

# Keysight 2-Port and 4-Port PNA-X Network Analyzer

N5244B – 900 Hz to 43.5 GHz

N5245B – 900 Hz to 50.0 GHz

Data Sheet and  
Technical  
Specifications

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This is a complete list of the technical specifications for the N5244B and N5245B with the following options:

**Option 029**, adds hardware and firmware for high-accuracy noise figure measurements. It requires one of Option 22x or 42x. [See the block diagram.](#)

**Option 201**, 2-port standard test set (includes six front-panel access loops) and power range. Figure 1. 2-Port N5244B and N5245B Base Unit Option 201

**Option 217**, 2-port standard test set (includes six front-panel access loops), power range, and source and receiver attenuators (extended power range). [below.](#)

**Option 219**, 2-port standard test set (includes six front-panel access loops), power range, source and receiver attenuators (extended power range), and bias-tees. [See the block diagram.](#)

**Option 222**, 2-port standard test set (includes six front-panel access loops), power range, source and receiver attenuators (extended power range), internal second source, a combiner, and mechanical switches to the 2-port analyzer. [below.](#)

**Option 224**, 2-port standard test set (includes six front-panel access loops), power range, source and receiver attenuators (extended power range), internal second source, a combiner, mechanical switches to the 2-port analyzer, and bias tees. [See the block diagram.](#)

**Option 401**, 4-port standard test set (includes twelve front-panel access loops), power range, and an internal second source (Option 080 recommended). [below.](#)

**Option 417**, 4-port standard test set (includes twelve front-panel access loops), power range, internal second source (Option 080 recommended), and source and receiver attenuators (extended power range). [below.](#)

**Option 419**, 4-port standard test set (includes twelve front-panel access loops), power range, internal second source (Option 080 recommended), and source and receiver attenuators (extended power range), and bias-tees. [See the block diagram.](#)

**Option 422**, 4-port standard test set (includes six front-panel access loops), power range, source and receiver attenuators (extended power range), internal second source, a combiner, and mechanical switches to the 4-port analyzer. [below.](#)

**Option 423**, 4-port standard test set (includes six front-panel access loops), power range, source and receiver attenuators (extended power range), internal second source, a combiner, mechanical switches to the 4-port analyzer, and bias tees. [See the block diagram.](#)

**Option 425**, (N5245B only) 4-port configurable test set, source and receiver attenuators, internal second source, combiner, mechanical switches, and low frequency extension (LFE). [See the block diagram.](#)

## Notes

[The Corrected System Performance with Cal Kits](#) and [Dynamic Accuracy Charts](#) apply ONLY to N5244B/45B models with serial numbers starting with MY5244/45, SG5244/45, and US5244/45, and above. This document provides technical specifications for the 85056A calibration kit, and the N4693A 2-Port ECal module. Please download our free Uncertainty Calculator from [http://www.keysight.com/find/na\\_calculator](http://www.keysight.com/find/na_calculator) to generate the curves for your calibration kit and PNA setup.

For all tables in this data sheet, the specified performance at the exact frequency of a break is the degraded value of the two specifications at that frequency.



## Definitions

All specifications and characteristics apply over a  $25\text{ °C} \pm 5\text{ °C}$  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.

**Supplemental performance data (SPD):** Represents the value of a parameter that is most likely to occur; the expected mean or average.

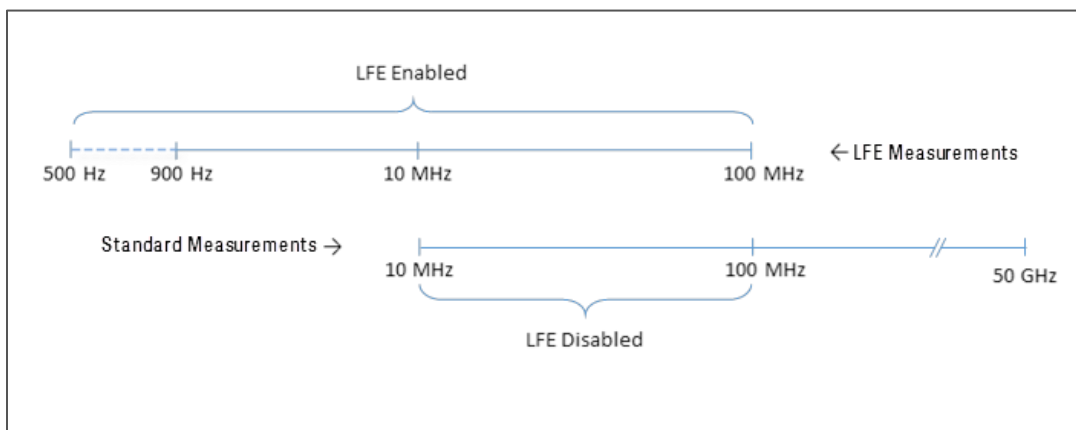
**Calibration:** The process of measuring known standards to characterize a network analyzer's systematic (repeatable) errors.

**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.

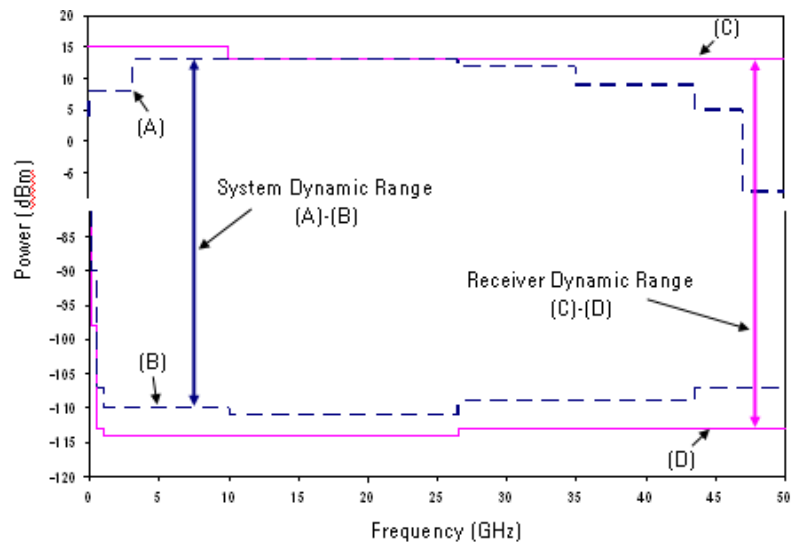
**Standard and LFE measurements:** With option 425, which adds low frequency extension (LFE) hardware, the LFE measurement range overlaps with the standard measurement range from 10 MHz to 100 MHz. With LFE Enabled, measurements from 500 Hz to 100 MHz use LFE hardware. With LFE Disabled, measurements from 10 MHz to 100 MHz use standard hardware. To measure below 10 MHz, LFE must be enabled. All measurements above 100 MHz use standard hardware, regardless of the LFE Enabled/Disabled setting.



## Dynamic Range

The specifications in this section apply for measurements made with the N5244B and N5245B analyzer with the following conditions:

- 10 Hz IF bandwidth
  - No averaging applied to data
  - Isolation calibration with an averaging factor of 8
  - Source in filtered mode where applicable
- 
- **System Dynamic Range** is defined as the measured source maximum output power (A) minus the measured noise floor (B).
  - **Extended Dynamic Range at Direct Access Input** is defined as the system dynamic range (typical) less the nominal loss associated with the test port coupler.
  - **Receiver Dynamic Range** is defined as the typical test port 0.1 dB compression (C) minus the typical noise floor (D).



## System Dynamic Range

Table 1a. System Dynamic Range at Test Port (dB), Options 201 or 401

Description	Specification		Typical	
	Ports <sup>1,2</sup> 1, 3	Ports <sup>1</sup> 2, 4	Ports <sup>1,2</sup> 1, 3	Ports <sup>1</sup> 2, 4
10 MHz to 50 MHz	91	89	97	97
50 MHz to 100 MHz	107	106	113	114
100 MHz to 500 MHz	113	113	125	127
500 MHz to 1 GHz	130	131	136	138
1 GHz to 2 GHz	132	134	139	141
2 GHz to 3.2 GHz	129	132	136	140
3.2 GHz to 10 GHz	133	131	140	138
10 GHz to 16 GHz	130	128	138	136
16 GHz to 20 GHz	129	129	136	137
20 GHz to 26.5 GHz	130	130	138	138
26.5 GHz to 30 GHz	125	126	133	133
30 GHz to 32 GHz	126	127	134	134
32 GHz to 35 GHz	127	128	134	135
35 GHz to 40 GHz	123	122	131	130
40 GHz to 43.5 GHz	122	122	130	130
43.5 GHz to 47 GHz	122	122	131	131
47 GHz to 50 GHz	112	113	124	124

<sup>1</sup> Either port can be used as the source port. Any other port can be used as the receiver port.

<sup>2</sup> System Dynamic Range measured in High Power Mode.

Table 1b. System Dynamic Range at Test Port (dB), Options 21x or 41x

Description	Specification		Typical (dB)	
	Ports <sup>1,2</sup> 1, 3	Ports <sup>1</sup> 2, 4	Ports <sup>1,2</sup> 1, 3	Ports <sup>1</sup> 2, 4
10 MHz to 50 MHz	88	90	96	97
50 MHz to 100 MHz	106	106	113	113
100 MHz to 500 MHz	114	114	126	127
500 MHz to 1 GHz	128	130	135	137
1 GHz to 2 GHz	131	133	138	140
2 GHz to 3.2 GHz	125	131	133	138
3.2 GHz to 10 GHz	130	131	138	137
10 GHz to 16 GHz	129	129	138	137
16 GHz to 20 GHz	127	128	136	136
20 GHz to 26.5 GHz	129	129	137	137
26.5 GHz to 30 GHz	123	123	131	131
30 GHz to 32 GHz	122	123	131	131
32 GHz to 35 GHz	123	123	132	131
35 GHz to 40 GHz	115	117	125	126
40 GHz to 43.5 GHz	115	116	125	125
43.5 GHz to 47 GHz	115	116	125	126
47 GHz to 50 GHz	104	103	118	118

<sup>1</sup> Either port can be used as the source port. Any other port can be used as the receiver port.

<sup>2</sup> System Dynamic Range measured in High Power Mode.

Table 1c. System Dynamic Range at Test Port (dB), Option 22x

Description	Specification		Typical (dB)	
	Source 2 Out 1 <sup>1</sup>	Source 2 Out 2	Source 2 Out 1 <sup>1</sup>	Source 2 Out 2
10 MHz to 50 MHz	90	89	97	97
50 MHz to 100 MHz	106	106	113	114
100 MHz to 500 MHz	112	113	125	126
500 MHz to 1 GHz	128	128	135	137
1 GHz to 2 GHz	132	135	139	142
2 GHz to 3.2 GHz	129	132	136	140
3.2 GHz to 10 GHz	133	133	140	141
10 GHz to 16 GHz	134	132	141	140
16 GHz to 20 GHz	132	132	139	140
20 GHz to 26.5 GHz	134	135	141	142
26.5 GHz to 30 GHz	128	129	136	136
30 GHz to 32 GHz	129	129	137	137
32 GHz to 35 GHz	130	130	137	137
35 GHz to 40 GHz	125	127	133	134
40 GHz to 43.5 GHz	123	126	132	134
43.5 GHz to 47 GHz	124	125	133	134
47 GHz to 50 GHz	116	118	127	129

<sup>1</sup> System Dynamic Range measured in High Power Mode.

Table 1d. System Dynamic Range at Test Port (dB), Options 22x, 422, or 423

Description	Specification		Typical			
	Ports <sup>1,2</sup> 1, 3	Ports <sup>1</sup> 2, 4	Ports <sup>1,2</sup> 1, 3	Ports <sup>1</sup> 2, 4	Source 1 Port 1 Combine Mode	Source 2 Port 1 Combine Mode
10 MHz to 50 MHz	90	89	97	97	82	83
50 MHz to 100 MHz	107	106	113	114	97	97
100 MHz to 500 MHz	114	114	126	127	104	104
500 MHz to 1 GHz	129	130	135	137	118	118
1 GHz to 2 GHz	131	132	138	140	120	120
2 GHz to 3.2 GHz	127	130	134	138	120	121
3.2 GHz to 10 GHz	132	130	138	136	124	123
10 GHz to 16 GHz	131	129	138	136	121	121
16 GHz to 20 GHz	128	128	136	136	117	117
20 GHz to 26.5 GHz	129	129	136	136	117	117
26.5 GHz to 30 GHz	124	123	131	131	114	113
30 GHz to 32 GHz	123	123	130	130	114	113
32 GHz to 35 GHz	124	124	131	131	114	113
35 GHz to 40 GHz	119	118	126	126	110	108
40 GHz to 43.5 GHz	119	118	126	126	110	108
43.5 GHz to 47 GHz	117	118	125	126	107	103
47 GHz to 50 GHz	109	107	118	118	96	92

<sup>1</sup> Either port can be used as the source port. Any other port can be used as the receiver port.

<sup>2</sup> System Dynamic Range measured in High Power Mode.

Table 1e. System Dynamic Range at Test Port (dB), Options (22x, 422, or 423) with 029<sup>1</sup>

Description	Specification		Typical			
	Port 1 <sup>2</sup>	Port 2	Port 1 <sup>2</sup>	Port 2	Source 1 Port 1 Combine Mode	Source 2 Port 1 Combine Mode
10 MHz to 50 MHz	91	91	97	98	80	81
50 MHz to 100 MHz	108	108	114	115	95	95
100 MHz to 500 MHz	115	116	126	128	102	102
500 MHz to 1 GHz	129	131	135	138	116	116
1 GHz to 2 GHz	131	133	138	140	118	118
2 GHz to 3.2 GHz	127	132	134	139	118	118
3.2 GHz to 10 GHz	131	130	137	137	122	121
10 GHz to 16 GHz	130	128	137	136	118	118
16 GHz to 20 GHz	126	127	134	135	116	116
20 GHz to 26.5 GHz	128	129	135	135	116	116
26.5 GHz to 30 GHz	122	122	129	129	114	113
30 GHz to 32 GHz	122	122	129	129	114	113
32 GHz to 35 GHz	123	123	129	130	114	113
35 GHz to 40 GHz	116	117	124	124	109	108
40 GHz to 43.5 GHz	115	116	123	124	109	108
43.5 GHz to 47 GHz	115	115	123	123	105	103
47 GHz to 50 GHz	106	104	116	116	93	89

<sup>1</sup> Option 029 affects system dynamic range with port 1 or port 2 as the source port. Refer to Table 1c and 1d for the system dynamic range with port 3 or port 4 as the source port. Port 1 impedance tuner switch is in bypass position and port 2 noise receiver switch is in normal position.

<sup>2</sup> System Dynamic Range measured in High Power Mode.

Table 1f. System Dynamic Range at Test Port (dB), Option 425

Description	Specification		Typical			
	Ports <sup>2,3</sup> 1, 3	Ports <sup>3</sup> 2, 4	Ports <sup>2,3</sup> 1, 3	Ports <sup>3</sup> 2, 4	Source 1 Port 1 Combine Mode	Source 2 Port 1 Combine Mode
10 MHz to 50 MHz <sup>1</sup>	84	82	91	90	75	75
50 MHz to 100 MHz <sup>1</sup>	104	103	110	110	92	92
100 MHz to 500 MHz	110	110	122	124	99	99
500 MHz to 1 GHz	126	128	133	135	113	113
1 GHz to 2 GHz	131	132	138	140	118	118
2 GHz to 3.2 GHz	127	130	134	138	118	119
3.2 GHz to 10 GHz	130	128	137	135	122	121
10 GHz to 16 GHz	129	126	137	135	119	119
16 GHz to 20 GHz	126	126	134	135	116	116
20 GHz to 26.5 GHz	128	127	136	135	116	116
26.5 GHz to 30 GHz	122	121	130	129	112	111
30 GHz to 32 GHz	121	123	130	130	112	111
32 GHz to 35 GHz	123	124	131	131	112	111
35 GHz to 40 GHz	117	117	125	126	111	111
40 GHz to 43.5 GHz	117	117	126	126	111	111
43.5 GHz to 47 GHz	114	117	124	126	106	106
47 GHz to 50 GHz	105	108	117	119	95	95

<sup>1</sup> With Option 425 installed and LFE disabled, applied to frequencies  $\leq$  100 MHz. Above 100 MHz, performance is the same for both LFE enabled or disabled. For LFE enabled performance  $\leq$  100 MHz, see Table 1f.

<sup>2</sup> System Dynamic Range measured in High Power Mode.

<sup>3</sup> Either port can be used as the source port. Any other port can be used as the receiver port.



Table 1g. System Dynamic Range at Test Port (dB), Option 425 (LFE Enabled)

Description	Specification		Typical	
	Ports 1, 3	Ports 2, 4	Ports 1, 3	Ports 2, 4
500 Hz to 900 Hz	--	--	105	105
900 Hz to 1 kHz	100	102	109	110
1 kHz to 10 kHz	103	105	110	111
10 kHz to 100 kHz	113	115	120	121
100 kHz to 1 MHz	120	121	124	125
1 MHz to 5 MHz	121	122	126	127
5 MHz to 10 MHz	112	114	118	119
10 MHz to 50 MHz	110	112	116	117
50 MHz to 100 MHz	110	112	116	117

Table 1h. System Dynamic Range at Test Port (dB), Option 425 (LFE Enabled), Combine Mode - Typical

Description	Source 1 Port 1	Source 2 Port 1
500 Hz to 900 Hz	99	98
900 Hz to 1 kHz	103	102
1 kHz to 10 kHz	104	103
10 kHz to 100 kHz	104	103
100 kHz to 1 MHz	118	118
1 MHz to 5 MHz	119	119
5 MHz to 10 MHz	111	110
10 MHz to 50 MHz	111	110
50 MHz to 100 MHz	111	110

Table 1i. System Dynamic Range at Test Port (dB), Option 425 with 029

Description	Specification		Typical			
	Port <sup>2</sup> 1	Port 2	Port <sup>2</sup> 1	Port 2	Source 1 Port 1 Combine Mode	Source 2 Port 1 Combine Mode
10 MHz to 50 MHz <sup>1</sup>	83	82	90	90	74	74
50 MHz to 100 MHz <sup>1</sup>	103	103	109	110	91	91
100 MHz to 500 MHz	109	110	121	124	98	98
500 MHz to 1 GHz	126	127	133	134	113	113
1 GHz to 2 GHz	131	131	138	139	118	118
2 GHz to 3.2 GHz	127	129	134	137	118	119
3.2 GHz to 10 GHz	130	127	137	134	122	121
10 GHz to 16 GHz	127	125	135	134	117	117
16 GHz to 20 GHz	124	125	132	134	114	114
20 GHz to 26.5 GHz	126	126	134	134	114	114
26.5 GHz to 30 GHz	120	120	128	128	110	109
30 GHz to 32 GHz	119	122	128	129	110	109
32 GHz to 35 GHz	121	123	129	130	110	109
35 GHz to 40 GHz	115	116	123	125	109	109
40 GHz to 43.5 GHz	115	116	124	125	109	109
43.5 GHz to 47 GHz	112	116	122	125	104	104
47 GHz to 50 GHz	103	107	115	118	93	93

<sup>1</sup> With Option 425 installed and LFE disabled, applied to frequencies  $\leq$  100 MHz. Above 100 MHz, performance is the same for both LFE enabled or disabled. For LFE enabled performance  $\leq$  100 MHz, see Table 1g.

<sup>2</sup> System Dynamic Range measured in High Power Mode.

## Extended Dynamic Range

Table 2a. Extended Dynamic Range at Direct Receiver Access Input (dB) - Typical

Description	Options 201, 401		Options 21x, 41x	
	Ports <sup>1</sup> 1, 3	Ports <sup>1</sup> 2, 4	Ports <sup>1</sup> 1, 3	Ports <sup>1</sup> 2, 4
10 MHz to 50 MHz	141	141	140	141
50 MHz to 100 MHz	143	144	143	143
100 MHz to 500 MHz	145	147	146	147
500 MHz to 1 GHz	156	158	155	157
1 GHz to 2 GHz	154	156	153	155
2 GHz to 3.2 GHz	151	155	148	153
3.2 GHz to 10 GHz	155	153	153	152
10 GHz to 16 GHz	153	151	153	152
16 GHz to 20 GHz	151	152	151	151
20 GHz to 26.5 GHz	152	152	151	151
26.5 GHz to 30 GHz	147	147	145	145
30 GHz to 32 GHz	148	148	145	145
32 GHz to 35 GHz	148	149	146	145
35 GHz to 40 GHz	145	144	139	140
40 GHz to 43.5 GHz	142	142	137	137
43.5 GHz to 47 GHz	143	143	137	138
47 GHz to 50 GHz	136	136	130	130

<sup>1</sup>Either port can be used as the source port. Any other port can be used as the receiver port.

Table 2b. Extended Dynamic Range at Direct Receiver Access Input (dB) – Typical

Description	Options 22x or 42x (except 425)				Options 22x or 42x (except 425)	
	Source 2 Out 1	Source2 Out 2	Ports <sup>1</sup> 1, 3	Ports <sup>1</sup> 2, 4	Source 1 Port 1 Combine Mode	Source 2 Port 1 Combine Mode
10 MHz to 50 MHz	141	141	141	141	117	118
50 MHz to 100 MHz	143	144	143	144	117	117
100 MHz to 500 MHz	145	146	146	147	124	124
500 MHz to 1 GHz	155	157	155	157	139	139
1 GHz to 2 GHz	154	157	153	155	140	140
2 GHz to 3.2 GHz	151	155	149	153	132	133
3.2 GHz to 10 GHz	155	156	153	151	136	135
10 GHz to 16 GHz	156	155	153	151	133	133
16 GHz to 20 GHz	154	155	151	151	129	129
20 GHz to 26.5 GHz	155	156	150	150	129	129
26.5 GHz to 30 GHz	150	150	145	145	124	123
30 GHz to 32 GHz	151	151	144	144	124	123
32 GHz to 35 GHz	151	151	145	145	124	123
35 GHz to 40 GHz	147	148	140	140	120	118
40 GHz to 43.5 GHz	144	146	138	138	120	118
43.5 GHz to 47 GHz	145	146	137	138	117	113
47 GHz to 50 GHz	139	141	130	130	106	102

<sup>1</sup>Either port can be used as the source port. Any other port can be used as the receiver port.

Table 2c. Extended Dynamic Range at Direct Receiver Input (dB), Options 422 or 423 with 029<sup>1</sup> - Typical

Description	Options 22x or 42x with 029 <sup>1</sup>		Options 22x or 42x with 029 <sup>1</sup>	
	Port 1	Port 2	Source 1 Port 1 Combine Mode	Source 2 Port 1 Combine Mode
10 MHz to 50 MHz	141	142	115	116
50 MHz to 100 MHz	144	145	115	115
100 MHz to 500 MHz	146	148	122	122
500 MHz to 1 GHz	155	158	137	137
1 GHz to 2 GHz	153	155	138	138
2 GHz to 3.2 GHz	149	154	130	130
3.2 GHz to 10 GHz	152	152	134	133
10 GHz to 16 GHz	152	151	130	130
16 GHz to 20 GHz	149	150	128	128
20 GHz to 26.5 GHz	149	149	128	128
26.5 GHz to 30 GHz	143	143	124	123
30 GHz to 32 GHz	143	143	124	123
32 GHz to 35 GHz	143	144	124	123
35 GHz to 40 GHz	138	138	119	118
40 GHz to 43.5 GHz	135	136	119	118
43.5 GHz to 47 GHz	135	135	115	113
47 GHz to 50 GHz	128	128	103	99

<sup>1</sup> Option 029 affects system dynamic range with port 1 or port 2 as the source port. Refer to Table 2b for the extended dynamic range with port 3 or port 4 as the source port. Port 1 impedance tuner switch is in bypass position and port 2 noise receiver switch is in normal position.

Table 2d. Extended Dynamic Range at Direct Receiver Access Input (dB), Option 425 - Typical

Description	Option 425	
	Ports <sup>1</sup> 1, 3	Ports <sup>1</sup> 2, 4
10 MHz to 50 MHz	135	134
50 MHz to 100 MHz	140	140
100 MHz to 500 MHz	142	144
500 MHz to 1 GHz	153	155
1 GHz to 2 GHz	153	155
2 GHz to 3.2 GHz	149	153
3.2 GHz to 10 GHz	152	150
10 GHz to 16 GHz	152	150
16 GHz to 20 GHz	149	150
20 GHz to 26.5 GHz	150	149
26.5 GHz to 30 GHz	144	143
30 GHz to 32 GHz	144	144
32 GHz to 35 GHz	145	145
35 GHz to 40 GHz	139	140
40 GHz to 43.5 GHz	138	138
43.5 GHz to 47 GHz	136	138
47 GHz to 50 GHz	129	131

<sup>1</sup> Either port can be used as the source port. Any other port can be used as the receiver port.

Table 2e. Extended Dynamic Range at Direct Receiver Access Input (dB), Option 425 with 029 - Typical

Description	Option 425 with 029	
	Port 1	Port 2
10 MHz to 50 MHz	134	134
50 MHz to 100 MHz	139	140
100 MHz to 500 MHz	141	144
500 MHz to 1 GHz	153	154
1 GHz to 2 GHz	153	154
2 GHz to 3.2 GHz	149	152
3.2 GHz to 10 GHz	152	149
10 GHz to 16 GHz	150	149
16 GHz to 20 GHz	147	149
20 GHz to 26.5 GHz	148	148
26.5 GHz to 30 GHz	142	142
30 GHz to 32 GHz	142	143
32 GHz to 35 GHz	143	144
35 GHz to 40 GHz	137	139
40 GHz to 43.5 GHz	136	137
43.5 GHz to 47 GHz	132	137
47 GHz to 50 GHz	127	130

## Receiver Dynamic Range

Table 3a. Receiver Dynamic Range (dB), All Options

Description	Typical
10 MHz to 50 MHz <sup>1</sup>	91
50 MHz to 100 MHz <sup>1</sup>	106
100 MHz to 500 MHz	113
500 MHz to 1 GHz	127
1 GHz to 2 GHz	129
2 GHz to 3.2 GHz	129
3.2 GHz to 10 GHz	129
10 GHz to 16 GHz	127
16 GHz to 20 GHz	127
20 GHz to 26.5 GHz	127
26.5 GHz to 30 GHz	126
30 GHz to 32 GHz	126
32 GHz to 35 GHz	126
35 GHz to 40 GHz	126
40 GHz to 43.5 GHz	126
43.5 GHz to 47 GHz	126
47 GHz to 50 GHz	126

<sup>1</sup> With Option 425 installed and LFE disabled, applied to frequencies  $\leq$  100 MHz. Above 100 MHz, performance is the same for both LFE enabled or disabled.

Table 3b. Receiver Dynamic Range (dB), All Ports, Option 425 (LFE Enabled)

Description	Typical
500 Hz to 900 Hz	106
900 Hz to 1 kHz	109
1 kHz to 10 kHz	109
10 kHz to 100 kHz	118
100 kHz to 1 MHz	123
1 MHz to 5 MHz	123
5 MHz to 10 MHz	119
10 MHz to 50 MHz	120
50 MHz to 100 MHz	120



## Corrected System Performance, All Options

Specifications are valid for temperatures of  $23^{\circ}\pm 3^{\circ}\text{C}$  and  $< 1^{\circ}\text{C}$  deviation from the calibration temperature. Specifications assume an N4697F flexible test port cable and a full 2-port calibration. For instruments with Option 029, the port 1 noise tuner switch is set to the bypass position, and the port 2 noise receiver switch is set to the normal position.

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

- $S_{jj} = 0$ .

