <b>Frequency resolution:</b>          | 100 kHz (standard);<br>1 Hz with Option 001;<br>Accuracy and stability not affected by Option 001. |
| <b>Frequency accuracy:</b>            | 10 ppm at 23° ± 3°C (can be locked to external frequency reference)                                |
| <b>Frequency stability (typical):</b> | ± 7.5 ppm over 0° to 55°C (temperature)<br>± 3 ppm per year (aging)                                |
| <b>Spectral purity (typical):</b>     |  |
| <i>Harmonics:</i>                     | < -15 dBc at +10 dBm (Opt. 006, < -15 dBc at +3 dBm)   |
| <i>Phase noise:</i>                   | < -35 dBc to 60 kHz from carrier   |
| <i>Spurs:</i>                         | < -40 dBc at 100 kHz<br>< -50 dBc at 200 kHz<br>< -65 dBc at > 200 kHz                             |

### SOURCE POWER SPECIFICATIONS (23° ± 3°C)

*Table 3-3. Power Range and Power Sweep*

| POWER RANGE           |          |          |          |          |
|-----------------------|----------|----------|----------|----------|
|                       | HP 8719C |          | HP 8720C |          |
|                       | Std.     | Opt.006  | Std.     | Opt. 006 |
| Maximum Leveled Power | +10 dBm  | +3 dBm   | +10 dBm  | +3 dBm   |
| Minimum Leveled Power | -65 dBm  | -70 dBm  | -65 dBm  | -70 dBm  |
| Resolution            | 0.05 dB  | 0.05 dB  | 0.05 dB  | 0.05 dB  |
| Flatness              | ± 2.5 dB | ± 3.5 dB | ± 2.5 dB | ± 4 dB   |

| POWER SWEEP              |          |          |
|--------------------------|----------|----------|
|                          | HP 8719C | HP 8720C |
| Range                    | 20 dB    | 20 dB    |
| Linearity                | ± 0.5 dB | ± 0.5 dB |
| Linearity (< 5 dB sweep) | ± 0.2 dB | ± 0.2 dB |

**Power accuracy:** ± 0.5 dB at 2 GHz at maximum power

HP 8719C and HP 8720C

Specifications 3-3

## GENERAL CHARACTERISTICS

### MEASUREMENT THROUGHPUT SUMMARY

The following table shows typical measurement times for the analyzer. This information is based on 50 MHz to 20 GHz sweep with 3 kHz IF bandwidth, including system retrace time and all source band changes; 2-port times based on chop mode.

*Table 3-4. Typical time for completion (msec) (1 of 2)*

| MEASUREMENT TIME (ms) VERSUS NUMBER OF POINTS (typical) |           |     |      |      |       |
|---|-----------|-----|------|------|-------|
| Measurement   | 3         | 51  | 101  | 201  | 1601  |
| 1-port (3 term) #                                       | 350       | 465 | 485  | 530* | 1300  |
| Full 2-port   | 740       | 990 | 1100 | 1335 | 4850  |
| Fast 2-port   | 350       | 480 | 560  | 725  | 3080  |
| Fast 2-port (narrow band, 1 GHz sweep)                  | 155       | 240 | 330  | 510  | 3010  |
| Time domain conversion                                  | 15        | 180 | 300  | 540  | 2840  |
| HP-IB data transfer                                     |           |     |      |      |       |
| 1: Binary   | 10        | 28  | 40   | 62   | 450   |
| 2: 32-bit   | 12        | 48  | 80   | 160  | 1180  |
| 3: 64 bit   | 15        | 65  | 120  | 235  | 1790  |
| 4: ASCII  | 40        | 480 | 940  | 1860 | 14700 |
| 5: 32-bit PC  | 12        | 48  | 86   | 165  | 1260  |
| * Reference used for following comparisons.             |           |     |      |      |       |
| MEASUREMENT TIME VERSUS SWEEP MODE (typical)            |           |     |      |      |       |
| Sweep Mode  | Time (ms) |     |      |      |       |
| Linear  | 530       |     |      |      |       |
| Log   | 1250      |     |      |      |       |
| List  | 1250      |     |      |      |       |
| CW Time   | 170       |     |      |      |       |
| Power   | 890       |     |      |      |       |
| MEASUREMENT TIME VERSUS FREQUENCY SPAN (typical)        |           |     |      |      |       |
| Frequency Range   | Time (ms) |     |      |      |       |
| 0.05 to 20 GHz  | 530       |     |      |      |       |
| 5 to 15 GHz   | 280       |     |      |      |       |
| 8 to 12 GHz   | 275       |     |      |      |       |
| 9 to 11 GHz   | 245       |     |      |      |       |

Table 3-4. Typical time for completion (msec) (2 of 2)

| MEASUREMENT TIME VERSUS IF BANDWIDTH (typical) |           |
|--|-----------|
| IF bandwidth                                   | Time (ms) |
| 3000   | 530       |
| 1000   | 660       |
| 300  | 1100      |
| 100  | 2400      |
| 30   | 7500      |
| 10   | 2200      |

# Measurements with no error correction, response, or response/isolation calc are similar.

## REAR PANEL CONNECTORS

**BIAS CONNECT:** DC bias input to internal tees, one for each port; internally fused to 500 mA maximum; 40 Vdc maximum

**EXT REF IN:** external frequency reference input, to which network analyzer locks its internal time-base; external reference must have following characteristics:

*Frequency:* 1 MHz  $\pm$  20 Hz  
 2 MHz  $\pm$  40 Hz  
 5 MHz  $\pm$  100 Hz  
 10 MHz  $\pm$  200 Hz

*Level:* -10 to +20 dBm

*Impedance:* 50 ohms

**EXT TRIGGER:** external trigger input, activated on negative TTL transition (+5 to 0V); internal 10 k-ohm pull-up resistor allows use of contact closure to ground; input can trigger these functions:

*Sweep:* begins entire sweep when armed

*Point:* acquires single data point of multi-point sweep

**EXT AM:** external AM input; 0 to +10 V into 100 k ohm; approximately -2 dB/volt sensitivity; 1 kHz maximum

**AUX INPUT:** auxiliary voltage input; -10 to +10 V; can be measured with "analog bus" and displayed as voltage on vertical axis in real format

### IO INTERCONNECT (DB-25):

pin 17: limit test output; LS TTL, +5V=pass, 0V=fail

pin 14: +22 Vdc power supply output

pin 8: transfer switch output; LS TTL, +5 V=forward, 0V= reverse

**EXT MON (RED/GREEN/BLUE):** video outputs to drive external monitors with the following characteristics:

*Format:* RGB (red green/blue) with sync on green

*Impedance:* 75 ohms

*Horizontal scan rate:* 25.5 kHz

*Refresh rate:* 60 Hz

*Level:* 1 Vp-p

**Compatible monitors:**

- HP 35731A/B monochrome monitor
- HP 35741A/B color monitor
- Most other analog multi-sync monitors

**REF IN, REF OUT:** reference link out/in, between reference power splitter and reference (R) sampler; user may add electrical length to "balance" test set for faster measurements on long devices, without IF shift distortion; has this on the front panel in Option 011

### EFFECT OF FREQUENCY RESOLUTION

The following table shows the differences in operation between the standard analyzer (100 kHz frequency resolution) and the option 001 (1 Hz frequency resolution) analyzer.

*Table 3-5*

|                                     | Standard   | Option 001 |
|-------------------------------------|------------|------------|
| <b>Source Control</b>               |            |            |
| Start/Stop/Center CW                | 100 kHz    | 1 Hz       |
| Min. span @ 101 points <sup>1</sup> | 10 MHz     | 100 Hz     |
| Min. span @ 201 points              | 20 MHz     | 200 Hz     |
| <b>Time domain:</b>                 |            |            |
| Max. time domain range <sup>2</sup> | 10 $\mu$ s | 1s         |
| <b>Group Delay:</b>                 |            |            |
| Max. group delay range              | 5 $\mu$ s  | 500 ms     |
| Minimum aperture                    | 100 kHz    | 1 Hz       |

1. Minimum span = (number of data points - 1) (frequency resolution)

2. Using time domain bandpass mode.

### Supplemental Characteristics

Supplemental characteristics are intended to provide information useful in applying the instrument, by giving typical but non-warranted performance parameters. These are denoted as "typical," "nominal," or "approximate."

*Table 3-6. Dynamic Range Specification (for transmission measurements)<sup>1</sup>*

| Dynamic Range <sup>2</sup> | Frequency Range |              |            |                          |
|----------------------------|-----------------|--------------|------------|--------------------------|
|                            | 0.05 to 0.5 GHz | 0.5 to 2 GHz | 2 to 8 GHz | 8 to 20 GHz <sup>3</sup> |
| Standard                   | 75 dB           | 100 dB       | 103 dB     | 103 dB                   |
| Option 006                 | 71 dB           | 96 db        | 98 dB      | 96 dB                    |

1. Refer to Chapter 4, *System Performance and Verification*.

2. The difference between maximum leveled power and the peak value of the system noise. Specified for an IF bandwidth of 10 Hz, using a full 2-port calibration (including an isolation calibration performed with an averaging factor of 16).

