2 Specifications

Specifications and Characteristics

Introduction

Specifications and characteristics differ as defined in the Table 2-1 and Table 2-2 on page 2-2. Both are based on certain operating conditions. Those conditions are defined in "Specification Assumptions" on page 2-5. Specifications describe the warranted performance of the instrument. To verify the specifications follow the *Agilent 8511A/B and Antenna Measurement System Performance Verification Software* assembly documentation. Characteristics provide information useful in applying the instrument by giving typical but *non-warranted* performance parameters.

Table 2-1 8510/8511B Specifications

Parameter	0.045 to 8 GHz	8 to 20 GHz	20 to 40 GHz	40 to 50 GHz
Frequency Response Tracking				
Magnitude (ripple)[1]	±1.5 dB	±1.5 dB	±1.5 dB	±1.5 dB
Phase (ripple)	±75 degrees	±75 degrees	±75 degrees	±75 degrees
Magnitude slope[2]	±0.055 dB/GHz	±0.055 dB/GHz	±0.055 dB/GHz	±0.055 dB/GHz
Crosstalk[3]	–85 dB	–85 dB	–75 dB	–70 dB
High Level Noise[4]				
Magnitude (ratio)	0.006 dB rms	0.009 dB rms	0.040 dB rms	0.060 dB rms
Phase (ratio)	0.08 degrees rms	0.145 degrees rms	0.245 degrees rms	0.400 degrees rms
Low Level Noise[5]	–100 dBm	–102 dBm	–102 dBm	–102 dBm
Conversion Gain[6]	1 dB to –4 dB	1 dB to –4 dB	–3 dB to –13 dB	–5 dB to –15 dB
Compression (0.1 dB point)[7]	–10 dBm	–10 dBm	–15 dBm	–20 dBm
Input Port [8]				
Impedance Match (return loss) (all 4 ports)	≥17 dB	≥15 dB	≥9 dB	≥7 dB

1. Deviation from a least-squares-straight-line fit, excluding noise and slope. Ratio measurement of any two ports.
2. Slope of least-squares-straight-line fit over full frequency range.
3. Uncorrected port to port crosstalk with averaging factor of 1024.
4. Trace noise, sweep to sweep variation.
5. Low level noise measured with 50 ohm load at port, and calculated as the mean value of a 101 point trace with IF averaging set at one. Low level noise varies with averaging factory: 10 log (average factor).
6. See figures on page 2-3.
7. Do not exceed –5 dBm input to sampler for proper phase lock operation.
8. Tested with sampler in non-conducting state. When diodes are turned on by the LO pulse, they present a short circuit across the sampler input port. This may affect the measured data.

Table 2-2 8510/8511B Characteristics[1]

Parameter	0.045 to 8 GHz	8 to 20 GHz	20 to 40 GHz	40 to 50 GHz
Dynamic Range[2]	110 dB	112 dB	107 dB	102 dB
all inputs	(–10 to –120 dBm)	(–10 to –122 dBm)	(–15 to –122 dBm)	(–20 to –122 dBm)
Accuracy Enhanced Crosstalk[3]				
–115 dB	–115 dB	–113 dB	–110 dB	–105 dB
Typical Drift (typical)		Magnitude 0.001 X V °C, linear		
Phase (0.01 + 0.01 f (GHz) X V °C, degrees				

Input Ports

Connector type: precision 2.4 mm female

Impedance: 50 ohms nominal

Damage level: +13 dBm (20 mW) CWRF input[4]

Port input power for phase lock:

Frequency	Minimum	Maximum
0.045 to 8 GHz	–41 dBm	–5 dBm
8 to 20 GHz	–39 dBm	–5 dBm
20 to 26.5 GHz	–32 dBm	–5 dBm
40 to 50 GHz	–30 dBm	–5 dBm

1. The performance parameters listed are characteristic of the 8511B. They are typical or nominal figures and are not field verifiable.
2. Determined by 0.1 dB compression level and system low level peak noise. Low level peak noise measured with 50 ohm load at port and 1024 averaging factor. Noise floor varies with averaging factor. (10 log averaging factor.) Low level noise is calculated from low level noise +10.4 dB.
3. Effective crosstalk with isolation, calibration, excludes noise.
4. Do not exceed –5 dBm input to the sampler for the proper phase lock operation.

