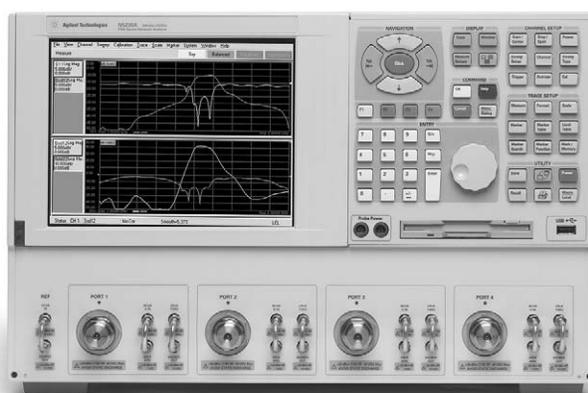
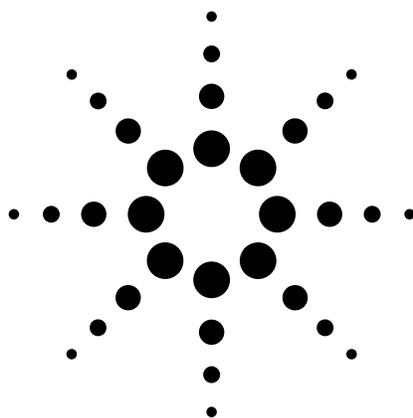


# Agilent 4-Port PNA-L Microwave Network Analyzer

## N5230A Options 240 and 245 300 kHz to 20 GHz

Data Sheet



**Note:**

Specification information in this document is also available within the PNA-L network analyzer's internal Help system.



**Agilent Technologies**

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This is a subset of technical specifications for the N5230A Option 240 and 245 network analyzer.

To view or print the N5230A technical specifications, visit our web site at [www.agilent.com/find/pnal](http://www.agilent.com/find/pnal)

This N5230A document provides technical specifications for the following calibration kit and ECal module only: 85052B and N4691A. Please download our free Uncertainty Calculator from [www.agilent.com/find/na\\_calculator](http://www.agilent.com/find/na_calculator) to generate the curves for your calibration kit and PNA setup.

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## Definitions

All specifications and characteristics apply over a 25 °C  $\pm$ 5 °C range (unless otherwise stated) and 90 minutes after the instrument has been turned on.

**Specification (spec.):** Warranted performance. Specifications include guardbands to account for the expected statistical performance distribution, measurement uncertainties, and changes in performance due to environmental conditions.

**Characteristic (char.):** A performance parameter that the product is expected to meet before it leaves the factory, but that is not verified in the field and is not covered by the product warranty. A characteristic includes the same guardbands as a specification.

**Typical (typ.):** Expected performance of an average unit which does not include guardbands. It is not covered by the product warranty.

**Nominal (nom.):** A general, descriptive term that does not imply a level of performance. It is not covered by the product warranty.

**Calibration:** The process of measuring known standards to characterize a network analyzer's systematic (repeatable) errors.

**Corrected (residual):** Indicates performance after error correction (calibration). It is determined by the quality of calibration standards and how well "known" they are, plus system repeatability, stability, and noise.

**Uncorrected (raw):** Indicates instrument performance without error correction. The uncorrected performance affects the stability of a calibration.

**Standard:** When referring to the analyzer, this includes no options unless noted otherwise.

## Corrected System Performance

The specifications in this section apply for measurements made with the N5230A Options 240 and 245 analyzer with the following conditions:

- 10 Hz IF bandwidth
- No averaging applied to data
- Isolation calibration with an averaging factor of 8

**Table 1. System dynamic range at test port<sup>1</sup>**

### Standard configuration and standard power range (Option 240)

Description	Specification (dB) at test port	Typical (dB) at test port
300 kHz to 10 MHz		111
10 MHz to 4 GHz <sup>2</sup>	120	128
4 GHz to 6 GHz	118	129
6 GHz to 10.5 GHz	115	127
10.5 GHz to 15 GHz	107	119
15 GHz to 20 GHz	103	116

### Configurable test set and extended power range (Option 245)

Description	Specification (dB) at test port	Typical (dB) at test port
300 kHz to 10 MHz		111
10 MHz to 4 GHz <sup>2</sup>	120	128
4 GHz to 6 GHz	118	128
6 GHz to 10.5 GHz	113	125
10.5 GHz to 15 GHz	105	117
15 GHz to 20 GHz	98	115

1. The system dynamic range is calculated as the difference between the noise floor and the specified source maximum output power. The effective dynamic range must take measurement uncertainties and interfering signals into account.
2. May be degraded by 10 dB at particular frequencies (multiples of 5 MHz) below 500 MHz due to spurious receiver residuals. Methods are available to regain the full dynamic range.

Table 2. Extended dynamic range<sup>1</sup>

**Configurable test set and extended power range (Option 245)**

<b>Description</b>	<b>Specification (dB) at direct receiver access input</b>	<b>Typical (dB) at direct receiver access input</b>
300 kHz to 10 MHz		127
10 MHz to 4 GHz <sup>2</sup>	136	
4 GHz to 6 GHz	134	
6 GHz to 10.5 GHz	129	
10.5 GHz to 15 GHz	121	
15 GHz to 20 GHz	114	

1. The direct receiver access input extended dynamic range is calculated as the difference between the direct receiver access input noise floor and the source maximum output power. The effective dynamic range must take measurement uncertainties and interfering signals into account. This set-up should only be used when the receiver input will never exceed its compression or damage level. When the analyzer is in segment sweep mode, it can have predefined frequency segments which will output a higher power level when the extended dynamic range is required (i.e. devices with high insertion loss), and reduced power when receiver compression or damage may occur (i.e. devices with low insertion loss). The extended range is only available in one-path transmission measurements.
2. May be degraded by 10 dB at particular frequencies (multiples of 5 MHz) below 500 MHz due to spurious receiver residuals. Methods are available to regain the full dynamic range.

## N5230A Option 245

### Corrected system performance with 3.5 mm connectors<sup>1</sup>

Note: For any  $S_{ij}$  reflection measurement:

$$S_{ji} = 0$$

For any  $S_{ij}$  transmission measurement:

$$S_{ji} = S_{ij} \text{ when } S_{ij} \leq 1$$

$$S_{ji} = 1/S_{ij} \text{ when } S_{ij} \geq 1$$

$$S_{kk} = 0 \text{ for all } k$$

**Table 3. 85052B Calibration kit**

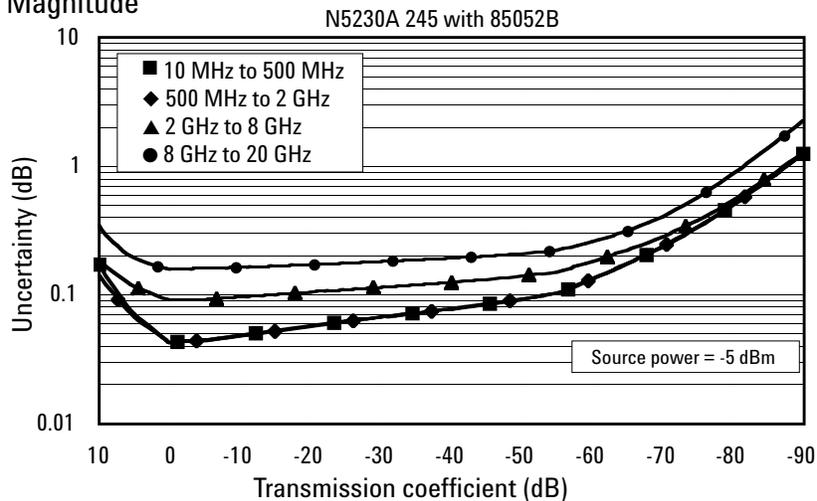
#### N5230A – configurable test set and extended power range (Option 245)

Applies to the N5230A Option 245 analyzers, 85052B (3.5mm) calibration kit, 85131F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition: Environmental temperature  $23^\circ \pm 3^\circ \text{C}$ , with  $< 1^\circ \text{C}$  deviation from calibration temperature.