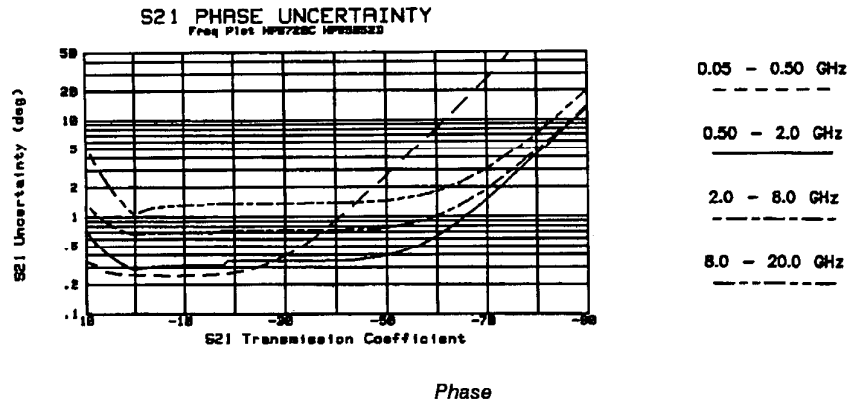
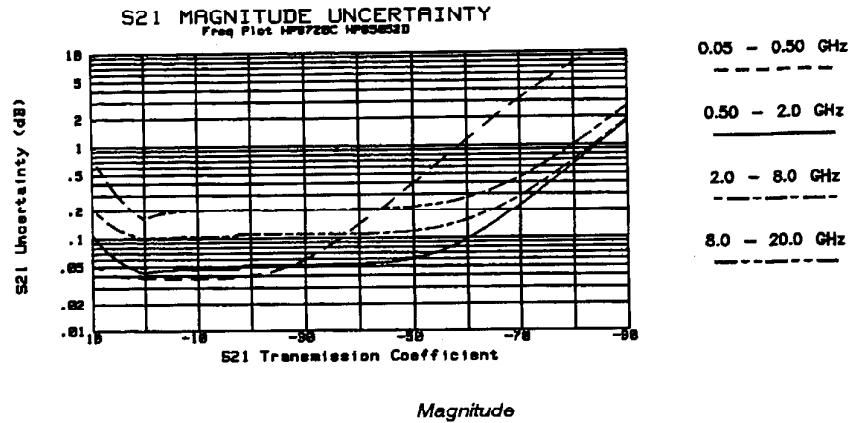
3. HP 8719C 8 to 13.5 GHz

# 3.5 MM SYSTEM SPECIFICATIONS

## DEVICES WITH 3.5 MM CONNECTORS

The following graphs show total worst case uncertainty for the network analyzer after accuracy enhancement using a full 2-port measurement calibration (including isolation) with the HP 85052D 3.5 mm calibration kit, HP 85131F 3.5 mm cable set, and an IF bandwidth of 10 Hz. This includes the residual systematic errors, as well as the system dynamic accuracy, 3.5 mm connector repeatability, noise, and switch repeatability.<sup>1</sup> Specific points on the graphs are verified by measuring the devices in the HP 85053B verification kit.

### Transmission Measurements<sup>2</sup> Standard

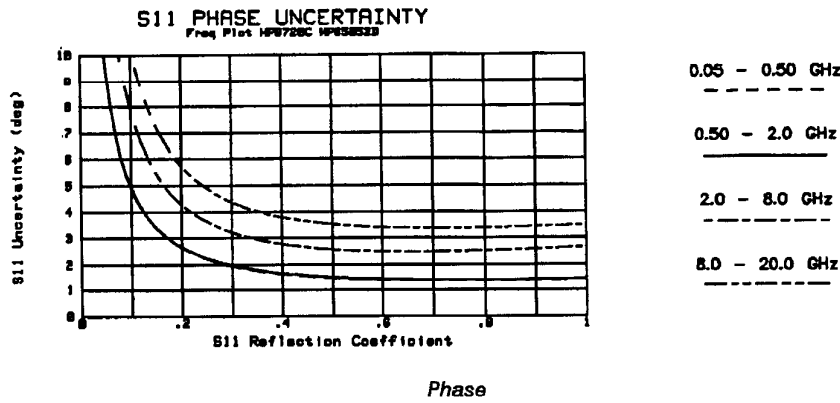
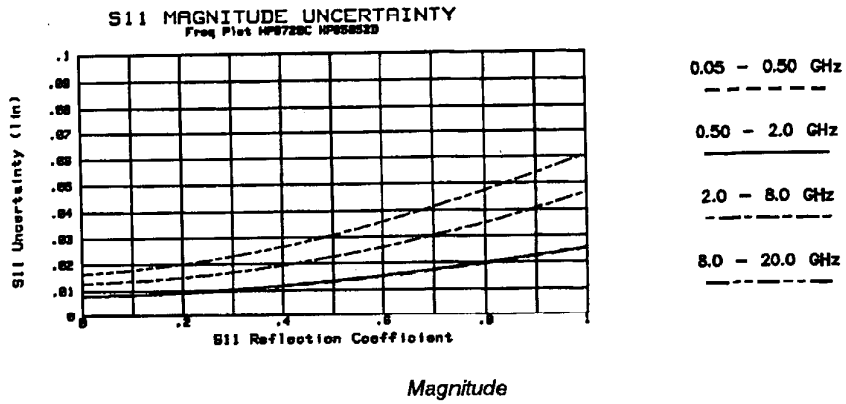


1. Cable stability and system drift are not included.
2. The graphs for transmission measurements assume a well-matched device ( $S_{11} = S_{22} = 0$ ).

HP 8719C and HP 8720C

Specifications 3-7

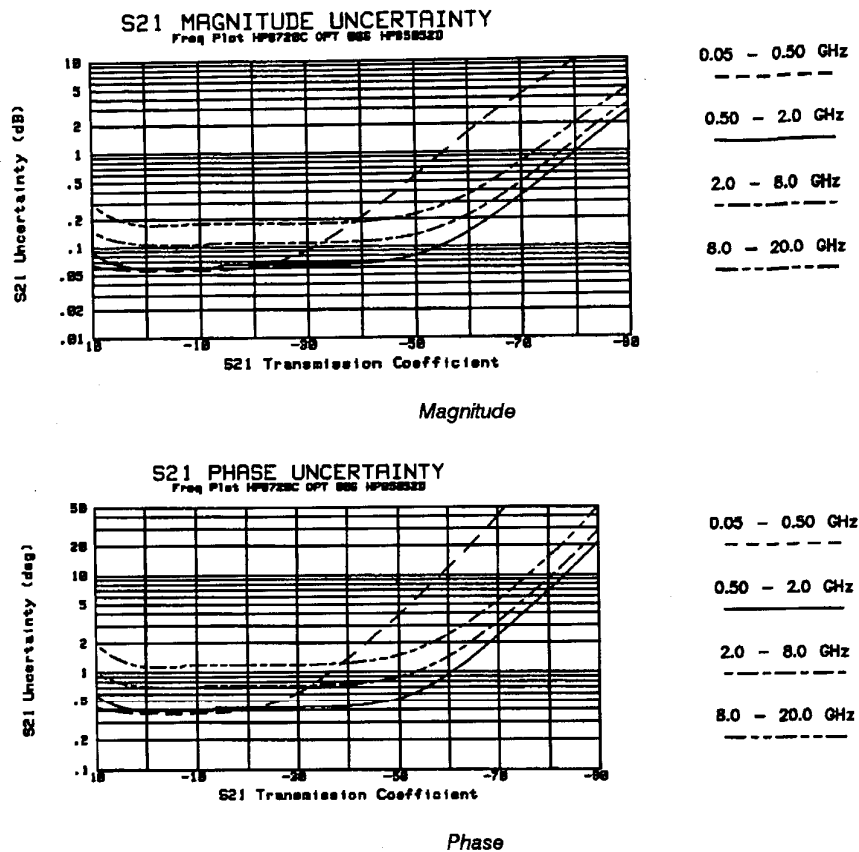
## Reflection Measurements<sup>1</sup> Standard



1. The graphs shown for reflection measurement uncertainty apply to a one-port device.



## Transmission Measurements<sup>1</sup> Option 006

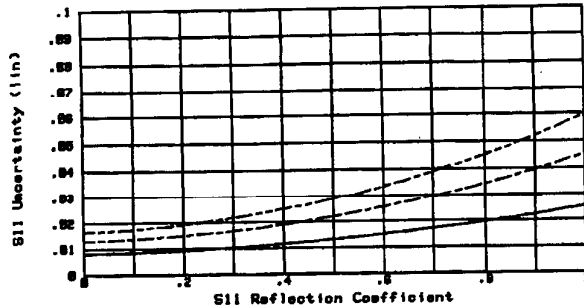


1. The graphs for transmission measurements assume a well-matched device ( $S_{11} = S_{22} = 0$ ).

## Reflection Measurements<sup>1</sup> Option 006

### S11 MAGNITUDE UNCERTAINTY

Freq Plot HP8720C OPT 006 HP80002D



0.05 - 0.50 GHz

0.50 - 2.0 GHz

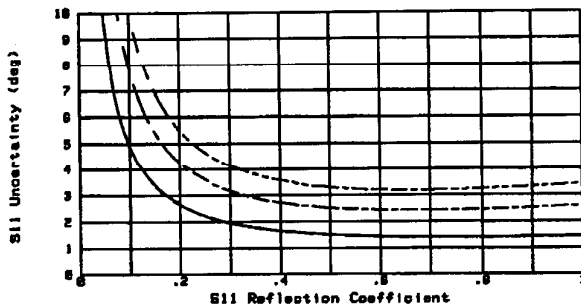
2.0 - 8.0 GHz

8.0 - 20.0 GHz

*Magnitude*

### S11 PHASE UNCERTAINTY

Freq Plot HP8720C OPT 006 HP80002D



0.05 - 0.50 GHz

0.50 - 2.0 GHz

2.0 - 8.0 GHz

8.0 - 20.0 GHz

*Phase*

1. The graphs shown for reflection measurement uncertainty apply to a one-port device.

### Measurement Port Specifications<sup>1</sup>

The following specifications show the residual system performance (including switch repeatability) after accuracy enhancement using a full 2-port measurement calibration (including isolation) with an IF bandwidth of 10 Hz and the specified calibration kit. Environmental temperature is  $23^{\circ} \pm 3^{\circ} \text{C}$ .

