Instrument Specifications

The specifications, listed in Table 4-1 on page 4-4, range from those guaranteed by Agilent Technologies, to those typical of most Agilent 87021D instruments, but not guaranteed.

Codes in the far right column of the table reference a specification definition, listed below. These definitions are intended to clarify the extent to which Agilent Technologies supports the specified performance of the Agilent 87021D.

S-1	This performance parameter is verifiable using performance tests documented in the service manual.
S-2	Due to limitations on available industry standards, the guaranteed performance of the instrument cannot be verified outside the factory. Field procedures can verify performance with a confidence prescribed by available standards.
S-3	These specifications are generally digital functions or are mathematically derived from tested specifications, and can therefore be verified by functional pass/fail testing.
T	Typical, but non-warranted, performance characteristics intended to provide information useful in applying the instrument. Typical characteristics are representative of most instruments, though not necessarily tested in each unit. Not field tested.

Table 4-1. Agilent 8702D Instrument Specifications and Characteristics (1 of 6)

Description	Specification or *Characteristic*	Code
TEST PORT OUTPUTS		
Frequency Characteristics		
Range		
Standard	30 kHz to 3 GHz	S-1
Option 006	30 kHz to 6 GHz	S-1
Accuracy (at 25°C ±5°C)	±10 ppm	
Stability		
0° to 55°C	*±7.5 ppm*	*T*
per year	*±3 ppm*	*T*
Resolution	1 Hz	S-3
Output Power Characteristics		
Range	–85 to +10 dBm	S-1
Resolution	0.05 dB	S-3
Level Accuracy (at 0 dBm output level) (at 25°C ±5°C)[a]	±1.0 dB	S-1[b]
Linearity (at 25°C ±5°C)[a]		
–15 to +5 dBm	±0.2 dB (relative to 0 dBm output level)	S-1
+5 to +10 dBm	±0.5 dB (relative to 0 dBm output level)	S-1
Impedance	*50 ohms >16 dB return loss to 3 GHz*	*T*
	>14 dB return loss to 6 GHz	*T*
Spectral Purity Characteristics		
2nd Harmonic (16 MHz to 3 GHz)		
at +10 dBm output level	<–25 dBc	S-1[b]
at 0 dBm output level	*<–40 dBc*	*T*
at –10 dBm output level	*<–50 dBc*	*T*
3rd Harmonic (16 MHz to 2 GHz)		
at +10 dBm output level	<–25 dBc	S-1[b]
at 0 dBm output level	*<–40 dBc*	*T*
at –10 dBm output level	*<–50 dBc*	*T*
Non-Harmonic Spurious Signals Mixer Related		
at +10 dBm output level	*<–30 dBc*	*T*
at –10 dBm output level	*<–55 dBc*	*T*
TEST PORT INPUTS		
Characteristics		
Frequency Range		
Standard	30 kHz to 3 GHz	S-1
Option 006	30 kHz to 6 GHz	S-1

Table 4-1. Agilent 8702D Instrument Specifications and Characteristics (2 of 6)

Description	Specification or *Characteristic*	Code
Impedance	50 ohms nominal	
30 kHz to 50 kHz	*≥10 dB return loss*	*T*
50 kHz to 300 kHz	*≥18 dB return loss*	*T*
300 kHz to 1.3 GHz	≥18 dB return loss	S-1
1.3 GHz to 3 GHz	≥16 dB return loss	S-1
3 GHz to 6 GHz	≥14 dB return loss	S-1
Maximum Input Level	+10 dBm	S-1
Damage Level	*+26 dBm or >35 Vdc*	*T*
Average Noise Level		
50 kHz to 3 GHz		
3 kHz IF bandwidth	–82 dBm	S-1[b]
10 Hz IF bandwidth	–102 dBm	S-1[b]
	–110 dBm	*T*
3 GHz to 6 GHz		
3 kHz IF bandwidth	–77 dBm	S-1[b]
10 Hz IF bandwidth	–97 dBm	S-1[b]
	–105 dBm	*T*
Frequency Response (25 ±5°C)		
300 kHz to 3 GHz	±1 dB	S-1[b]
3 GHz to 6 GHz	±2 dB	S-1[b]
Internally Generated Harmonics (Option 002)		
2nd Harmonic		
at +8 dBm input level	<–15 dBc	S-1[b]
at +0 dBm input level	*<–30 dBc*	*T*
at –15 dBm input level	*<–45 dBc*	*T*
3rd Harmonic		
at +8 dBm input level	<–30 dBc	S-1[b]
at +0 dBm input level	*<–50 dBc*	*T*
at –15 dBm input level	*<–50 dBc*	*T*
Harmonic Measurement Accuracy (25 ±5°C)		
16 MHz to 3 GHz	±1 dB	S-1
3 GHz to 6 GHz[c]	±3 dB	S-1
Harmonic Measurement Dynamic Range (with output at –10 dBm and input at <–15 dBm)	*–40 dBc*	*T*
R CHANNEL INPUT		
Frequency Offset Operation[d,e]		
Frequency Range[c]	300 kHz to 6 GHz	S-1
R Channel Input Requirements	0 to –35 dBm, to 3 GHz	S-1