Dynamic Accuracy

Figure 2-1 and Figure 2-2 illustrate a worst case magnitude and phase uncertainty due to IF residuals and detector inaccuracies. This data excludes uncertainty due to noise, frequency response, directivity, port matches and connector repeatability.

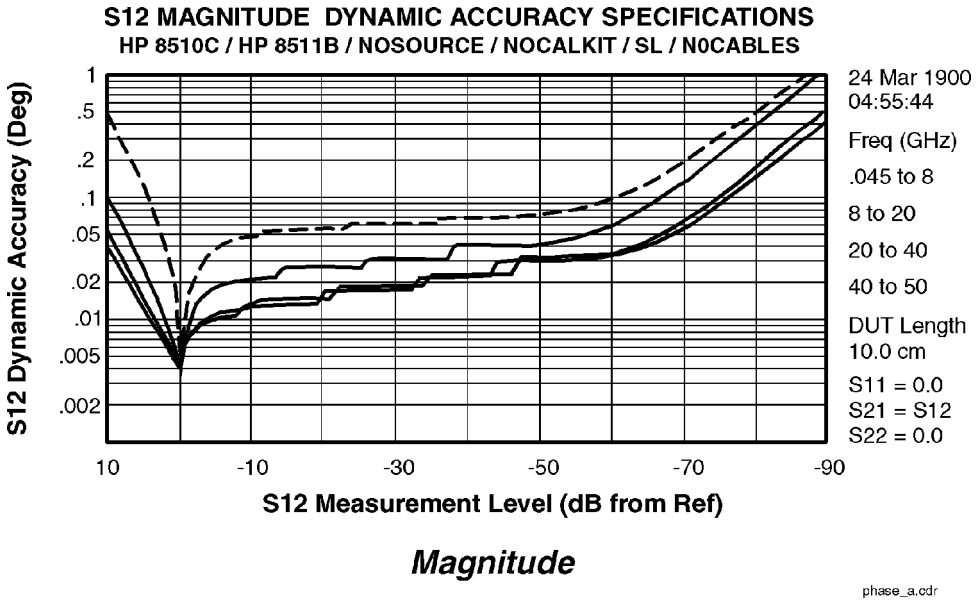

Figure 2-1 Worst Case Dynamic Accuracy (Magnitude)