### Calibration Kit: HP 85052D (male and female broadband precision fixed loads)

Table 3-7. HP 85052D

|                       | Frequency Range |              |            |                          |
|-----------------------|-----------------|--------------|------------|--------------------------|
|                       | .050 to 0.5 GHz | 0.5 to 2 GHz | 2 to 8 GHz | 8 to 20 GHz <sup>2</sup> |
| Directivity           | 42 dB           | 42 dB        | 38 dB      | 36 dB                    |
| Source Match          | 37 dB           | 37 dB        | 30 dB      | 28 dB                    |
| Load Match            | 42 dB           | 41 dB        | 36 dB      | 34 dB                    |
| Reflection Tracking   | .005 dB         | .010 dB      | .030 dB    | .031 dB                  |
| Transmission Tracking | .014 dB         | .020 dB      | .080 dB    | .139 dB                  |

1. Crosstalk, after an isolation calibration, is no higher than the system noise floor and can be ignored.

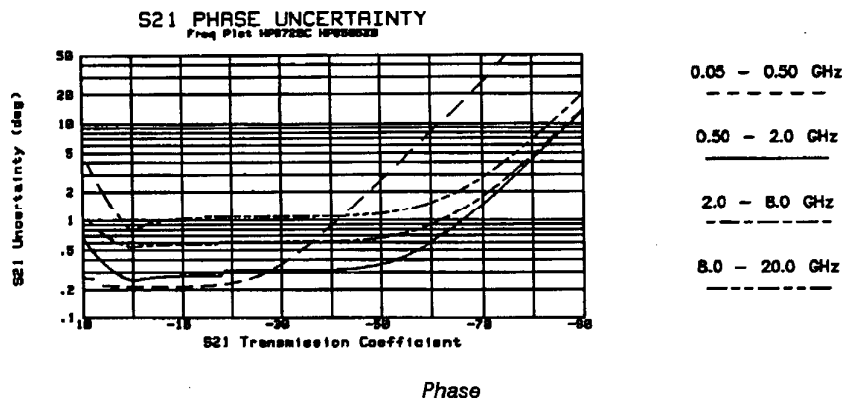
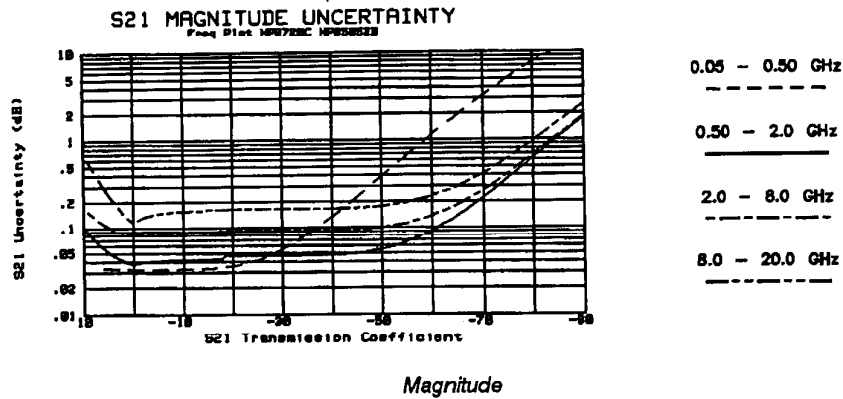
2. HP 8719C: 8 to 13.5 GHz.

## Measurement Uncertainty: HP 85052B Calibration Kit

The graphs shown for reflection measurement uncertainty apply to a one-port device.

The following graphs show total worst case uncertainty for the network analyzer after accuracy enhancement using a full 2-port measurement calibration (including isolation) with the HP 85052B 3.5 mm calibration kit, HP 85131F 3.5 mm cable set, and an IF bandwidth of 10 Hz. This includes the residual systematic errors, as well as the system dynamic accuracy, 3.5 mm connector repeatability, noise, and switch repeatability.<sup>1</sup> Specific points on the graphs are verified by measuring the devices in the HP 85053B verification kit.

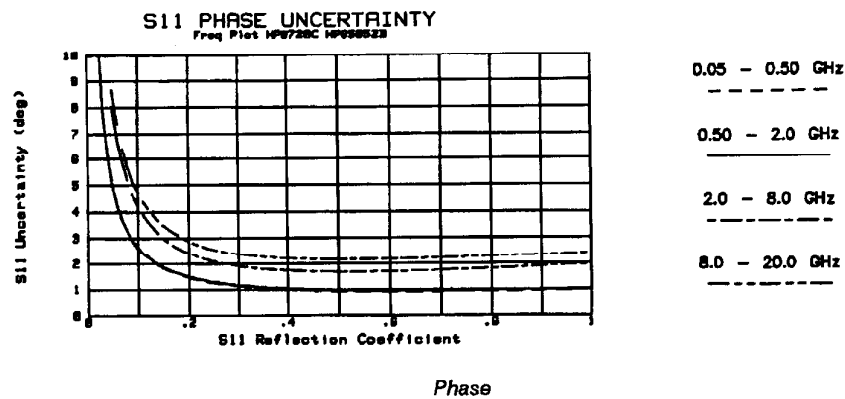
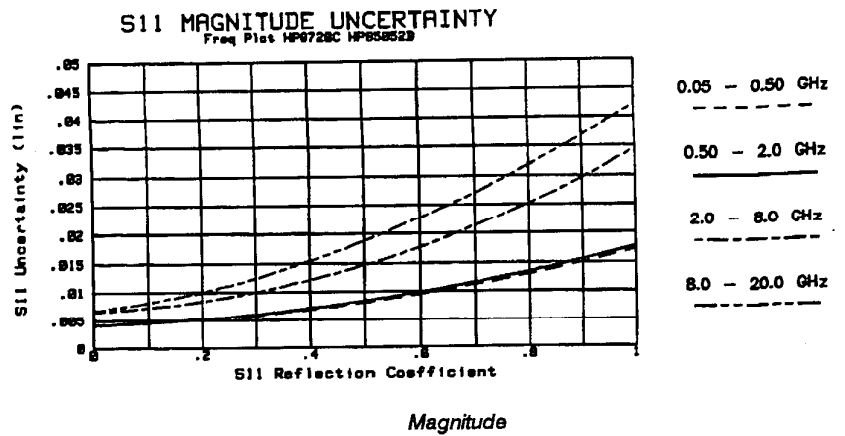
### Transmission Measurements<sup>2</sup> Standard



1. Cable stability and system drift are not included.

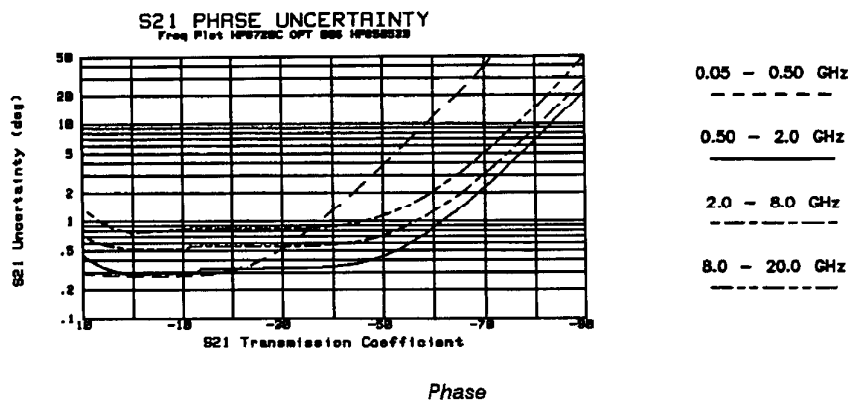
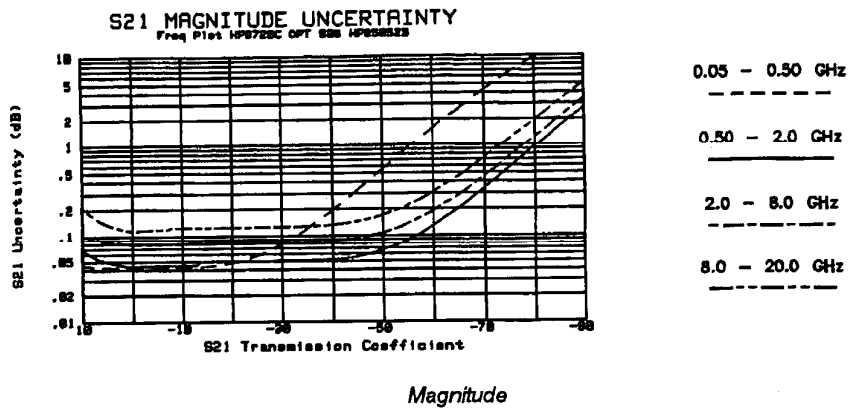
2. The graphs for transmission measurements assume a well-matched device ( $S_{11} = S_{22} = 0$ ).