Table 4-1. Agilent 8702D Instrument Specifications and Characteristics (3 of 6)

Description	Specification or *Characteristic*	Code
(required for phase-locked operation)	0 to –30 dBm, 3 GHz to 6 GHz	S-1
LO Spectral Purity and Accuracy		
Maximum Spurious Input	*<–25 dBc*	*T*
Residual FM	*<20 kHz*	*T*
Frequency Accuracy	*–1 to +1 MHz of nominal frequency*	*T*
Accuracy (see Magnitude Characteristics and Phase Characteristics)		
External Source Mode[e,f] (CW Time sweep only)		
Frequency Range[c]	300 kHz to 6 GHz	S-1
R Input Requirements		
Power Level	*0 to –25 dBm*	*T*
Spectral Purity		
Maximum Spurious Input	*<–30 dBc*	*T*
Residual FM	*<20 kHz*	*T*
Setting Time		
Auto	*500 ms*	*T*
Manual	*50 ms*	*T*
Frequency Readout Accuracy (auto)	*0.1%*	*T*
Input Frequency Margin		
Manual	*–0.5 to 5 MHz*	*T*
Auto		
≤50 MHz	*±5 MHz of nominal CW frequency*	*T*
>50 MHz	*±10% of nominal CW frequency*	*T*
Accuracy (see Magnitude Characteristics and Phase Characteristics)[f]		
INPUT GENERAL		
Magnitude Characteristics		
Display Resolution	0.01 dB/division	S-3
Marker[g] Resolution	0.001 dB	S-3
Dynamic Range[h]		
30 kHz to 300 kHz	*100 dB*	*T*
30 kHz to 50 kHz	*90 dB*	*T*
300 kHz to 16 MHz	100 dB (std), 105 dB (option 075)	S-1
300 kHz to 1.3 GHz	110 dB (std), 105 dB (option 075)	S-1
1.3 GHz to 3 GHz	110 dB (std), 105 dB (option 075)	S-1
3 GHz to 6 GHz	105 dB	S-1
Dynamic Accuracy (10 Hz BW, inputs Test Port 1 and Test Port 2; R to –35 dBm) (see graph)		S-1

Table 4-1. Agilent 8702D Instrument Specifications and Characteristics (4 of 6)

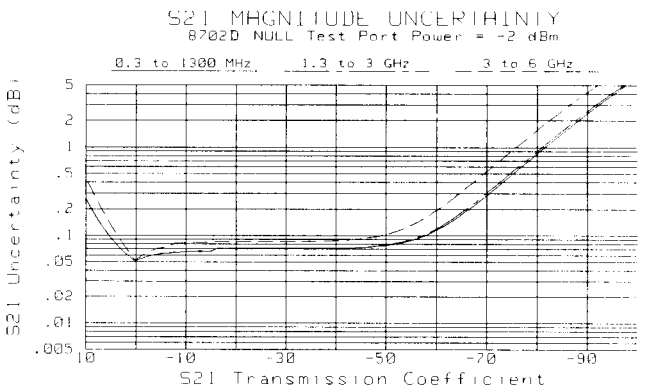
Description	Specification or *Characteristic*	Code
Dynamic Accuracy (Magnitude)		
		
Trace Noise[f]		
30 kHz to 3 GHz	<0.006 dB rms	S-1
3 GHz to 6 GHz	<0.010 dB rms	S-1
Reference Level		
Range	±500 dB	S-3
Resolution	0.001 dB	S-3
Stability		
30 kHz to 3 GHz	*0.02 dB/°C*	*T*
3 GHz to 6 GHz	*0.04 dB/°C*	*T*
Phase Characteristics		
Range	±180°	S-3
Display Resolution	0.01°/division	S-3
Marker Resolution[g]	0.01°	S-3
Dynamic Accuracy (10 Hz BW, inputs Test Port 1 and Test Port 2; R to –35 dBm) (see graph)		S-1