For any  $S_{ij}$  transmission measurement:

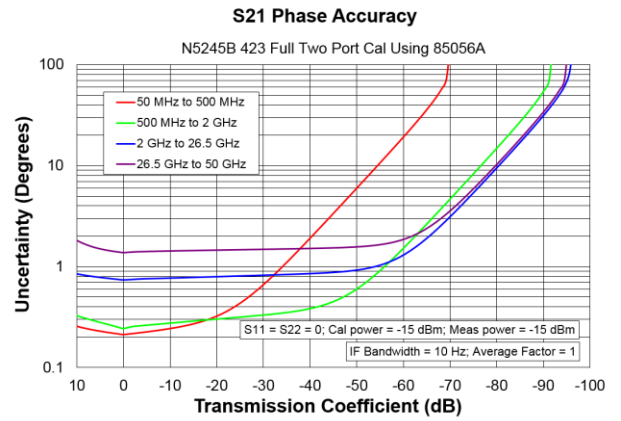
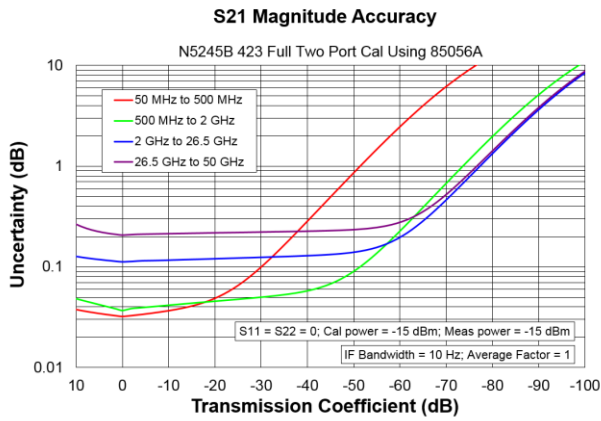
- $S_{ji} = S_{ij}$  when  $S_{ij} \leq 1$
- $S_{ji} = 1/S_{ij}$  when  $S_{ij} > 1$
- $S_{kk} = 0$  for all  $k$

Please download our free Uncertainty Calculator from [http://www.keysight.com/find/na\\_calculator](http://www.keysight.com/find/na_calculator) for specifications for other calibration kits and measurement setups.

Table 4a. 85056A Calibration Kit

Description	Specification (dB)						
	10 MHz to 50 MHz	50 MHz to 2 GHz	2 GHz to 10 GHz	10 GHz to 20 GHz	20 GHz to 30 GHz	30 GHz to 40 GHz	40 GHz to 50 GHz
Directivity	41	41	41	41	37	37	35
Source Match	41	41	37	37	33	33	31
Load Match	41	41	41	41	37	37	35
<b>Reflection Tracking</b>							
Mag	$\pm 0.0015$	$\pm 0.0015$	$\pm 0.0082$	$\pm 0.0082$	$\pm 0.021$	$\pm 0.021$	$\pm 0.028$
Phase ( $^{\circ}$ )	$\pm 0.0093$	$\pm 0.0093$	$\pm 0.055$	$\pm 0.055$	$\pm 0.14$	$\pm 0.14$	$\pm 0.19$
<b>Transmission Tracking</b>							
Mag	$\pm 0.061$	$\pm 0.069$	$\pm 0.089$	$\pm 0.079$	$\pm 0.15$	$\pm 0.15$	$\pm 0.20$
Phase ( $^{\circ}$ )	$\pm 0.41$	$\pm 0.46$	$\pm 0.59$	$\pm 0.52$	$\pm 1.0$	$\pm 1.0$	$\pm 1.4$

## Transmission Uncertainty



## Reflection Uncertainty

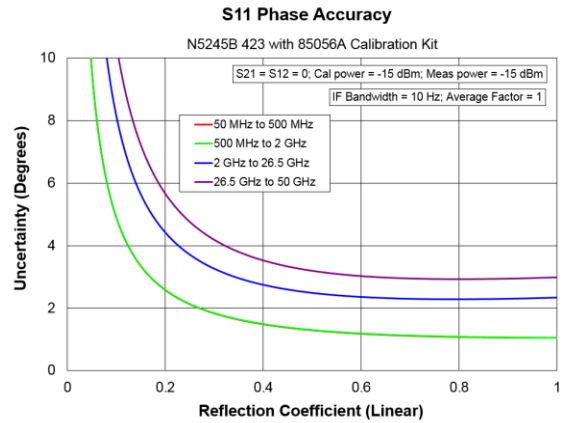
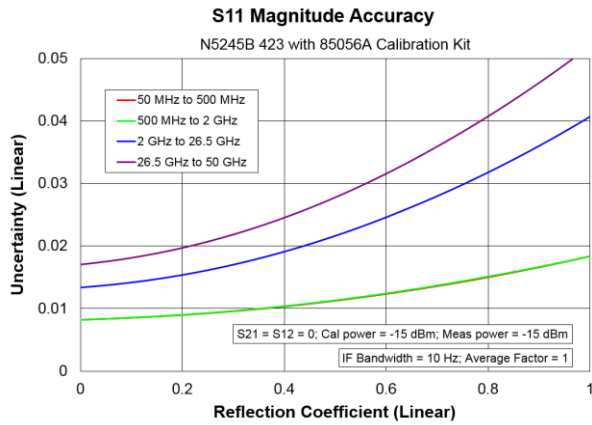
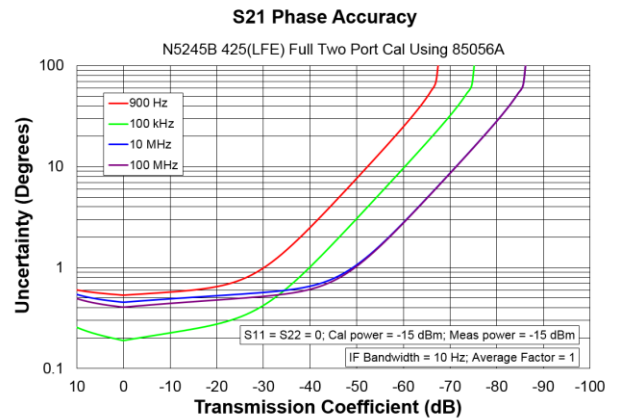
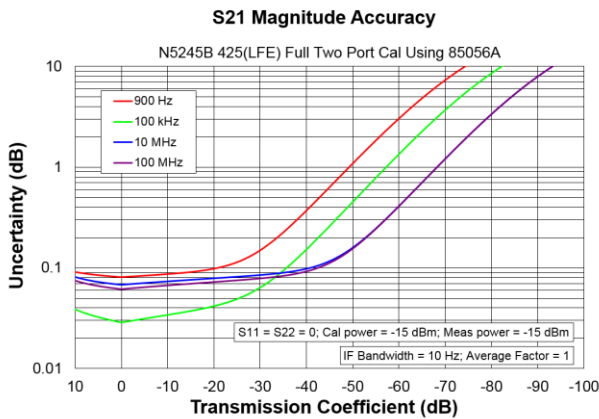


Table 4b. 85056A Calibration Kit, LFE Enabled (Option 425)

Description	Specification (dB)				
	1 kHz to 10 kHz	10 kHz to 1 MHz	1 MHz to 5 MHz	5 MHz to 50 MHz	50 MHz to 100 MHz
Directivity	41	41	41	41	41
Source Match	41	41	41	41	41
Load Match	41	41	41	41	41
<b>Reflection Tracking</b>					
Mag	±0.0015	±0.0015	±0.0015	±0.0015	±0.0015
Phase (°)	±0.0093	±0.0093	±0.0093	±0.0093	±0.0093
<b>Transmission Tracking</b>					
Mag	±0.065	±0.021	±0.046	±0.061	±0.055
Phase (°)	±0.43	±0.14	±0.31	±0.41	±0.36

**Transmission Uncertainty, Option 425**



**Reflection Uncertainty, Option 425**

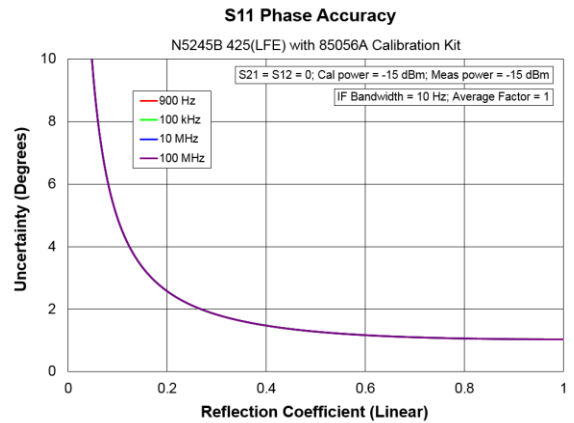
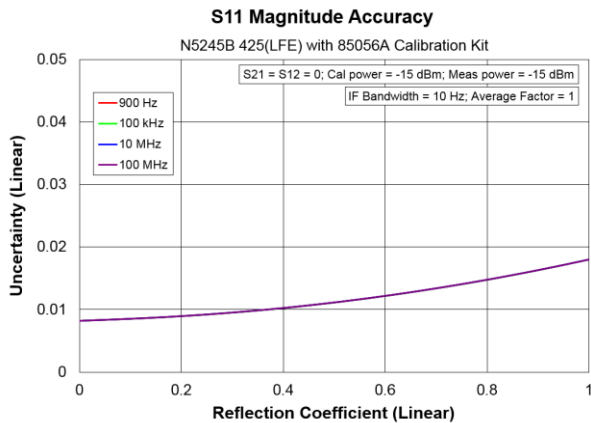
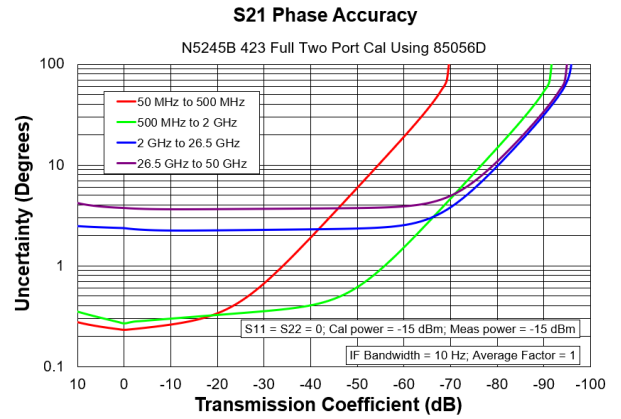
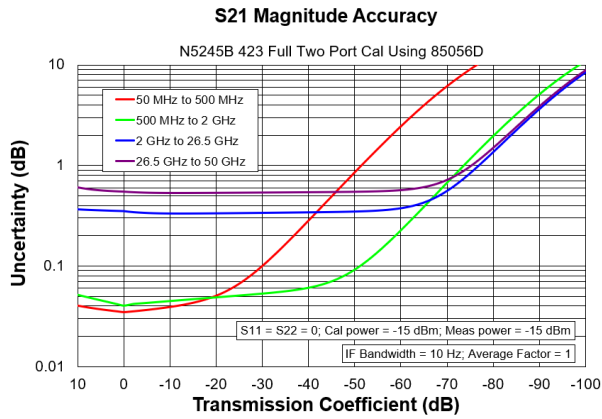


Table 4c. 85056D Calibration Kit

Description	Specification (dB)						
	10 MHz to 50 MHz	50 MHz to 2 GHz	2 GHz to 10 GHz	10 GHz to 20 GHz	20 GHz to 30 GHz	30 GHz to 40 GHz	40 GHz to 50 GHz
Directivity	41	41	33	33	25	25	25
Source Match	39	39	30	30	23	23	23
Load Match	41	41	33	33	25	25	25
<b>Reflection Tracking</b>							
Mag	±0.0025	±0.0025	±0.029	±0.029	±0.080	±0.080	±0.075
Phase (°)	±0.016	±0.016	±0.19	±0.19	±0.53	±0.53	±0.50
<b>Transmission Tracking</b>							
Mag	±0.051	±0.030	±0.095	±0.12	±0.46	±0.46	±0.50
Phase (°)	±0.34	±0.20	±0.63	±0.79	±3.2	±3.2	±3.4

## Transmission Uncertainty



## Reflection Uncertainty

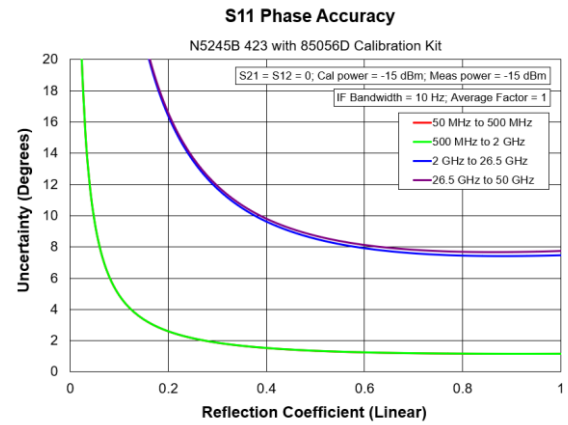
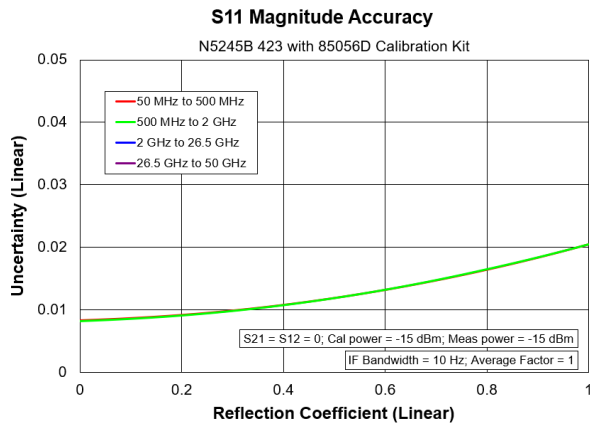
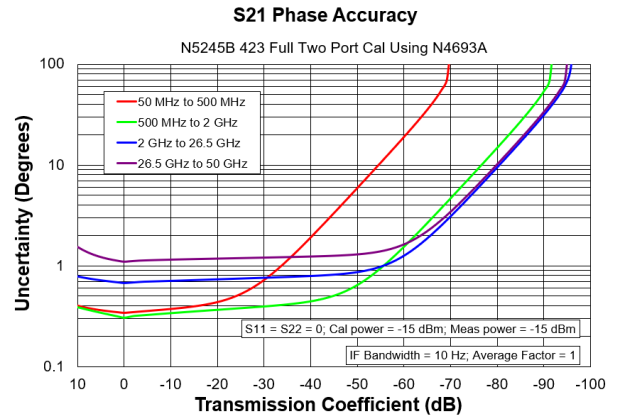
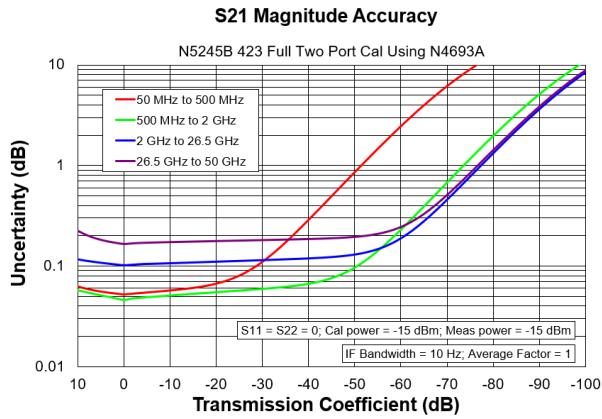


Table 5a. N4693A Calibration Kit

Description	Specification (dB)						
	10 MHz to 50 MHz	50 MHz to 2 GHz	2 GHz to 10 GHz	10 GHz to 20 GHz	20 GHz to 30 GHz	30 GHz to 40 GHz	40 GHz to 50 GHz
Directivity	32	42	49	45	41	41	36
Source Match	25	44	42	37	35	35	32
Load Match	24	43	40	36	33	33	30
<b>Reflection Tracking</b>							
Mag	±0.051	±0.031	±0.041	±0.051	±0.061	±0.061	±0.081
Phase (°)	±0.34	±0.20	±0.27	±0.34	±0.40	±0.40	±0.54
<b>Transmission Tracking</b>							
Mag	±0.12	±0.041	±0.047	±0.064	±0.095	±0.095	±0.15
Phase (°)	±0.79	±0.28	±0.31	±0.43	±0.63	±0.63	±0.94

## Transmission Uncertainty



## Reflection Uncertainty

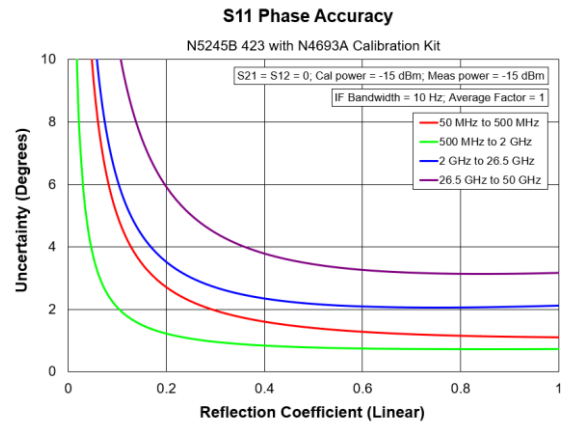
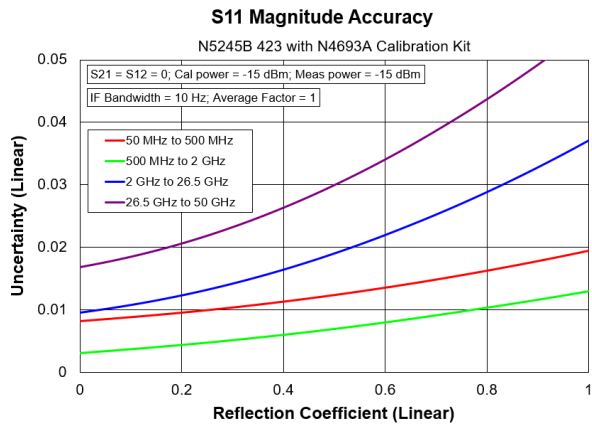
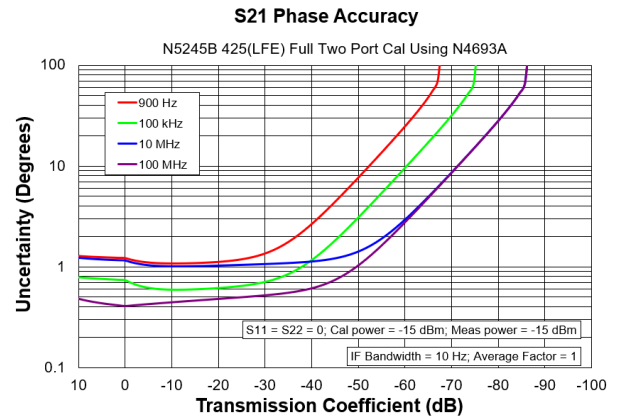
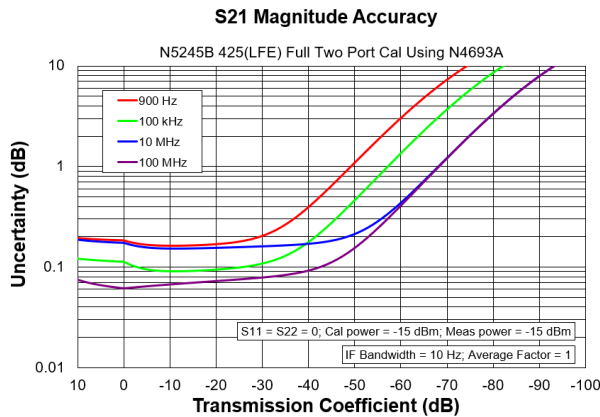


Table 5b. N4693A Calibration Kit, LFE Enabled (Option 425)

Description	Specification (dB)				
	1 kHz to 10 kHz	10 kHz to 1 MHz	1 MHz to 5 MHz	5 MHz to 50 MHz	50 MHz to 100 MHz
Directivity	32	32	32	32	42
Source Match	25	25	25	25	44
Load Match	24	24	24	24	42
<b>Reflection Tracking</b>					
Mag	±0.051	±0.051	±0.051	±0.051	±0.031
Phase (°)	±0.34	±0.34	±0.34	±0.34	±0.20
<b>Transmission Tracking</b>					
Mag	±0.15	±0.075	±0.12	±0.14	±0.055
Phase (°)	±0.98	±0.50	±0.74	±0.91	±0.36

**Transmission Uncertainty, Option 425**



**Reflection Uncertainty, Option 425**

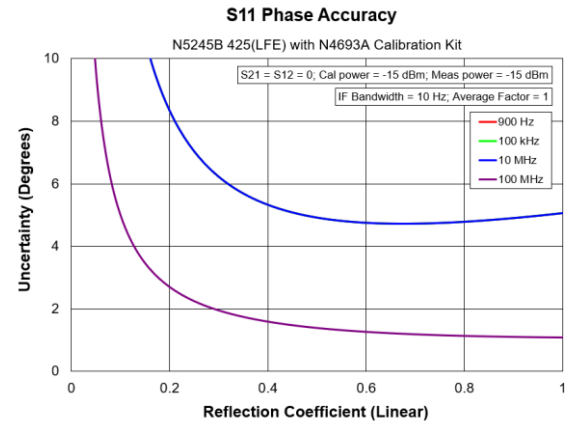
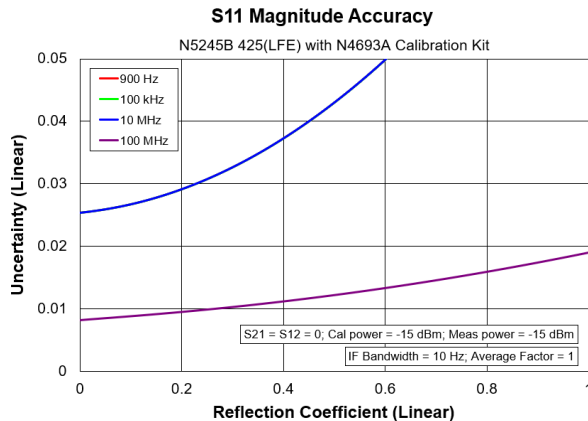
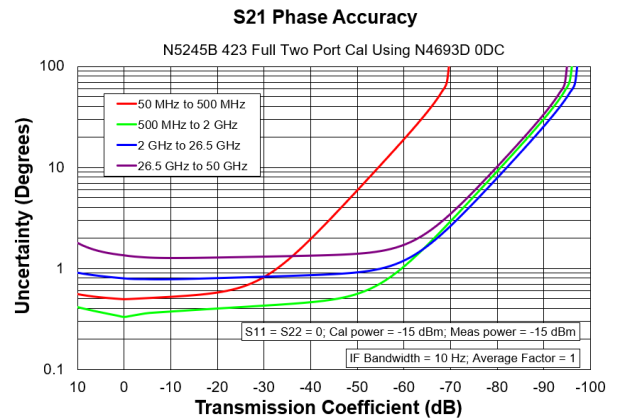
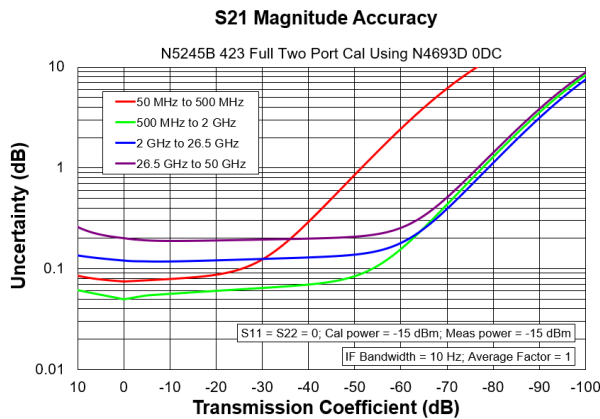




Table 5c. N4693D Calibration Kit

Description	Specification (dB)						
	10 MHz to 50 MHz	50 MHz to 2 GHz	2 GHz to 10 GHz	10 GHz to 20 GHz	20 GHz to 30 GHz	30 GHz to 40 GHz	40 GHz to 50 GHz
Directivity	40	40	47	44	38	38	34
Source Match	38	44	42	37	35	35	32
Load Match	36	42	40	36	33	33	30
<b>Reflection Tracking</b>							
Mag	±0.051	±0.051	±0.041	±0.051	±0.061	±0.061	±0.081
Phase (°)	±0.34	±0.34	±0.27	±0.34	±0.40	±0.40	±0.54
<b>Transmission Tracking</b>							
Mag	±0.078	±0.064	±0.049	±0.066	±0.11	±0.11	±0.16
Phase (°)	±0.52	±0.43	±0.33	±0.44	±0.72	±0.72	±1.1

### Transmission Uncertainty



## Reflection Uncertainty

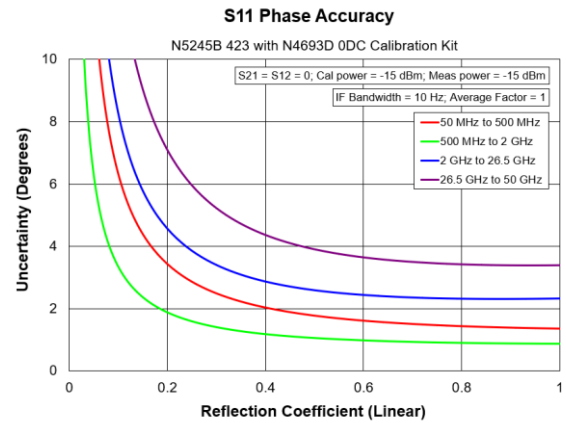
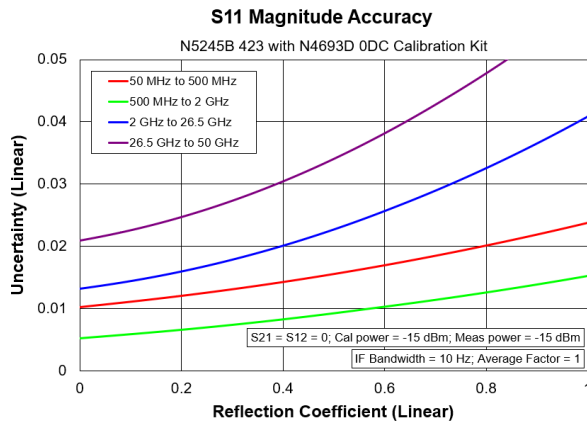
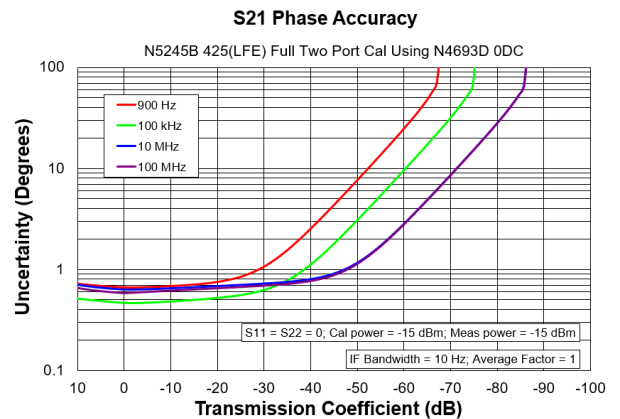
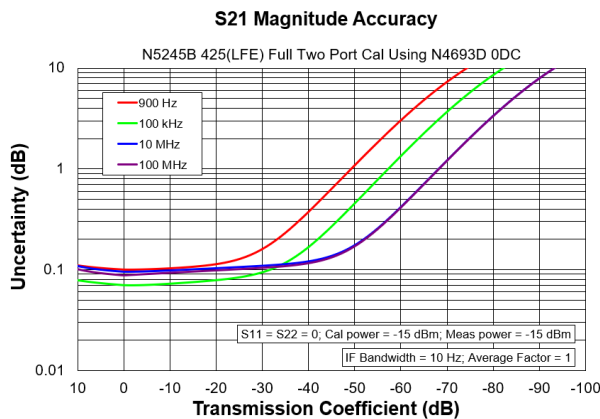


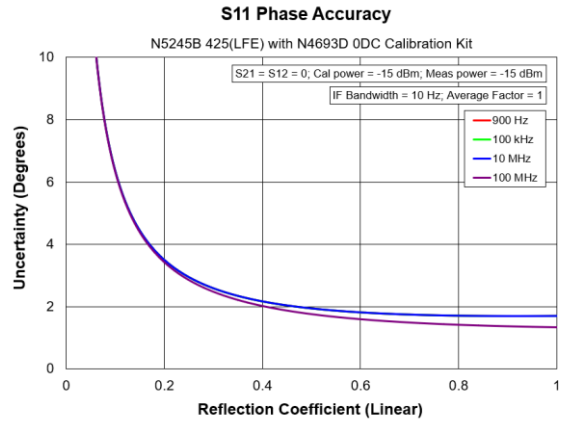
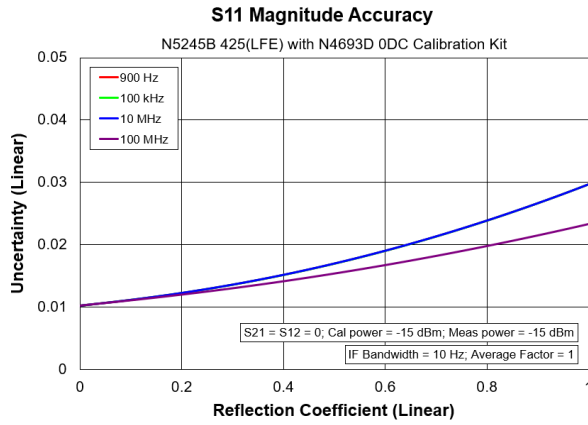
Table 5d. N4693D Calibration Kit, LFE Enabled (Option 425)

Description	Specification (dB)				
	1 kHz to 10 kHz	10 kHz to 1 MHz	1 MHz to 5 MHz	5 MHz to 50 MHz	50 MHz to 100 MHz
Directivity	40	40	40	40	40
Source Match	38	38	38	38	44
Load Match	36	37	36	36	41
<b>Reflection Tracking</b>					
Mag	±0.051	±0.051	±0.051	±0.051	±0.051
Phase (°)	±0.34	±0.34	±0.34	±0.34	±0.34
<b>Transmission Tracking</b>					
Mag	±0.089	±0.060	±0.075	±0.085	±0.081
Phase (°)	±0.59	±0.40	±0.50	±0.56	±0.54

## Transmission Uncertainty, Option 425



# Reflection Uncertainty, Option 425



## Uncorrected System Performance

Specifications apply to following conditions:

- Cable loss not included in Transmission Tracking.
- Crosstalk measurement conditions: normalized to a thru, measured with shorts on all ports, 10 Hz IF bandwidth, averaging factor of 8, alternate mode, source power set to the specified maximum power.
- With option 029, port 1 impedance tuner switch is in bypass position and port 2 noise receiver switch is in normal position unless specified. Refer to Options 201, 21x, 22x, 401, 41x, 42x for Option 029 Ports 3 and 4 performances.