## Reflection Measurements' Standard



1. The graphs shown for reflection measurement uncertainty apply to a one-port device.

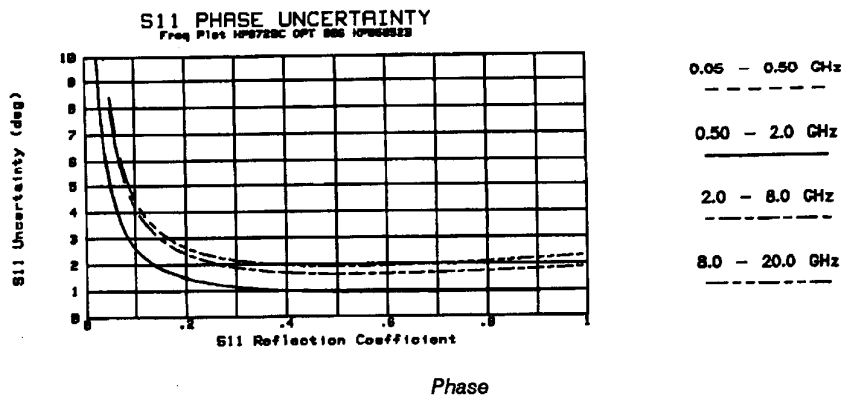
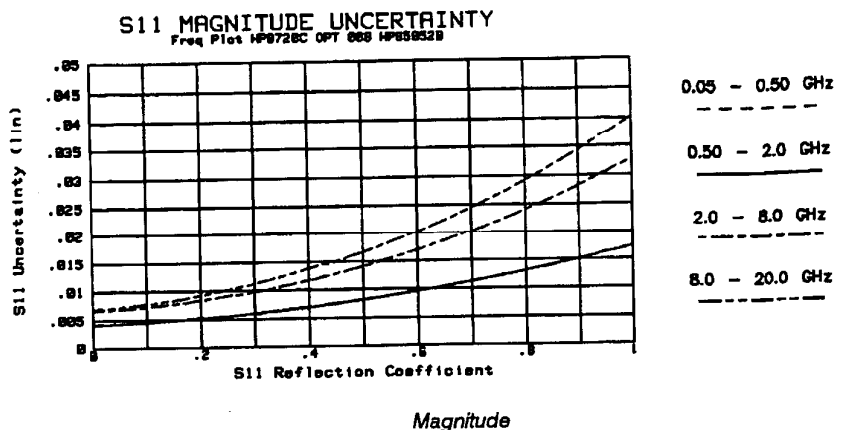
# Transmission Measurements<sup>1</sup> Option 006



1. The graphs for transmission measurements assume a well-matched device ( $S_{11} = S_{22} = 0$ ).

## Reflection Measurements<sup>1</sup> Option 006

1. The graphs shown for reflection measurement uncertainty apply to a one-port device.



1. The graphs shown for reflection measurement uncertainty apply to a one-port device.

## Measurement Port Specifications<sup>1</sup>

The following specifications show the residual system performance (including switch repeatability) after accuracy enhancement using a full 2-port measurement calibration (including isolation) with an IF bandwidth of 10 Hz and the specified calibration kit. Environmental temperature is  $23^{\circ} \pm 3^{\circ}\text{C}$ .

### Calibration Kit: HP 85052B (male and female lowband and sliding loads)

Table 3-8. HP 85052B

|                       | Frequency Range |              |            |                          |
|-----------------------|-----------------|--------------|------------|--------------------------|
|                       | .050 to 0.5 GHz | 0.5 to 2 GHz | 2 to 8 GHz | 8 to 20 GHz <sup>2</sup> |
| Directivity           | 48 dB           | 48 dB        | 44 dB      | 44 dB                    |
| Source Match          | 40 dB           | 39 dB        | 32 dB      | 30 dB                    |
| Load Match            | 48 dB           | 45 dB        | 39 dB      | 37 dB                    |
| Reflection Tracking   | .006 dB         | .010 dB      | .030 dB    | .031 dB                  |
| Transmission Tracking | .009 dB         | .016 dB      | .065 dB    | .106 dB                  |

1. Crosstalk, after an isolation calibration, is no higher than the system noise floor and can be ignored.

2. HP 8719C: 8 to 13.5 GHz.



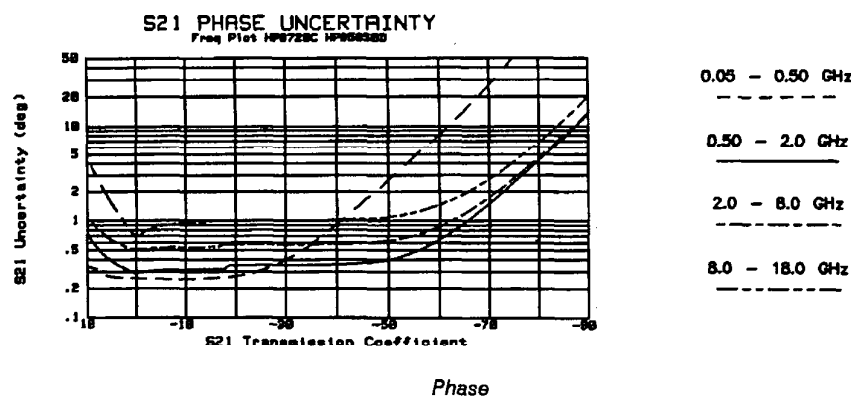
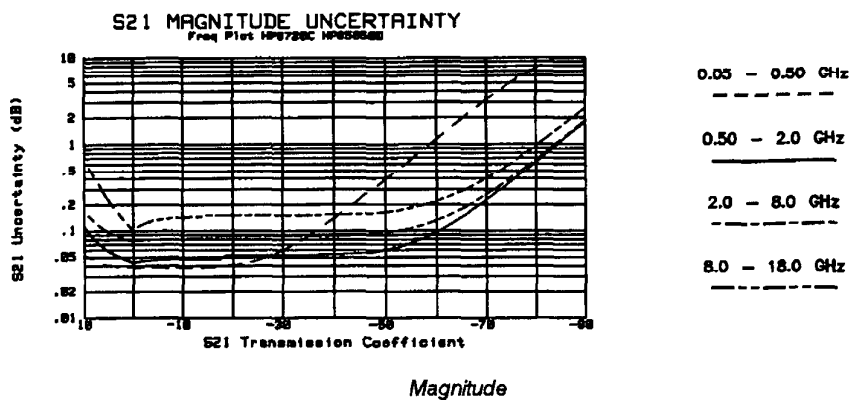
## 7 MM SYSTEM SPECIFICATIONS

### DEVICES WITH 7 MM CONNECTORS

#### Measurement Uncertainty: HP 85050D Calibration Kit

The following graphs show total worst case measurement uncertainty for the network analyzer after accuracy enhancement using a full 2-port measurement calibration (including isolation) with the HP 85050D 7 mm calibration kit, HP 85132D cable set, and an IF bandwidth of 10 Hz. This includes the residual systematic errors, as well as the system dynamic accuracy, 7 mm connector repeatability, noise, and switch repeatability.<sup>1</sup> The HP 85130B special 3.5 mm to 7 mm adapter set is used to adapt the 3.5 mm test ports to 7 mm. Specific points on the graphs are verified by measuring the devices in the HP 85051B verification kit.

#### Transmission Measurements<sup>2</sup> Standard



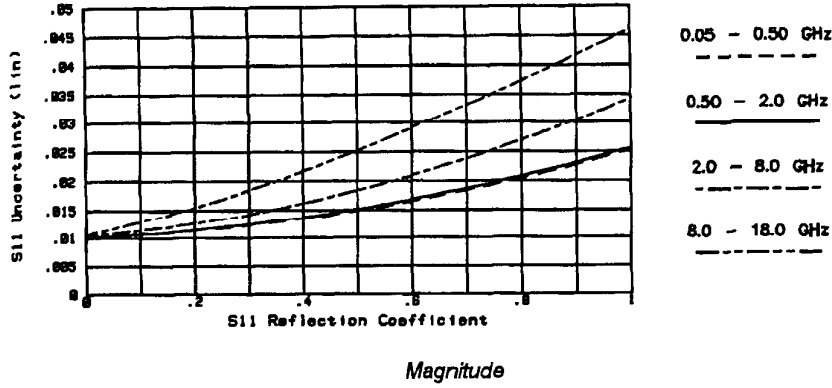
1. Cable stability and system drift are not included.