Description	Specification (dB)			
	10 MHz to 500 MHz	500 MHz to 2 GHz	2 to 8 GHz	8 to 20 GHz
Directivity	48	48	44	44
Source match	40	40	33	31
Load match	48	48	44	44
Reflection tracking	$\pm 0.003$ (+0.01/°C)	$\pm 0.003$ (+0.01/°C)	$\pm 0.003$ (+0.02/°C)	$\pm 0.006$ (+0.03/°C)
Transmission tracking	$\pm 0.017$ (+0.01/°C)	$\pm 0.017$ (+0.01/°C)	$\pm 0.062$ (+0.02/°C)	$\pm 0.125$ (+0.03/°C)

#### Transmission uncertainty (specifications)

#### Magnitude

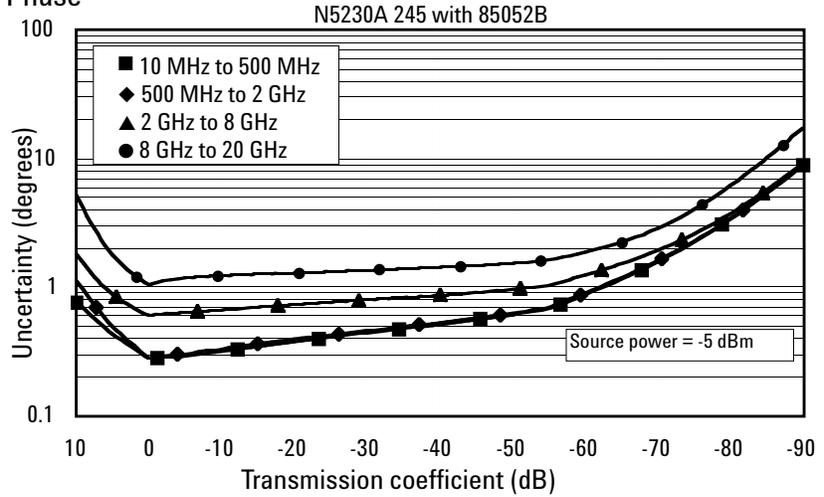


1. From 300 kHz to 10 MHz, performance is characterized as "typical". To generate these typical values, please download our free Uncertainty Calculator from [www.agilent.com/find/na\\_calculator](http://www.agilent.com/find/na_calculator).

85052B Calibration kit (continued)

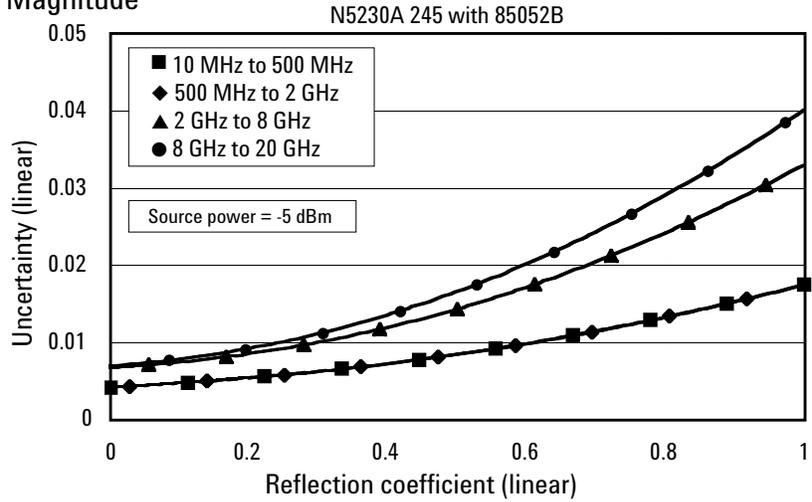
N5230A – configurable test set and extended power range (Option 245)

Phase

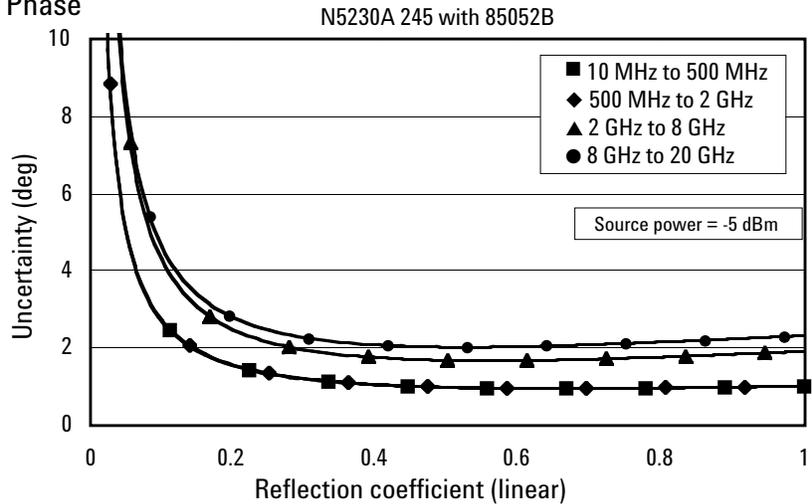


Reflection uncertainty (specifications)

Magnitude



Phase



# N5230A Option 245

## Corrected system performance with 3.5 mm connectors<sup>1</sup> (continued)

Table 4. N4691A Electronic calibration module

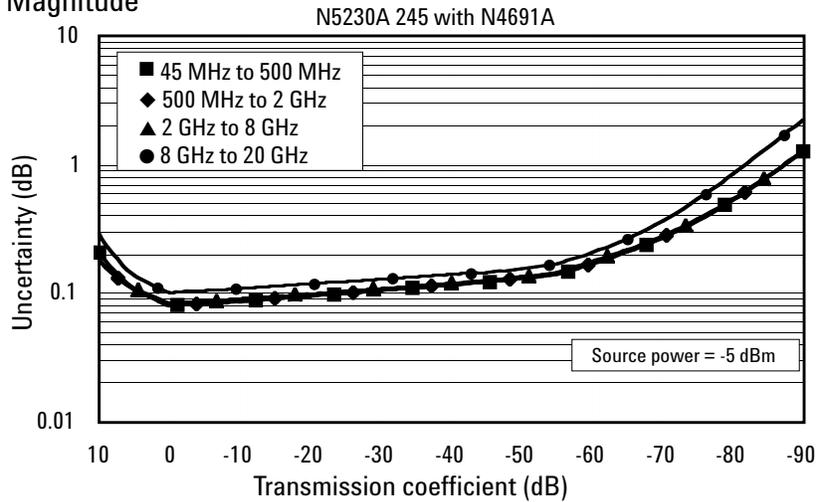
### N5230A – configurable test set and extended power range (Option 245)

Applies to the N5230A Option 245 analyzers, N4691A electronic calibration module, 85131F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition: Environmental temperature 23° ±3 °C, with < 1 °C deviation from calibration temperature.

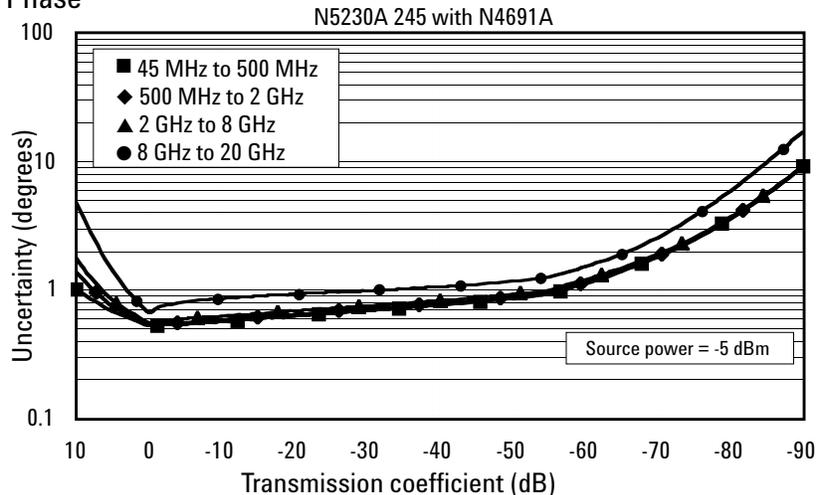
Description	Specification (dB)			
	45 MHz to 500 MHz	500 MHz to 2 GHz	2 to 8 GHz	8 to 20 GHz
Directivity	56	56	54	49
Source match	47	47	45	44
Load match	46	46	45	43
Reflection tracking	±0.050 (+0.01/°C)	±0.050 (+0.01/°C)	±0.070 (+0.02/°C)	±0.090 (+0.03/°C)
Transmission tracking	±0.055 (+0.01/°C)	±0.056 (+0.01/°C)	±0.057 (+0.02/°C)	±0.071 (+0.03/°C)

### Transmission uncertainty (specifications)

#### Magnitude



#### Phase



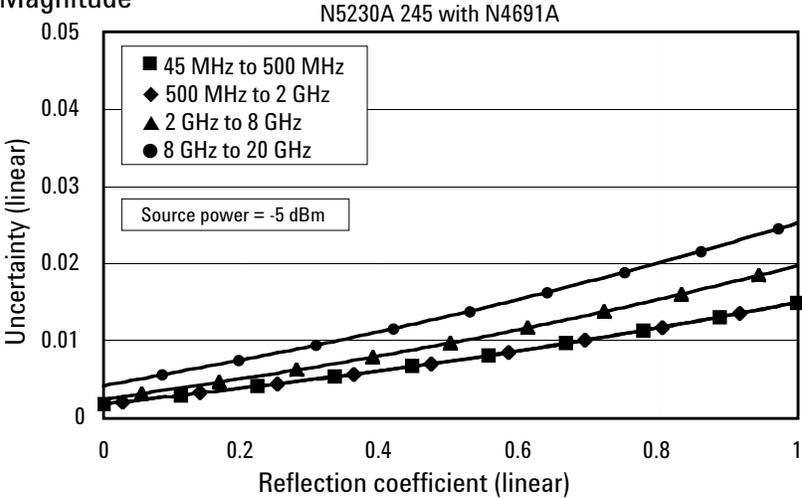
1. From 300 kHz to 10 MHz, performance is characterized as “typical”. To generate these typical values, please download our free Uncertainty Calculator from [www.agilent.com/find/na\\_calculator](http://www.agilent.com/find/na_calculator).