Table 4-1. Agilent 8702D Instrument Specifications and Characteristics (5 of 6)

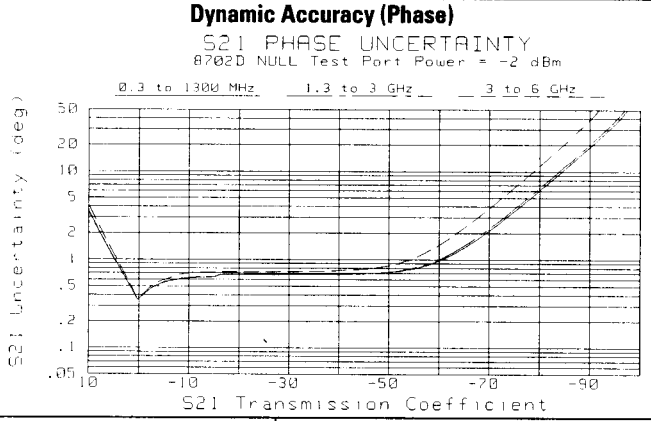
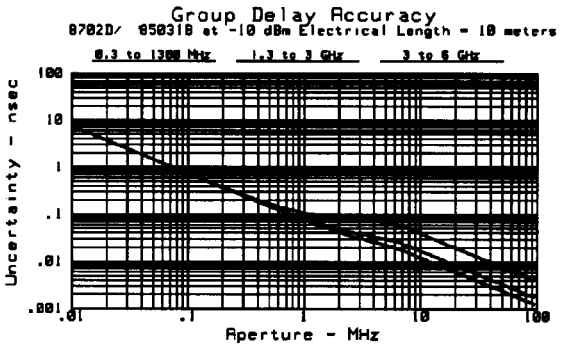
Description	Specification or *Characteristic*	Code
Dynamic Accuracy (Phase)		
		
Trace Noise (+5 dBm into Test Port, ratio measurement)		
30 kHz to 3 GHz	<0.038° rms	S-1
3 GHz to 6 GHz	<0.070° rms	S-1
Reference Level		
Range	±500°	S-3
Resolution	0.01°	S-3
Stability		
30 kHz to 3 GHz	*0.05°/degree C*	*T*
3 GHz to 6 GHz	*0.20°/degree C*	*T*
Polar Characteristics (Ratio Measurement)		
Range	10 x 10^{-12} up to 1000 units full scale	S-3
Reference	range of ±500 units	S-3
Group Delay Characteristics		
Group delay is computed by measuring the phase change within a specified frequency step (determined by the frequency span and the number of points per sweep).		
Aperture (selectable)	(frequency span)/(number of points – 1)	S-3
Maximum Aperture	20% of frequency span	S-3
Range	1/2 x (1/minimum aperture)	S-3
(The maximum delay is limited to measuring no more than 180° of phase change within the minimum aperture.)		
Accuracy	(see graph)	S-3

Table 4-1. Agilent 8702D Instrument Specifications and Characteristics (6 of 6)

Description	Specification or *Characteristic*	Code

The following graph shows group delay accuracy with 7 mm full 2-port calibration and a 10 Hz IF bandwidth. Insertion loss is assumed to be <2 dB and electrical length to be ten meters.

Group Delay Accuracy vs. Aperture



In general, the following formula can be used to determine the accuracy, in seconds, of specific group delay measurement:

±[0.003 x Phase Accuracy (deg)]/Aperture (Hz)

Depending on the aperture and device length, the phase accuracy used is either incremental phase accuracy or worst case phase accuracy.

a. Typical 30 kHz to 300 kHz and typical from 2 to 3 GHz for Option 075.
b. Explicitly tested as part of an on-site verification performed by Agilent Technologies.
c. Operation from 3 GHz to 6 GHz requires Option 006.
d. The Agilent 8702D RF source characteristics in this mode are dependent on the stability of the external LO source. The RF source tracks the LO to maintain a stable IF signal at the R channel receiver input. Degradation in accuracy is negligible with an Agilent 8642A/B or Agilent 8656B RF signal generator as the LO source.
e. Refer to the Agilent 8702D descriptions and options in this manual for a functional description.
f. Measurement accuracy is dependent on the stability of the input signal.
g. Marker resolution for magnitude, phase, and delay is dependent upon the value measured; resolution is limited to 5 digits.
h. The specifications described apply to transmission measurements using 10 Hz IF BW and full 2-port correction. Dynamic range is limited by the maximum test port power and the receiver's noise floor.
i. CW sweep, +5 dBm into Test Port, ratio measurement, 3 kHz BW.