2. The graphs for transmission measurements assume a well-matched device ( $S_{11} = S_{22} = 0$ ).

# Reflection Measurements<sup>1</sup> Standard

## S11 MAGNITUDE UNCERTAINTY

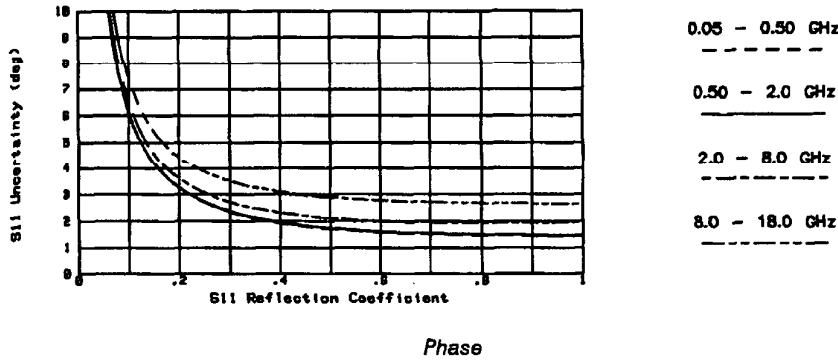
Freq Plot HP8720C HP85054D



Magnitude

## S11 PHASE UNCERTAINTY

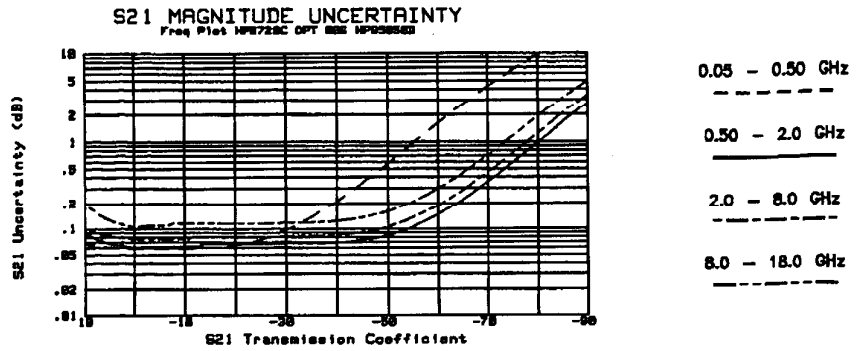
Freq Plot HP8720C HP85054D



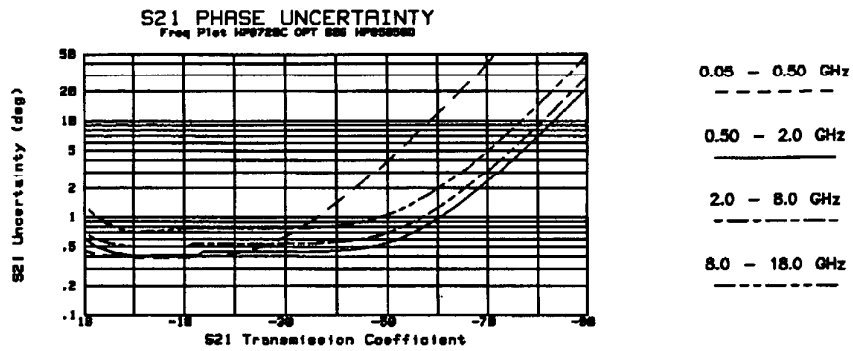
Phase

1. The graphs for transmission measurements assume a well-matched device ( $S_{11} = S_{22} = 0$ ).

## Transmission Measurements<sup>1</sup> Option 006



*Magnitude*



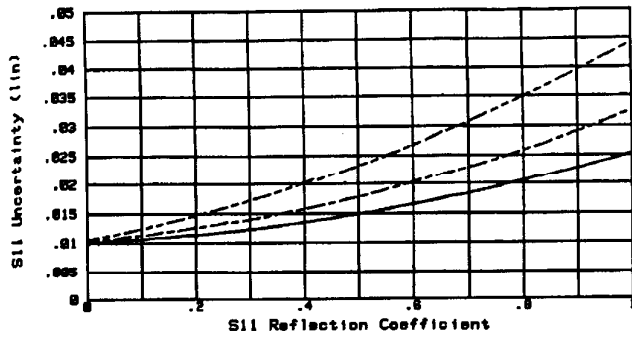
*Phase*

1. The graphs for transmission measurements assume a well-matched device ( $S_{11} = S_{22} = 0$ ).

## Reflection Measurements<sup>1</sup> Option 006

### S11 MAGNITUDE UNCERTAINTY

Freq Plot HP8720C OPT 006 HP8535B



0.05 - 0.50 GHz

0.50 - 2.0 GHz

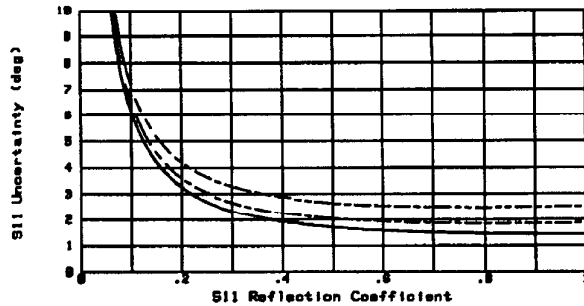
2.0 - 8.0 GHz

8.0 - 18.0 GHz

*Magnitude*

### S11 PHASE UNCERTAINTY

Freq Plot HP8720C OPT 006 HP8535B



0.05 - 0.50 GHz

0.50 - 2.0 GHz

2.0 - 8.0 GHz

8.0 - 18.0 GHz

*Phase*

1. The graphs shown for reflection measurement uncertainty apply to a one-port device.

### Measurement Port Specifications<sup>1</sup>

The following specifications show the residual system performance (including switch repeatability) after accuracy enhancement using a full 2-port measurement calibration (including isolation) with an IF bandwidth of 10 Hz and the specified calibration kit. Environmental temperature is 23° ± 3°C.

### Calibration Kit: HP 85050D (broadband precision fixed load)

Table 3-9. HP 85050D

|                       | Frequency Range |              |            |                          |
|-----------------------|-----------------|--------------|------------|--------------------------|
|                       | .050 to 0.5 GHz | 0.5 to 2 GHz | 2 to 8 GHz | 8 to 18 GHz <sup>2</sup> |
| Directivity           | 40 dB           | 40 dB        | 40 dB      | 40 dB                    |
| Source Match          | 39 dB           | 38 dB        | 35 dB      | 33 dB                    |
| Load Match            | 40 dB           | 39 dB        | 37 dB      | 36 dB                    |
| Reflection Tracking   | .011 dB         | .014 dB      | .050 dB    | .104 dB                  |
| Transmission Tracking | .015 dB         | .021 dB      | .060 dB    | .092 dB                  |

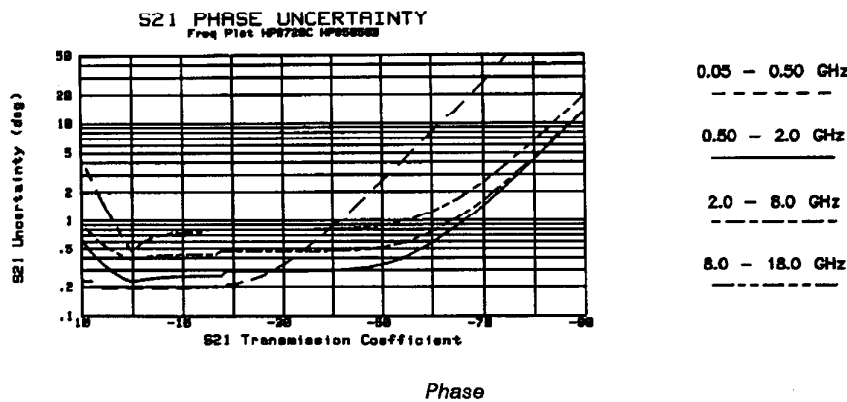
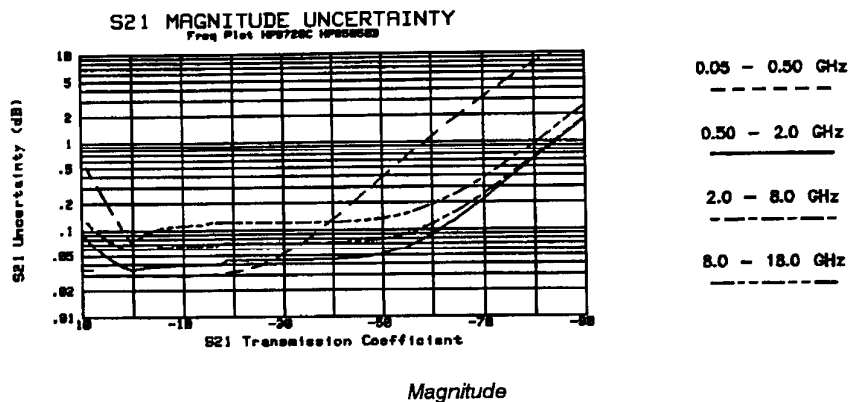
1. Crosstalk after an isolation calibration, is no higher than the system noise floor and can be ignored.

2. HP 8719C 8 to 13.5 GHz

## Measurement Uncertainty: 85050B Calibration Kit

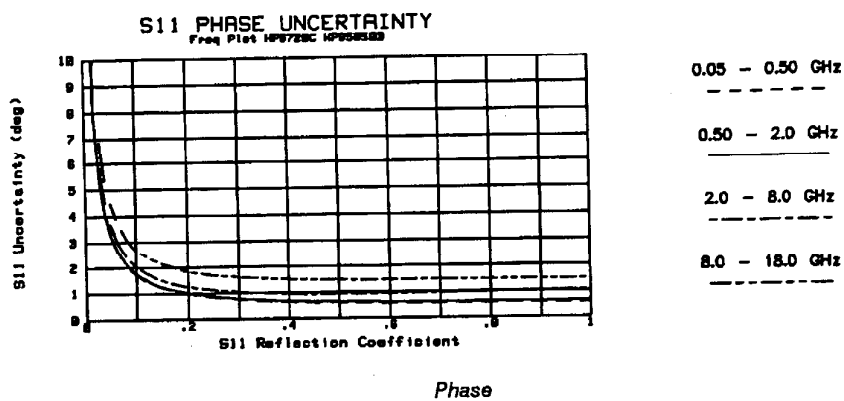
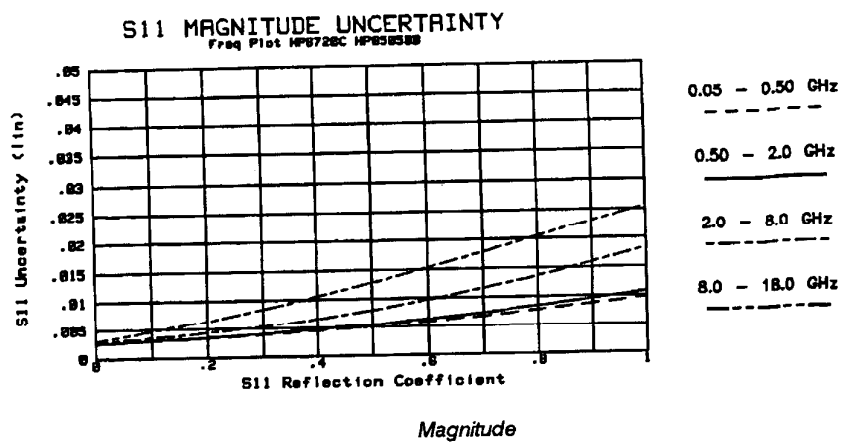
The following graphs show total worst case measurement uncertainty for the network analyzer after accuracy enhancement using a full 2-port measurement calibration (including isolation) with the HP 85050B 7 mm calibration kit, HP 85132D cable set, and an IF bandwidth of 10 Hz. This includes the residual systematic errors, as well as the system dynamic accuracy, 7 mm connector repeatability, noise, and switch repeatability.<sup>1</sup> The HP 85130B special 3.5 mm to 7 mm adapter set is used to adapt the 3.5 mm test ports to 7 mm. Specific points on the graphs are verified by measuring the devices in the HP 85051B verification kit.