**N4691A Electronic calibration module (continued)**

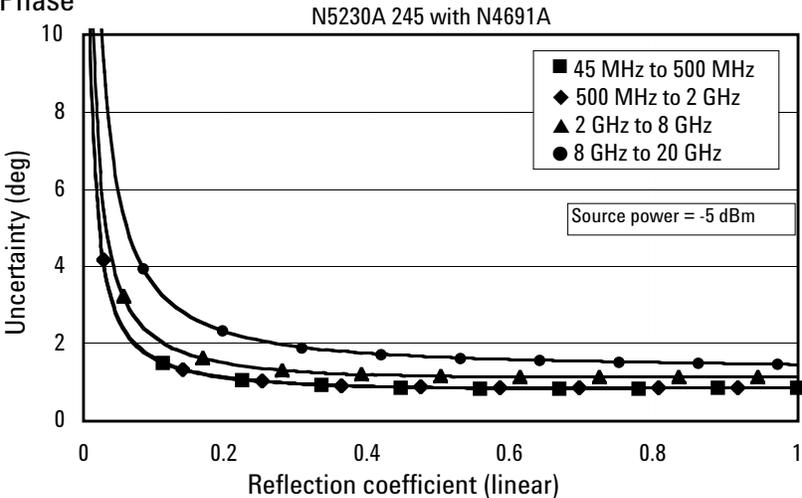
**N5230A – configurable test set and extended power range (Option 245)**

**Reflection uncertainty (specifications)**

**Magnitude**



**Phase**



**Table 5. Uncorrected system performance<sup>1</sup>**

<b>Directivity</b>	<b>Specifications</b>	<b>Typicals</b>
	<b>Options 240, 245</b>	<b>Options 240, 245</b>
300 kHz to 10 MHz		-23 dB
10 MHz to 1 GHz	-28 dB	
1 GHz to 3 GHz	-25 dB	
3 GHz to 5 GHz	-20 dB	
5 GHz to 11.5 GHz	-17 dB	
11.5 GHz to 20 GHz	-15 dB	

**Source match**

300 kHz to 10 MHz		-8 dB
10 MHz to 1 GHz	-12 dB	
1 GHz to 3 GHz	-12 dB	
3 GHz to 5 GHz	-12 dB	
5 GHz to 10.5 GHz	-12 dB	
10.5 GHz to 11.5 GHz	-10 dB	
11.5 GHz to 20 GHz	-8 dB	

**Load match**

300 kHz to 10 MHz		-9 dB
10 MHz to 1 GHz	-20 dB	
1 GHz to 3 GHz	-20 dB	
3 GHz to 5 GHz	-18 dB	
5 GHz to 11.5 GHz	-12 dB	
11.5 GHz to 16 GHz	-7 dB	
16 GHz to 20 GHz	-7.5 dB	

**Crosstalk<sup>2</sup>**

300 kHz to 5 MHz		-70 dB
5 MHz to 10 MHz		-100 dB
10 MHz to 45 MHz		-110 dB
45 MHz to 4 GHz		-122 dB
4 GHz to 6 GHz		-123 dB
6 GHz to 10.5 GHz		-120 dB
10.5 GHz to 15 GHz		-115 dB
15 GHz to 20 GHz		-110 dB

1. Specifications apply over environmental temperature of 25 °C ±5 °C with less than 1 °C variation from calibration temperature.
2. Measurement conditions: normalized to a thru, measured with two shorts, 10 Hz IF bandwidth, averaging factor of 8, alternate mode source power set to the lesser of the maximum power out or the maximum receiver power.

Table 6. Test port output<sup>1</sup>

Description	Specifications		Typicals	
	Option 240	Option 245	Option 240	Option245
<b>Frequency range</b>	300 KHz to 20 GHz			
<b>Nominal power</b>	-5 dB	-8 dB	Preset power; attenuator switch point 10 dB below nominal power	
<b>Frequency resolution</b>	1 Hz			
<b>CW accuracy</b>	±1 ppm			
<b>Frequency stability</b>			±0.05 ppm. -10° to 70° C ±0.1 ppm/yr maximum	

Description	Specifications		Typicals	
	Option 240	Option 245	Option 240	Option245
<b>Power level accuracy</b>	Variation from nominal power in range 0			
300 kHz to 10 MHz			±1.0 dB	±1.0dB
10 MHz to 2 GHz	±1.0 dB	±1.0 dB		
2 GHz to 10.5 GHz	±1.5 dB	±1.5 dB		
10.5 GHz to 20 GHz	±2.5 dB	±2.5 dB		
<b>Max leveled power</b>				
300 kHz to 10 MHz			+8 dBm	+8 dBm
10 MHz to 4 GHz	+8 dBm	+8 dBm	+12 dBm	+11 dBm
4 GHz to 6 GHz	+6 dBm	+6 dBm	+10 dBm	+9 dBm
6 GHz to 10.5 GHz	+3 dBm	+1 dBm	+8 dBm	+6 dBm
10.5 GHz to 15 GHz	0 dBm	-2 dBm	+5 dBm	+3 dBm
15 GHz to 20 GHz	-3 dBm	-8 dBm	+2 dBm	-1 dBm
<b>Power level linearity</b>	Specified on Port 1 only. Ports 2, 3, 4 performance is Typical. Test is at the nominal power level.			
300 kHz to 10 MHz			±2.0 dB	±2.0 dB
10 MHz to 1 GHz	±2.0 dB	±2.0 dB		
1 GHz to 20 GHz	±1.5 dB	±1.5 dB		
<b>Power sweep range (ALC)</b>	ALC range starts at maximum-leveled power and decreases by the dB amount specified here.			
300 kHz to 10 MHz			35 dB	35 dB
10 MHz to 4 GHz	33 dB	33 dB		
4 GHz to 6 GHz	31 dB	31 dB		
6 GHz to 10.5 GHz	28 dB	26 dB		
10.5 GHz to 15 GHz	25 dB	23 dB		
15 GHz to 20 GHz	22 dB	17 dB		
<b>Power resolution</b>	0.01 dB	0.01 dB		

Table 6. Test port output<sup>1</sup> (Continued)

Description	Specifications		Typicals	
	Option 240	Option 245	Option 240	Option245
<b>Power range</b>				
300 kHz to 10 MHz			-27 to +8 dBm	-87 to +8 dBm
10 MHz to 45 MHz			-27 to +12 dBm	-87 to +11 dBm
45 MHz to 4 GHz			-27 to +12 dBm	-87 to +11 dBm
4 GHz to 6 GHz			-27 to +10 dBm	-87 to +9 dBm
6 GHz to 10.5 GHz			-27 to +8 dBm	-87 to +6 dBm
10.5 GHz to 15 GHz			-27 to +5 dBm	-87 to +3 dBm
15 GHz to 20 GHz			-27 to +2 dBm	-87 to -1 dBm
<b>Power settings</b>				
Minimum power setting			-30 dBm	-90 dBm
Maximum power setting			+20 dBm	+20 dBm
<b>Harmonics (2nd or 3rd) at maximum output power</b>				
In-band source harmonics				
300 kHz to 10 MHz			-17 dBc	
10 MHz to 1 GHz			-17 dBc	
1 GHz to 20 GHz			-20 dBc	
<b>Non-harmonic spurious (at nominal output power)</b>				
300 kHz to 20 GHz			-50 dBc for offset frequency > 1 kHz	
<b>Typical performance</b>				
<b>Phase noise (Nominal power at test port)</b>				
	<b>10 kHz Offset</b>	<b>100 kHz Offset</b>	<b>1 MHz Offset</b>	
300 kHz to 10 MHz	-86 dBc/Hz	-86 dBc/Hz	-95 dBc/Hz	
10 MHz to 1.5 GHz	-86 dBc/Hz	-91 dBc/Hz	-95 dBc/Hz	
1.5 GHz to 3.125 GHz	-83 dBc/Hz	-91 dBc/Hz	-95 dBc/Hz	
3.125 GHz to 6.25 GHz	-77 dBc/Hz	-85 dBc/Hz	-89 dBc/Hz	
6.25 GHz to 12.5 GHz	-71 dBc/Hz	-79 dBc/Hz	-83 dBc/Hz	
12.5 GHz to 20 GHz	-65 dBc/Hz	-73 dBc/Hz	-77 dBc/Hz	

1. Performance specified on Port 1 only. Ports 2, 3, and 4 performance is a typical. Test reference is at the nominal power level.