Table 6a. Directivity, All Options, All Ports (dB)

Description	Specification	Typical
10 MHz to 50 MHz <sup>1</sup>	18	21
50 MHz to 200 MHz <sup>1</sup>	22	27
200 MHz to 500 MHz	23	27
500 MHz to 3.2 GHz	23	30
3.2 GHz to 10 GHz	22	25
10 GHz to 13.5 GHz	18	23
13.5 GHz to 16 GHz	18	21
16 GHz to 20 GHz	18	20
20 GHz to 24 GHz	16	20
24 GHz to 35 GHz	16	22
35 GHz to 43.5 GHz	15	21
43.5 GHz to 47 GHz	15	21
47 GHz to 50 GHz	15	19

<sup>1</sup> With Option 425 installed and LFE disabled, applied to frequencies  $\leq$  100 MHz. Above 100 MHz, performance is the same for both LFE enabled or disabled. For LFE enabled performance  $\leq$  100 MHz, see Table 6g and 6h.

Table 6b. Source Match (dB)

Description	Specification		Typical	
	Options 201, 21x, 22x, 401, 41x, 42x	Option 029	Options 201, 21x, 22x, 401, 41x, 42x	Option 029
	All Ports	Ports 1, 2	All Ports	Ports 1, 2
10 MHz to 50 MHz <sup>1</sup>	10 (7)	10	13 (11)	13
50 MHz to 200 MHz <sup>1</sup>	18 (6)	18	27 (10)	27
200 MHz to 500 MHz	18 (6)	18	21 (8)	27
500 MHz to 3.2 GHz	16 (7)	16	20 (8)	21
3.2 GHz to 10 GHz	14 (9)	13	17 (13)	20
10 GHz to 13.5 GHz	12 (10)	12	17 (14)	17
13.5 GHz to 16 GHz	12 (10)	12	18 (16)	17
16 GHz to 20 GHz	12 (8)	11	16 (11)	18
20 GHz to 24 GHz	11 (8)	10	17 (11)	16
24 GHz to 26.5 GHz	11 (7)	9	12 (10)	15
26.5 GHz to 35 GHz	7 (7)	7	12 (10)	12
35 GHz to 43.5 GHz	7 (7)	7	13 (8)	12
43.5 GHz to 46 GHz	7 (7)	7	13 (9)	13
46 GHz to 47 GHz	6 (6)	6	11 (11)	11
47 GHz to 50 GHz	6 (6)	6	13 (8)	11

( ) With Option 425 installed.

<sup>1</sup> With Option 425 installed and LFE disabled, applied to frequencies  $\leq$  100 MHz. Above 100 MHz, performance is the same for both LFE enabled or disabled. For LFE enabled performance  $\leq$  100 MHz, see Table 6g and 6h.

Table 6c. Load Match (dB)

Description	Specification		Typical	
	Options 201, 21x, 22x, 401, 41x, 42x	Option 029	Options 201, 21x, 22x, 401, 41x, 42x	Option 029
	All Ports	Ports 1, 2	All Ports	Ports 1, 2
10 MHz to 50 MHz	10 (8)	10	15 (10)	15
50 MHz to 200 MHz	16 (7)	16	22 (9)	22
200 MHz to 500 MHz	16 (7)	16	18 (8)	22
500 MHz to 3.2 GHz	14 (6)	13	17 (8)	18
3.2 GHz to 10 GHz	13 (6)	11	16 (12)	17
10 GHz to 13.5 GHz	11 (8)	11	15 (13)	16
13.5 GHz to 16 GHz	11 (8)	11	16 (13)	15
16 GHz to 20 GHz	11 (7)	11	16 (12)	16
20 GHz to 24 GHz	10 (6)	8	16 (11)	16
24 GHz to 26.5 GHz	10 (6)	8	12 (11)	16
26.5 GHz to 46 GHz	7 (6)	7	12 (10)	12
46 GHz to 47 GHz	7 (6)	6	11 (13)	11
47 GHz to 50 GHz	7 (6)	6	15 (11)	11

( ) With Option 425 installed.

<sup>1</sup> With Option 425 installed and LFE disabled, applied to frequencies  $\leq 100$  MHz. Above 100 MHz, performance is the same for both LFE enabled or disabled. For LFE enabled performance  $\leq 100$  MHz, see Table 6g and 6h.

Table 6d. Reflection /Transmission Tracking, Crosstalk (dB), All Options, All Ports-Typical

Description	Reflection Tracking	Transmission Tracking	Cross-talk
10 MHz to 50 MHz	$\pm 1.5$	$\pm 1.5$	-82
50 MHz to 100 MHz	$\pm 1.5$	$\pm 1.5$	-85
100 MHz to 500 MHz	$\pm 1.5$	$\pm 1.5$	-110
500 MHz to 26.5 GHz	$\pm 1.5$	$\pm 1.5$	-120
26.5 GHz to 35 GHz	$\pm 1.5^1$	$\pm 1.5$	-120
35 GHz to 43.5 GHz	$\pm 1.5^1$	$\pm 1.5$	-115
43.5 GHz to 46 GHz	$\pm 1.5$	$\pm 1.5$	-115
46 GHz to 47 GHz	$\pm 1.5$	$\pm 1.5$	-105
46 GHz to 50 GHz	$\pm 1.5$	$\pm 1.5$	-100

<sup>1</sup> Reflection tracking from 26.5 GHz to 43.5 GHz with Option 029 is degraded to  $\pm 1.5/-7$ .

Table 6e. Noise Mode<sup>1</sup> Uncorrected System Performance (dB), Option 029 - Specification

Description	Source Match		Load Match	
	Port 1	Port 2	Port 1	Port 2
10 MHz to 50 MHz	4	5	4	5
50 MHz to 200 MHz	9	17	10	16
200 MHz to 500 MHz	9	17	10	16
500 MHz to 3.2 GHz	10	16	10	14
3.2 GHz to 10 GHz	10	14	9	13
10 GHz to 16 GHz	10	12	9	11
16 GHz to 20 GHz	8	10	9	10
20 GHz to 24 GHz	8	8	9	8
24 GHz to 26.5 GHz	8	8	9	6
26.5 GHz to 50 GHz	6	6	6	6

<sup>1</sup>Noise mode sets port 1 impedance tuner switch to tuner position and port 2 noise receiver switch to noise receiver position.

Table 6f. Noise Mode<sup>1</sup> Uncorrected System Performance (dB), Option 029 - Typical

Description	Source Match		Load Match		Reflection Tracking		Transmission Tracking
	Port 1	Port 2	Port 1	Port 2	Port 1	Port 2	Ports 1, 2
10 MHz to 50 MHz	5	7	6	6	-1.5/-6	±2.5	±1.5
50 MHz to 500 MHz	12	25	12	22	-1.5/-6	±1.5	±1.5
500 MHz to 3.2 GHz	12	21	12	18	-1.5/-6	±1.5	±1.5
3.2 GHz to 10 GHz	14	20	14	17	-1.5/-6	±1.5	±1.5
10 GHz to 13.5 GHz	15	17	15	16	-1.5/-6	±1.5	±1.5
13.5 GHz to 16 GHz	19	17	15	15	-1.5/-6	±1.5	±1.5
16 GHz to 20 GHz	17	18	16	16	-4/-10	±1.5	±1.5
20 GHz to 24 GHz	16	16	16	16	-4/-10	±1.5	±1.5
24 GHz to 26.5 GHz	15	15	16	15	-4/-10	±1.5	±1.5
26.5 GHz to 43.5 GHz	12	12	12	12	-4/-8	±2.5	±1.5
43.5 GHz to 46 GHz	13	13	12	12	-6/-9	±3	±1.5
46 GHz to 50 GHz	11	11	11	11	-6/-9	±3	±1.5

<sup>1</sup>Noise mode sets port 1 impedance tuner switch to tuner position and port 2 noise receiver switch to noise receiver position.



Table 6g. Uncorrected System Performance (dB), All Ports, Option 425 (LFE Enabled) - Specifications

Description	Directivity	Source Match	Load Match	Transmission Tracking	Reflection Tracking	Crosstalk
1 kHz to 10 kHz	1	7	7	--	--	--
10 kHz to 1 MHz	16	15	19	--	--	--
1 MHz to 5 MHz	16	9	11	--	--	--
5 MHz to 50 MHz	5	7	8	--	--	--
50 MHz to 100 MHz	5	8	9	--	--	--

Table 6h. Uncorrected System Performance (dB), All Ports, Option 425 (LFE Enabled)- Typical

Description	Directivity	Source Match	Load Match	Transmission Tracking	Reflection Tracking	Crosstalk
500 Hz to 900 Hz	--	--	--	--	--	-102
900 Hz to 1 kHz	4	8	9	±1.5	±1.5	-106
1 kHz to 10 kHz	5	9	8	±1.5	±1.5	-100
10 kHz to 100 kHz	23	19	23	±1.5	±1.5	-106
100 kHz to 1 MHz	23	19	23	±1.5	±1.5	-126
1 MHz to 5 MHz	26	13	14	±1.5	±1.5	-121
5 MHz to 10 MHz	11	9	10	±1.5	±1.5	-121
10 MHz to 50 MHz	11	9	10	±1.5	±1.5	-117
50 MHz to 100 MHz	11	11	11	±1.5	±1.5	-117

## Test Port Output

See [Block diagrams](#) for all models and options.

With option 029, port 1 tuner switch is in bypass position and port 2 noise receiver switch is in normal position unless specified.

Table 7. Frequency Information, All Options

Description	Specification	Typical
N5244B Frequency Range	10 MHz to 43.5 GHz	--
N5245B Frequency Range	10 MHz to 50.0 GHz	--
Frequency Range (Option 425)	900 Hz to 50.0 GHz	500Hz to 900 Hz
Frequency Resolution	1 Hz	--
Frequency Accuracy	$\pm 0.7$ ppm	--
Initial Frequency Accuracy <sup>1</sup>	$\pm 0.2$ ppm	$\pm 0.1$ ppm
Frequency Stability	--	$\pm 0.05$ ppm, $-10^{\circ}$ to $70^{\circ}$ C <sup>2</sup> $\pm 0.5$ ppm (first year) <sup>3</sup>

<sup>1</sup> Verified after Factory Frequency Reference adjustment, or after adjustment at a Keysight Service Center.

<sup>2</sup> Assumes no variation in time.

<sup>3</sup> Assumes no variation in temperature. Stability generally improves over time.

Table 8a. Maximum Leveled Power (dBm), Options 201 or 401

Description	Specification			Typical		
	Ports <sup>1</sup> 1, 3		Ports <sup>1</sup> 2, 4	Ports <sup>1</sup> 1, 3		Ports <sup>1</sup> 2, 4
	Filtered Mode <sup>2</sup>	Hi Power Mode <sup>2</sup>		Filtered Mode <sup>2</sup>	Hi Power Mode <sup>2</sup>	
10 MHz to 50 MHz	4	12	12	12	20	19
50 MHz to 500 MHz	8	13	13	13	20	20
500 MHz to 1 GHz	8	13	13	14	19	19
1 GHz to 2 GHz	8	13	13	14	17	19
2 GHz to 3.2 GHz	8	10	13	14	15	19
3.2 GHz to 10 GHz	13	13	13	19	19	19
10 GHz to 16 GHz	13	13	13	18	18	17
16 GHz to 26.5 GHz	13	13	13	17	17	17
26.5 GHz to 30 GHz	12	12	12	17	17	17
30 GHz to 32 GHz	11	11	11	16	16	16
32 GHz to 35 GHz	12	12	12	17	17	17
35 GHz to 43.5 GHz	9	9	9	13	13	13
43.5 GHz to 47 GHz	5	5	5	11	11	11
47 GHz to 50 GHz	-5	-5	-5	2	2	2

<sup>1</sup> Either port can be used as the source port.

<sup>2</sup> In Filtered Mode, the signal path goes through filters to minimize harmonics below 3.2 GHz. In Hi Power Mode, the signal bypasses the filters to maximize output power.

Table 8b. Maximum Leveled Power (dBm), Options 21x or 41x

Description	Specification			Typical		
	Ports <sup>1</sup> 1, 3		Ports <sup>1</sup> 2, 4	Ports <sup>1</sup> 1, 3		Ports <sup>1</sup> 2, 4
	Filtered Mode <sup>2</sup>	Hi Power Mode <sup>2</sup>		Filtered Mode <sup>2</sup>	Hi Power Mode <sup>2</sup>	
10 MHz to 50 MHz	4	9	12	13	20	19
50 MHz to 500 MHz	8	13	13	13	20	20
500 MHz to 1 GHz	8	13	13	14	19	20
1 GHz to 2 GHz	8	12	13	12	17	19
2 GHz to 3.2 GHz	8	10	13	15	15	17
3.2 GHz to 10 GHz	13	13	13	18	18	18
10 GHz to 16 GHz	11	11	11	16	16	16
16 GHz to 26.5 GHz	10	10	10	15	15	15
26.5 GHz to 30 GHz	9	9	9	15	15	15
30 GHz to 32 GHz	7	7	7	13	13	13
32 GHz to 35 GHz	9	9	9	14	14	14
35 GHz to 43.5 GHz	4	4	4	9	9	9
43.5 GHz to 47 GHz	-1	-1	-1	6	6	6
47 GHz to 50 GHz	-11	-11	-11	-5	-5	-5

<sup>1</sup> Either port can be used as the source port.

<sup>2</sup> In Filtered Mode, the signal path goes through filters to minimize harmonics below 3.2 GHz. In Hi Power Mode, the signal bypasses the filters to maximize output power.

Table 8c. Maximum Leveled Power (dBm), Options 22x, 422, or 423

Description	Specification			Typical		
	Ports <sup>1</sup> 1, 3		Ports <sup>1</sup> 2, 4	Ports <sup>1</sup> 1, 3		Ports <sup>1</sup> 2, 4
	Filtered Mode <sup>2</sup>	Hi Power Mode <sup>2</sup>		Filtered Mode <sup>2</sup>	Hi Power Mode <sup>2</sup>	
10 MHz to 50 MHz	4	11	10	13	20	19
50 MHz to 500 MHz	8	13	13	13	20	20
500 MHz to 1 GHz	8	13	13	13	18	19
1 GHz to 2 GHz	8	13	13	12	17	18
2 GHz to 3.2 GHz	8	10	13	12	14	17
3.2 GHz to 10 GHz	13	13	13	18	18	18
10 GHz to 16 GHz	11	11	11	16	16	15
16 GHz to 26.5 GHz	10	10	10	14	14	14
26.5 GHz to 30 GHz	9	9	9	14	14	14
30 GHz to 32 GHz	7	7	7	13	13	13
32 GHz to 35 GHz	9	9	9	13	13	13
35 GHz to 43.5 GHz	4	4	4	9	9	8
43.5 GHz to 47 GHz	-2	-2	-2	6	6	6
47 GHz to 50 GHz	-12	-12	-12	-4	-4	-3

<sup>1</sup> Either port can be used as the source port.

<sup>2</sup> In Filtered Mode, the signal path goes through filters to minimize harmonics below 3.2 GHz. In Hi Power Mode, the signal bypasses the filters to maximize output power.

Table 8d. Maximum Levelled Power (dBm), Option 425

Description	Specification			Typical		
	Ports <sup>1</sup> 1, 3		Ports <sup>1</sup> 2, 4	Ports <sup>1</sup> 1, 3		Ports <sup>1</sup> 2, 4
	Filtered Mode <sup>2</sup>	Hi Power Mode <sup>2</sup>		Filtered Mode <sup>2</sup>	Hi Power Mode <sup>2</sup>	
10 MHz to 50 MHz <sup>3</sup>	-3	4	3	6	12	12
50 MHz to 500 MHz <sup>3</sup>	3	8	8	7	14	14
500 MHz to 1 GHz	3	8	8	7	13	13
1 GHz to 2 GHz	6	11	11	9	15	15
2 GHz to 3.2 GHz	6	8	11	9	12	12
3.2 GHz to 10 GHz	11	11	11	15	15	15
10 GHz to 16 GHz	9	9	9	13	13	13
16 GHz to 26.5 GHz	8	8	8	13	13	13
26.5 GHz to 30 GHz	7	7	7	13	13	13
30 GHz to 32 GHz	6	6	6	12	12	12
32 GHz to 35 GHz	8	8	8	13	13	13
35 GHz to 43.5 GHz	4	4	4	10	10	10
43.5 GHz to 47 GHz	-2	-2	-2	6	6	6
47 GHz to 50 GHz	-12	-12	-12	-4	-4	-3

<sup>1</sup> Either port can be used as the source port.

<sup>2</sup> In Filtered Mode, the signal path goes through filters to minimize harmonics below 3.2 GHz. In Hi Power Mode, the signal bypasses the filters to maximize output power.

<sup>3</sup> With Option 425 installed and LFE disabled, applied to frequencies  $\leq$  100 MHz. Above 100 MHz, performance is the same for both LFE enabled or disabled. For LFE enabled performance  $\leq$  100 MHz, see Table 8p.

Table 8e. Maximum Levelled Power (dBm), Options 22x, 422, or 423, Combine Mode – Typical

Description	Source 1 Port 1		Source 2 Port 1	
	Filtered Mode <sup>1</sup>	Hi Power Mode <sup>1</sup>	Filtered Mode <sup>1</sup>	Hi Power Mode <sup>1</sup>
10 MHz to 50 MHz	6	13	7	13
50 MHz to 1 GHz	6	11	6	11
1 GHz to 2 GHz	6	10	6	9
2 GHz to 3.2 GHz	6	6	7	6
3.2 GHz to 10 GHz	10	10	9	9
10 GHz to 16 GHz	7	7	7	7
16 GHz to 26.5 GHz	3	3	3	3
26.5 GHz to 35 GHz	1	1	0	0
35 GHz to 43.5 GHz	-3	-3	-5	-5
43.5 GHz to 47 GHz	-6	-6	-10	-10
47 GHz to 50 GHz	-17	-17	-21	-21

<sup>1</sup> In Filtered Mode, the signal path goes through filters to minimize harmonics below 3.2 GHz. In Hi Power Mode, the signal bypasses the filters to maximize output power.

Table 8f. Maximum Levelled Power (dBm), Option 425, Combine Mode – Typical

Description	Source 1 Port 1		Source 2 Port 1	
	Filtered Mode <sup>1</sup>	Hi Power Mode <sup>1</sup>	Filtered Mode <sup>1</sup>	Hi Power Mode <sup>1</sup>
10 MHz to 50 MHz <sup>2</sup>	-1	6	-1	6
50 MHz to 1 GHz <sup>2</sup>	1	6	1	6
1 GHz to 2 GHz	4	8	4	7
2 GHz to 3.2 GHz	4	4	5	4
3.2 GHz to 10 GHz	8	8	7	7
10 GHz to 16 GHz	5	5	5	5
16 GHz to 26.5 GHz	2	2	2	2
26.5 GHz to 35 GHz	-1	-1	-2	-2
35 GHz to 43.5 GHz	-2	-2	-2	-2
43.5 GHz to 47 GHz	-7	-7	-7	-7
47 GHz to 50 GHz	-18	-18	-18	-18

<sup>1</sup> In Filtered Mode, the signal path goes through filters to minimize harmonics below 3.2 GHz. In Hi Power Mode, the signal bypasses the filters to maximize output power.

<sup>2</sup> With Option 425 installed and LFE disabled, applied to frequencies  $\leq$  100 MHz. Above 100 MHz, performance is the same for both LFE enabled or disabled. For LFE enabled performance  $\leq$  100 MHz, see Table 8k.

Table 8g. Maximum Levelled Power (dBm), Port 1 and 2, Option 425 with 029<sup>1</sup>

Description	Specification			Typical		
	Port 1		Port 2	Port 1		Port 2
	Filt. Mode <sup>2</sup>	Hi Pwr Mode <sup>2</sup>		Filt. Mode <sup>2</sup>	Hi Pwr Mode <sup>2</sup>	
10 MHz to 50 MHz <sup>3</sup>	-4	3	3	5	11	12
50 MHz to 500 MHz <sup>3</sup>	2	7	8	6	13	14
500 MHz to 1 GHz	3	8	7	7	13	12
1 GHz to 2 GHz	6	11	10	9	15	14
2 GHz to 3.2 GHz	6	8	10	9	12	11
3.2 GHz to 10 GHz	11	11	10	15	15	14
10 GHz to 16 GHz	7	7	8	11	11	12
16 GHz to 26.5 GHz	6	6	7	11	11	12
26.5 GHz to 30 GHz	5	5	6	11	11	12
30 GHz to 32 GHz	4	4	5	10	10	11
32 GHz to 35 GHz	6	6	7	11	11	12
35 GHz to 43.5 GHz	2	2	3	8	8	9
43.5 GHz to 47 GHz	-4	-2	-3	4	4	5
47 GHz to 50 GHz	-14	-14	-13	-6	-6	-4

<sup>1</sup> Option 029 only affects port 1 and port 2 maximum leveled power. Refer to Table 8h for ports 3 and 4.

<sup>2</sup> In Filtered Mode, the signal path goes through filters to minimize harmonics below 3.2 GHz. In Hi Power Mode, the signal bypasses the filters to maximize output power.

<sup>3</sup> With Option 425 installed and LFE disabled, applied to frequencies  $\leq$  100 MHz. Above 100 MHz, performance is the same for both LFE enabled or disabled. For LFE enabled performance  $\leq$  100 MHz, see Table 8p.



Table 8h. Maximum Leveled Power (dBm), Option 425 with 029, Combine Mode – Typical

Description	Source 1 Port 1		Source 2 Port 1	
	Filtered Mode <sup>1</sup>	Hi Power Mode <sup>1</sup>	Filtered Mode <sup>1</sup>	Hi Power Mode <sup>1</sup>
10 MHz to 50 MHz <sup>3</sup>	-3	4	-2	4
50 MHz to 1 GHz <sup>3</sup>	1	8	1	8
1 GHz to 2 GHz	1	6	1	5
2 GHz to 3.2 GHz	1	2	1	2
3.2 GHz to 10 GHz	6	6	5	5
10 GHz to 16 GHz	2	2	2	2
16 GHz to 26.5 GHz	0	0	0	0
26.5 GHz to 35 GHz	0	0	-1	-1
35 GHz to 43.5 GHz	-5	-5	-6	-6
43.5 GHz to 47 GHz	-9	-9	-11	-11
47 GHz to 50 GHz	-21	-21	-25	-25

<sup>1</sup> In Filtered Mode, the signal path goes through filters to minimize harmonics below 3.2 GHz. In Hi Power Mode, the signal bypasses the filters to maximize output power.

<sup>2</sup> With Option 425 installed and LFE disabled, applied to frequencies  $\leq$  100 MHz. Above 100 MHz, performance is the same for both LFE enabled or disabled. For LFE enabled performance  $\leq$  100 MHz, see Table 8i.

Table 8i. Maximum Power (dBm), All Ports, Option 425 with 029 (LFE Enabled), Combine Mode - Typical

Description	Source 1 Port 1	Source 2 Port 1
500 Hz to 900 Hz	6	6
900 Hz to 1 kHz	7	6
1 kHz to 10 kHz	7	7
10 kHz to 100 kHz	8	7
100 kHz to 1 MHz	8	7
1 MHz to 5 MHz	7	6
5 MHz to 10 MHz	5	4
10 MHz to 50 MHz	5	4
50 MHz to 100 MHz	5	4

Table 8j. Maximum Leveled Power (dBm), Noise Mode<sup>1</sup>, Options 425 with 029 - Typical

Description	Port 1				Source 2 Port 1		Port 2
	Normal Mode		Combine Mode		Combine Mode		
	Filtered Mode <sup>2</sup>	Hi Power Mode <sup>2</sup>	Filtered Mode <sup>2</sup>	Hi Power Mode <sup>2</sup>	Filtered Mode <sup>2</sup>	Hi Power Mode <sup>2</sup>	
10 MHz to 50 MHz <sup>3</sup>	-2	5	-9	-2	-8	-2	-1
50 MHz to 500 MHz <sup>3</sup>	3	10	-4	3	-4	3	6
500 MHz to 1 GHz	3	11	-3	4	-3	4	4
1 GHz to 2 GHz	3	9	-3	2	-3	1	4
2 GHz to 3.2 GHz	3	6	-3	-2	-3	-2	3
3.2 GHz to 10 GHz	9	9	1	1	0	0	4
10 GHz to 16 GHz	5	5	-4	-4	-4	-4	1
16 GHz to 26.5 GHz	4	4	-7	-7	-7	-7	0
26.5 GHz to 30 GHz	6	6	-6	-6	-7	-7	-8
30 GHz to 32 GHz	3	3	-7	-7	-8	-8	0
32 GHz to 35 GHz	5	5	-7	-7	-8	-8	-8
35 GHz to 43.5 GHz	0	0	-12	-12	-13	-13	-3
43.5 GHz to 47 GHz	-5	-5	-17	-17	-19	-19	-5
47 GHz to 50 GHz	-16	-16	-29	-29	-33	-33	-17

<sup>1</sup> Noise mode sets port 1 impedance tuner switch to tuner position and port 2 noise receiver switch to noise receiver position.

<sup>2</sup> In Filtered Mode, the signal path goes through filters to minimize harmonics below 3.2 GHz. In Hi Power Mode, the signal bypasses the filters to maximize output power.

<sup>3</sup> With Option 425 installed and LFE disabled, applied to frequencies  $\leq$  100 MHz. Above 100 MHz, performance is the same for both LFE enabled or disabled.