### Transmission Measurements<sup>2</sup> Standard



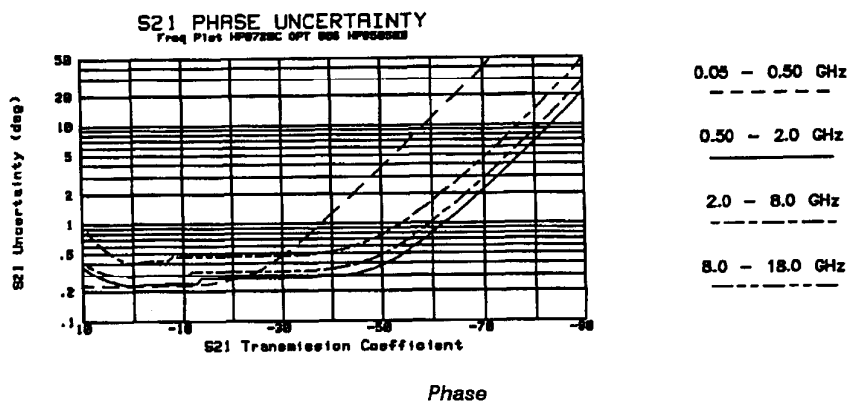
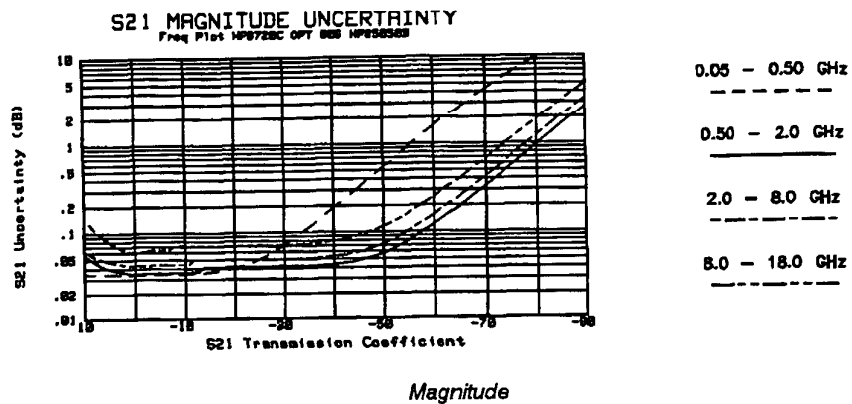
1. Cable stability and system drift are not included.
2. The graphs for transmission measurements assume a well-matched device ( $S_{11} = S_{22} = 0$ ).

## Reflection Measurements<sup>1</sup> Standard



1. The graphs shown for reflection measurement uncertainty apply to a one-port device.

## Transmission Measurements<sup>1</sup> Option 006



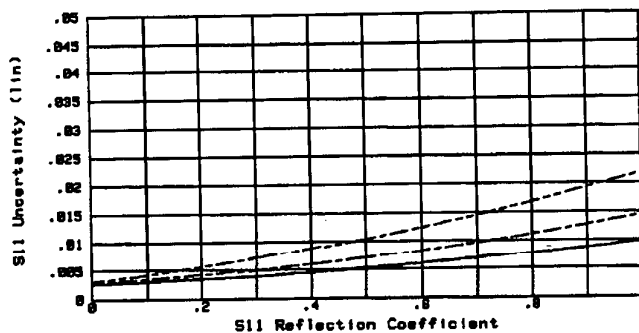
1. The graphs for transmission measurements assume a well-matched device ( $S_{11} = S_{22} = 0$ ).



## Reflection Measurements<sup>1</sup> Option 006

### S11 MAGNITUDE UNCERTAINTY

From Plot HP8720C OPT 006 HP85050B



0.05 - 0.50 GHz

0.50 - 2.0 GHz

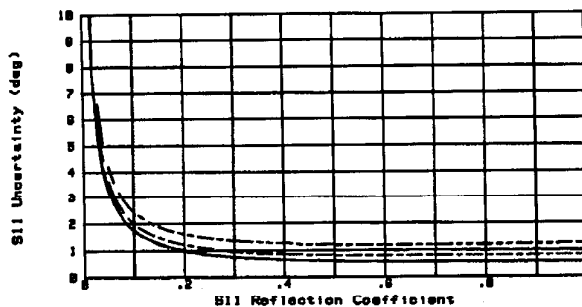
2.0 - 8.0 GHz

8.0 - 18.0 GHz

*Magnitude*

### S11 PHASE UNCERTAINTY

From Plot HP8720C OPT 006 HP85050B



0.05 - 0.50 GHz

0.50 - 2.0 GHz

2.0 - 8.0 GHz

8.0 - 18.0 GHz

*Phase*

1. The graphs shown for reflection measurement uncertainty apply to a one-port device.

## Measurement Port Specifications<sup>1</sup>

The following specifications show the residual system performance (including switch repeatability) after accuracy enhancement using a full 2-port measurement calibration (including isolation) with an IF bandwidth of 10 Hz and the specified calibration kit. Environmental temperature is  $23^{\circ} \pm 3^{\circ}\text{C}$ .

### Calibration Kit: HP 85050B (lowband and sliding loads)

Table 3-10 HP 85050B

|                       | Frequency Range |              |            |                          |
|-----------------------|-----------------|--------------|------------|--------------------------|
|                       | .050 to 0.5 GHz | 0.5 to 2 GHz | 2 to 8 GHz | 8 to 18 GHz <sup>2</sup> |
| Directivity           | 52 dB           | 52 dB        | 52 dB      | 52 dB                    |
| Source Match          | 48 dB           | 45 dB        | 39 dB      | 36 dB                    |
| Load Match            | 51 dB           | 47 dB        | 40 dB      | 38 dB                    |
| Reflection Tracking   | .006 dB         | .010 dB      | .034 dB    | .056 dB                  |
| Transmission Tracking | .007 dB         | .013 dB      | .047 dB    | .071 dB                  |

1. Crosstalk after an isolation calibration, is no higher than the system noise floor and can be ignored.

2. HP 8719C 8 to 13.5 GHz

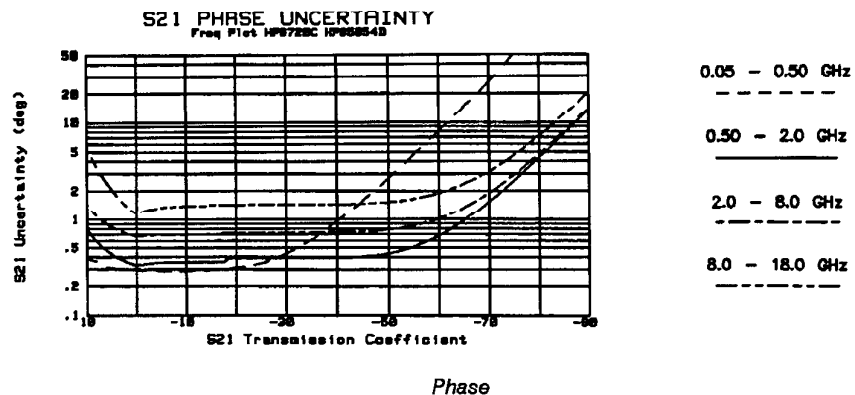
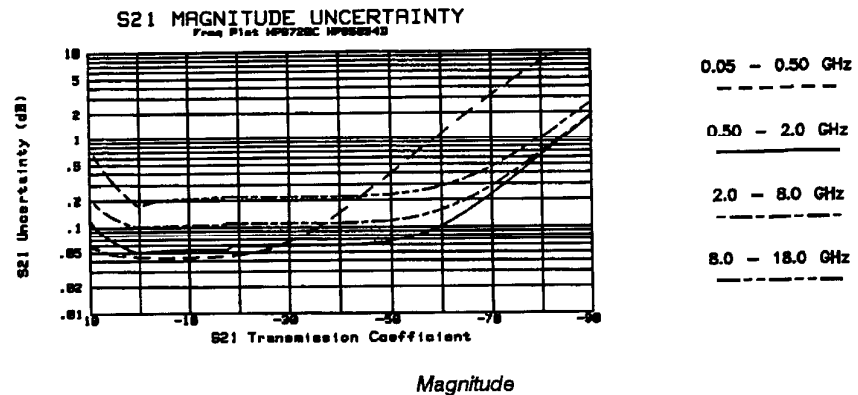
# TYPE-N SYSTEM SPECIFICATIONS

## DEVICES WITH TYPE-N CONNECTORS

### Measurement Uncertainty: HP 85054D Calibration Kit

The following graphs show total worst case measurement uncertainty for the network analyzer after accuracy enhancement using a full 2-port measurement calibration (including isolation) with the HP 85054D type-N calibration kit, HP 85132D cable set, and an IF bandwidths of 10 Hz. This includes the residual systematic errors, as well as the system dynamic accuracy, type-N connector repeatability, noise, and switch repeatability.<sup>1</sup> The 85054-60031 and 85054-60032 special 7 mm to type-N adapter sets are used to adapt the 7 mm cable ports to type-N. Specific points on the graphs are verified by measuring the devices in the HP 85055A verification kit.