Table 7: Test port input

Description	Specification		Typicals	
	Options 240, 245		Option 240, 245	
<b>Test port noise floor</b>				
Total average (rms) noise power calculated as the mean value of a linear magnitude trace expressed in dBm.				
<b>10 Hz IF bandwidth</b>				
300 kHz to 10 MHz				< -103 dBm
10 MHz to 500 MHz	< -112 dBm			< -116 dBm
500 MHz to 4 GHz	< -112 dBm			< -120 dBm
4 GHz to 10.5 GHz	< -112 dBm			< -119 dBm
10.5 GHz to 15 GHz	< -107 dBm			< -114 dBm
15 GHz to 20 GHz	< -106 dBm			< -114 dBm
<b>1 KHz IF bandwidth</b>				
300 kHz to 10 MHz				< -83 dBm
10 MHz to 500 MHz	< -92 dBm			< -96 dBm
500 MHz to 4 GHz	< -92 dBm			< -100 dBm
4 GHz to 10.5 GHz	< -92 dBm			< -99 dBm
10.5 GHz to 15 GHz	< -87 dBm			< -94 dBm
15 GHz to 20 GHz	< -86 dBm			< -94 dBm
<b>Direct receiver access input noise floor (Option 245 only)</b>				
Total average (rms) noise power calculated as the mean value of a linear magnitude trace expressed in dBm.				
<b>10 Hz IF bandwidth</b>				
300 kHz to 10 MHz				< -119 dBm
10 MHz to 500 MHz	< -128 dBm			< -132 dBm
500 MHz to 4 GHz	< -128 dBm			< -136 dBm
4 GHz to 10.5 GHz	< -128 dBm			< -135 dBm
10.5 GHz to 15 GHz	< -123 dBm			< -130 dBm
15 GHz to 20 GHz	< -122 dBm			< -130 dBm
<b>1 KHz IF bandwidth</b>				
300 kHz to 10 MHz				< -99 dBm
10 MHz to 500 MHz	< -108 dBm			< -112 dBm
500 MHz to 4 GHz	< -108 dBm			< -116 dBm
4 GHz to 10.5 GHz	< -108 dBm			< -115 dBm
10.5 GHz to 15 GHz	< -103 dBm			< -110 dBm
15 GHz to 20 GHz	< -102 dBm			< -110 dBm

Description	Specification		Typicals	
	Options 240, 245		Option 240, 245	
<b>Compression level (at +8 dBm except as noted)</b>				
	<b>Power</b>	<b>Compression</b>	<b>Power</b>	<b>Compression</b>
300 kHz to 10 MHz			+5 dBm	0.10 dB
10 MHz to 50 MHz	+8 dBm	0.35 dB		
50 MHz to 1 GHz	+8 dBm	0.35 dB		
1 GHz to 8 GHz	+8 dBm	0.25 dB		
8 GHz to 12.5 GHz	+8 dBm	0.30 dB		
12.5 GHz to 20 GHz	+8 dBm	0.55 dB		
<b>Test port compression at 0.1 dB</b>				
300 kHz to 10 MHz			+5 dBm	
10 MHz to 1 GHz			+9 dBm	
1 GHz to 12.5 GHz			+10 dBm	
12.5 GHz to 20 GHz			+9 dBm	

Table 7. Test port input (Continued)

Description	Specifications		Typicals	
	Option 240	Option 245	Option 240	Option245
<b>Trace noise magnitude</b>				
Ratioed measurement, nominal power at test port.				
<b>100 kHz IF bandwidth</b>				
300 kHz to 10 MHz			.015 dB rms.	.030 dB rms
10 MHz to 10.5 GHz	.006 dB rms	.008 dB rms	.004 dB rms.	.005 dB rms
10.5 GHz to 20 GHz	.010 dB rms	.014 dB rms	.007 dB rms.	.009 dB rms
<b>600 kHz IF bandwidth</b>				
300 kHz to 10 MHz			.015 dB rms.	.030 dB rms
10 MHz to 10.5 GHz			.013 dB rms.	.015 dB rms
10.5 GHz to 20 GHz			.017 dB rms.	.023 dB rms
<b>100 kHz IF bandwidth</b>				
Measured at maximum specified power				
300 kHz to 10 MHz			.005 dB rms.	.010 dB rms
10 MHz to 2 GHz			.001 dB rms.	.003 dB rms
2 GHz to 10.5 GHz			.002 dB rms.	.003 dB rms
10.5 GHz to 20 GHz			.006 dB rms.	.009 dB rms
<b>Trace noise phase</b>				
Ratioed measurement, nominal power at test port.				
<b>100 kHz IF bandwidth</b>				
300 kHz to 10 MHz			.110 deg rms.	.180 deg rms
10 MHz to 10.5 GHz	.05 deg rms	.07 deg rms	.025 deg rms.	.035 deg rms
10.5 GHz to 20 GHz	.08 deg rms	.10 deg rms	.050 deg rms.	.060 deg rms
<b>600 kHz IF bandwidth</b>				
300 kHz to 10 MHz			.110 deg rms.	.180 deg rms
10 MHz to 10.5 GHz			.080 deg rms.	.100 deg rms
10.5 GHz to 20 GHz			.120 deg rms.	.160 deg rms
<b>100 kHz IF bandwidth</b>				
Measured at maximum specified power				
300 kHz to 10 MHz			.040 deg rms.	.050 deg rms
10 MHz to 2 GHz			.007 deg rms.	.012 deg rms
2 GHz to 10.5 GHz			.012 deg rms.	.015 deg rms
10.5 GHz to 20 GHz			.040 deg rms.	.060 deg rms
<b>Reference level magnitude</b>				
Range	±200 dB	±200 dB		
Resolution	.001 dB	.001 dB		
<b>Reference level phase</b>				
Range	±500°	±550°		
Resolution	.01°	.01°		
<b>Stability magnitude</b>				
Stability as defined as a ratio measurement made at the test port.				
300 kHz to 10 MHz			±.015 dB/° C	
10 MHz to 2 GHz			±.010 dB/° C	
2 GHz to 4 GHz			±.015 dB/° C	
4GHz to 16 GHz			±.020 dB/° C	
16 GHz to 19 GHz			±.025 dB/° C	
19 GHz to 20 GHz			±.030 dB/° C	

**Table 7. Test port input (Continued)**

Description	Specifications		Typicals	
	Option 240	Option 245	Option 240	Option245
<b>Stability phase</b>				
Stability as defined as a ratio measurement made at the test port.				
300 kHz to 10 MHz			±.360 dB/° C	
10 MHz to 45 MHz			±.020 dB/° C	
45 MHz to 500 MHz			±.030 dB/° C	
500 MHz to 2 GHz			±.050 dB/° C	
2 GHz to 4 GHz			±.100 dB/° C	
4GHz to 8 GHz			±.150 dB/° C	
8 GHz to 16 GHz			±.300 dB/° C	
16 GHz to 20 GHz			±.350 dB/° C	

Description	Typicals	
	Option 240	Option245
<b>Damage input level</b>		
Test port 1, 2, 3, and 4	+27 dBm or ±16 VDC	+27 dBm or ±16 VDC
Receivers R, A, B, C, D		+15 dBm or ±16 VDC
Source out (reference)		+20 dBm or ±16 VDC
Source out (test ports)		+27 dBm or ±16 VDC
Coupler thru		+27 dBm or ±16 VDC
Coupler arm		+15 dBm or ±0 VDC