Table 8k. Maximum Power (dBm), All Ports, Option 425 (LFE Enabled), Combine Mode - Typical

Description	Source 1 Port 1	Source 2 Port 1
500 Hz to 900 Hz	6	6
900 Hz to 1 kHz	7	6
1 kHz to 10 kHz	7	7
10 kHz to 100 kHz	8	7
100 kHz to 1 MHz	8	7
1 MHz to 5 MHz	7	6
5 MHz to 10 MHz	5	4
10 MHz to 50 MHz	5	4
50 MHz to 100 MHz	5	4

Table 8l. Maximum Levelled Power (dBm), Option 22x

Description	Specification			Typical		
	Source 2 Out 1		Source 2 Out 2	Source 2 Out 1		Source 2 Out 2
	Filtered Mode <sup>1</sup>	Hi Power Mode <sup>1</sup>		Filtered Mode <sup>1</sup>	Hi Power Mode <sup>1</sup>	
10 MHz to 50 MHz	4	13	13	13	20	19
50 MHz to 500 MHz	8	18	15	13	20	20
500 MHz to 1 GHz	8	16	13	14	19	20
1 GHz to 2 GHz	8	13	13	13	18	20
2 GHz to 3.2 GHz	8	11	13	13	16	18
3.2 GHz to 10 GHz	14	14	16	20	20	20
10 GHz to 16 GHz	12	12	13	19	19	18
16 GHz to 26.5 GHz	14	14	14	19	19	19
26.5 GHz to 30 GHz	14	14	14	19	19	19
30 GHz to 32 GHz	13	13	14	18	18	19
32 GHz to 35 GHz	14	14	14	19	19	19
35 GHz to 43.5 GHz	11	11	12	15	15	16
43.5 GHz to 47 GHz	7	7	8	13	13	14
47 GHz to 50 GHz	-2	-2	-2	5	5	8

<sup>1</sup> In Filtered Mode, the signal path goes through filters to minimize harmonics below 3.2 GHz. In Hi Power Mode, the signal bypasses the filters to maximize output power.

Table 8m. Maximum Leveled Power (dBm), Options 22x, 422, or 423 with 029<sup>1</sup>

Description	Specification			Typical		
	Port 1		Port 2	Port 1		Port 2
	Filtered Mode <sup>2</sup>	Hi Power Mode <sup>2</sup>		Filtered Mode <sup>2</sup>	Hi Power Mode <sup>2</sup>	
10 MHz to 50 MHz	4	11	10	11	18	19
50 MHz to 500 MHz	8	13	13	11	18	19
500 MHz to 1 GHz	8	13	13	10	18	16
1 GHz to 2 GHz	8	13	13	10	16	16
2 GHz to 3.2 GHz	8	10	13	10	13	16
3.2 GHz to 10 GHz	13	13	13	16	16	16
10 GHz to 16 GHz	10	10	10	13	13	13
16 GHz to 26.5 GHz	8	8	8	13	13	13
26.5 GHz to 30 GHz	7	7	7	13	13	13
30 GHz to 32 GHz	5	5	5	11	11	11
32 GHz to 35 GHz	7	7	7	13	13	13
35 GHz to 43.5 GHz	1	1	1	8	8	8
43.5 GHz to 47 GHz	-4	-4	-4	4	4	5
47 GHz to 50 GHz	-15	-15	-15	-7	-7	-6

<sup>1</sup> Option 029 affects port 1 and port 2 maximum leveled power. Refer to Table 8h for other ports.

<sup>2</sup> In Filtered Mode, the signal path goes through filters to minimize harmonics below 3.2 GHz. In Hi Power Mode, the signal bypasses the filters to maximize output power.

Table 8n. Maximum Leveled Power (dBm), Options 22x or 42x with 029<sup>1</sup>, Combine Mode-Typical

Description	Source 1 Port 1		Source 2 Port 1	
	Filtered Mode <sup>2</sup>	Hi Power Mode <sup>2</sup>	Filtered Mode <sup>2</sup>	Hi Power Mode <sup>2</sup>
10 MHz to 50 MHz	4	11	5	11
50 MHz to 1 GHz	4	11	4	11
1 GHz to 2 GHz	4	9	4	8
2 GHz to 3.2 GHz	4	5	4	5
3.2 GHz to 10 GHz	8	8	7	7
10 GHz to 16 GHz	4	4	4	4
16 GHz to 26.5 GHz	2	2	2	2
26.5 GHz to 35 GHz	1	1	0	0
35 GHz to 43.5 GHz	-4	-4	-5	-5
43.5 GHz to 47 GHz	-8	-8	-10	-10
47 GHz to 50 GHz	-20	-20	-24	-24

<sup>1</sup> Option 029 affects port 1 and port 2 maximum leveled power. Refer to Table 8h for other ports.

<sup>2</sup> In Filtered Mode, the signal path goes through filters to minimize harmonics below 3.2 GHz. In Hi Power Mode, the signal bypasses the filters to maximize output power.

Table 8o. Maximum Leveled Power (dBm), Noise Mode<sup>1</sup>, Options 22x or 42x with 029<sup>1</sup> - Typical

Description	Port 1				Source 2 Port 1		Port 2
	Normal Mode		Combine Mode		Combine Mode		
	Filtered Mode <sup>2</sup>	Hi Power Mode <sup>2</sup>	Filtered Mode <sup>2</sup>	Hi Power Mode <sup>2</sup>	Filtered Mode <sup>2</sup>	Hi Power Mode <sup>2</sup>	
10 MHz to 50 MHz	5	12	-2	5	-1	5	6
50 MHz to 500 MHz	7	14	0	7	0	7	10
500 MHz to 1 GHz	6	14	0	7	0	7	7
1 GHz to 2 GHz	6	12	0	5	0	4	7
2 GHz to 3.2 GHz	6	9	0	1	0	1	6
3.2 GHz to 10 GHz	11	11	3	3	2	2	6
10 GHz to 16 GHz	7	7	-2	-2	-2	-2	3
16 GHz to 26.5 GHz	6	6	-5	-5	-5	-5	2
26.5 GHz to 30 GHz	7	7	-5	-5	-6	-6	-7
30 GHz to 32 GHz	4	4	-6	-6	-7	-7	1
32 GHz to 35 GHz	6	6	-6	-6	-7	-7	-7
35 GHz to 43.5 GHz	1	1	-11	-11	-12	-12	-2
43.5 GHz to 47 GHz	-4	-4	-16	-16	-18	-18	-4
47 GHz to 50 GHz	-15	-15	-28	-28	-32	-32	-16

<sup>1</sup> Noise mode sets port 1 tuner switch to tuner position and port 2 noise receiver switch to noise receiver position.

<sup>2</sup> In Filtered Mode, the signal path goes through filters to minimize harmonics below 3.2 GHz. In Hi Power Mode, the signal bypasses the filters to maximize output power.

Table 8p. Maximum Power (dBm), All Ports – Option 425 and Option 425 with 029 (LFE Enabled)

Description	Specification	Typical <sup>1</sup>
500 Hz to 900 Hz	--	12
900 Hz to 1 kHz	10	13
1 kHz to 10 kHz	12	13
10 kHz to 100 kHz	12	14
100 kHz to 1 MHz	12	14
1 MHz to 5 MHz	10	13
5 MHz to 10 MHz	9	11
10 MHz to 50 MHz	8	10
50 MHz to 100 MHz	8	10

<sup>1</sup> Values apply to all ports. Ports 2 and 4 typically 1 dB higher.

Table 8q. SRC3 Rear Panel Maximum Output Power (dBm) – Option XSB<sup>1</sup>

Description	Typical
10 MHz to 6 GHz	9
6 GHz to 7.6 GHz	8.5
7.6 GHz to 9.6 GHz	8.5
9.6 GHz to 12 GHz	6.5
12 GHz to 13.5 GHz	7.5

<sup>1</sup> Option XSB requires Option 422 or Option 423.



Table 9a. Power Level Accuracy (dB) at Nominal Power<sup>1</sup>, All Options

Description	Specification		Typical	
	Ports <sup>2</sup> 1, 2, 3, 4	Source 2 Out 1 Source 2 Out 2	Ports <sup>2</sup> 1, 2, 3, 4	Source 2 Out 1 Source 2 Out 2
10 MHz to 50 MHz <sup>3</sup>	± 1.5	± 2.5	± 0.27	± 0.30
50 MHz to 1 GHz <sup>3</sup>	± 1.2	± 2.0	± 0.24	± 0.26
1 GHz to 3.2 GHz	± 1.2	± 2.0	± 0.33	± 0.20
3.2 GHz to 13.5 GHz	± 1.5	± 2.0	± 0.33	± 0.20
13.5 GHz to 20 GHz	± 1.5	± 2.5	± 0.36	± 0.52
20 GHz to 26.5 GHz	± 2.0	± 2.5	± 0.47	± 0.44
26.5 GHz to 43.5 GHz	± 3.0	± 3.5	± 0.25	± 0.27
43.5 GHz to 50 GHz	± 3.5	± 3.5	± 0.97	± 0.82

<sup>1</sup> Level accuracy at power other than nominal power, Power Level Accuracy (dB) at Nominal Power + Power Level Linearity (dB)

<sup>2</sup> Any port can be used as the source port. Source in filtered mode where applicable.

<sup>3</sup> With Option 425 installed and LFE disabled, applied to frequencies ≤ 100 MHz. Above 100 MHz, performance is the same for both LFE enabled or disabled. For LFE enabled performance ≤ 100 MHz, see Table 9b.

Table 9b. Power Level Accuracy (dB), All Ports, Option 425 and Option 425 with 029 (LFE Enabled)

Description	Specification	Typical
500 Hz to 900 Hz	--	± 0.1
900 Hz to 1 kHz	± 1.0	± 0.1
1 kHz to 10 kHz	± 1.0	± 0.1
10 kHz to 100 kHz	± 1.0	± 0.1
100 kHz to 1 MHz	± 1.0	± 0.15
1 MHz to 5 MHz	± 1.0	± 0.15
5 MHz to 10 MHz	± 1.0	± 0.2
10 MHz to 50 MHz	± 1.0	± 0.2
50 MHz to 100 MHz	± 1.0	± 0.2

Table 10a. Power Level Linearity<sup>1</sup> (dB), All Options - Specification

Description	Ports 1, 3 <sup>2</sup> -25 dBm ≤ P < -20 dBm	Ports 1, 3 <sup>2</sup> -20 dBm ≤ P < -15 dBm	Ports 1, 3 <sup>2</sup> P ≥ -15 dBm
10 MHz to 50 GHz <sup>3</sup>	± 1.5	± 1.5	± 1.5

<sup>1</sup> Referenced to nominal power.

<sup>2</sup> Either port can be used as the source port. Source in filtered mode.

<sup>3</sup> With Option 425 installed and LFE disabled, applied to frequencies ≤ 100 MHz. Above 100 MHz, performance is the same for both LFE enabled or disabled. For LFE enabled performance ≤ 100 MHz, see Table 10d.

Table 10b. Power Level Linearity<sup>1</sup> (dB), All Options - Specification

Description	Ports 2, 4 <sup>2</sup> -25 dBm ≤ P < -20 dBm	Ports 2, 4 <sup>2</sup> -20 dBm ≤ P < -15 dBm	Ports 2, 4 <sup>2</sup> P ≥ -15 dBm
10 MHz to 50 GHz <sup>3</sup>	± 2.0	± 1.5	± 1.5

<sup>1</sup> Referenced to nominal power.

<sup>2</sup> Either port can be used as the source port.

<sup>3</sup> With Option 425 installed and LFE disabled, applied to frequencies ≤ 100 MHz. Above 100 MHz, performance is the same for both LFE enabled or disabled. For LFE enabled performance ≤ 100 MHz, see Table 10d.

Table 10c. Power Level Linearity<sup>1</sup> (dB), Option 22x - Specification

Description	Source 2 Out 1 <sup>2</sup> P ≥ -15 dBm	Source 2 Out 2 -15 dBm ≤ P < -10 dBm	Source 2 Out 2 P ≥ -10 dBm
10 MHz to 50 GHz <sup>3</sup>	± 1.0	± 1.0	± 1.0

<sup>1</sup> Referenced to nominal power.

<sup>2</sup> Source in filtered mode.

<sup>3</sup> With Option 425 installed and LFE disabled, applied to frequencies ≤ 100 MHz. Above 100 MHz, performance is the same for both LFE enabled or disabled. For LFE enabled performance ≤ 100 MHz, see Table 10d.

Table 10d. Power Level Linearity<sup>1</sup> (dB), All Ports, Option 425 and Option 425 with 029 (LFE Enabled)

Description	Specification
500 Hz to 900 Hz	--
900 Hz to 100 MHz	±1.0

<sup>1</sup> Referenced to nominal power, from -25 dBm to max power.

Table 11a. Power Sweep Range (dB), Options 201 or 401

Description	Specification		Typical	
	Ports <sup>1</sup> 1, 3	Ports <sup>1</sup> 2, 4	Ports <sup>1</sup> 1, 3	Ports <sup>1</sup> 2, 4
10 MHz to 50 MHz	37	37	47	46
50 MHz to 500 MHz	38	38	47	47
500 MHz to 1 GHz	38	38	46	46
1 GHz to 2 GHz	38	38	44	46
2 GHz to 3.2 GHz	35	38	42	46
3.2 GHz to 10 GHz	38	38	46	46
10 GHz to 16 GHz	38	38	45	44
16 GHz to 26.5 GHz	38	38	43	44
26.5 GHz to 30 GHz	37	37	44	44
30 GHz to 32 GHz	36	36	43	43
32 GHz to 35 GHz	37	37	44	44
35 GHz to 43.5 GHz	34	34	40	40
43.5 GHz to 47 GHz	30	30	38	38
47 GHz to 50 GHz	20	20	29	29

<sup>1</sup> Either port can be used as the source port. Source in Hi Power mode where applicable.

Table 11b. Power Sweep Range (dB), Options 21x or 41x

Description	Specification		Typical	
	Ports <sup>1</sup> 1, 3	Ports <sup>1</sup> 2, 4	Ports <sup>1</sup> 1, 3	Ports <sup>1</sup> 2, 4
10 MHz to 50 MHz	34	37	47	46
50 MHz to 500 MHz	38	38	47	47
500 MHz to 1 GHz	38	38	46	47
1 GHz to 2 GHz	37	38	44	46
2 GHz to 3.2 GHz	35	38	42	44
3.2 GHz to 10 GHz	38	38	45	45
10 GHz to 16 GHz	36	36	43	43
16 GHz to 26.5 GHz	35	35	42	42
26.5 GHz to 30 GHz	34	34	42	42
30 GHz to 32 GHz	32	32	40	40
32 GHz to 35 GHz	34	34	41	41
35 GHz to 43.5 GHz	29	29	36	36
43.5 GHz to 47 GHz	24	24	33	33
47 GHz to 50 GHz	14	14	22	22

<sup>1</sup> Either port can be used as the source port. Source in Hi Power mode where applicable.

Table 11c. Power Sweep Range (dB), Options 22x, 422, or 423

Description	Specification		Typical	
	Ports <sup>1</sup> 1, 3	Ports <sup>1</sup> 2, 4	Ports <sup>1</sup> 1, 3	Ports <sup>1</sup> 2, 4
10 MHz to 50 MHz	36	35	47	46
50 MHz to 500 MHz	38	38	47	47
500 MHz to 1 GHz	38	38	45	46
1 GHz to 2 GHz	38	38	44	45
2 GHz to 3.2 GHz	35	38	41	44
3.2 GHz to 10 GHz	38	38	45	45
10 GHz to 16 GHz	36	36	43	42
16 GHz to 26.5 GHz	35	35	41	41
26.5 GHz to 30 GHz	34	34	41	41
30 GHz to 32 GHz	32	32	40	40
32 GHz to 35 GHz	34	34	40	40
35 GHz to 43.5 GHz	29	29	36	35
43.5 GHz to 47 GHz	23	23	33	33
47 GHz to 50 GHz	13	13	23	24

<sup>1</sup> Either port can be used as the source port. Source in Hi Power mode where applicable.

Table 11d. Power Sweep Range (dB), Option 22x

Description	Specification		Typical	
	Source 2 Out 1 <sup>1</sup>	Source 2 Out 2	Source 2 Out 1 <sup>1</sup>	Source 2 Out 2
10 MHz to 50 MHz	28	28	37	36
50 MHz to 500 MHz	33	30	37	37
500 MHz to 1 GHz	31	28	36	37
1 GHz to 2 GHz	28	28	35	37
2 GHz to 3.2 GHz	26	28	33	35
3.2 GHz to 10 GHz	29	31	37	37
10 GHz to 16 GHz	27	28	36	35
16 GHz to 26.5 GHz	29	29	36	36
26.5 GHz to 30 GHz	29	29	36	36
30 GHz to 32 GHz	28	29	35	36
32 GHz to 35 GHz	29	29	36	36
35 GHz to 43.5 GHz	26	27	32	33
43.5 GHz to 47 GHz	22	23	30	31
47 GHz to 50 GHz	13	13	22	25

<sup>1</sup> Source in Hi Power mode where applicable.

Table 11e. Power Sweep Range (dB), Options 22x, 422, or 423 with 029<sup>1</sup>

Description	Specification		Typical	
	Port 1 <sup>2</sup>	Port 2	Port 1 <sup>2</sup>	Port 2
10 MHz to 50 MHz	36	35	45	46
50 MHz to 500 MHz	38	38	45	46
500 MHz to 1 GHz	38	38	45	43
1 GHz to 2 GHz	38	38	43	43
2 GHz to 3.2 GHz	35	38	40	43
3.2 GHz to 10 GHz	38	38	43	43
10 GHz to 16 GHz	35	35	40	40
16 GHz to 26.5 GHz	33	33	40	40
26.5 GHz to 30 GHz	30	32	40	40
30 GHz to 32 GHz	30	30	38	38
32 GHz to 35 GHz	32	32	40	40
35 GHz to 43.5 GHz	26	26	35	35
43.5 GHz to 47 GHz	21	21	31	32
47 GHz to 50 GHz	10	10	20	21

<sup>1</sup> Option 029 affects port 1 and port 2 power sweep ranges. Refer to Table 11c and 11d for other ports.

<sup>2</sup> Source in Hi Power mode where applicable.

Table 11f. Power Sweep Range (dB), Option 425

Description	Specification (dBm)		Typical (dBm)	
	Port 1, 3	Port 2, 4	Port 1, 3	Port 2, 4
10 MHz to 50 MHz <sup>1</sup>	29	28	39	39
50 MHz to 500 MHz <sup>1</sup>	33	33	41	41
500 MHz to 1 GHz	33	33	40	40
1 GHz to 2 GHz	36	36	42	42
2 GHz to 3.2 GHz	33	36	39	39
3.2 GHz to 10 GHz	36	36	42	42
10 GHz to 16 GHz	34	34	40	40
16 GHz to 26.5 GHz	33	33	40	40
26.5 GHz to 30 GHz	32	32	40	40
30 GHz to 32 GHz	31	31	39	39
32 GHz to 35 GHz	33	33	40	40
35 GHz to 43.5 GHz	29	29	37	37
43.5 GHz to 47 GHz	23	23	33	33
47 GHz to 50 GHz	13	13	23	24

<sup>1</sup> With Option 425 installed and LFE disabled, applied to frequencies  $\leq$  100 MHz. Above 100 MHz, performance is the same for both LFE enabled or disabled. For LFE enabled performance  $\leq$  100 MHz, see Table 11h.



Table 11g. Power Sweep Range (dB), Option 425 with 029

Description	Specification (dBm)				Typical (dBm)			
	Port 1	Port 2	Port 3	Port 4	Port 1	Port 2	Port 3	Port 4
10 MHz to 50 MHz <sup>1</sup>	28	28	29	28	38	39	39	39
50 MHz to 500 MHz <sup>1</sup>	32	33	33	33	40	41	41	41
500 MHz to 1 GHz	33	32	33	33	40	39	40	40
1 GHz to 2 GHz	36	35	36	36	42	41	42	42
2 GHz to 3.2 GHz	33	35	33	36	39	38	39	39
3.2 GHz to 10 GHz	36	35	36	36	42	41	42	42
10 GHz to 16 GHz	32	33	34	34	38	39	40	40
16 GHz to 26.5 GHz	31	32	33	33	38	39	40	40
26.5 GHz to 30 GHz	30	31	32	32	38	39	40	40
30 GHz to 32 GHz	29	30	31	31	37	38	39	39
32 GHz to 35 GHz	31	32	33	33	38	40	40	40
35 GHz to 43.5 GHz	27	28	29	29	35	36	37	37
43.5 GHz to 47 GHz	21	22	23	23	31	32	33	33
47 GHz to 50 GHz	11	12	13	13	21	23	23	24

<sup>1</sup> With Option 425 installed and LFE disabled, applied to frequencies  $\leq$  100 MHz. Above 100 MHz, performance is the same for both LFE enabled or disabled. For LFE enabled performance  $\leq$  100 MHz, see Table 11h.

Table 11h. Power Sweep Range (dB) –Option 425 and Option 425 with 029 (LFE Enabled)

Description	Specification	Typical
500 Hz to 900 Hz	--	39
900 Hz to 1 kHz	35	40
1 kHz to 10 kHz	37	40
10 kHz to 100 kHz	37	41
100 kHz to 1 MHz	37	41
1 MHz to 5 MHz	35	40
5 MHz to 10 MHz	34	38
10 MHz to 50 MHz	33	37
50 MHz to 100 MHz	33	37

Table 12. Nominal Power (Preset Power, dBm)

Description	Specification			Typical	
	All Options	Option 22x		Options 22x, 42x	
	Ports <sup>1</sup> 1, 2, 3, 4	Source 2 Out 1	Source 2 Out 2	Source 1 Port 1 Combine Mode	Source 2 Port 1 Combine Mode
N5244B	-5	-5	-5	-15	-15
N5245B	-15	-5	-5	-25	-30

<sup>1</sup> Any port can be used as the source port.

Table 13. Power Resolution and Maximum/Minimum Settable Power, All Ports<sup>1</sup>

Description	Specification (dB)	Typical (dBm)		
	All Options	All Options	Options 201, 401	Options 21x, 41x, 22x, 42x
Power Resolution	0.01	--	--	--
Maximum Settable Power	--	30	--	--
Minimum Settable Power	--	--	-30	-90

<sup>1</sup> Any port can be used as the source port.

Table 14a. 2<sup>nd</sup> and 3<sup>rd</sup> Harmonics at Max Specified Power (dBc), All Options - Typical

Listed frequency is fundamental frequency; test at max specified power.

Description	2 <sup>nd</sup> Harmonic		3 <sup>rd</sup> Harmonic	
	Ports <sup>1</sup> 1, 3 Source 2 Out 1 <sup>2</sup>	Ports <sup>1</sup> 2, 4 Source 2 Out 2	Ports <sup>1</sup> 1, 3 Source 2 Out 1 <sup>2</sup>	Ports <sup>1</sup> 2, 4 Source 2 Out 2
10 MHz to 50 MHz <sup>3</sup>	-44	-15	-49	-15
50 MHz to 2 GHz <sup>3</sup>	-55	-23	-60	-15
2 GHz to 13.5 GHz	-60	-20	-65	-19
13.5 GHz to 16.7 GHz	-60	-60	-65	-65
16.7 GHz to 25 GHz	-60	-60	--	--

<sup>1</sup> Any port can be used as the source port. Source in Filtered mode where applicable.

<sup>2</sup> At port 1 max specified power.

<sup>3</sup> With an LFE option installed and LFE disabled, applied to frequencies  $\leq 100$  MHz. Above 100 MHz, performance is the same for both LFE enabled or disabled. For LFE enabled performance  $\leq 100$  MHz, see Table 14b.

Table14b. 2<sup>nd</sup> and 3<sup>rd</sup> Harmonics at Max Specified Power (dBc), All Ports, Option 425 (LFE Enabled) – Typical

Listed frequency is fundamental frequency; test at max specified power.

Description	2nd Harmonic	3rd Harmonic
500 Hz to 900 Hz	-32	-31
900 Hz to 1 kHz	-22	-23
1 kHz to 10 kHz	-22	-23
10 kHz to 100 kHz	-22	-23
100 kHz to 1 MHz	-25	-22
1 MHz to 5 MHz	-28	-24
5 MHz to 10 MHz	-27	-22
10 MHz to 33 MHz	-28	-21
33 MHz to 50 MHz	-28	--

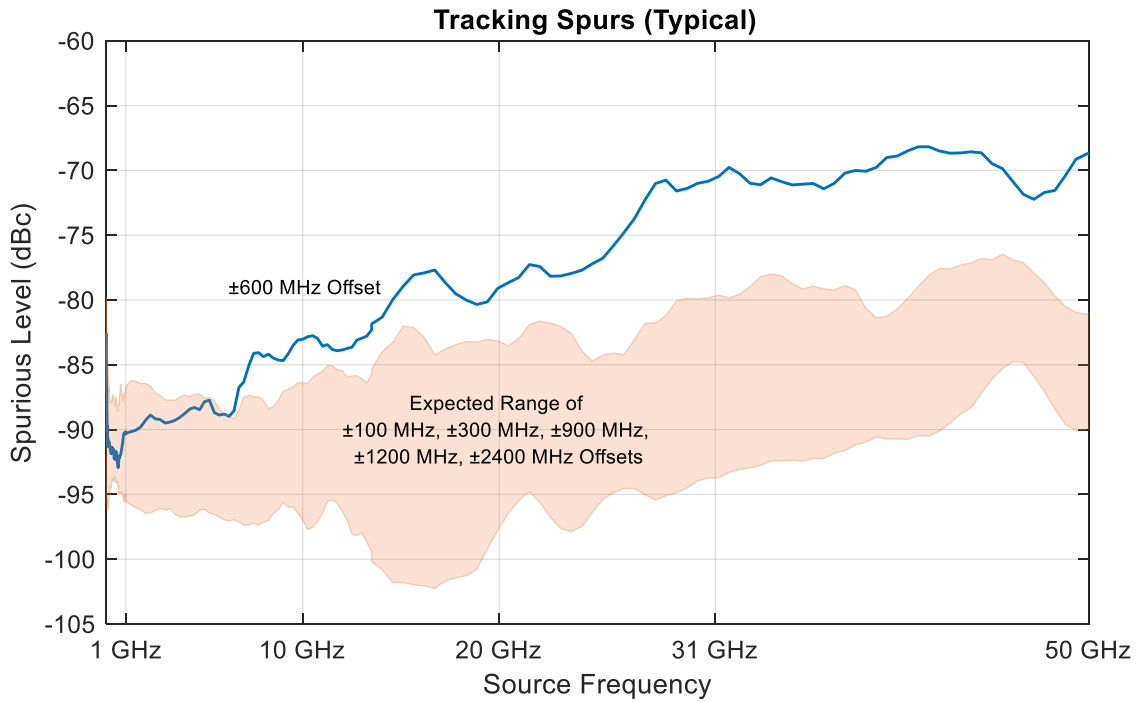
Table 15. Non-Harmonic Spurs<sup>1</sup> at Nominal Power (dBc), All Options – Typical

Listed frequency is Source CW frequency, tested at 0 dBm.

Description	Non-Harmonic	±600 MHz Tracking Spur
10 MHz to 1 GHz	-80	-80
1 GHz to 10 GHz	-85	-81
10 GHz to 20 GHz	-82	-75
20 GHz to 31 GHz	-80	-70
31 GHz to 50 GHz	-77	-67

<sup>1</sup> Non-harmonic spurs are negligible with Option 425 installed and LFE enabled.