### Transmission Measurements<sup>2</sup> Standard

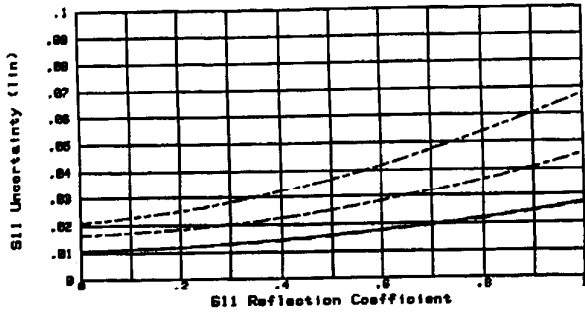


1. Cable stability and system drift are not included.

2. The graphs for transmission measurements assume a well-matched device ( $S_{11} = S_{22} = 0$ ).

# Reflection Measurements<sup>1</sup> Standard

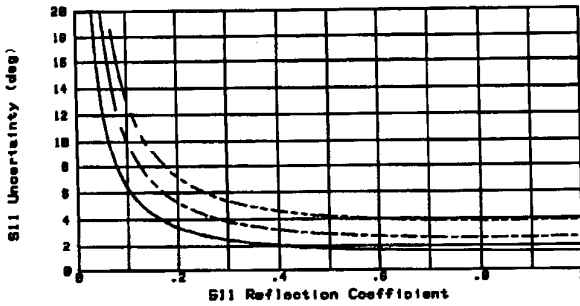
**S11 MAGNITUDE UNCERTAINTY**  
Freq Plot HP8720C HP8504D



0.05 - 0.50 GHz  
 -----  
 0.50 - 2.0 GHz  
 \_\_\_\_\_  
 2.0 - 8.0 GHz  
 - · - · - ·  
 8.0 - 18.0 GHz  
 - - - - -

*Magnitude*

**S11 PHASE UNCERTAINTY**  
Freq Plot HP8720C HP8504D

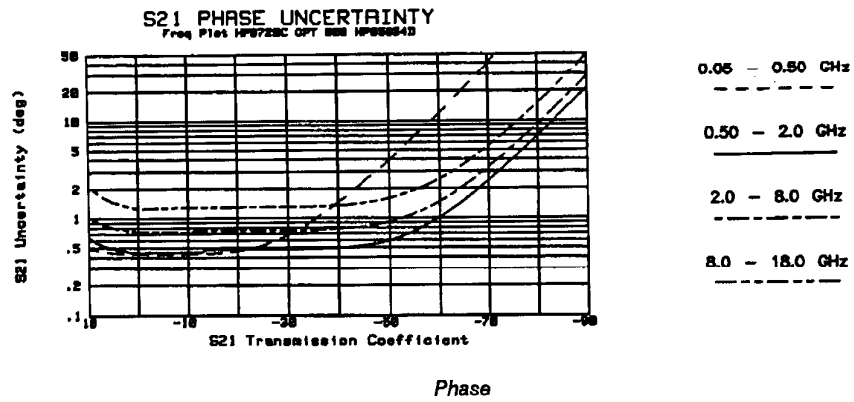
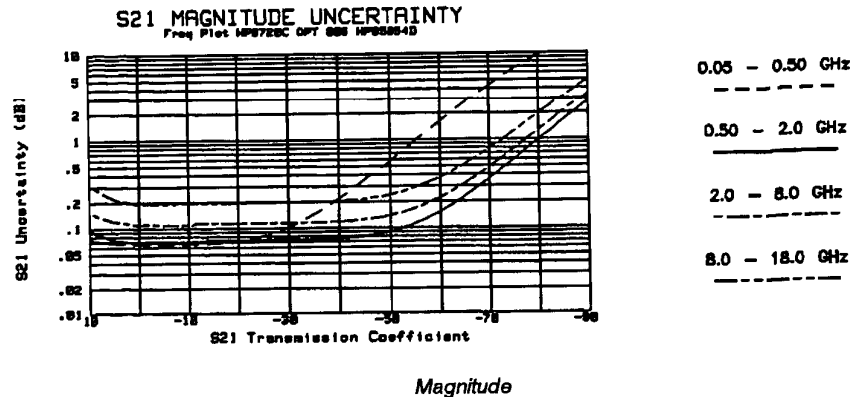


0.05 - 0.50 GHz  
 -----  
 0.50 - 2.0 GHz  
 \_\_\_\_\_  
 2.0 - 8.0 GHz  
 - · - · - ·  
 8.0 - 18.0 GHz  
 - - - - -

*Phase*

1. The graphs shown for reflection measurement uncertainty apply to a one-port device.

## Transmission Measurements<sup>1</sup> Option 006

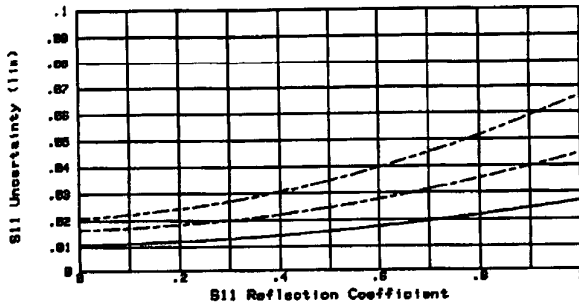


1. The graphs for transmission measurements assume a well-matched device ( $S_{11} = S_{22} = 0$ ).

## Reflection Measurements<sup>1</sup> Option 006

### S11 MAGNITUDE UNCERTAINTY

Freq Plot HP8720C OPT 006 HP8854D



0.05 - 0.50 GHz

0.50 - 2.0 GHz

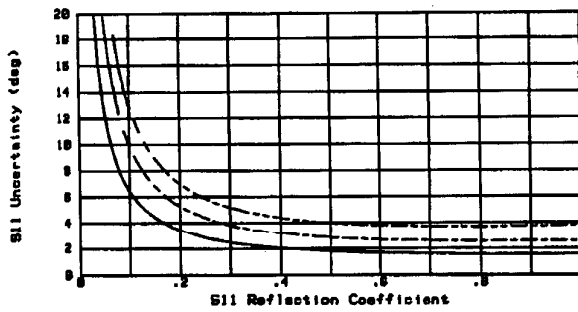
2.0 - 8.0 GHz

8.0 - 18.0 GHz

*Magnitude*

### S11 PHASE UNCERTAINTY

Freq Plot HP8720C OPT 006 HP8854D



0.05 - 0.50 GHz

0.50 - 2.0 GHz

2.0 - 8.0 GHz

8.0 - 18.0 GHz

*Phase*

1. The graphs shown for reflection measurement uncertainty apply to a one-port device.

### Measurement Port Specifications<sup>1</sup>

The following specifications show residual system performance (including switch repeatability) after accuracy enhancement using a full 2-port measurement calibration (including isolation) with an HP 85054D type-N calibration kit, and an IF bandwidth of 10 Hz and the specified calibration kit. Environmental temperature is  $23^{\circ} \pm 3^{\circ}\text{C}$ .

### Calibration Kit: HP 85054D (male and female broadband precision fixed load)

Table 3-11 HP 85054D

|                       | Frequency Range |              |            |                          |
|-----------------------|-----------------|--------------|------------|--------------------------|
|                       | .050 to 0.5 GHz | 0.5 to 2 GHz | 2 to 8 GHz | 8 to 18 GHz <sup>2</sup> |
| Directivity           | 40 dB           | 40 dB        | 36 dB      | 34 dB                    |
| Source Match          | 38 dB           | 38 dB        | 32 dB      | 28 dB                    |
| Load Match            | 40 dB           | 39 dB        | 35 dB      | 33 dB                    |
| Reflection Tracking   | .006 dB         | .010 dB      | .031 dB    | .040 dB                  |
| Transmission Tracking | .015 dB         | .021 dB      | .077 dB    | .144 dB                  |

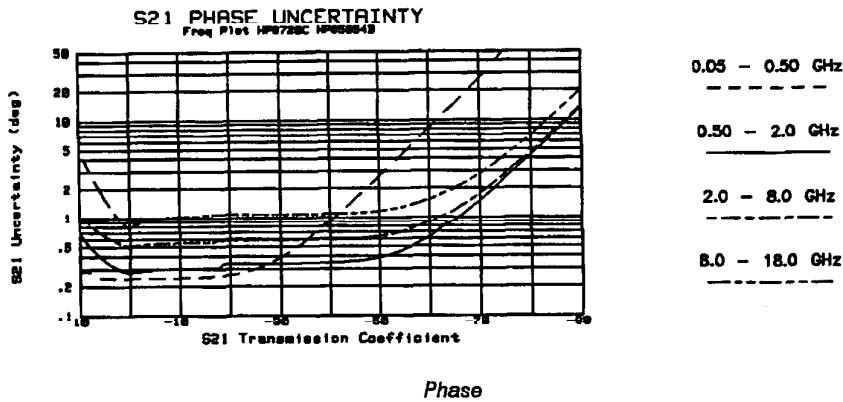
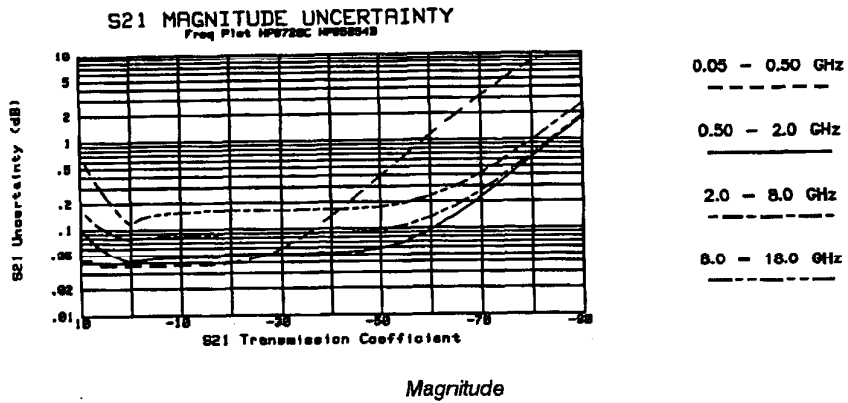
1. Crosstalk after an isolation calibration, is no higher than the system noise floor and can be ignored.