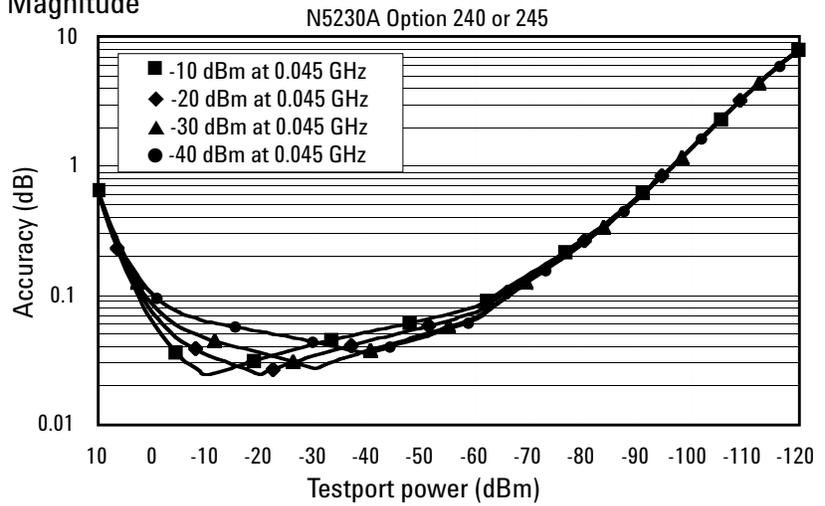
**Table 8. Dynamic Accuracy (specification)**

Accuracy of the test port input power reading relative to the reference input power level. Dynamic accuracy is verified with the following measurements:

- Compression over frequency
- IF linearity at a single frequency of 1.195 GHz using a reference level of  $-20$  dBm for an input power range of 0 to  $-110$  dBm

**Dynamic Accuracy 0.045 GHz**

**Magnitude**



**Phase**

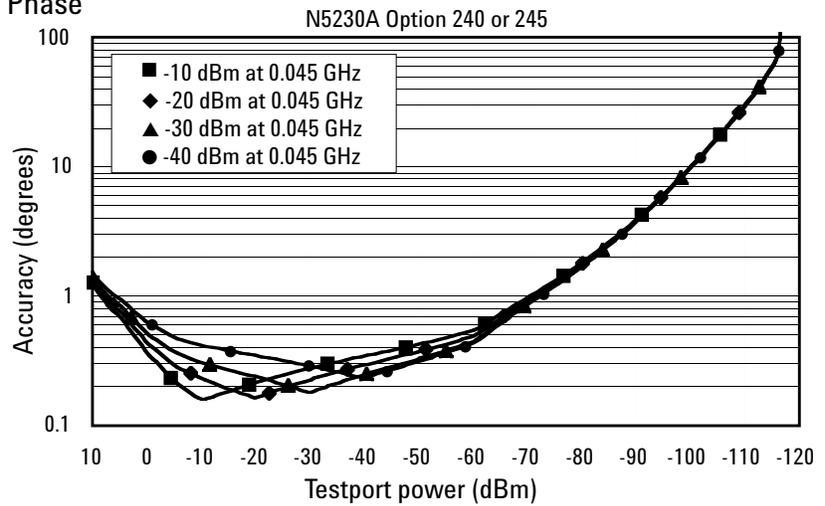
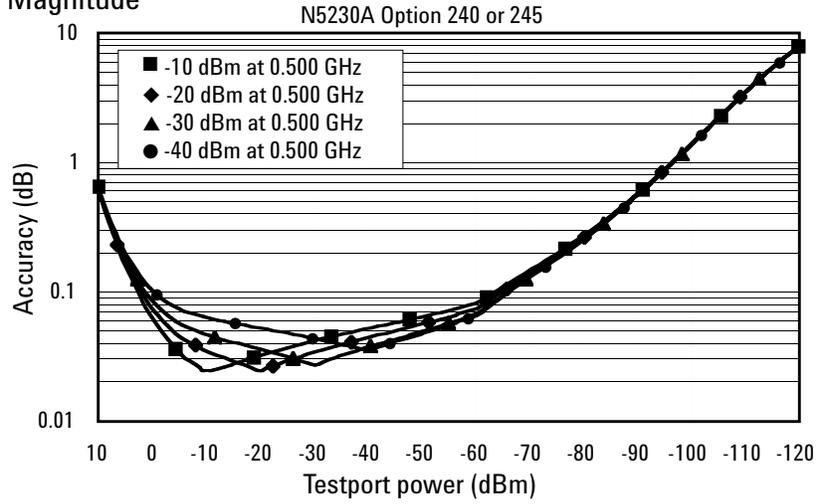


Table 8. Dynamic Accuracy (continued)

Dynamic Accuracy 0.500 GHz

Magnitude



Phase

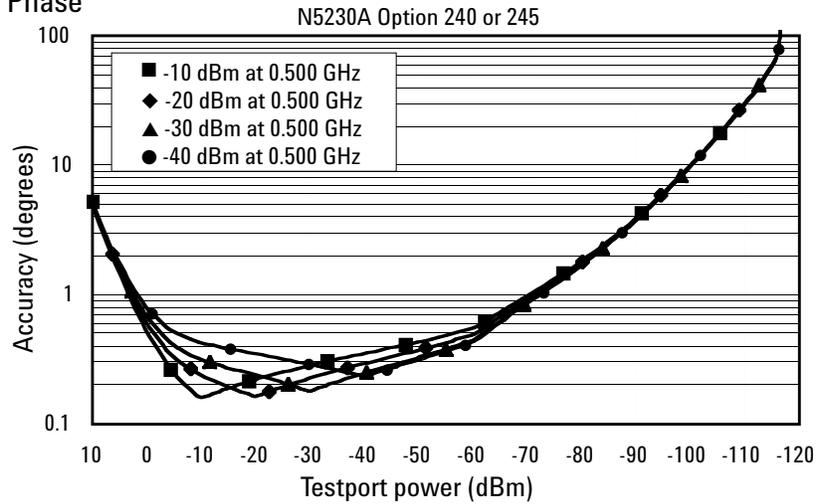
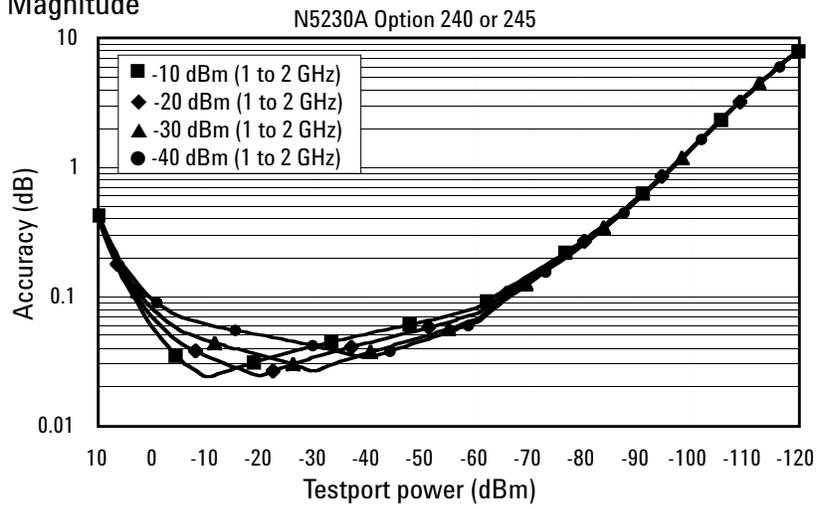


Table 8. Dynamic Accuracy (continued)