## Tracking Spurs (Linear Frequency Scale)



## Tracking Spurs (Logarithmic Frequency Scale)

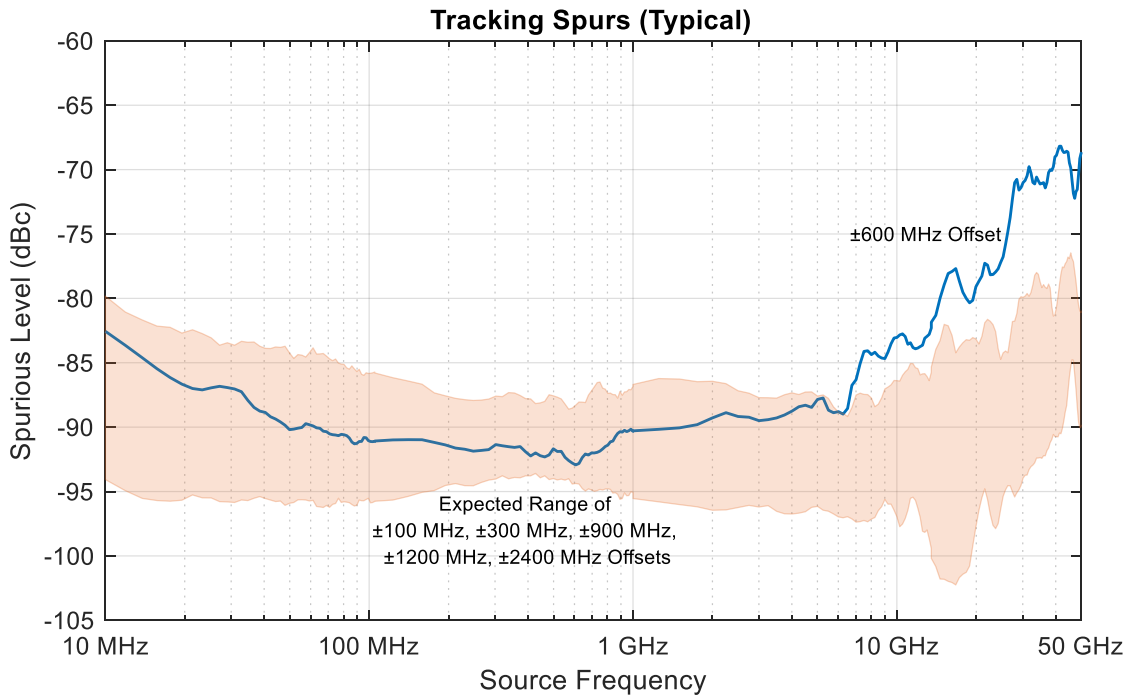


Table 16a. Phase Noise (dBc/Hz), All Options, with UNY, Port 1, 3, Src2Out1 - Typical

CW Frequency	100 Hz Offset	1 kHz Offset	10 kHz Offset	100 kHz Offset	1 MHz Offset	10 MHz Offset
1 GHz	-112	-132	-137	-143	-145	-144
5 GHz	-103	-123	-132	-135	-147	-150
10 GHz	-96	-116	-126	-130	-142	-146
20 GHz	-91	-111	-118	-123	-135	-139
26.5 GHz	-87	-106	-115	-121	-131	-135

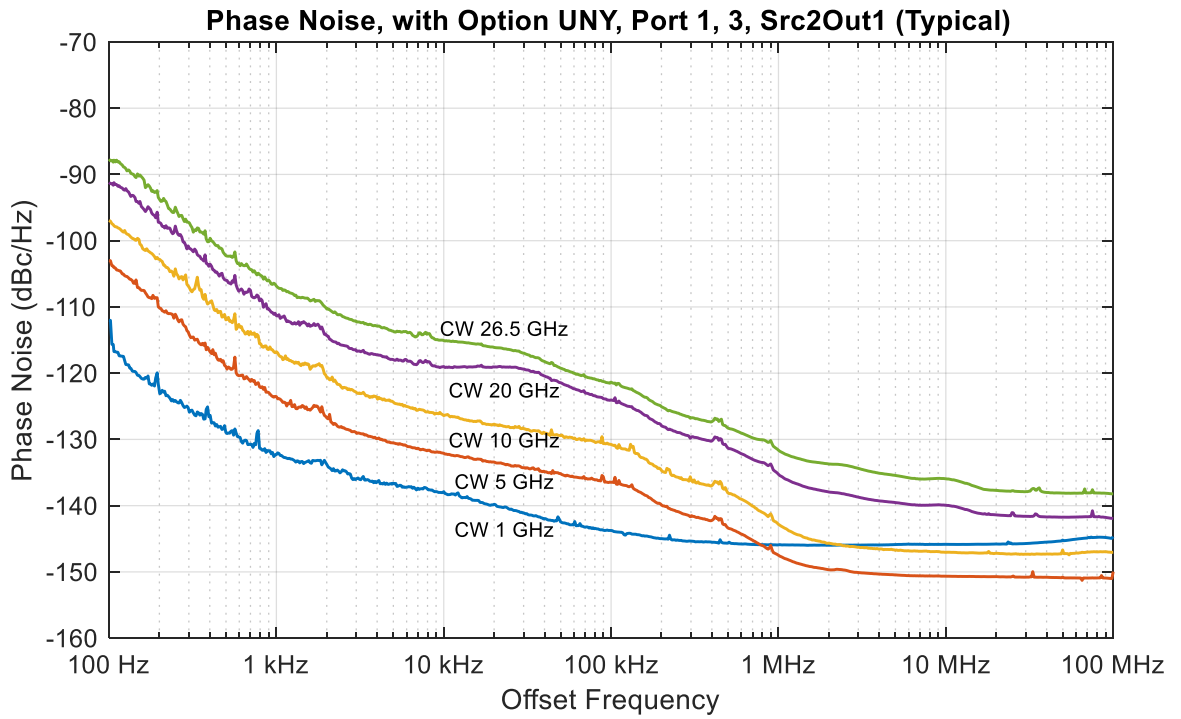
Table 16b. Phase Noise (dBc/Hz), All Options, with UNY, Port 2, 4, Src2Out2 - Typical

CW Frequency	100 Hz Offset	1 kHz Offset	10 kHz Offset	100 kHz Offset	1 MHz Offset	10 MHz Offset
1 GHz	-111	-121	-132	-145	-149	-149
5 GHz	-103	-122	-128	-134	-145	-149
10 GHz	-96	-112	-120	-127	-140	-147
20 GHz	-90	-108	-116	-123	-134	-139
26.5 GHz	-86	-106	-114	-121	-131	-135

Table 16c. Phase Noise (dBc/Hz), All Options, with UNY, All Ports – Supplemental Performance Data

CW Frequency	100 Hz Offset	1 kHz Offset	10 kHz Offset	100 kHz Offset	1 MHz Offset	10 MHz Offset
43.5 GHz	-82	-106	-113	-117	-129	-135
50 GHz	-81	-101	-109	-116	-127	-132

## Phase Noise with Option UNY



## Phase Noise with Option UNY (Supplemental Performance Data)

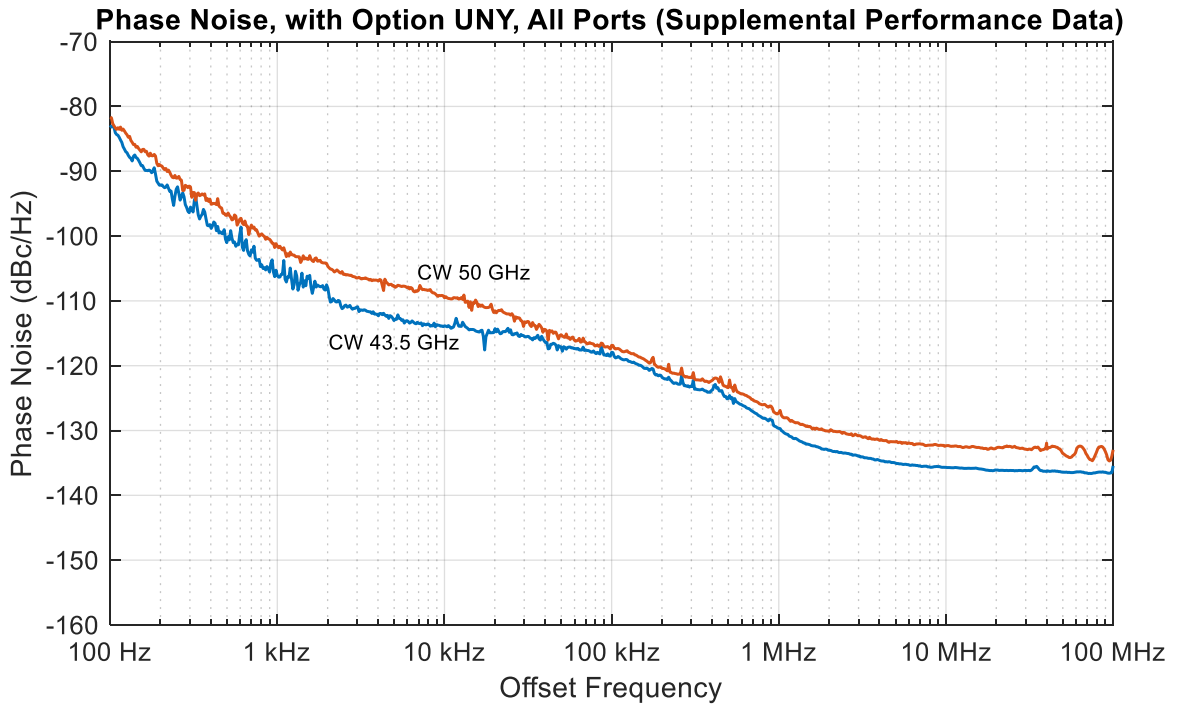


Table 16d. Phase Noise (dBc/Hz), Option 425, 425 with 029, and with UNY, All Ports (LFE Enabled) – Typical

Description	1 kHz Offset	10 kHz Offset	100 kHz Offset	1 MHz Offset
500 Hz to 100 MHz	-120	-130	-125	-135

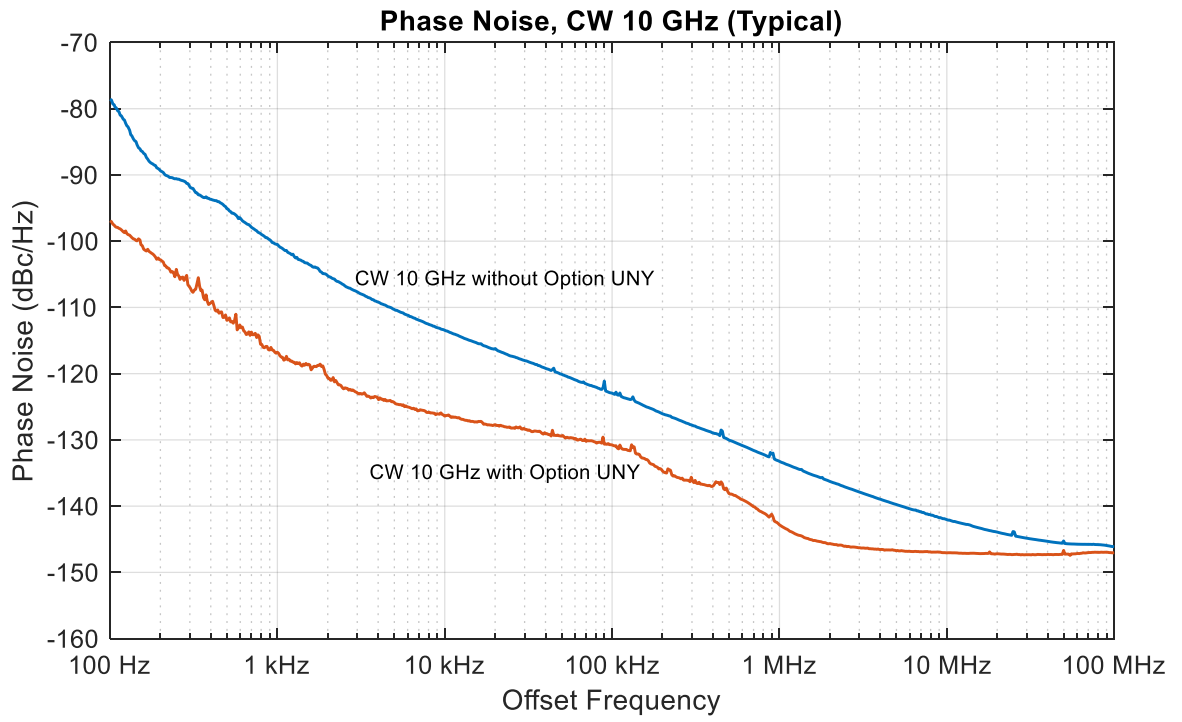
Table 16e. Phase Noise (dBc/Hz), All Options, without UNY, All Ports – Typical

CW Frequency	100 Hz Offset	1 kHz Offset	10 kHz Offset	100 kHz Offset	1 MHz Offset	10 MHz Offset
1 GHz	-94	-116	-130	-141	-145	-146
5 GHz	-83	-106	-119	-128	-139	-147
10 GHz	-78	-100	-113	-122	-133	-142
20 GHz	-72	-94	-107	-116	-127	-135
26.5 GHz	-67	-90	-104	-114	-124	-132

Table 16f. Phase Noise (dBc/Hz), All Options, without UNY, All Ports – Supplemental Performance Data

CW Frequency	100 Hz Offset	1 kHz Offset	10 kHz Offset	100 kHz Offset	1 MHz Offset	10 MHz Offset
43.5 GHz	-70	-90	-103	-112	-122	-130
50 GHz	-66	-86	-101	-111	-121	-130

Phase Noise, CW 10 GHz, with Option UNY and without Option UNY





## Test Port Input

Table 17a. Noise Floor<sup>1</sup> (dBm) @ 10 Hz IFBW, All Options, All Ports

Description	Specification		Typical	
	Test Port	Direct Receiver Access Input	Test Port	Direct Receiver Access Input
10 MHz to 50 MHz <sup>2,3</sup>	-70	-105	-76	-111
50 MHz to 100 MHz <sup>2,3</sup>	-85	-105	-91	-111
100 MHz to 500 MHz <sup>2</sup>	-90	-110	-98	-118
500 MHz to 1 GHz	-106	-127	-112	-133
1 GHz to 2 GHz	-110	-130	-114	-134
2 GHz to 10 GHz	-110	-122	-114	-126
10 GHz to 26.5 GHz	-111	-123	-114	-126
26.5 GHz to 40 GHz	-108	-118	-113	-123
40 GHz to 43.5 GHz	-109	-119	-113	-123
43.5 GHz to 50 GHz	-107	-117	-113	-123

<sup>1</sup> Total average (rms) noise power calculated as the mean value of a linear magnitude trace expressed in dBm.

<sup>2</sup> May typically be degraded at particular frequencies below 500 MHz due to spurious receiver residuals.

<sup>3</sup> With Option 425 installed and LFE disabled, applied to frequencies  $\leq$  100 MHz. Above 100 MHz, performance is the same for both LFE enabled or disabled. For LFE enabled performance  $\leq$  100 MHz, see Table 17b.

Table 17b. Test Port Noise Floor (dBm) @ 10 Hz IFBW Option 425 (LFE Enabled)

Description	Specification	Typical
500 Hz to 900 Hz	--	-93
900 Hz to 1 kHz	-90	-96
1 kHz to 10 kHz	-91	-96
10 kHz to 100 kHz	-101	-105
100 kHz to 1 MHz	-107	-110
1 MHz to 5 MHz	-108	-112
5 MHz to 10 MHz	-102	-106
10 MHz to 50 MHz	-102	-106
50 MHz to 100 MHz	-102	-106

<sup>1</sup> May be degraded at 100 MHz due to spurious receiver residuals.

Table 18a. 0.1 dB Compression, All Options, All Ports - Typical

Description	Test Port Power (dBm)
10 MHz to 10 GHz <sup>1</sup>	15
10 GHz to 50 GHz	13

<sup>1</sup> With Option 425 installed and LFE disabled, applied to frequencies  $\leq$  100 MHz. Above 100 MHz, performance is the same for both LFE enabled or disabled. For LFE enabled performance  $\leq$  100 MHz, see Table 18b.

Table 18b. 0.1 dB Compression, All Ports, Option 425 (LFE Enabled) - Typical

Description	Test Port Power (dBm)
500 Hz to 900 Hz	13
900 Hz to 1 kHz	13
1 kHz to 10 kHz	13
10 kHz to 100 kHz	13
100 kHz to 1 MHz	13
1 MHz to 5 MHz	11
5 MHz to 10 MHz	13
10 MHz to 50 MHz	14
50 MHz to 100 MHz	14

Table 18c. Compression, All Ports, Option 425 (LFE Enabled)- Specification

Description	Test Port Power (dBm)	Receiver Compression	
		Magnitude (dB)	Phase (degrees)
500 Hz to 900 Hz	--	--	--
900 Hz to 1 kHz	10	0.2	1
1 kHz to 10 kHz	12	0.2	1
10 kHz to 100 kHz	12	0.2	1
100 kHz to 1 MHz	12	0.2	1
1 MHz to 5 MHz	10	0.2	1
5 MHz to 10 MHz	9	0.2	1
10 MHz to 50 MHz	8	0.2	1
50 MHz to 100 MHz	8	0.2	1

Table 19. Compression, All Ports - Specification

Description	Test Port Power			Receiver compression	
	Options 201, 401	Options 21x, 41x	Options 22x, 42x	Magnitude (dB)	Phase (degree)
500 MHz to 10 GHz <sup>1</sup>	13	13	13	0.15	1.5
10 GHz to 13.5 GHz	13	11	10	0.15	1.5
13.5 GHz to 20 GHz	13	9	9	0.15	1.5
20 GHz to 26.5 GHz	13	9	9	0.18	1.5
26.5 GHz to 32 GHz	13	9	8	0.18	1.5
32 GHz to 40 GHz	9	8	8	0.18	1.5
40 GHz to 43.5 GHz	8	8	8	0.18	1.5
43.5 GHz to 45 GHz	8	8	8	0.2	1.5
45 GHz to 47 GHz	6	6	6	0.2	1.5
47 GHz to 50 GHz	5	1	0	0.2	1.5

<sup>1</sup> Test port receiver compression at input levels below 500 MHz is negligible due to coupler roll off.

Table 20a. Trace Noise<sup>1</sup> Magnitude (dB rms), All Options, All Ports

Description	Specification	Typical		
		1 kHz IFBW	100 kHz IFBW	600 kHz IFBW
10 MHz to 50 MHz <sup>2</sup>	0.200	0.08	0.800	2.000
50 MHz to 100 MHz <sup>2</sup>	0.030	0.013	0.120	0.300
100 MHz to 500 MHz	0.020	0.005	0.050	0.150
500 MHz to 1 GHz	0.003	0.002	0.012	0.030
1 GHz to 26.5 GHz	0.002	0.002	0.011	0.026
26.5 GHz to 43.5 GHz	0.003	0.002	0.011	0.026
43.5 GHz to 50 GHz	0.004	0.002	0.011	0.026

<sup>1</sup> Ratioed measurement, nominal power at test port.

<sup>2</sup> With Option 425 installed and LFE disabled, applied to frequencies  $\leq$  100 MHz. Above 100 MHz, performance is the same for both LFE enabled or disabled. For LFE enabled performance  $\leq$  100 MHz, see Table 20b.

Table 20b. Trace Noise<sup>1</sup> Magnitude (dB rms), All Ports, Option 425 (LFE Enabled)

Description	Specification		Typical			
	100 Hz IFBW	1 kHz IFBW	100 Hz IFBW	1 kHz IFBW	100 kHz IFBW	600 kHz IFBW
500 Hz to 900 Hz	--	--	0.002	--	--	--
900 Hz to 4 kHz	0.004	--	0.001	--	--	--
4 kHz to 300 kHz	--	0.004	--	0.002	--	--
300 kHz to 2 MHz	--	0.004	--	0.001	0.01	--
2 MHz to 100 MHz	--	0.004	--	0.001	0.01	0.025

<sup>1</sup> Ratioted measurement, -5 dBm at test port.

Table 20c. Trace Noise<sup>1</sup> Phase (deg rms), All Options, All Ports

Description	Specification	Typical		
	1 kHz IFBW	1 kHz IFBW	100 kHz IFBW	600 kHz IFBW
10 MHz to 50 MHz <sup>2</sup>	1	0.6	6	14
50 MHz to 100 MHz <sup>2</sup>	1	0.1	1	1.8
100 MHz to 500 MHz	0.5	0.035	0.35	1.0
500 MHz to 1 GHz	0.02	0.009	0.1	0.25
1 GHz to 26.5 GHz	0.02	0.009	0.08	0.18
26.5 GHz to 50 GHz	0.03	0.015	0.09	0.2

<sup>1</sup> Ratioted measurement, nominal power at test port.

<sup>2</sup> With Option 425 installed and LFE disabled, applied to frequencies  $\leq$  100 MHz. Above 100 MHz, performance is the same for both LFE enabled or disabled. For LFE enabled performance  $\leq$  100 MHz, see Table 20d.

Table 20d. Trace Noise<sup>1</sup> Phase (deg rms), All Ports, Option 425 (LFE Enabled)

Description	Specification		Typical			
	100 Hz IFBW	1 kHz IFBW	100 Hz IFBW	1 kHz IFBW	100 kHz IFBW	600 kHz IFBW
500 Hz to 900 Hz	--	--	0.012	--	--	--
900 Hz to 4 kHz	0.03	--	0.008	--	--	--
4 kHz to 300 kHz	--	0.03	--	0.014	--	--
300 kHz to 2 MHz	--	0.03	--	0.007	0.064	--
2 MHz to 100 MHz	--	0.03	--	0.007	0.068	0.166

<sup>1</sup> Ratioted measurement, -5 dBm at test port.

Table 21. Reference Level - Specification

Description	Magnitude (dB)	Phase (°)
Range	±500	±500
Resolution	0.001	0.01

Table 22a. Stability<sup>1</sup> - Typical

Description	Magnitude (dB/°C)	Phase (°/°C)
10 MHz to 50 MHz <sup>2</sup>	0.02	0.3
50 MHz to 3.2 GHz <sup>2</sup>	0.01	0.15
3.2 GHz to 10 GHz	0.01	0.2
10 GHz to 16 GHz	0.01	0.25
16 GHz to 20 GHz	0.015	0.3
20 GHz to 26.5 GHz	0.015	0.4
26.5 GHz to 32 GHz	0.02	0.55
32 GHz to 40 GHz	0.025	0.7
40 GHz to 47 GHz	0.025	0.75
47 GHz to 50 GHz	0.03	0.8

<sup>1</sup> Stability is defined as a ratio measurement made at the test port.

<sup>2</sup> With Option 425 installed and LFE disabled, applied to frequencies ≤ 100 MHz. Above 100 MHz, performance is the same for both LFE enabled or disabled. For LFE enabled performance ≤ 100 MHz, see Table 22b.

Table 22b. Stability<sup>1</sup>, Option 425 (LFE Enabled) - Typical

Description	Magnitude (dB/°C)	Phase (°/°C)
500 Hz to 900 Hz	0.010	0.2
900 Hz to 1 kHz	0.010	0.2
1 kHz to 10 kHz	0.010	0.2
10 kHz to 100 kHz	0.010	0.2
100 kHz to 1 MHz	0.010	0.1
1 MHz to 5 MHz	0.010	0.1
5 MHz to 10 MHz	0.010	0.1
10 MHz to 50 MHz	0.010	0.1
50 MHz to 100 MHz	0.020	0.1

<sup>1</sup> Stability is defined as a ratio measurement made at the test port.

Table 23 Damage Input Level - Specification

Description	RF (dBm)	DC (V)
Test Ports 1, 2, 3, 4	> +30	> 40
Test Ports 1, 2, 3, 4 (Options 217, 222, 417, 422)	> +30	> 7
Source 2 Out 1, Source 2 Out 2 (Option 22x only)	> +30	> 0
Test Port 1, Noise Mode <sup>1</sup> (Option 029 only)	> +10	> 40
Test Port 2, Noise Mode <sup>1</sup> (Option 029 without Option 425 )	> +27	> 40
Test Ports (Option 425)	> +20	> 50

<sup>1</sup> Noise mode sets port 1 impedance tuner switch to internal tuner position and port 2 noise receiver switch to noise receiver position.

## Noise Receiver Input (Option 029 only)

Table 24. Noise Receiver Bandwidth

Description	Allowable Bandwidths
10 MHz to 25 MHz	800 kHz, 2 MHz
25 MHz to 60 MHz	800 kHz, 2/4 MHz
60 MHz to 150 MHz	800 kHz, 2/4/8 MHz <sup>1</sup>
150 MHz to 50 GHz	800 kHz, 2/4/8/24 MHz <sup>1</sup>

<sup>1</sup> 8 and 24 MHz bandwidths are available only with calibration using noise source.

Table 25a. Receiver Noise Figure (dB), Port 2, at 4 MHz BW, High Gain Setting

Description	Specification	Typical
10 MHz to 50 MHz	--	9
50 MHz to 1.5 GHz	10	7
1.5 GHz to 5 GHz	12	10
5 GHz to 20 GHz	15	11
20 GHz to 45 GHz	16	11
45 GHz to 50 GHz	21	14

Table 25b. Receiver Noise Figure (dB), Port 2, @ 4 MHz BW, High Gain Setting, Option 425 with 029

Description	Specification	Typical
10 MHz to 50 MHz	--	9
50 MHz to 1.5 GHz	15.5	12.5
1.5 GHz to 5 GHz	14	12
5 GHz to 20 GHz	16	12
20 GHz to 45 GHz	16	11
45 GHz to 50 GHz	21	14

Table 26. Noise Figure Trace Noise<sup>1</sup> (dB rms) at 4 MHz BW, All Gain Settings

Frequency	Specification	Typical
10 MHz to 50 MHz	--	0.07
50 MHz to 50 GHz	0.11	0.07

<sup>1</sup> Trace noise magnitude performance on noise figure trace or sometimes called noise jitter, 201 points, 1 noise average, with terminated input. May typically be degraded at frequencies below 500 MHz due to spurious noise receiver residuals.

Table 27. Noise Receiver Linearity (dB) at 4 MHz BW - Specification

Power Range (dBm)			Specification
Low Gain Setting Reference to -60dBm	Medium Gain Setting Reference to -70 dBm	High Gain Setting Reference to -80 dBm	
-36 to -64	-48 to -76	-58 to -85	±0.05
-64 to -70	-76 to -87	-85 to -92	±0.07

Table 28a. Noise Receiver Input Range - Specification

Description	Max DUT NF + Gain (dB) <sup>1</sup>			Max Input Power (dBm) for <0.1 dB Compression <sup>2</sup>		
	High Gain Setting	Medium Gain Setting	Low Gain Setting	High Gain Setting	Medium Gain Setting	Low Gain Setting
500 MHz to 4.5 GHz	37	53	68	≤-51	≤-35	≤-20
4.5 GHz to 6 GHz	38	53	71	≤-50	≤-35	≤-17
6 GHz to 24 GHz	47	57	66	≤-41	≤-31	≤-22
24 GHz to 26.5 GHz	45	58	66	≤-43	≤-30	≤-22
26.5 GHz to 36 GHz	45	56	57	≤-43	≤-32	≤-31
36 GHz to 50 GHz	39	51	58	≤-49	≤-37	≤-30

<sup>1</sup> Limited by 0.1 dB receiver compression. Applies to devices with bandwidth <400 MHz. For devices with higher bandwidths, calculate the DUT output noise power as -174 dBm + 10\*log10(B) + Gain (dB) + NF (dB), where B is the bandwidth of the DUT in Hz, and use the Max Input Power specification.

<sup>2</sup> Derived from ensuring < 0.25 dB compression with a CW signal 5 dB higher than the stated max input power value for 0.1 dB compression. Referenced to test port 2.