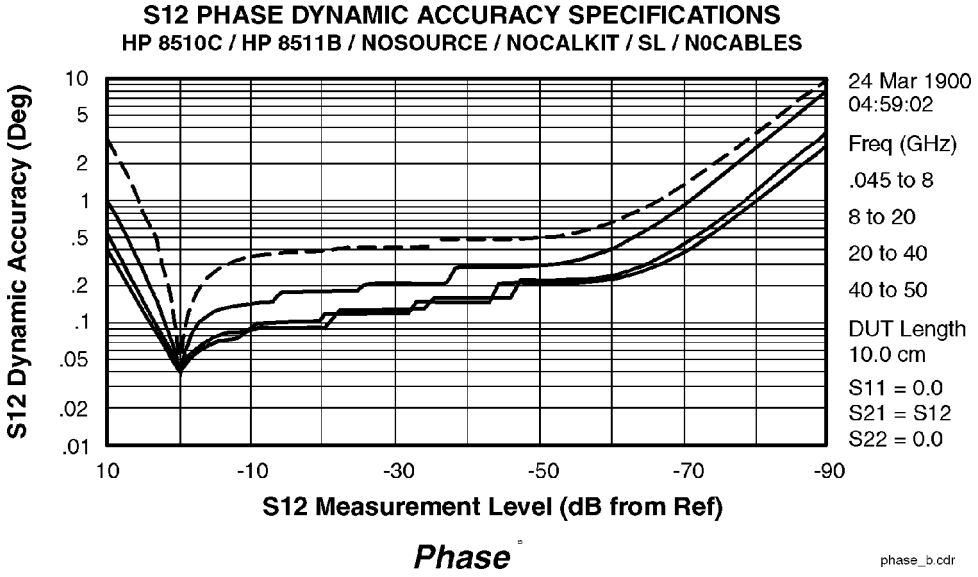

*Figure 2-2 Worst Case Dynamic Accuracy (Phase)**

* Phase detector accuracy is better than 0.02 degrees, useful for measurements where only phase changes.

Table 2-3 8510/8511B Characteristics (continued)

Source of System Dynamic Accuracy Errors:

The factors affecting dynamic accuracy listed below are primarily a function of the IF detector. However, compression is primarily a function of the sampler/mixer circuitry. In order to measure these values, some of the system cables must be disconnected to gain access to the individual instruments.

IF Amplifier Gain Accuracy	IF Amplifier Power Range (dBm)[1]	Maximum Gain Error (dB)
	–10 to –34	0
	–34 to –46	±0.005
	–46 to –58	±0.010
	–58 to –70	±0.015
	≤ 70	±0.025

Detector Circularity Error:	±0.003 dB peak
IF Residuals:	–140 dBm[1]
IF Linearity:	±0.003 dB

Incremental Phase Accuracy (Phase versus Phase) at Measurement Reference:

±0.001 degrees/degree, not to exceed 0.02 degrees peak.

Operating Temperature:	0 °C to 55 °C
Power:	110, 120, 220 or 240 ±10% Vac; 47 to 66 Hz line frequency
Dimensions:	460 mm x 133 mm x 609 mm (18.1 x 5.25 x 24 inches)
Weight:	13 kg (29 lb) net; 17 kg (38 lb) shipping

1. Measured at the IF input to the 8510, not at the test set test ports.

Specification Assumptions

The specifications of the Agilent 8511B require that the following operating conditions are met:

- All system instruments have reached stable operating temperature.
- RF source: Agilent 83651A. When used with another recommended source, the performance specifications may differ from those for the 8510/8511/83651A configuration. The performance test software will display and print the limits for the chosen configuration.
- Performance verification temperature: 23 ±3 °C.
- RF source power levels as follows:

Test	Power at Input Level (dBm)		
	0.045 to 20 GHz	20 to 40 GHz	40 to 50 GHz
Compression, Crosstalk	–10	–15	–20
Conversion Gain, Tracking, High Level Noise	–15	–20	–25

Recommended Test Equipment

Table 2-4 lists the test equipment that is required when trouble shooting, operating, and performance testing the 8511B

Table 2-4 Recommended Test Equipment

Item	Critical Specifications	Recommended Agilent Model (or Part Number)	Use[1]
Network analyzer	no substitute	8510A,B,C	O,P,T
Multimeter	range: 0 to 50 V	3456A	T
Oscilloscope	50 MHz bandwidth	1740A	T
Semi-rigid cables			T,P
Power splitter	45 MHz to 50 GHz	11667C	P,T
Power meter		436A, 437A, 438A	P
Power sensor	no substitute	8487A	P
2.4 mm coax cables (2)	no substitute	08511-20031	P,T
2.4 mm (f) to 2.4 mm (m) adapter	no substitute	1250-2186	P
20 dB fixed attenuator	no substitute	33340D Option 020[2]	P
RF cable	2.4 (m) semi-rigid 2-in long	08511-20031A	P,T
6 dB fixed attenuator (2)	no substitute	33340D Option 006	P
2.4 mm 50 ohm load (m)	no substitute	85148A	P
2.4 mm 50 ohm load (f)	no substitute	85138B	P

1. O = Operation; P = Performance test; T = Troubleshooting
2. Supplied in the 8511B Service Kit (part number 08511-60016)