2. HP 8719C 8 to 13.5 GHz

## Measurement Uncertainty: HP 85054B Calibration Kit

The following graphs show total worst case measurement uncertainty for the network analyzer after accuracy enhancement using a full 2-port measurement calibration (including isolation) with the HP 85054B type-N calibration kit, HP 85132D cable set, and an IF bandwidths of 10 Hz. This includes the residual systematic errors, as well as the system dynamic accuracy, type-N connector repeatability, noise, and switch repeatability.<sup>1</sup> The 85054-60031 and 85054-60032 special 7 mm to type-N adapter sets are used to adapt the 7 mm cable ports to type-N. Specific points on the graphs are verified by measuring the devices in the HP 85055A verification kit.

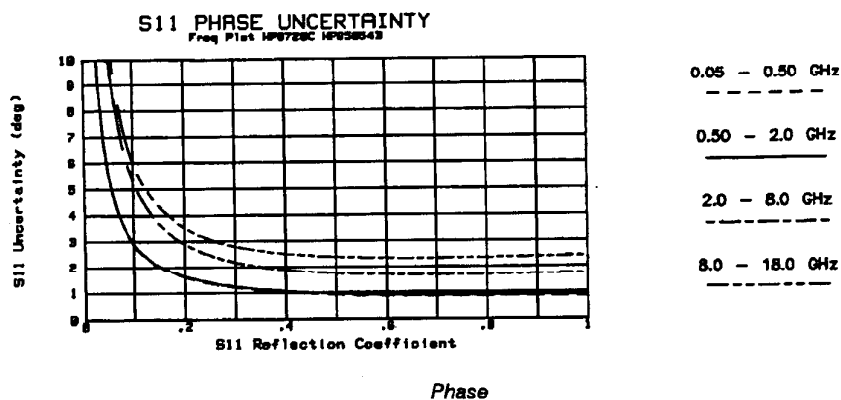
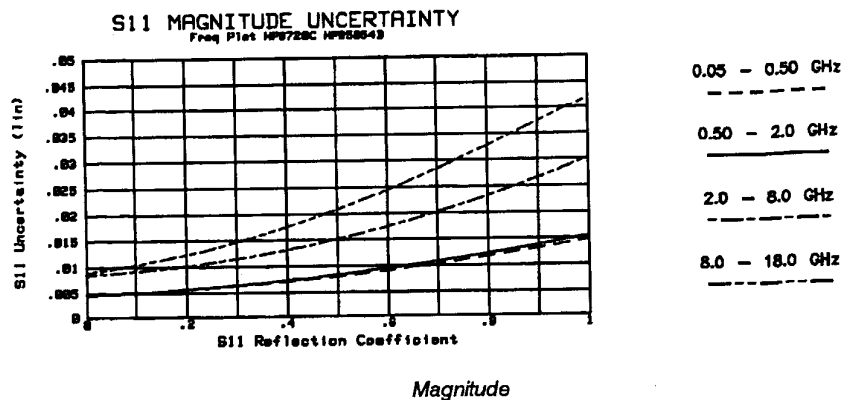
### Transmission Measurements<sup>2</sup> Standard



1. Cable stability and system drift are not included.
2. The graphs for transmission measurements assume a well-matched device ( $S_{11} = S_{22} = 0$ ).

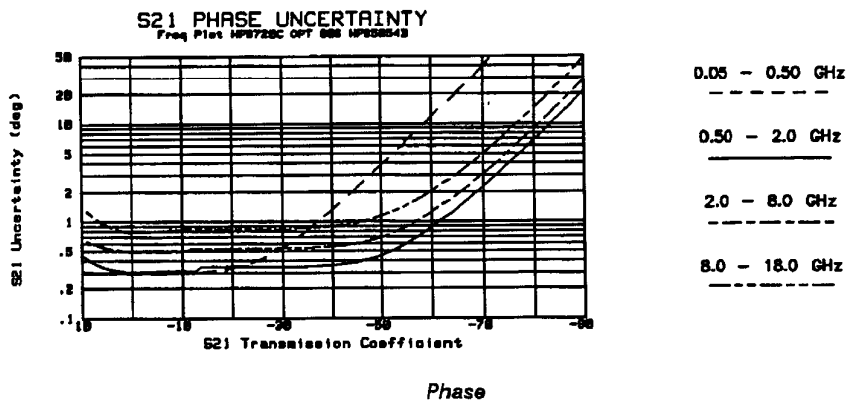
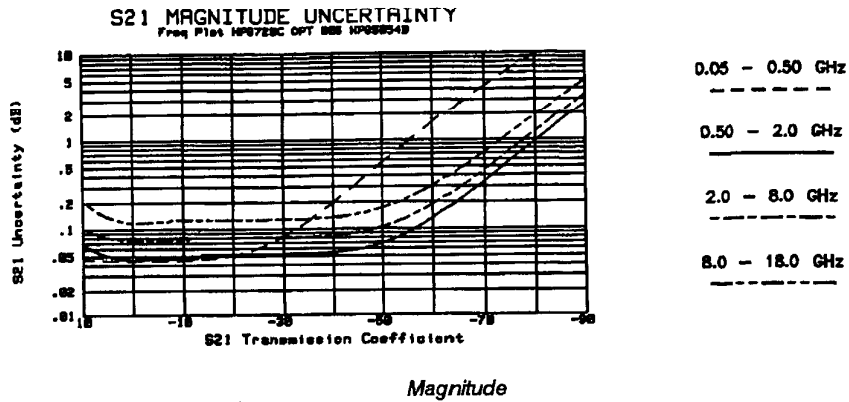


## Reflection Measurements<sup>1</sup> Standard



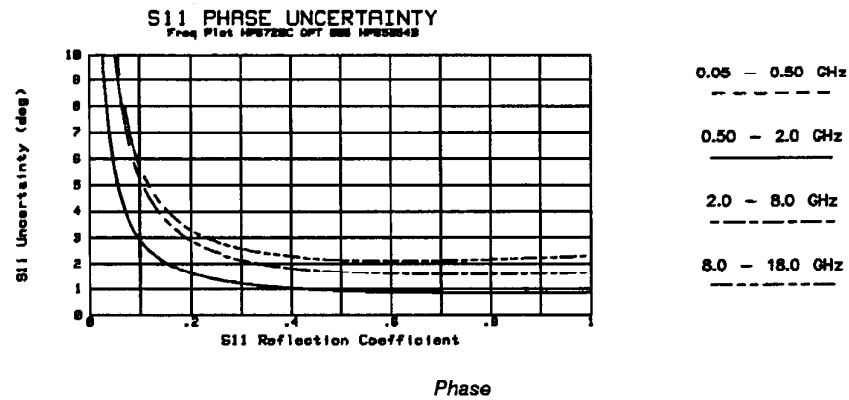
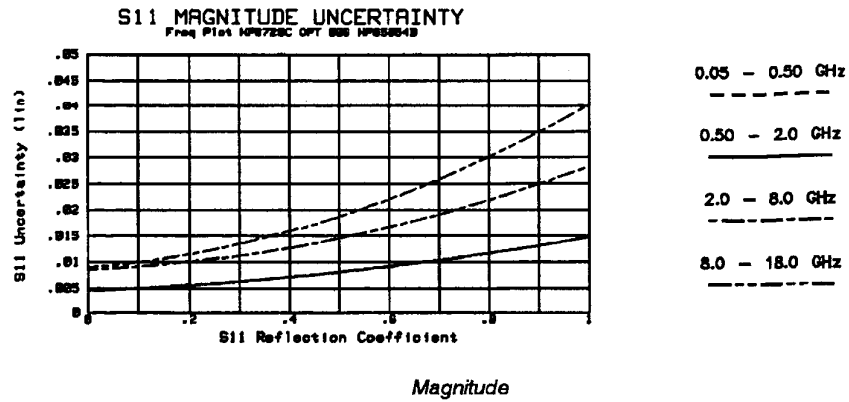
1. The graphs shown for reflection measurement uncertainty apply to a one-port device.

## Transmission Measurements<sup>1</sup> Option 006



1. The graphs for transmission measurements assume a well-matched device ( $S_{11} = S_{22} = 0$ ).

## Reflection Measurements<sup>1</sup> Option 006



1. The graphs shown for reflection measurement uncertainty apply to a one-port device.

## Measurement Port Specifications<sup>1</sup>

The following specifications show residual system performance (including switch repeatability) after accuracy enhancement using a full 2-port measurement calibration (including isolation) with an HP 85054D type-N calibration kit, and an IF bandwidth of 10 Hz and the specified calibration kit. Environmental temperature is  $23^{\circ} \pm 3^{\circ}\text{C}$ .

### Calibration Kit: HP 85054B (male and female lowband and sliding loads)

Table 3-12 HP 85054B

|                       | Frequency Range |              |            |                          |
|-----------------------|-----------------|--------------|------------|--------------------------|
|                       | .050 to 0.5 GHz | 0.5 to 2 GHz | 2 to 8 GHz | 8 to 18 GHz <sup>2</sup> |
| Directivity           | 48 dB           | 48 dB        | 42 dB      | 42 dB                    |
| Source Match          | 45 dB           | 43 dB        | 35 dB      | 31 dB                    |
| Load Match            | 48 dB           | 45 dB        | 38 dB      | 37 dB                    |
| Reflection Tracking   | .005 dB         | .010 dB      | .030 dB    | .030 dB                  |
| Transmission Tracking | .008 dB         | .014 dB      | .058 dB    | .100 dB                  |

1. Crosstalk after an isolation calibration, is no higher than the system noise floor and can be ignored.

2. HP 8719C 8 to 13.5 GHz