Table 28b. Noise Receiver Input Range, Option 425 with 029 - Specification

Description	Max DUT NF + Gain (dB) <sup>1</sup>			Max Input Power (dBm) for <0.1 dB Compression <sup>2</sup>		
	High Gain Setting	Medium Gain Setting	Low Gain Setting	High Gain Setting	Medium Gain Setting	Low Gain Setting
500 MHz to 4.5 GHz	37	53	68	≤-51	≤-35	≤-20
4.5 GHz to 6 GHz	38	53	71	≤-50	≤-35	≤-17
6 GHz to 24 GHz	47	57	66	≤-41	≤-31	≤-22
24 GHz to 26.5 GHz	45	58	66	≤-43	≤-30	≤-22
26.5 GHz to 36 GHz	45	56	57	≤-43	≤-32	≤-31
36 GHz to 50 GHz	39	51	58	≤-50	≤-38	≤-30

<sup>1</sup> Limited by 0.1 dB receiver compression. Applies to devices with bandwidth <400 MHz. For devices with higher bandwidths, calculate the DUT output noise power as  $-174 \text{ dBm} + 10 \cdot \log_{10}(B) + \text{Gain (dB)} + \text{NF (dB)}$ , where B is the bandwidth of the DUT in Hz, and use the Max Input Power specification.

<sup>2</sup> Derived from ensuring < 0.25 dB compression with a CW signal 5 dB higher than the stated max input power value for 0.1 dB compression. Referenced to test port 2.

# Dynamic Accuracy

Table 29. Dynamic Accuracy - Specification

Standard receiver accuracy of the test port input power reading relative to the reference input power level. It is verified with the following measurements:

- Compression over frequency
- IF linearity at a single frequency of 1.998765 GHz using a reference level of -20 dBm for an input power range of 0 to -60 dBm. For value below -60 dBm, refer to “VNA Receiver Dynamic Accuracy Specifications and Uncertainties”.

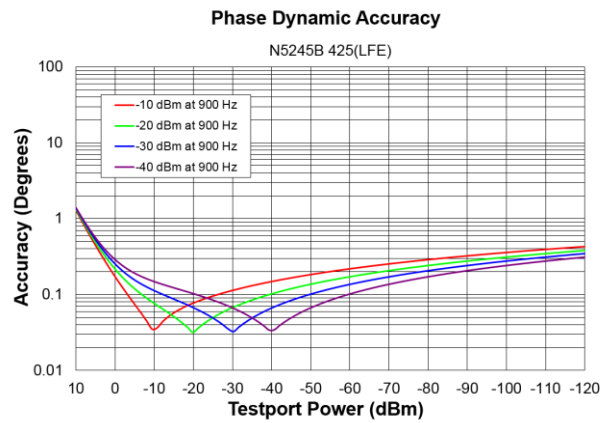
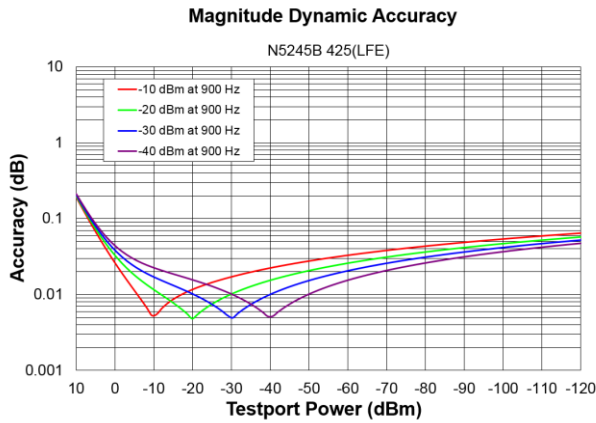
Applies to the N5244B and N5245B with the following serial numbers.

N5244B and N5244BS: MY5244/SG5244/US5244 and above

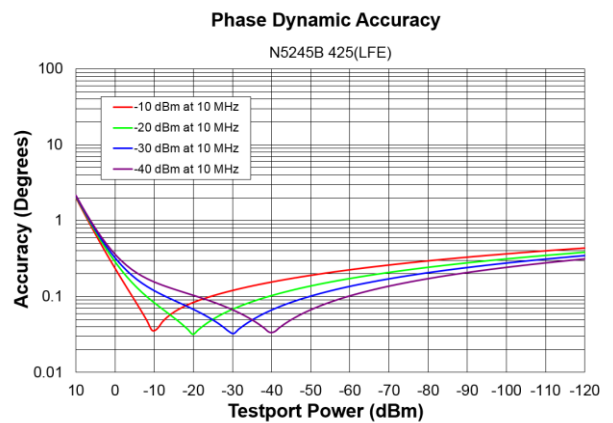
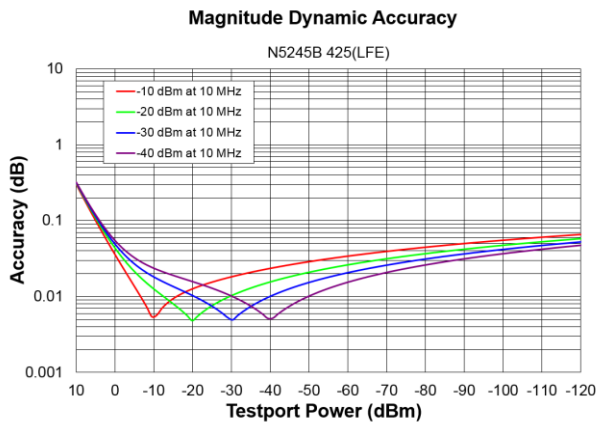
N5245B and N5245BS: MY5245/SG5245/US5245 and above

Please download our free Uncertainty Calculator from [http://www.keysight.com/find/na\\_calculator](http://www.keysight.com/find/na_calculator) to generate the curves for your PNA.

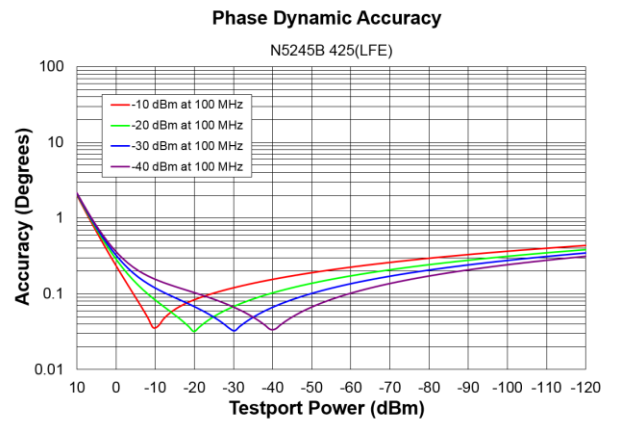
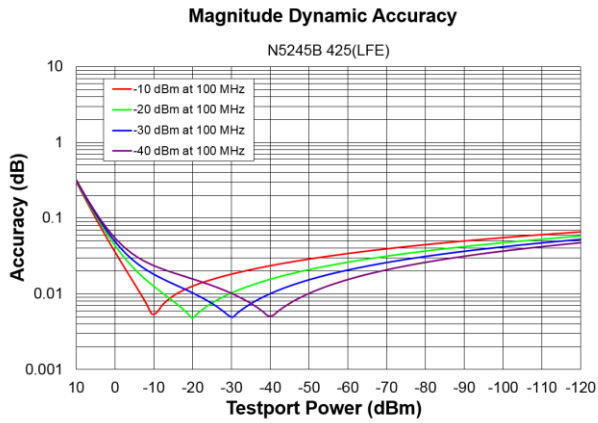
## Dynamic Accuracy, 900 Hz (LFE Enabled) - Specification



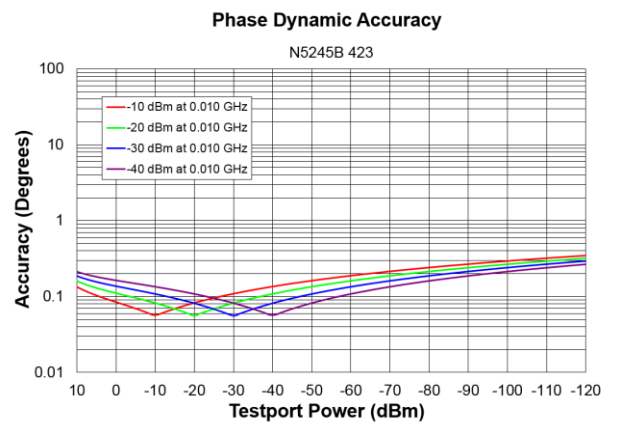
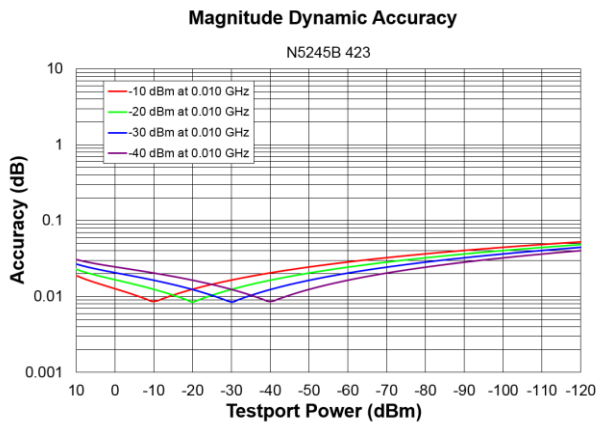
## Dynamic Accuracy, 10 MHz (LFE Enabled) - Specification



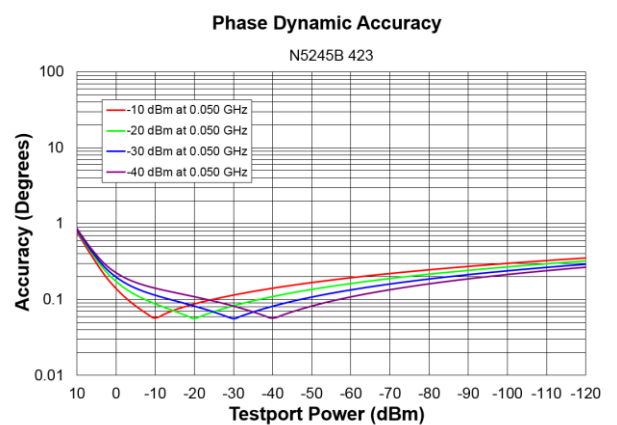
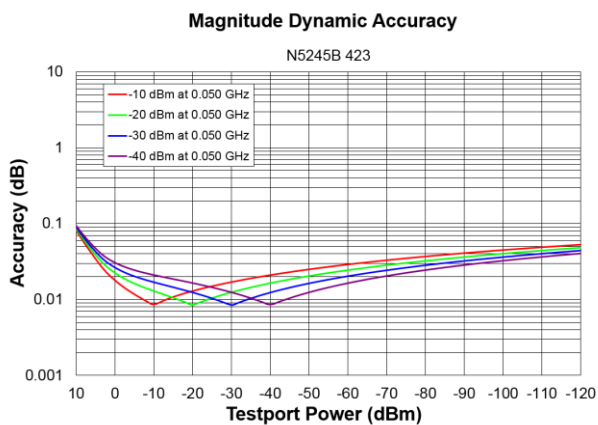
## Dynamic Accuracy, 100 MHz (LFE Enabled) - Specification



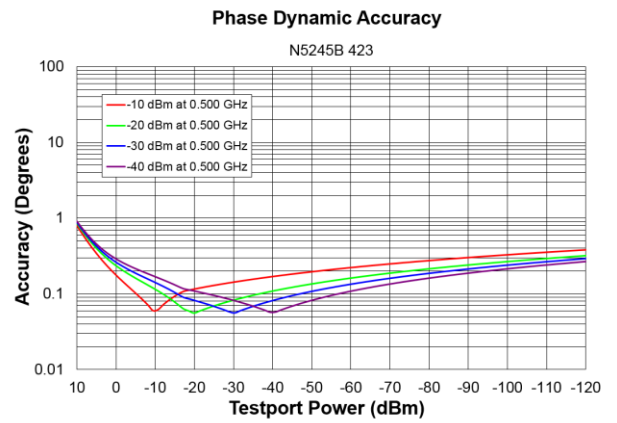
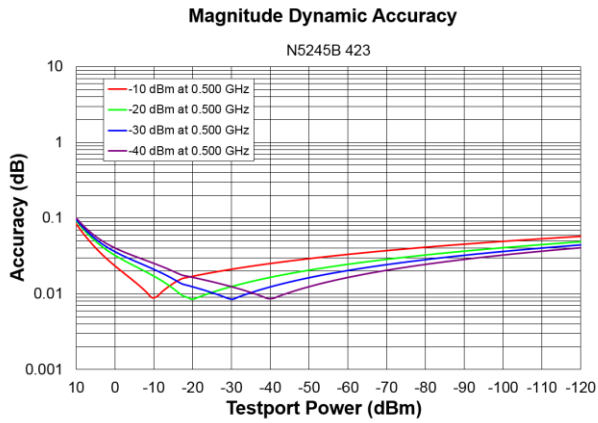
## Dynamic Accuracy, 10 MHz



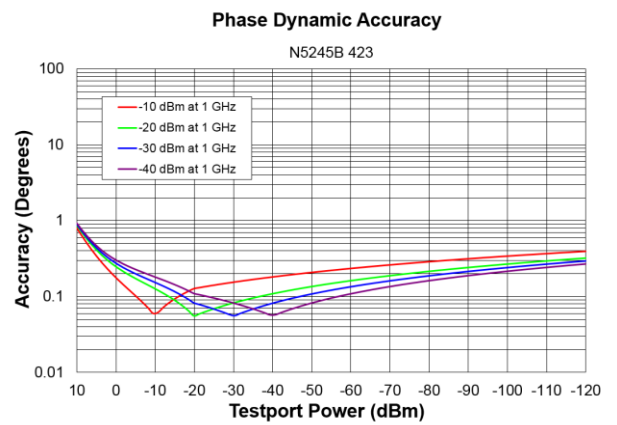
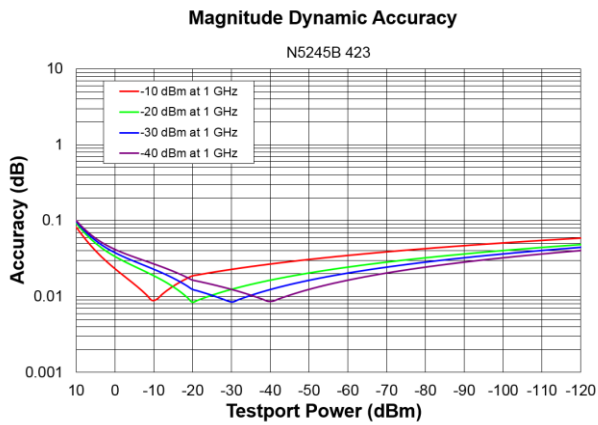
## Dynamic Accuracy, 50 MHz



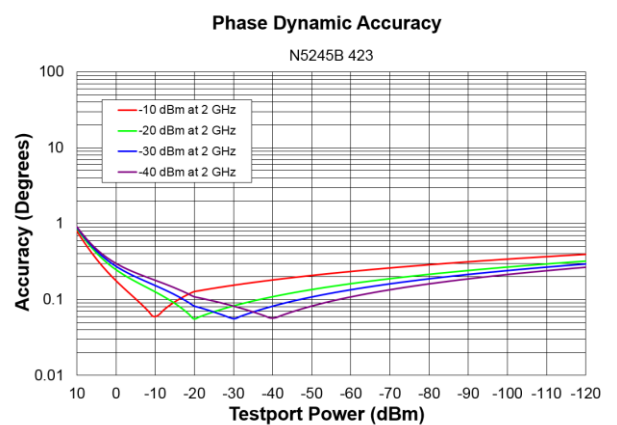
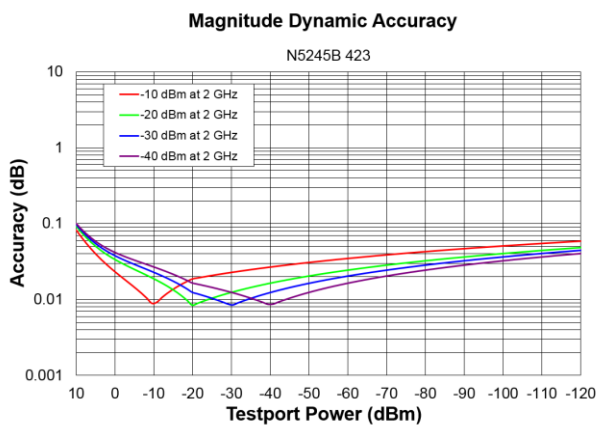
## Dynamic Accuracy, 500 MHz



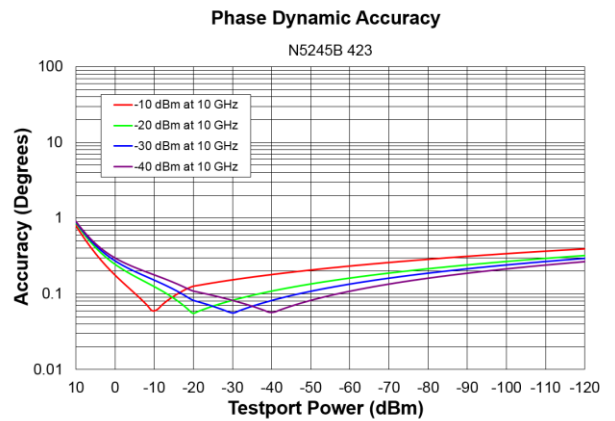
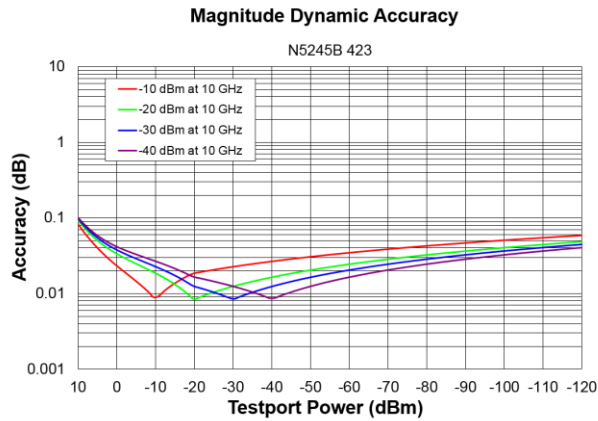
## Dynamic Accuracy, 1 GHz



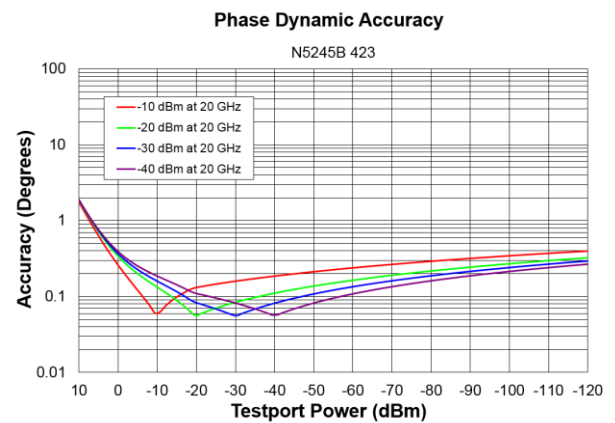
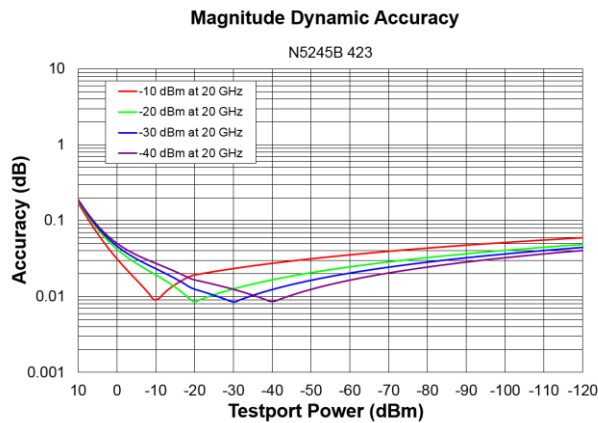
## Dynamic Accuracy, 2 GHz



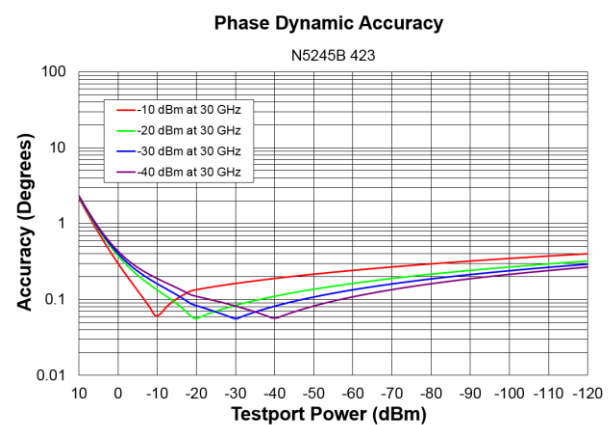
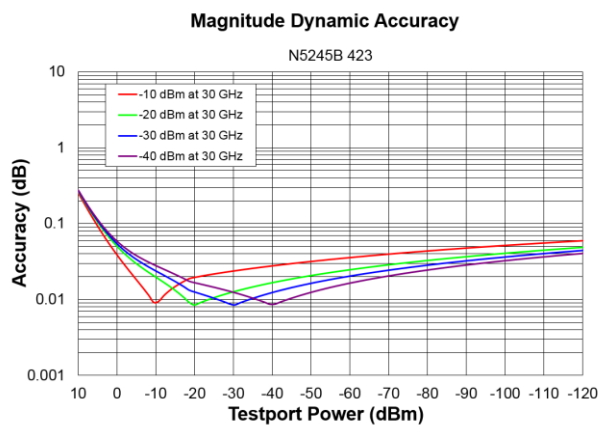
## Dynamic Accuracy, 10 GHz



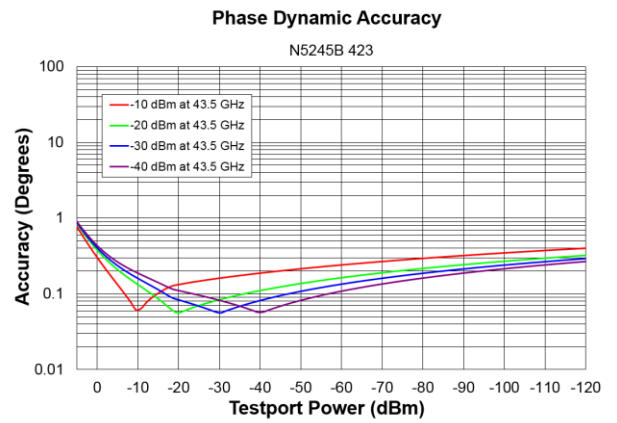
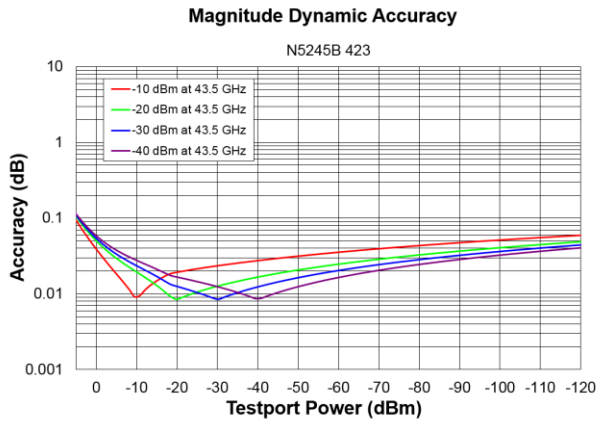
## Dynamic Accuracy, 20 GHz



## Dynamic Accuracy, 30 GHz



## Dynamic Accuracy, 43.5 GHz



## Dynamic Accuracy, 50 GHz

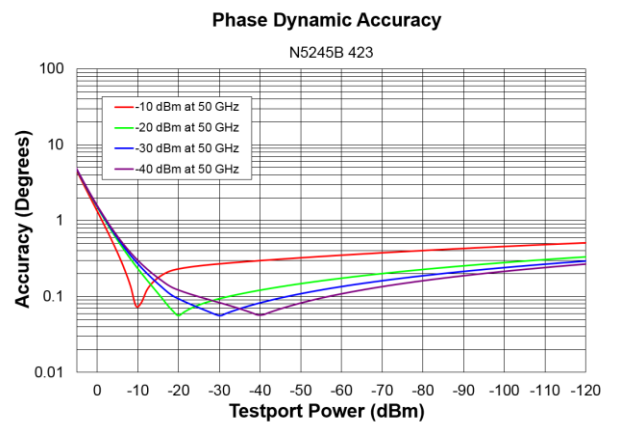
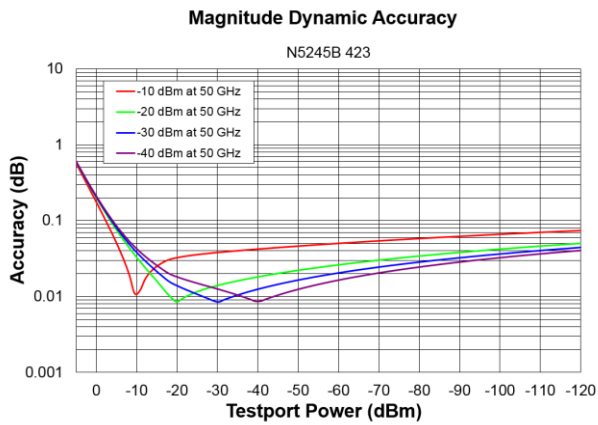


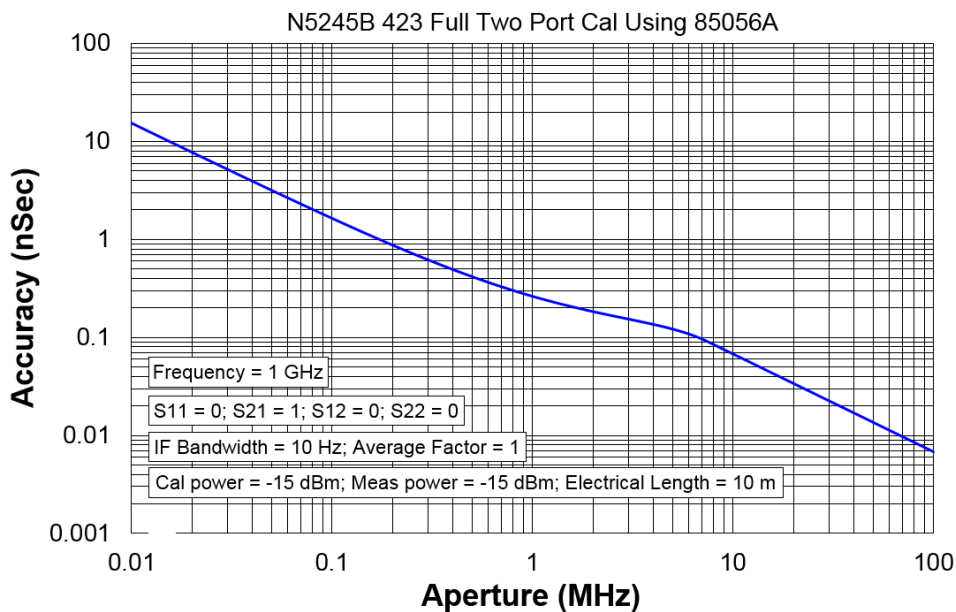
Table 30. Test Port Input (Group Delay)<sup>1</sup>

Description	Typical Performance
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,  $S_{ii} = 0$ ,  $S_{ij} = 1$ ,  $S_{ji} = 0$ ,  $S_{kl} = 0$  for all  $kl \neq ij$

### Group Delay Accuracy (Typical)



In general, the following formula can be used to determine the accuracy, in seconds, of specific group delay measurement:  
 $\pm \text{Phase Accuracy (deg)} / [360 \times \text{Aperture (Hz)}]$

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

<sup>1</sup> 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).