Dynamic Accuracy 1 to 2 GHz

Magnitude



Phase

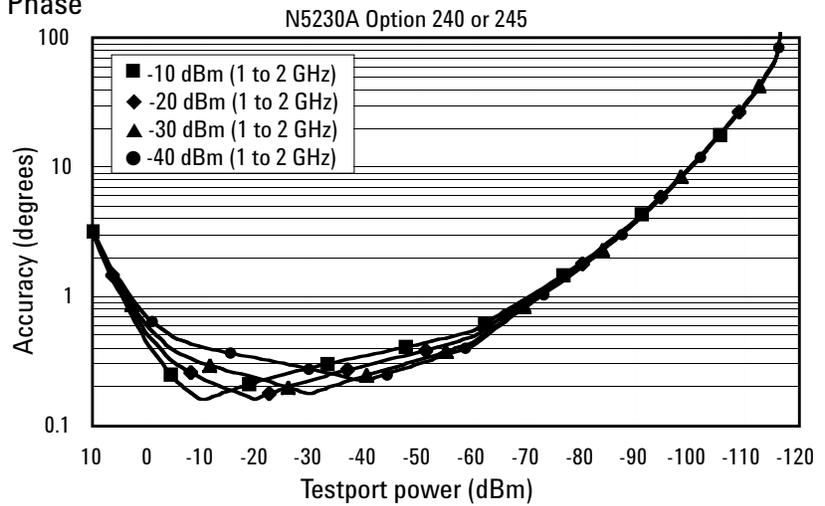
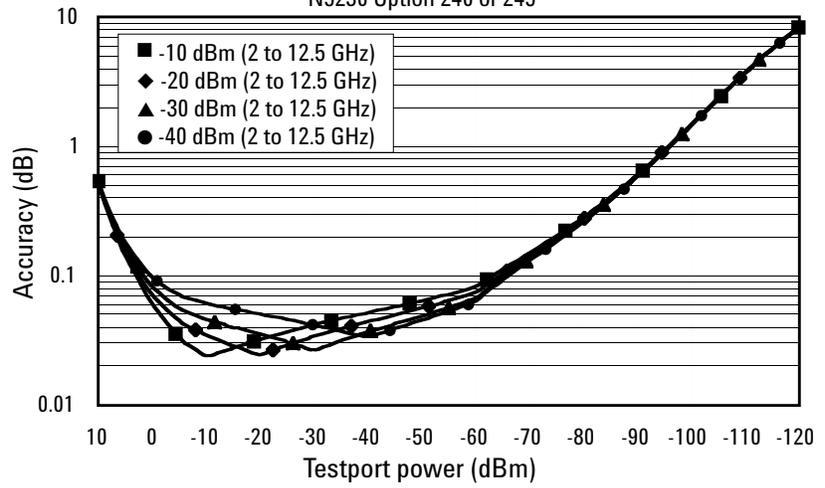


Table 8. Dynamic Accuracy (continued)

Dynamic Accuracy 2 to 12.5 GHz

Magnitude



Phase

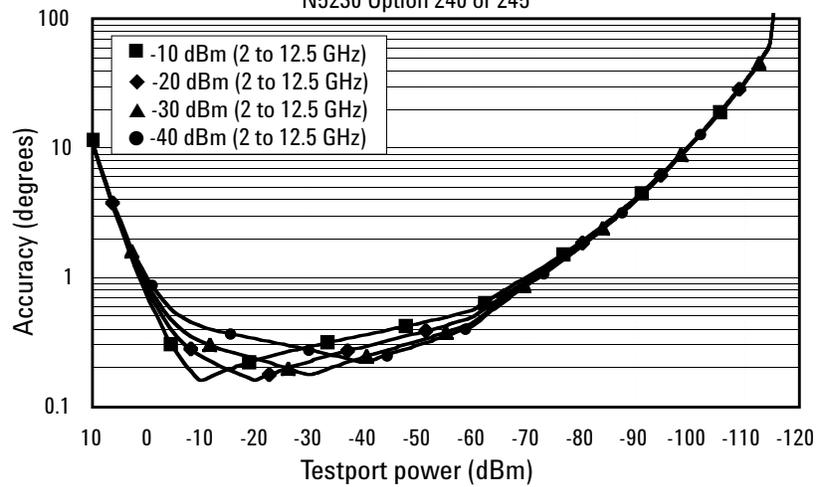
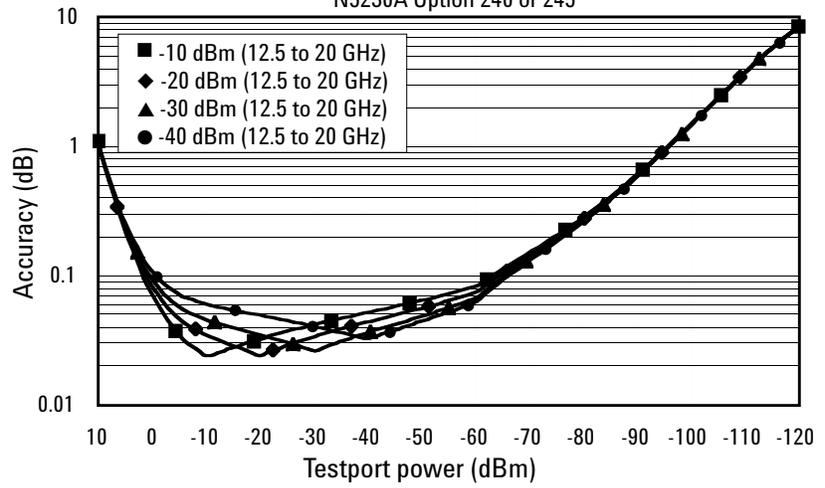


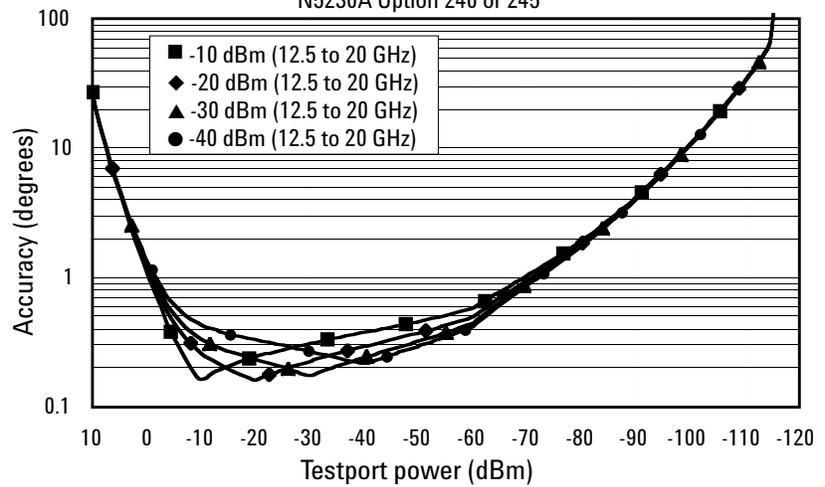
Table 8. Dynamic Accuracy (continued)

Dynamic Accuracy 12.5 to 20 GHz

Magnitude



Phase

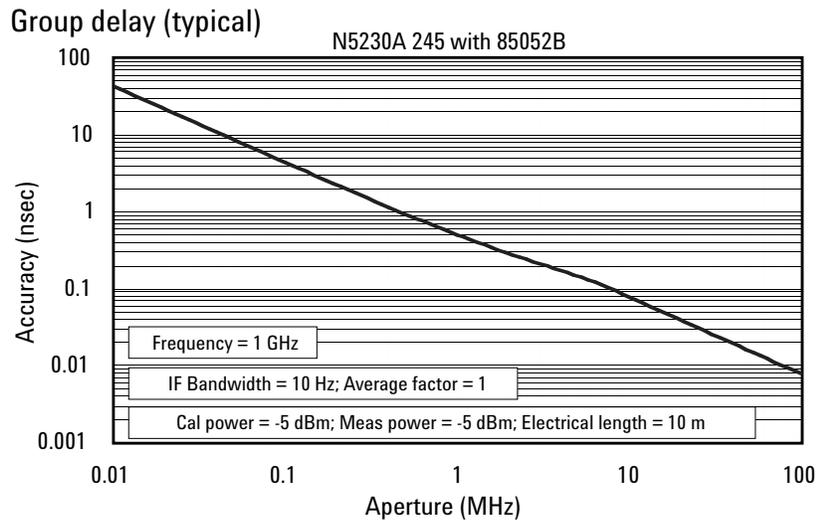


**Table 9. Test port input (group delay)<sup>1</sup>**

Description	Specification	Supplemental information (typ.)
Aperture (selectable)		(frequency span)/(number of points -1)
Maximum aperture		20% of frequency span
Range		0.5 x (1/minimum aperture)
Maximum delay		Limited to measuring no more than 180° of phase change within the minimum aperture
Accuracy		See graph below. Char.

The following graph shows characteristic group delay accuracy with 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.