## General Information

- Miscellaneous Information
- Front Panel
- Rear Panel
- Environment and Dimensions

Table 31. Miscellaneous Information

Description	Supplemental Information
System IF Bandwidth Range	1 Hz to 15 MHz, nominal (7 MHz, 10 MHz, and 15 MHz IFBW are available ONLY with FW A.09.42 and later, and with DSP version 5)
CPU	For the latest information on CPUs and associated hard drives, visit: <a href="http://na.support.keysight.com/pna/hdnumbers.html">http://na.support.keysight.com/pna/hdnumbers.html</a>
LXI	Class C

Table 32. Front Panel Information, All Options

Description	Typical Performance
<b>RF Connectors</b>	
Test Ports	2.4 mm (male), 50 ohm (nominal), 0.002 in. Center Pin Recession (characteristic)
Jumpers	2.4 mm (female) connectors with 2.4 mm (male) jumper cables
<b>USB 2.0 Ports - Master (4 ports)</b>	
Standard	Compatible with USB 2.0
Connector	USB Type-A female
<b>Display</b>	
Size	31 cm (12.1 in) diagonal color active matrix LCD; 1280 (horizontal) X 800 (vertical) resolution
Refresh Rate	Vertical 60 Hz; Horizontal 49.31 kHz
Pixels	Any of the following would cause a display to be considered faulty: <ul style="list-style-type: none"> <li>• A complete row or column consists of “stuck” or “dark” pixels.</li> <li>• More than six “stuck on” pixels (but not more than three green) or more than 0.002% of the total pixels are within the LCD specifications.</li> <li>• More than twelve “dark” pixels (but no more than seven of the same color) or more than 0.004% of the total pixels are within the LCD specifications.</li> <li>• Two or more consecutive “stuck on” pixels or three or more consecutive “dark” pixel (but no more than one set of two consecutive dark pixels).</li> <li>• “Stuck on” pixels or more than two “dark” pixels less than 6.5 mm apart (excluding consecutive pixels).</li> </ul>



Table 32. (Continued) Front Panel Information, All Options

Description	Typical Performance
<b>Display Range</b>	
Magnitude	±2500 dB (at 500 dB/div), max
Phase	±2500° (at 500 degrees/div), max
Polar	10 pUnits, min 10,000 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	10 pUnit, min

Table 33. Rear Panel Information, All Options

Description	Typical Performance
<b>10 MHz Reference In</b>	
Connector	BNC, female
Input Frequency	10 MHz ±1 ppm, 100 MHz ±1 ppm
Input Level	10 MHz: -15 dBm to +20 dBm 100 MHz: -10 dBm to +20 dBm
Input Impedance	50 Ω, nom.
<b>10 MHz Reference Out</b>	
Connector	BNC, female
Output Frequency	10 MHz ±0.7 ppm, 100 MHz ±0.7 ppm
Signal Type	Sine Wave
Output Level	+10 dBm ±4 dB into 50 Ω
Output Impedance	50 Ω, nominal
Harmonics	<-40 dBc, typical
<b>SRC3 (Option XSB)</b>	
Connector	SMA, female
Output Frequency	10 MHz to 13.5 GHz
Maximum Output Power	See Table 8q

Table 33. (Continued) Rear Panel Information, All Options

Description	Typical Performance			
<b>External IF Inputs</b>				
Function	Allows use of external IF signals from remote mixers, bypassing the PNA's first converters			
Connectors	SMA (female); A, B, C, D, R (4-port); A, B, R1, R2 (2-port)			
Frequency				
Path	DSP Version	IF Bandwidth	RF Frequency	IF Frequency
Normal IF path:	4	All	< 53 MHz	2.535211 MHz
		All	>= 53 MHz	7.605634 MHz
	5	≤ 600 kHz	< 53 MHz	2.479339 MHz
			>= 53 MHz	7.438017 MHz
		1 MHz	All	7.692 MHz
		1.5 MHz	All	7.368 MHz
		2 MHz	All	8.450 MHz
		3 MHz	All	8.163 MHz
		5 MHz	All	6.897 MHz
		7 MHz	All	10.53 MHz
10 MHz	All	15.38 MHz		
		15 MHz	All	22.22 MHz
Narrowband IF path:	4 or 5	All	All	10.70 MHz
Input Impedance	50 Ω			
RF Damage Level	+23 dBm			
DC Damage Level	5.5 VDC			
0.1 dB Compression Point				
Normal IF path	-9.0 dBm at 7.438 MHz			
Narrowband IF path	-17 dBm at 10.70 MHz			
<b>Pulse Inputs (IF Gates)</b>				
Function	Internal receiver gates used for point-in-pulse and pulse-profile measurements			
Connectors	15-pin mini D-sub			
Input Impedance	1 K Ohm			
Source Modulators	20 ns minimum pulse width			
Receiver Gates	20 ns minimum pulse width			
DC Damage Level	5.5 VDC			
Drive Voltage	0 V (off), +3.3 V (on), nominal			

Table 33. (Continued) Rear Panel Information, All Options

Description	Typical Performance	
<b>RF Pulse Modulator Input (Source Modulator)</b>		
<b>On/Off Ratio</b>		
10 MHz to 3.2 GHz	-64 dB	
3.2 GHz to 50 GHz	-80 dB	
<b>Pulse Period</b>		
Minimum	20 ns	
Maximum	70 s	
<b>Pulse Outputs</b>		
Voltage (TTL)	High: 3.3V to 3.5V Low: <1V	
Impedance	50 Ohm	
<b>External Test Set Driver</b>		
Function	Used for driving remote mixers	
Connections	3.5 mm (female)	
RF Output Frequency Range	3.2 GHz to 19 GHz	
LO Output Frequency Range	0.01 GHz to 26.5 GHz	
<b>Rear Panel LO Power<sup>1</sup></b>	<b>Upper Limit, Typical (dBm)</b>	<b>Lower Limit, Typical (dBm)</b>
10 MHz to 1.7 GHz	--	--
1.7 GHz to 6.78 GHz	5	-3
6.78 GHz to 15.4 GHz	0	-6
15.4 GHz to 26.5 GHz	4	-5
<b>Rear Panel RF Power</b>	<b>Upper Limit, Typical (dBm)</b>	<b>Lower Limit, Typical (dBm)</b>
3.2 GHz to 19 GHz	-3	-8

Table 33. (Continued) Rear Panel Information, All Options

Description	Typical Performance
<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>Bias Tee Inputs</b>	
Connectors	BNC(f) for ports 1, 2, 3 and 4
Fuse	500 mA, bi-pin style
Maximum Bias Current	±200 mA with no degradation of RF specifications
Maximum Bias Voltage	±40 VDC
Trigger Inputs/Outputs	BNC(f), TTL/CMOS compatible
Test Set IO	25-pin D-Sub connector, available for external test set control
Power IO	9-pin D-Sub, female; analog and digital IO
Handler IO	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
Pulse I/O	15-pin D connector provides access to Pulse Modulators and Generators
GPIB	Two ports - dedicated controller and dedicated talker/listener. 24-pin D-sub (Type D-24), female; compatible with IEEE-488
PCIe	Cabled PCIe x4 connector is a 4-lane slot (not currently used)
USB Ports	Two SuperSpeed USB ports (900 mA each), one USB port below LAN connector, and one USB device port. There are also four USB ports (500 mA each) on the front panel. The total current limit for all rear panel USB ports is 2.3 amps. The total current limit for all front panel USB ports is 2 amps.
LAN	10/100/1000 BaseT Ethernet, 8-pin configuration; auto selects between the data rates
VGA Video Output	15-pin mini D-Sub; Drives VGA compatible monitors
Mini DisplayPort	Miniature DisplayPort connector for connection to external displays
<b>Line Power</b>	
Frequency, Voltage	50/60/400 Hz for 100 to 120 VAC 50/60 Hz for 220 to 240 VAC
	Power supply is auto switching
Max	575 watts

**Table 34. Analyzer Dimensions and Weight**

All models are shipped with bottom feet, handles and front and rear hardware.

See detailed PNA dimension drawings at: <http://na.support.keysight.com/pna/PNADimensions.pdf>

<b>Cabinet Dimensions</b>	<b>Metric (mm)</b>	<b>Imperial (inches)</b>
<b>Height</b>		
Without bottom feet:EIA RU1 = 6	266.1	10.5
With bottom feet	279.1	11.0
<b>Width</b>		
Without handles or rack-mount flanges	425.6	16.8
With handles, without rack-mount flanges	458.7	18.1
With handles and rack-mount flanges	482.9	19.0
<b>Depth</b>		
Without front and rear panel hardware	582.3	22.9
With front and rear panel hardware, handles	649.6	25.6
<b>Weight (nominal)</b>	<b>Net</b>	<b>Shipping</b>
2-port models (Option 22x with 029)	46.3 kg (102 lb)	62.1 kg (137 lb)
4-port models (Option 42x with 029)	49.0 kg (108 lb)	65.3 kg (144 lb)

<sup>1</sup> Electronics Industry Association rack units. 1 RU = 1.75 in.

### Regulatory and Environmental Information

For Regulatory and Environmental information, refer to the PNA Series Installation and Quick Start Guide, located online at <http://literature.cdn.keysight.com/litweb/pdf/E8356-90001.pdf>.

## Measurement Throughput Summary

- Typical Cycle Time for Measurement Completion
- Cycle Time vs. IF Bandwidth
- Cycle Time vs. Number of Points
- Data Transfer Time

Cycle time 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. LF Auto BW off.

Table 35a. Cycle Time (ms) for Measurement Completion, All Models, All Options - Typical

Sweep Range	IF Bandwidth		Number of Points				
			201	401	1601	16001	32001
9 GHz to 10 GHz	600 kHz	Uncorrected	3.1	3.3	7.2	56.5	110
		2-Port cal	6.7	7.3	15	112	219
	10 kHz	Uncorrected	41.2	51.7	200	1992	3976
		2-Port cal	82.9	116	414	4003	7991
	1 kHz	Uncorrected	224	445	1744	17028	33828
		2-Port cal	447	898	3150	30669	67680
10 GHz to 20 GHz	600 kHz	Uncorrected	19.6	21	28.4	77.9	122
		2-Port cal	39.4	42.2	56.9	148	238
	10 kHz	Uncorrected	65.5	123	313	1999	3989
		2-Port cal	131	261	626	4016	8003
	1 kHz	Uncorrected	233	456	1781	17375	34516
		2-Port cal	475	922	3570	34758	69055

Table 35b. N5244B Cycle Time (ms) for Full-Span Measurement Completion - Typical

10 MHz to 43.5 GHz		Number of Points				
IF Bandwidth		201	401	1601	16001	32001
600 kHz	Uncorrected	51.7	70	99	196	250
	2-Port cal	99.6	135	193	378	485
10 kHz	Uncorrected	87.5	147	503	2221	4236
	2-Port cal	175	302	1016	4350	8384
1 kHz	Uncorrected	250	477	1822	17617	34984
	2-Port cal	505	959	3647	35250	69992

Table 35c. N5245B Cycle Time (ms) for Full-Span Measurement Completion - Typical

10 MHz to 50 GHz		Number of Points				
IF Bandwidth		201	401	1601	16001	32001
600 kHz	Uncorrected	57	73.4	99.1	205	261
	2-Port cal	110	143	194	396	506
10 kHz	Uncorrected	87.5	147	504	2235	4265
	2-Port cal	180	307	1027	4364	8422
1 kHz	Uncorrected	252	480	1825	17648	35031
	2-Port cal	509	966	3656	35305	70086

**Table 36. Cycle Time vs. IF Bandwidth - Typical**

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)

Cycle time includes sweep and retrace time.

<b>Description</b>		<b>N5244B/45B</b>	
IF Bandwidth (Hz)	Cycle Time (ms)	Trace Noise Magnitude (dB rms)	
600,000	2.19	0.005	
100,000	3.28	0.0024	
30,000	6.88	0.0017	
10,000	26.68	0.0014	
3,000	68.95	0.001	
1,000	219	0.0008	
300	637	0.0006	
100	1821	0.0005	
30	5980	0.0005	
10	17830	0.0005	
3	59275	0.0004	



**Table 37. Cycle Time (ms) vs. Number of Points - Typical**

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)

Cycle time includes sweep and retrace time.

Description	IF Bandwidth (Hz)			
	1,000	10,000	30,000	600,000
3	4.98	2.34	2.11	1.8
11	13.89	5.7	3.52	1.72
51	57.48	7.97	3.36	1.8
101	111.56	14.18	4.28	1.95
201	218.75	26.76	7.03	2.81
401	432.03	51.62	12.01	3.12
801	854.88	101.41	22.15	4.53
1,601	1695.39	200.62	42.11	7.19
6,401	6682.81	797.27	162.5	23.44
16,001	16561.2	1990.89	399.74	52.08
32,001	32882.81	3976.56	805.99	109.38

Table 38. Data Transfer Time<sup>1</sup> (ms) - Typical

Description	Number of Points				
	201	401	1601	16,001	32,001
<b>SCPI over GPIB</b> (Program executed on external PC <sup>2</sup> )					
32-bit floating point	4.6	9.3	38	352	720
64-bit floating point	9.4	18.8	73.4	730	1455
ASCII	36.7	72.5	288	2882	5762
<b>SCPI over SICT/LAN or TCP/IP Socket<sup>3</sup></b> (Program executed in the analyzer)					
32-bit floating point	<1	<1	<1	1.2	2.4
64-bit floating point	<1	<1	<1	2.3	4.6
ASCII	2.1	4	15	148	295
<b>COM<sup>1</sup></b> (Program executed in the analyzer)					
32-bit floating point	<1	<1	<1	<1	<1
Variant type	<1	<1	1.4	12.4	25.5
<b>DCOM over LAN<sup>3</sup></b> (Program executed on external PC)					
32-bit floating point	<1	<1	<1	2.3	4.4
Variant type	<1	1.6	5.3	52	105.5

<sup>1</sup> Measured with the analyzer display off. Values will increase slightly if the analyzer display is on.

<sup>2</sup> Measured when using the SCPI command DISPlay: VISible OFF.

<sup>3</sup> Values are for real and imaginary pairs, with the analyzer display off, using Gigabit Ethernet.

**NOTE**

Specifications for Recall & Sweep Speed are not provided for the N522xB analyzers.

Table 39. Typical Cycle Time for Amplifier Noise Figure Measurement (Option 029 and S93029A)

**Conditions:**

Frequency range: 4 – 6 GHz

IF bandwidth: 1 kHz

Noise settings: 4 MHz noise bandwidth, 10 averages, low-noise receiver

Impedance states for vector noise cal: 5

Other: NA application display on; correction on

Description	Number of Points			
	51	101	201	401
Scalar noise cal cycle time (ms, typical)	1154	2276	4512	8980
Vector noise cal cycle time (ms, typical)	5280	10,432	20,744	41,356

Table 40. Typical Cycle Time for Amplifier Gain Compression Measurement (Option S93086A)

Conditions:

Frequency range: 4 – 6 GHz  
 IF bandwidth: 1 kHz  
 Sweep type: Smart  
 Compression type: 1 dB compression from linear gain (0.05 dB tolerance)  
 Other: NA application display on; correction on

Description	Number of Points			
	51	101	201	401
Cycle time (ms, typical)	175	267	430	756

Table 41. Typical Cycle Time for Amplifier Swept Intermodulation Distortion Measurement (Option S93087A)

Conditions:

Frequency range: 4 – 6 GHz  
 Main tone IF bandwidth: 10 kHz  
 IM tone IF bandwidth: 1 kHz  
 Measurement parameters: PwrMain (avg), IM3 (dB relative to carrier)  
 Other: NA application display on; correction on

Description	Number of Points			
	51	101	201	401
Cycle time (ms, typical)	248	463	891	1752

Table 42. Typical Cycle Time for Converter Noise Figure Measurement (Option 029 and S93029A)

Conditions:

Input frequency: 3 GHz CF, 75 MHz span  
 LO frequency: 2.12 GHz fixed  
 Output frequency: 880 MHz CF, 75 MHz span  
 IF bandwidth: 1 kHz  
 Noise settings: 4 MHz noise bandwidth, 10 averages, low-noise receiver  
 Impedance states for vector noise cal: 5  
 Other: NA application display on; correction on

Description	Number of Points			
	51	101	201	401
Scalar noise cal cycle time (ms, typical)	1330	2617	5181	10,230
Vector noise cal cycle time (ms, typical)	5540	10,958	21,626	42,977

Table 43. Typical Cycle Time for Converter Measurement with SMC + Phase (Option S93083A)

Conditions:

Input frequency: 3 GHz CF, 75 MHz span  
 LO frequency: 2.12 GHz fixed  
 Output frequency: 880 MHz CF, 75 MHz span  
 Other: NA application display on; correction on (includes match correction but not SC12 sweep)

Description	Number of Points			
	51	101	201	401
Cycle time, 10 kHz IF bandwidth (ms, typical)	87	123	193	330
Cycle time, 1 kHz IF bandwidth (ms, typical)	215	375	690	1320

Table 44. Typical Cycle Time for Converter Gain Compression Measurement (Option S93086A)

Conditions:

Input frequency: 3 GHz CF, 75 MHz span  
 LO frequency: 2.12 GHz fixed  
 Output frequency: 880 MHz CF, 75 MHz span  
 IF bandwidth: 1 kHz  
 Sweep type: Smart  
 Compression type: 1 dB compression from linear gain (0.05 dB tolerance)  
 Other: NA application display on; correction on

Description	Number of Points			
	51	101	201	401
Cycle time (ms, typical)	235	342	554	980

Table 45. Typical Cycle Time for Converter Swept Intermodulation Distortion Measurement (Option S93087A)

Conditions:

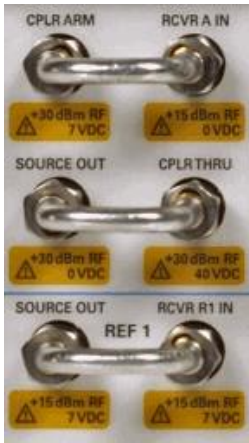
Input frequency: 3 GHz CF, 75 MHz span  
 LO frequency: 2.12 GHz fixed  
 Output frequency: 880 MHz CF, 75 MHz span  
 Main tone IF bandwidth: 10 kHz  
 IM tone IF bandwidth: 1 kHz  
 Measurement parameters: PwrMain (avg), IM3 (dB relative to carrier)  
 Other: NA application display on; correction on

Description	Number of Points			
	51	101	201	401
Cycle time (ms, typical)	474	905	1767	3517

## Front-Panel Jumpers

### NOTE

All PNA-X options have the following front-panel jumpers for each port.



- Measurement Receiver Inputs
- Reference Receiver Inputs and Reference Source Outputs
- Source Outputs
- Coupler Inputs
- Damage Level

Table 46. Measurement Receiver Inputs (dBm) - Typical

(RCVR A, B, C, D IN) @ 0.1dB Typical Compression

Description	All Options
10 MHz to 1 GHz	-3
1 GHz to 2 GHz	-2
2 GHz to 10 GHz	-2
10 GHz to 16 GHz	-4
16 GHz to 26.5 GHz	-4
26.5 GHz to 43.5 GHz	-5
43.5 GHz to 50 GHz	-6

Table 47a. Reference Receiver Inputs and Reference Source Outputs (dBm) - Typical

(RCVR R1 IN, REF 1 SOURCE OUT) @ Max Specified Output Power

Description	Option 201, 401		Option 21x, 41x		Option 22x, 42x	
	Filtered Mode <sup>1</sup>	Hi Power Mode <sup>1</sup>	Filtered Mode <sup>1</sup>	Hi Power Mode <sup>1</sup>	Filtered Mode <sup>1</sup>	Hi Power Mode <sup>1</sup>
10 MHz to 50 MHz	-33	-25	-32	-27	-32	-25
50 MHz to 500 MHz	-21	-16	-19	-14	-19	-14
500 MHz to 1 GHz	-9	-4	-7	-2	-7	-2
1 GHz to 2 GHz	-9	-4	-7	-3	-7	-2
2 GHz to 3.2 GHz	-8	-6	-6	-4	-7	-5
3.2 GHz to 10 GHz	-3	-3	0	0	-3	-3
10 GHz to 16 GHz	-3	-3	-1	-1	-3	-3
16 GHz to 26.5 GHz	-3	-3	-1	-1	-4	-4
26.5 GHz to 30 GHz	-3	-3	0	0	-3	-3
30 GHz to 32 GHz	-4	-4	-2	-2	-5	-5
32 GHz to 35 GHz	-2	-2	0	0	-2	-2
35 GHz to 43.5 GHz	-3	-3	-1	-1	-5	-5
43.5 GHz to 47 GHz	-6	-6	-5	-5	-23	-23
47 GHz to 50 GHz	-19	-19	-17	-17	-22	-22

<sup>1</sup> In Filtered Mode, the signal path goes through filters to minimize harmonics below 3.2 GHz. In Hi Power Mode, the signal bypasses the filters to maximize output power.

Table 47b. Reference Receiver Inputs and Reference Source Outputs (dBm) – Typical

(RCVR R2, R3, R4 IN, REF 2, 3, 4 SOURCE OUT) @ Max Specified Output Power

Description	Option 401		Options 201, 401	Option 41x		Options 21x, 41x
	RCVR R3 IN, REF 3 SOURCE OUT	RCVR R3 IN, REF 3 SOURCE OUT	RCVR R2, R4 IN, REF 2, 4 SOURCE OUT	RCVR R3 IN, REF 3 SOURCE OUT	RCVR R3 IN, REF 3 SOURCE OUT	RCVR R2, R4 IN, REF 2, 4 SOURCE OUT
	Filtered Mode <sup>1</sup>	Hi Power Mode <sup>1</sup>		Filtered Mode <sup>1</sup>	Hi Power Mode <sup>1</sup>	
10 MHz to 50 MHz	-31	-23	-27	-31	-26	-25
50 MHz to 500 MHz	-19	-14	-14	-18	-13	-14
500 MHz to 1 GHz	-7	-2	-2	-6	-1	-2
1 GHz to 2 GHz	-7	-2	-2	-6	-2	-2
2 GHz to 3.2 GHz	-7	-5	-2	-4	-2	-2
3.2 GHz to 10 GHz	-1	-1	-1	1	1	-1
10 GHz to 16 GHz	-1	-1	-1	0	0	-2
16 GHz to 26.5 GHz	-1	-1	-1	1	1	-2
26.5 GHz to 30 GHz	0	0	-1	2	2	-3
30 GHz to 32 GHz	-1	-1	-2	0	0	-5
32 GHz to 35 GHz	0	0	-1	2	2	-3
35 GHz to 43.5 GHz	-2	-2	-2	0	0	-5
43.5 GHz to 47 GHz	-5	-5	-5	-4	-4	-9
47 GHz to 50 GHz	-17	-17	-17	-16	-16	-21

<sup>1</sup> In Filtered Mode, the signal path goes through filters to minimize harmonics below 3.2 GHz. In Hi Power Mode, the signal bypasses the filters to maximize output power.

Table 47c. Reference Receiver Inputs and Reference Source Outputs (dBm) - Typical

(RCVR R2, R3, R4 IN, REF 2, 3, 4 SOURCE OUT) @ Max Specified Output Power

Description	Options 42x		Options 22x, 42x
	RCVR R3 IN, REF 3 SOURCE OUT	RCVR R3 IN, REF 3 SOURCE OUT	RCVR R2, R4 IN, REF 2, 4 SOURCE OUT
	Filtered Mode <sup>1</sup>	Hi Power Mode <sup>1</sup>	
10 MHz to 50 MHz	-31	-24	-29
50 MHz to 500 MHz	-18	-13	-16
500 MHz to 2 GHz	-6	-1	-4
2 GHz to 3.2 GHz	-5	-3	-4
3.2 GHz to 10 GHz	0	0	0
10 GHz to 26.5 GHz	-2	-2	-2
26.5 GHz to 30 GHz	-1	-1	-2
30 GHz to 32 GHz	-3	-3	-4
32 GHz to 35 GHz	0	0	-2
35 GHz to 43.5 GHz	-3	-3	-4
43.5 GHz to 47 GHz	-22	-22	-8
47 GHz to 50 GHz	-21	-21	-21

<sup>1</sup> In Filtered Mode, the signal path goes through filters to minimize harmonics below 3.2 GHz. In Hi Power Mode, the signal bypasses the filters to maximize output power.



Table 48a. Source Outputs (dBm) - Typical

(PORT 1, 2, 3, 4 SOURCE OUT) @ Max Specified Output Power

Description	Options 201, 401		Options 21x, 41x			
	PORT 1, 3 SOURCE OUT	PORT 2, 4 SOURCE OUT	PORT 1, 3 SOURCE OUT	PORT 2, 4 SOURCE OUT	PORT 2, 4 SOURCE OUT	
	Filtered Mode <sup>1</sup>	Hi Power Mode <sup>1</sup>		Filtered Mode <sup>1</sup>	Hi Power Mode <sup>1</sup>	
10 MHz to 50 MHz	4	12	12	5	10	13
50 MHz to 1 GHz	8	13	13	9	14	14
1 GHz to 2 GHz	9	14	14	9	13	14
2 GHz to 3.2 GHz	9	11	14	9	11	14
3.2 GHz to 10 GHz	14	14	14	14	14	14
10 GHz to 16 GHz	14	14	14	13	13	13
16 GHz to 26.5 GHz	14	15	15	13	13	13
26.5 GHz to 30 GHz	14	14	14	12	12	12
30 GHz to 32 GHz	13	13	13	10	10	10
32 GHz to 35 GHz	14	14	14	12	12	12
35 GHz to 43.5 GHz	11	11	11	8	8	8
43.5 GHz to 47 GHz	8	8	8	4	4	4
47 GHz to 50 GHz	-5	-5	-5	-8	-8	-8

<sup>1</sup> In Filtered Mode, the signal path goes through filters to minimize harmonics below 3.2 GHz. In Hi Power Mode, the signal bypasses the filters to maximize output power.

Table 48b. Source Outputs (dBm) - Typical

(PORT 1, 2, 3, 4 SOURCE OUT) @ Max Specified Output Power

Description	Options 22x, 42x, 029		
	PORT 1, 3 SOURCE OUT		PORT 2, 4 SOURCE OUT
	Filtered Mode <sup>1</sup>	Hi Power Mode <sup>1</sup>	
10 MHz to 50 MHz	5	12	11
50 MHz to 2 GHz	9	14	14
2 GHz to 3.2 GHz	9	11	14
3.2 GHz to 10 GHz	14	14	14
10 GHz to 26.5 GHz	13	13	13
26.5 GHz to 30 GHz	12	12	12
30 GHz to 32 GHz	10	10	10
32 GHz to 35 GHz	12	12	12
35 GHz to 43.5 GHz	8	8	8
43.5 GHz to 47 GHz	3	3	3
47 GHz to 50 GHz	-9	-9	-10

<sup>1</sup> In Filtered Mode, the signal path goes through filters to minimize harmonics below 3.2 GHz. In Hi Power Mode, the signal bypasses the filters to maximize output power.

**Table 49. Coupler Inputs (dB) - Typical**

(PORT 1, 2, 3, 4 CPLR THRU) Insertion Loss of Coupler Thru

Description	Options 201, 401	Options 21x, 41x, 22x, 42x	Option 029 <sup>1</sup>
	All Ports	All Ports	Ports 1, 2
10 MHz to 500 MHz	0.25	1	1.5
500 MHz-to 2 GHz	0.5	1	1.5
2 GHz to 10 GHz	1	1	1.5
10 GHz to 16 GHz	1	2	2.5
16 GHz to 26.5 GHz	1.5	2.5	3.0
26.5 GHz to 35 GHz	2	3	3.7
35 GHz to 43.5 GHz	2.5	4	4.7
43.5 GHz to 47 GHz	2.5	5	5.7
47 GHz to 50 GHz	3	6	7

<sup>1</sup> Option 029 affects only port 1 and 2 coupler thru insertion loss. Refer to Options 21x, 41x, 22x, 42x for the coupler thru insertion loss on port 3 or port 4. Port 1 impedance tuner switch is in bypass position and port 2 noise receiver switch is in normal position.