For any  $S_{ij}$  group delay measurement,  $S_{ij} = 0$ ,  $S_{ij} = 0$ ,  $S_{kl} = 0$  for all  $kl \neq ij$



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

$$\pm \text{Phase Accuracy (deg)} / [360^\circ \text{ Aperture (Hz)}]$$

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

## General Information

Table 10. Miscellaneous information

Description	Specification	Supplemental information
System IF bandwidth range		1 Hz to 600 kHz, nominal
CPU		Intel® 500 MHz Pentium® III

Table 11. Front panel information

Description	Supplemental information
<b>RF connectors</b>	
Type	Option 240 or 245: 3.5 mm (male), 50 ohm, (nominal)
Center pin recession	0.002 in. (characteristic)
<b>Display</b>	
Size	21.3 cm (8.4 in) diagonal color active matrix LCD; 640 (horizontal) X 480 (vertical) resolution
Refresh rate	Vertical 59.83 Hz; Horizontal 31.41 kHz
<b>Display range</b>	
Magnitude	±500 dB (at 20 dB/div), max
Phase	±500°, max
Polar	10 pUnits, min 1000 Units, max
<b>Display resolution</b>	
Magnitude	0.001 dB/div, min
Phase	0.01°/div, min
<b>Marker resolution</b>	
Magnitude	0.001 dB, min
Phase	0.01°, min
Polar	0.01 mUnit, min; 0.01°, min

**Table 13. Rear panel information**

<b>Description</b>	<b>Supplemental information</b>
<b>10 MHz Reference in</b>	
Connector	BNC, female
Input frequency	10 MHz $\pm$ 10 ppm, typical
Input level	-15 dBm to +20 dBm, typical
Input impedance	200 $\Omega$ , nom.
<b>10 MHz Reference out</b>	
Connector	BNC, female
Output frequency	10 MHz $\pm$ 1 ppm, typical
Signal type	Sine Wave, typical
Output level	+10 dBm $\pm$ 4 dB into 50 $\Omega$ , typical
Output impedance	50 $\Omega$ , nominal
Harmonics	< -40 dBc, typical
<b>VGA Video output</b>	
Connector	15-pin mini D-Sub; Drives VGA compatible monitors
<b>Devices supported</b>	
	<b>Resolutions:</b>
Flat panel (TFT)	1024 X 768, 800 X 600, 640 X 480
Flat panel (DSTN)	800 X 600, 640 X 480
CRT monitor	1280 X 1024, 1024 X 768, 800 X 600, 640 X 480
	Simultaneous operation of the internal and external displays is allowed, but with 640 X 480 resolution only. If you change resolution, you can only view the external display (internal display will "white out").
<b>Test set IO</b>	
	25-pin D-Sub connector, female, available for external test set control
<b>Aux IO</b>	
	25-pin D-Sub connector, male, analog and digital IO
<b>Handler IO</b>	
	36-pin parallel I/O port; all input/output signals are default set to negative logic; can be reset to positive logic via GPIB command
<b>GPIB</b>	
	24-pin D-sub (Type D-24), female; compatible with IEEE-488.
<b>Parallel port (LPT1)</b>	
	25-pin D-Sub miniature connector, female; provides connection to printers or any other parallel port peripherals
<b>Serial Port (COM 1)</b>	
	9-pin D-Sub, male; compatible with RS-232
<b>USB Port</b>	
	One port on front panel and five ports on rear panel. Universal Serial Bus jack, Type A configuration (4 contacts inline, contact 1 on left); female
Contact 1	Vcc: 4.75 to 5.25 VDC, 500 mA, maximum
Contact 2	-Data
Contact 3	+Data
Contact 4	Ground
<b>LAN</b>	
	10/100BaseT Ethernet, 8-pin configuration; auto selects between the two data rates
<b>Line power</b> A third-wire ground is required.	
Frequency	50/60/400 Hz
Voltage	120/240 VAC (Power supply is auto switching.)
Max	500 Watts

**Note:** Option H08 and Option H11 are not available with the N5230A network analyzer.

**Table 13. Analyzer environment and dimensions**

Description	Supplemental information
<b>General environmental</b>	
RFI/EMI susceptibility	Defined by CISPR Pub. 11, Group 1, Class A, and IEC 50082-1
ESD	Minimize by using static-safe work procedures and an antistatic bench mat
Dust	Minimize for optimum reliability
<b>Operating environment</b>	
Temperature	0 °C to +40 °C
	Instrument powers up and displays no error messages within this temperature range (except for "source unlevelled" error message that may occur at temperatures outside the specified performance temperature range of 25 ± 5 °C).
Error-corrected temperature range	23 °C ± 3 °C with less than 1 °C deviation from calibration temp.
Humidity	5% to 95% at +40 °C
Altitude	0 to 4500 m (14,760 ft.)
<b>Non-operating storage environment</b>	
Temperature	-40 °C to +70 °C
Humidity	0% to 90% at +65 °C (non-condensing)
Altitude	0 to 4500 m (14,760 ft.)
<b>Cabinet dimensions</b>	
	<b>Height    Width    Depth</b>
Excluding front and rear panel hardware and feet	267 mm    426 mm    427 mm 10.5 in    16.75    16.8 in
As shipped - includes front panel connectors, rear panel bumpers, and feet.	280 mm    435 mm    470 mm 11 in    17.10 in    18.5 in
As shipped plus handles	280 mm    458 mm    501 mm 11 in    18 in    19.7 in
As shipped plus rack-mount flanges	280 mm    483 mm    470 mm 11 in    19 in    18.5 in
As shipped plus handles and rack-mount flanges	280 mm    483 mm    501 mm 11 in    19 in    19.7 in
<b>Weight</b>	
Net	
N5230A	24.9 kg (55 lb), nominal
Shipping	
N5230A	36.3 kg (80 lb), nominal

# Measurement Throughput Summary

Table 14. Typical cycle time<sup>1</sup> (ms) for measurement completion

	Number of Points				
	201	401	801	1601	16,001
<b>Start 8 GHz, stop 18 GHz, 600 kHz IF bandwidth</b>					
Uncorrected	26.2	26.7	27.6	29.2	76.5
4-Port cal	93.0	104.1	125.2	164.0	939.6
<b>Start 300 kHz, stop 10 GHz, 600 kHz IF bandwidth</b>					
Uncorrected	24.8	28.0	30.4	35.0	91.8
4-Port cal	87.5	109.0	134.6	180.5	990.8
<b>Start 300 kHz, stop 20 GHz, 600 kHz IF bandwidth</b>					
Uncorrected	38.3	40.2	43.6	46.6	93.8
4-Port cal	140.2	158.3	190.0	224.2	1012.3
<b>Start 8 GHz, stop 18 GHz, 100 kHz IF bandwidth</b>					
Uncorrected	43.1	56.9	60.9	62.1	193.4
4-Port cal	160.4	222.2	248.8	274.5	1291.1
<b>Start 300 kHz, stop 10 GHz, 100 kHz IF bandwidth</b>					
Uncorrected	41.8	48.3	51.1	53.7	209.9
4-Port cal	155.1	180.0	214.2	260.5	1362.7
<b>Start 300 kHz, stop 20 GHz, 100 kHz IF bandwidth</b>					
Uncorrected	51.4	76.4	94.0	99.8	211.4
4-Port cal	190.3	292.4	379.8	419.8	1378.7
<b>Start 8 GHz, stop 18 GHz, 50 kHz IF bandwidth</b>					
Uncorrected	47.1	75.1	94.6	97.3	380.9
4-Port cal	171.6	290.1	381.0	410.0	1894.4
<b>Start 300 kHz, stop 10 GHz, 50 kHz IF bandwidth</b>					
Uncorrected	49.1	67.2	72.7	75.9	395.1
4-Port cal	180.0	261.4	293.1	330.6	1941.2
<b>Start 300 kHz, stop 20 GHz, 50 kHz IF bandwidth</b>					
Uncorrected	54.9	87.1	131.2	154.4	396.3
4-Port cal	207.0	337.7	523.9	633.6	1948.2

1. Includes sweep time, retrace time and band-crossing time. Analyzer display turned off with DISPLAY:ENABLE OFF. Add 21 ms for display on. Data for one trace (S<sub>11</sub>) measurement.

**Table 15. Cycle Time vs IF Bandwidth**

Applies to the preset condition (201 points, correction off) except for the following changes:

- CF = 10 GHz
- Span = 100 MHz
- Display off (add 21 ms for display on)

<b>Description</b>	<b>Typical performance</b>	
<b>IF Bandwidth (Hz)</b>	<b>Cycle time (ms)<sup>1</sup></b>	<b>Trace noise</b>
600,000	7.523394495	0.003533948
360,000	7.54179941	0.002688865
280,000	7.5703125	0.002287365
200,000	7.71344	0.002102872
150,000	7.762206897	0.001696417
100,000	7.806733333	0.001284263
70,000	7.874966555	0.001170092
50,000	9.076777778	0.000987238
30,000	11.46182377	0.0008445
20,000	14.72636574	0.000647383
15,000	17.5863125	0.000534657
10,000	28.64310448	0.000477914
7000	37.16706481	0.000439644
5000	48.58746512	0.000350175
3000	72.52639344	0.00030881
2000	102.2277778	0.000279538
1500	130.7245	0.00015128
1000	218.5535	0.000154337
700	294.1385333	0.000135211
500	399.9245455	0.000125675
300	636.411	0.000103409
200	932.7632	
100	1826.966667	
30	6004.446	
10	17903.564	
1	178398.611	

1. Cycle time includes sweep and retrace time.

**Table 16. Cycle time vs number of points<sup>1</sup>**

Applies to the preset condition (correction off) except for the following changes:

- CF = 10 GHz
- Span = 100 MHz
- Display off (add 21 ms for display on)

<b>IF Bandwidth (Hz)</b>	<b>Number of points</b>	<b>Cycle time (ms)<sup>2</sup></b>
30,000	3	6.7
	11	7.4
	51	6.9
	101	7.8
	201	11.2
	401	18.3
	801	32.4
	1,601	59.4
	6,401	224.7
	16,001	556.9
100,000	3	6.7
	11	6.6
	51	6.8
	101	7
	201	7.5
	401	9
	801	13.5
	1,601	22.9
	6,401	75.3
	16,001	180.3
600,000	3	6.5
	11	6.6
	51	6.8
	101	6.9
	201	7.3
	401	8.1
	801	9.4
	1,601	12
	6,401	27.7
	16,001	59.3

1. Cycle time includes sweep and retrace time.

**Table 17. Data transfer time (ms)<sup>1</sup>**

	<b>Number of points</b>			
	201	401	1601	16,001
<b>SCPI over GPIB (program executed on external PC)</b>				
32-bit floating point	7	12	43	435
64-bit floating point	12	22	84	856
ASCII	64	124	489	5054
<b>SCPI (program executed in the analyzer)</b>				
32-bit floating point	1	2	3	30
64-bit floating point	2	2	4	40
ASCII	29	56	222	2220
<b>COM (program executed in the analyzer)</b>				
32-bit floating point	< 0.4	0.4	0.5	1.9
Variant type	0.7	1	3	32
<b>DCOM over LAN (program executed on external PC)</b>				
32-bit floating point	< 0.8	1	1.5	7.1
Variant type	1.8	2.7	8.5	80

**Note:** Specifications for recall and sweep speed are not provided for the N5230A analyzers.

## Specifications: Front-Panel Jumpers

**Table 18: Measurement receiver inputs (rcvr A In, rcvr B In, rcvr C in, rcvr D in)  
0.1 dB Typical compression**

Description	Specification	Typical Option 245
<b>Maximum input level</b>		
300 kHz to 10 MHz		-11 dBm
10 MHz to 1 GHz		-7 dBm
1 GHz to 12.5 GHz		-6 dBm
12.5 GHz to 20 GHz		-7 dBm
<b>Damage level</b>		
N5230A		+15 dBm
<b>Maximum DC level</b>		
N5230A		±16 V

**Table 19: Reference receiver input (rcvr in)  
at maximum specified output power**

Description	Specification	Typical Option 245
<b>Maximum input level</b>		
300 kHz to 10 MHz		-15 dBm
10 MHz to 45 MHz		-15 dBm
45 MHz to 500 MHz		-15 dBm
500 MHz to 4 GHz		-15 dBm
4 GHz to 6 GHz		-16 dBm
6 GHz to 10.5 GHz		-20 dBm
10.5 GHz to 15 GHz		-21 dBm
15 GHz to 20 GHz		-27 dBm
<b>Damage level</b>		
N5230A		+15 dBm
<b>Maximum DC level</b>		
N5230A		±16 V

**Table 20: Reference output (source out)  
at maximum specified output power**

Description	Specification	Typical Option 245
<b>Maximum output level</b>		
300 kHz to 10 MHz		-15 dBm
10 MHz to 45 MHz		-15 dBm
45 MHz to 500 MHz		-15 dBm
500 MHz to 4 GHz		-15 dBm
4 GHz to 6 GHz		-15 dBm
6 GHz to 10.5 GHz		-20 dBm
10.5 GHz to 15 GHz		-21 dBm
15 GHz to 20 GHz		-27 dBm
<b>Damage level</b>		
N5230A		+27 dBm
<b>Maximum DC level</b>		
N5230A		±16 V

**Table 21: Source outputs (port 1 source out, port 2 source out, port 3 source out, port 4 source out) at maximum specified output power**

Description	Specification	Typical Option 245
<b>Maximum output level</b>		
300 kHz to 10 MHz		+10 dBm
10 MHz to 45 MHz		+10 dBm
45 MHz to 500 MHz		+10 dBm
500 MHz to 4 GHz		+10 dBm
4 GHz to 6 GHz		+9 dBm
6 GHz to 10.5 GHz		+4 dBm
10.5 GHz to 15 GHz		+1 dBm
15 GHz to 20 GHz		-4 dBm
<b>Damage level</b>		
N5230A		+27 dBm
<b>Maximum DC level</b>		
N5230A		±16 V

**Table 22: Coupler inputs (port 1 cplr thru, port 2 cplr thru, port 3 cplr thru, port 4 cplr thru) Insertion loss of coupler thru**

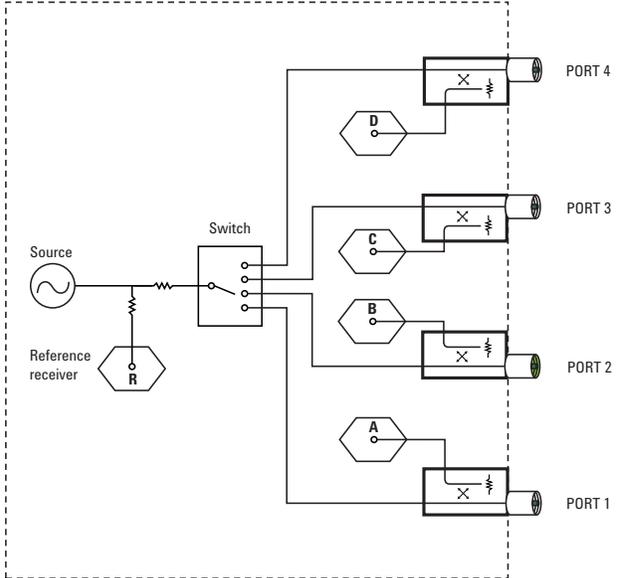
Description	Specification	Typical Option 245
<b>Insertion loss to test port</b>		
300 kHz to 10 MHz		1.5 dB
10 MHz to 45 MHz		1.5 dB
45 MHz to 500 MHz		1.5 dB
500 MHz to 4 GHz		2.0 dB
4 GHz to 6 GHz		2.5 dB
6 GHz to 10.5 GHz		2.5 dB
10.5 GHz to 15 GHz		3.0 dB
15 GHz to 20 GHz		3.0 dB
<b>Damage level</b>		
N5230A		+27 dBm
<b>Maximum DC level</b>		
N5230A		±16 V

**Table 23: Coupler outputs (port 1 cplr arm, port 2 cplr arm, port 3 cplr arm, port 4 cplr arm)**

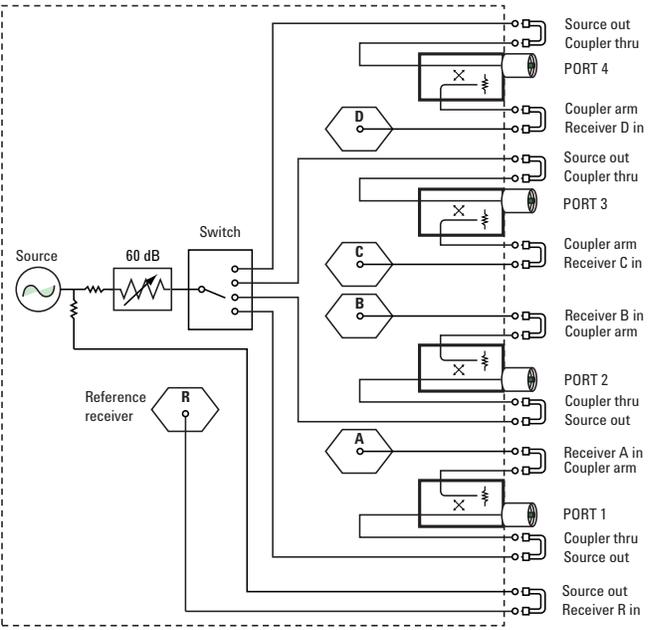
Description	Specification	Typical Option 245
<b>Damage level</b>		
N5230A		+15 dBm
<b>Maximum DC level</b>		
N5230A		0 V

# Test Set Block Diagrams

## N5230A Option 240 (standard test set and standard power range) network analyzer



## N5230A Option 245 (configurable test set and extended power range) network analyzer



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(tel) 0800 047 866  
(fax) 0800 286 331

##### Other Asia Pacific

##### Countries:

(tel) (65) 6375 8100  
(fax) (65) 6755 0042

Email: [tm\\_ap@agilent.com](mailto:tm_ap@agilent.com)

Contacts revised: 05/27/05

**The complete list is available at:**  
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