**Table 50. Damage Level - Typical**

Description	RF (dBm)	DC (v)
RCVR A, B, C, D IN	15	7
RCVR R1, R2, R3, R4 IN	15	7
REF 1 SOURCE OUT	15	7
REF 2, 3, 4 SOURCE OUT	30	7
PORT 1, 2, 3, 4 SOURCE OUT	27	5
PORT 1 CPLR THRU	27 (10 <sup>1</sup> ) (20 <sup>3</sup> )	40 (7 <sup>2</sup> ) (50 <sup>3</sup> )
PORT 2, 3, 4 CPLR THRU	27 (20 <sup>3</sup> )	40 (7 <sup>2</sup> ) (50 <sup>3</sup> )
PORT 1, 2, 3, 4 CPLR ARM	30	7

<sup>1</sup> When the source impedance tuner is switched in the path of Option 224 or 423 with Option S93029A configuration, +10 dBm input to port 1 CPLR THRU damages the tuner.

<sup>2</sup> With a thru connection between test ports of option 217, 222, 417 or 422 configuration, 7 VDC input to CPLR THRU ports damages the source attenuator on the connected port.

<sup>3</sup> With option 425 installed.

# Test Set Block Diagrams

**NOTE**

For best readability, use a color printer for printing the following graphics.

## Legend

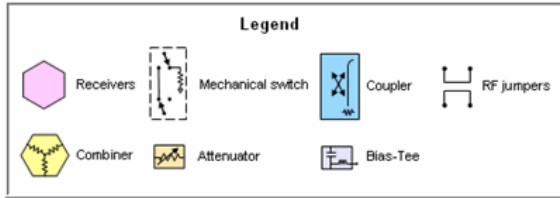


Figure 1. 2-Port N5244B and N5245B Base Unit Option 201

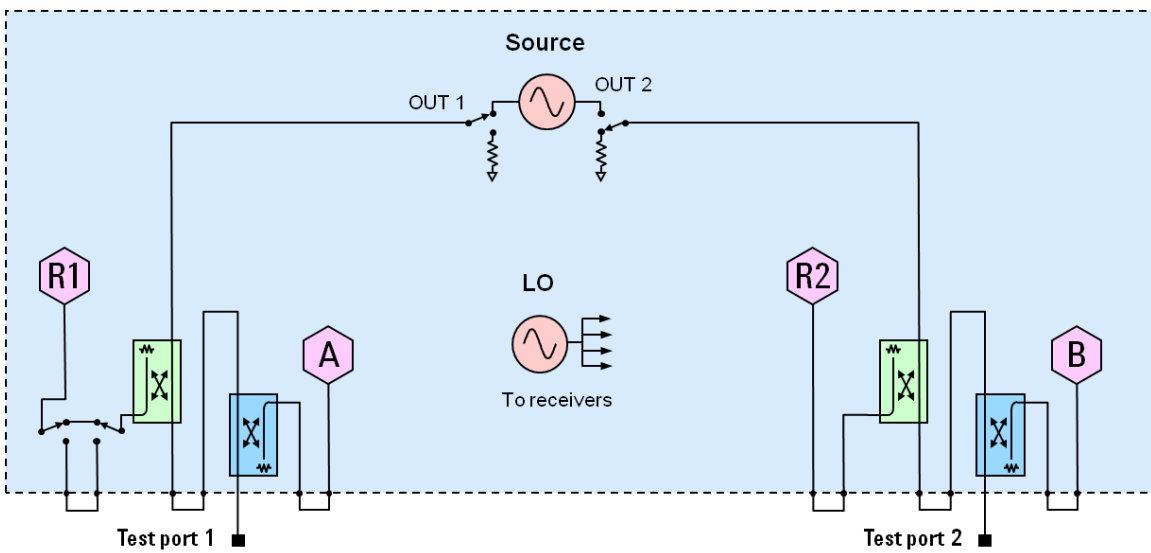


Figure 2. 2-Port N5244B and N5245B Option 217

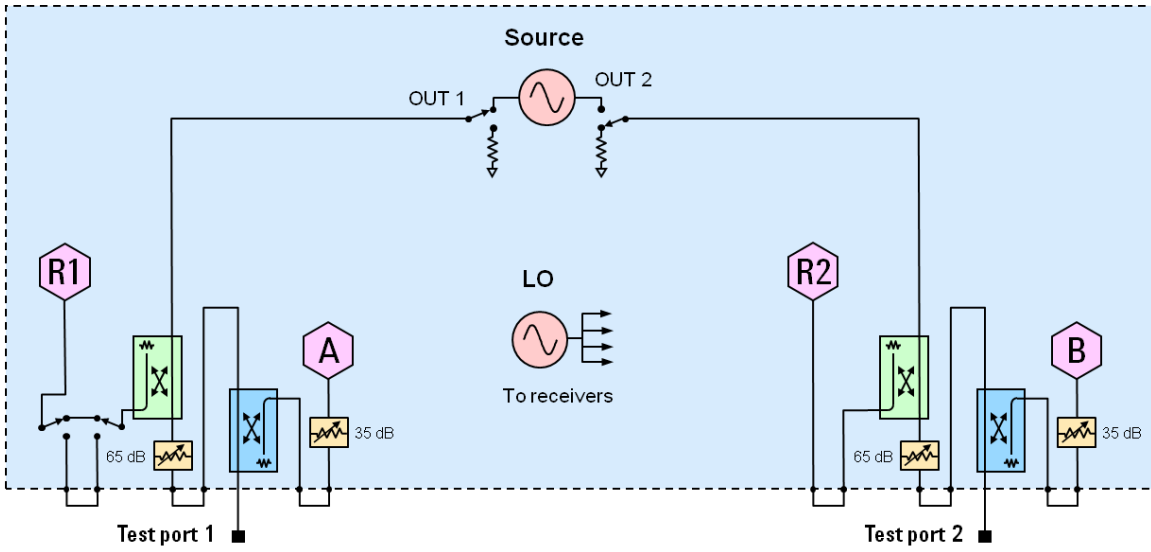


Figure 3. 2-Port N5244B and N5245B Option 219

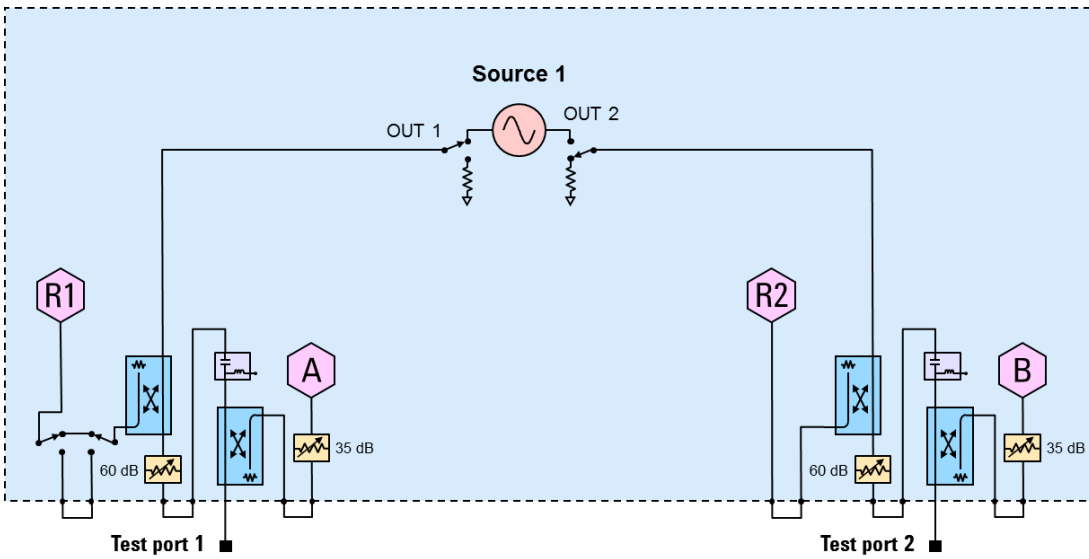


Figure 4. 2-Port N5244B and N5245B Option 222

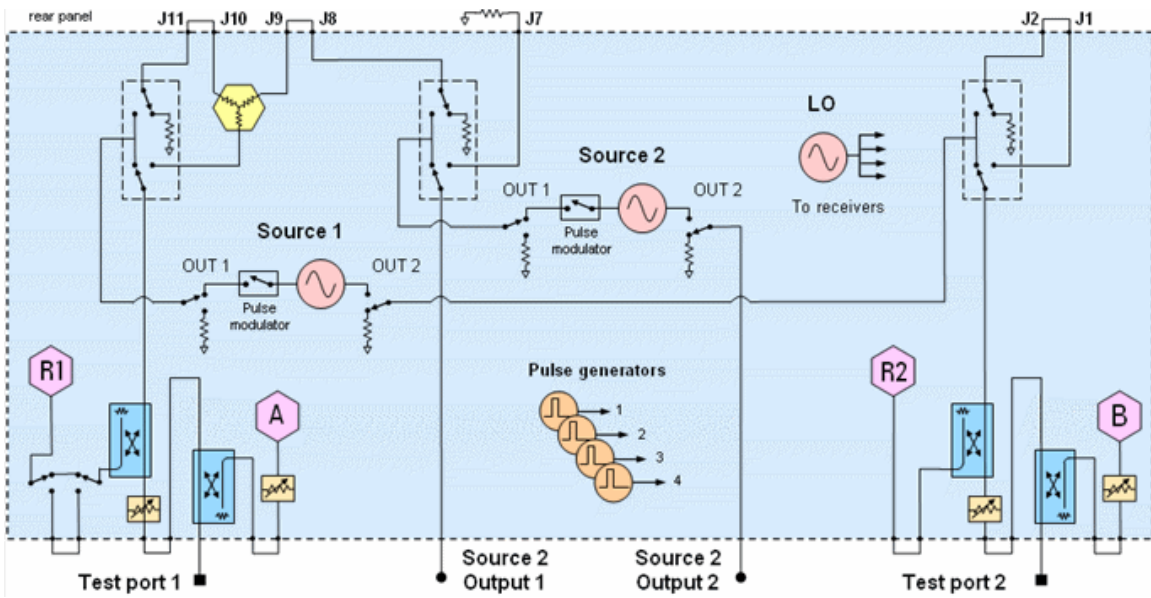


Figure 5. 2-Port N5244B and N5245B Option 224

Also shown, Option 025 adds 4 pulse generators. Option 021 and 022 adds pulse modulators.

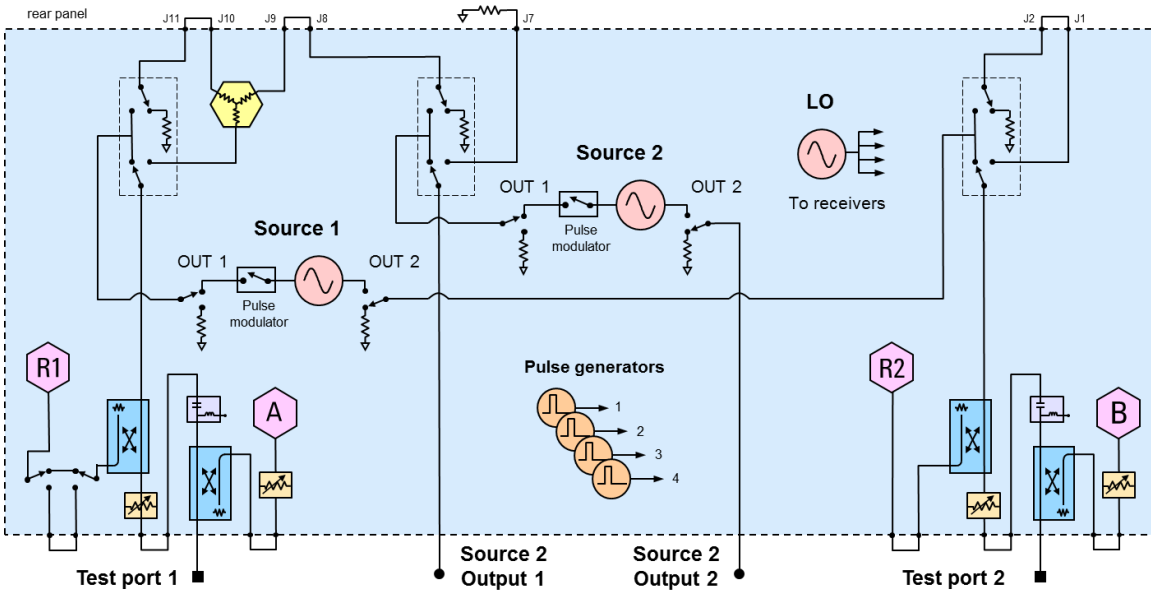


Figure 6. 2-Port N5244B and N5245B Option 224 with 029

Also shown, Option 025 adds 4 pulse generators. Option 021 and 022 adds pulse modulators.

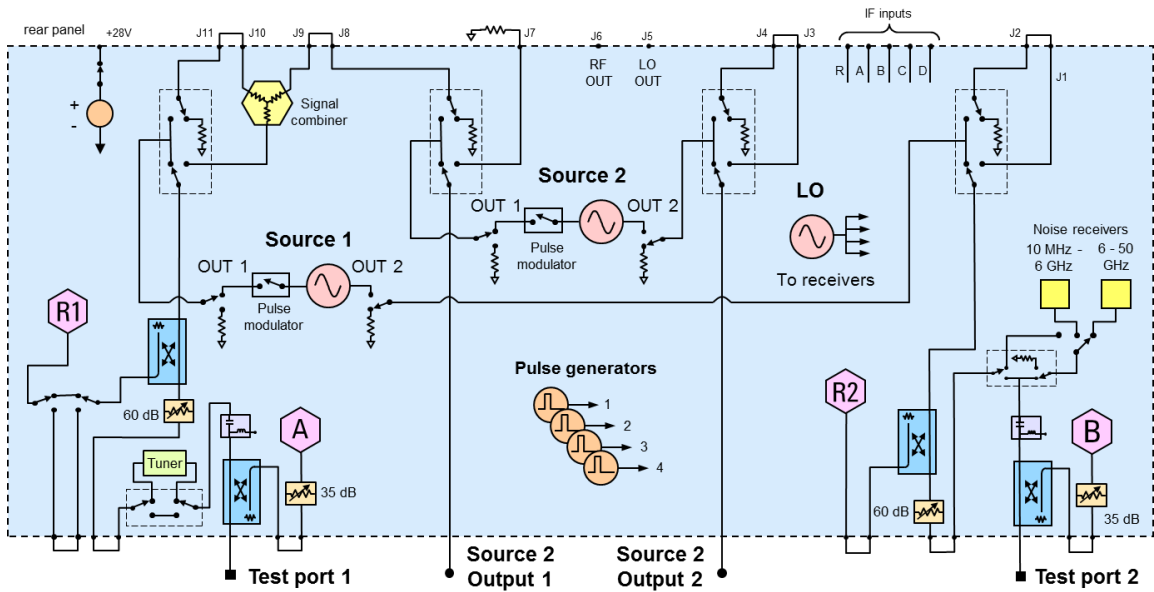


Figure 7. 4-Port N5244B and N5245B Base Unit Option 401

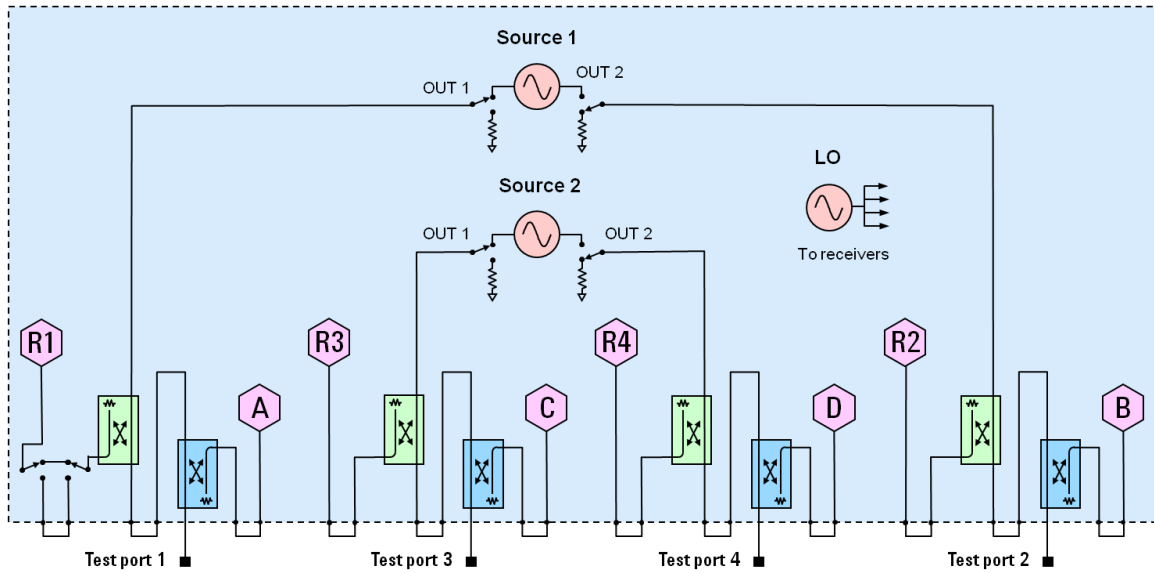


Figure 8. 4-Port N5244B and N5245B Option 417

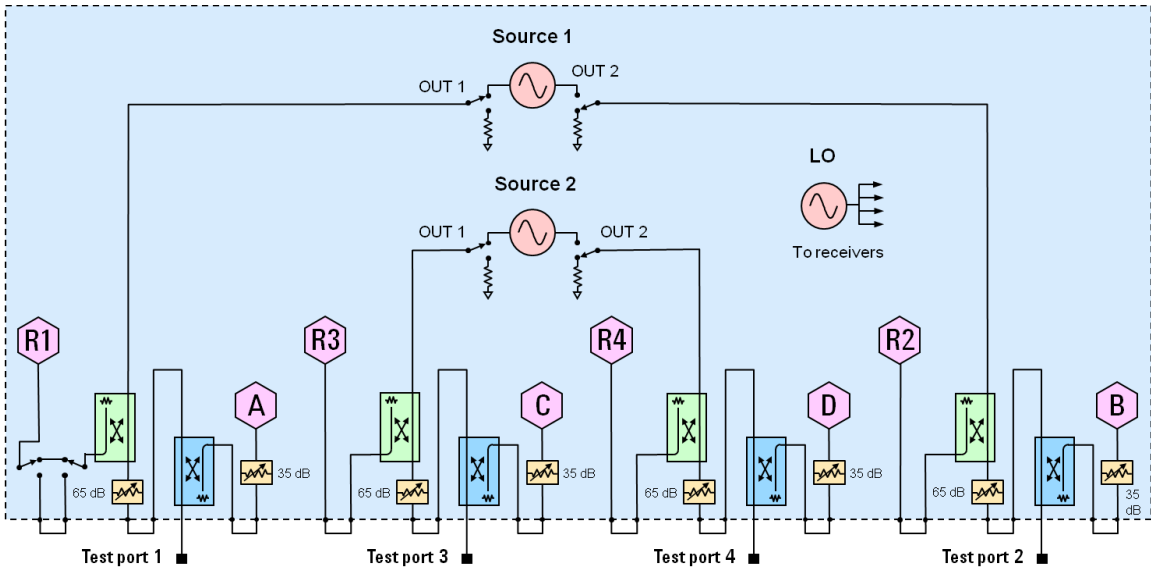


Figure 9. 4-Port N5244B and N5245B Option 419

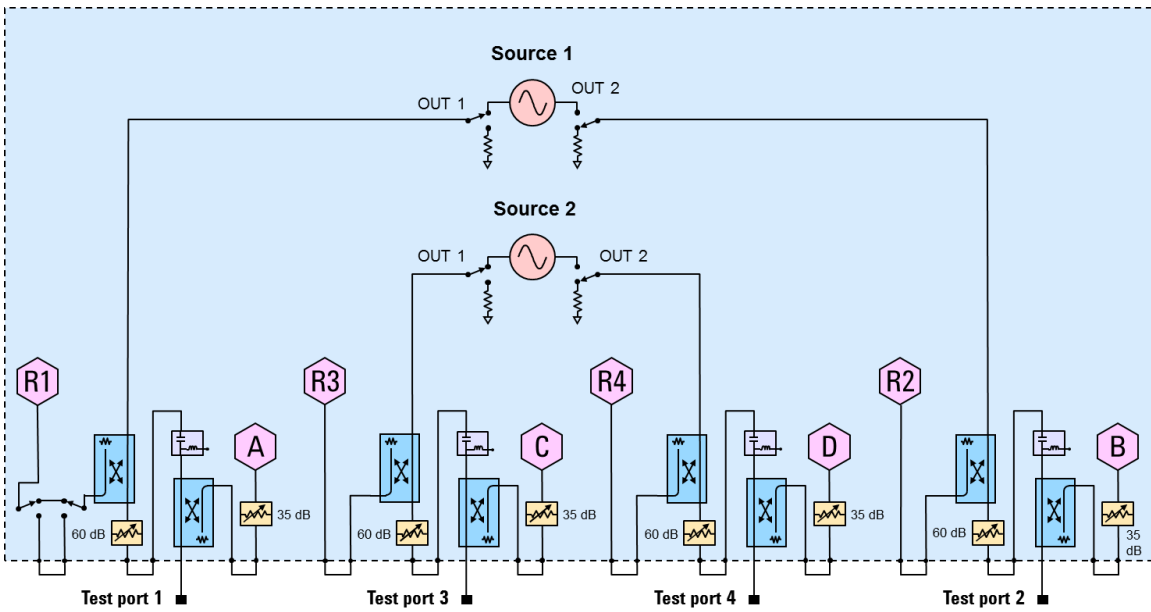




Figure 10. 4-Port N5244B and N5245B Option 422

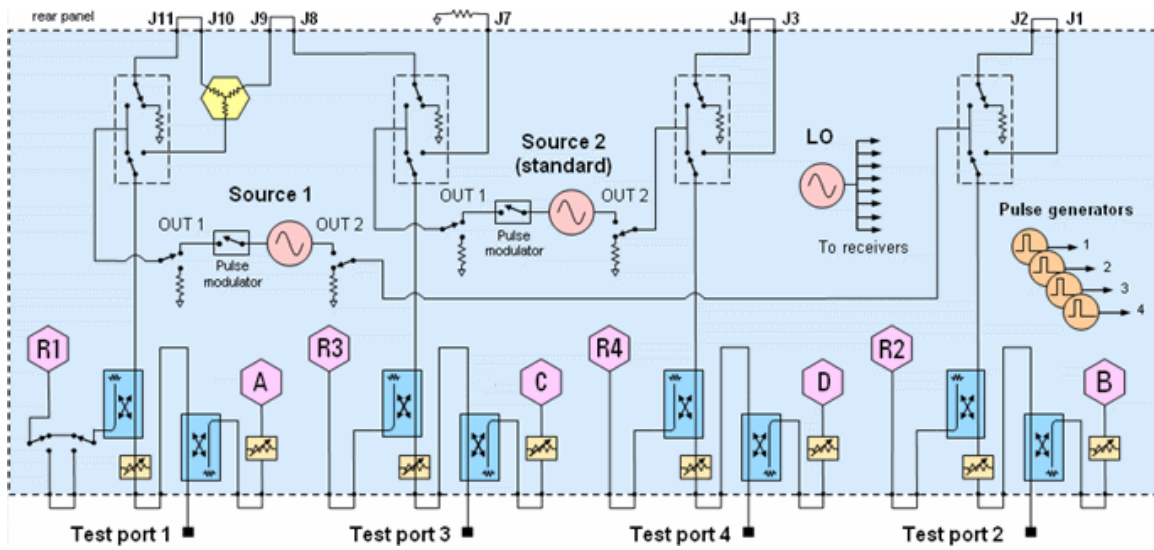


Figure 11. 4-Port N5244B and N5245B Option 423

Also shown, Option 025 adds 4 pulse generators. Option 021 and 022 adds pulse modulators.

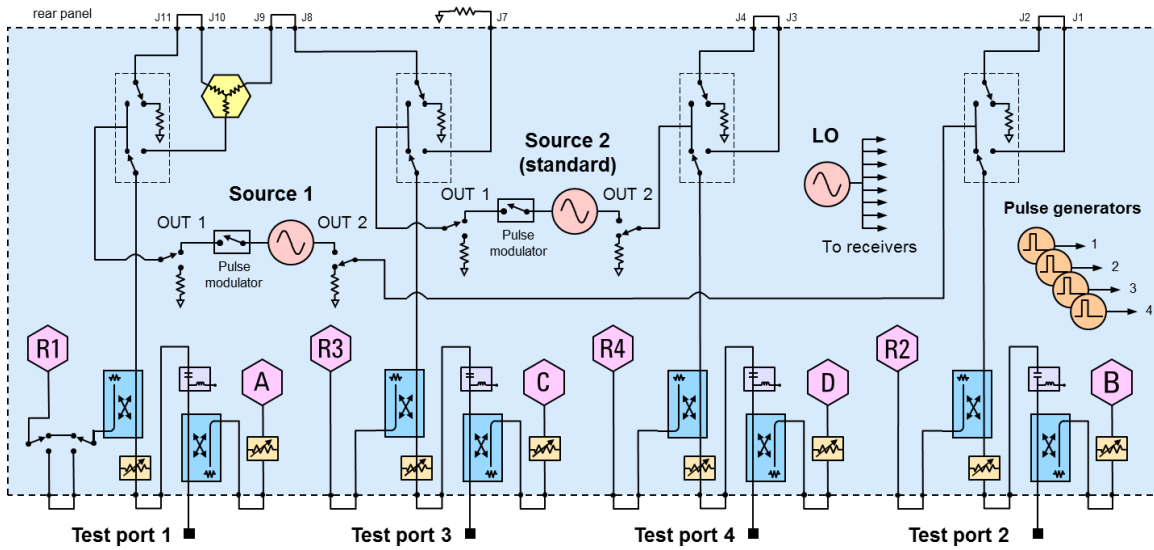
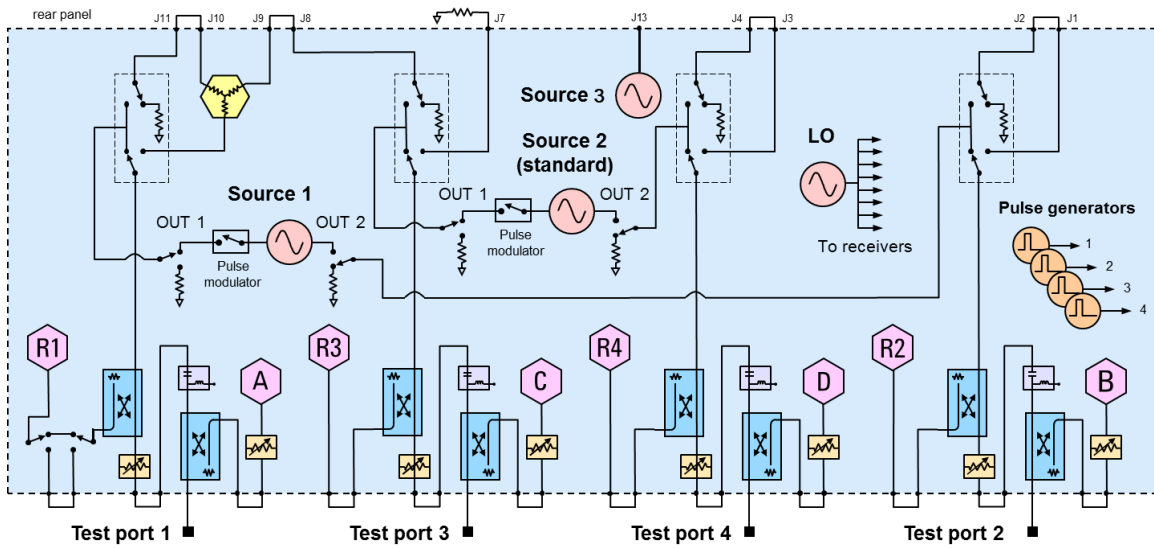


Figure 12. 4-Port N5244B and N5245B Option 423 with XSB



**NOTE**

Option XSB is available with Option 422 also. Option 422 does not have the bias tees.

Figure 13. 4-Port N5244B and N5245B Option 423 with 029

Also shown, Option 025 adds 4 pulse generators. Option 021 and 022 adds pulse modulators.

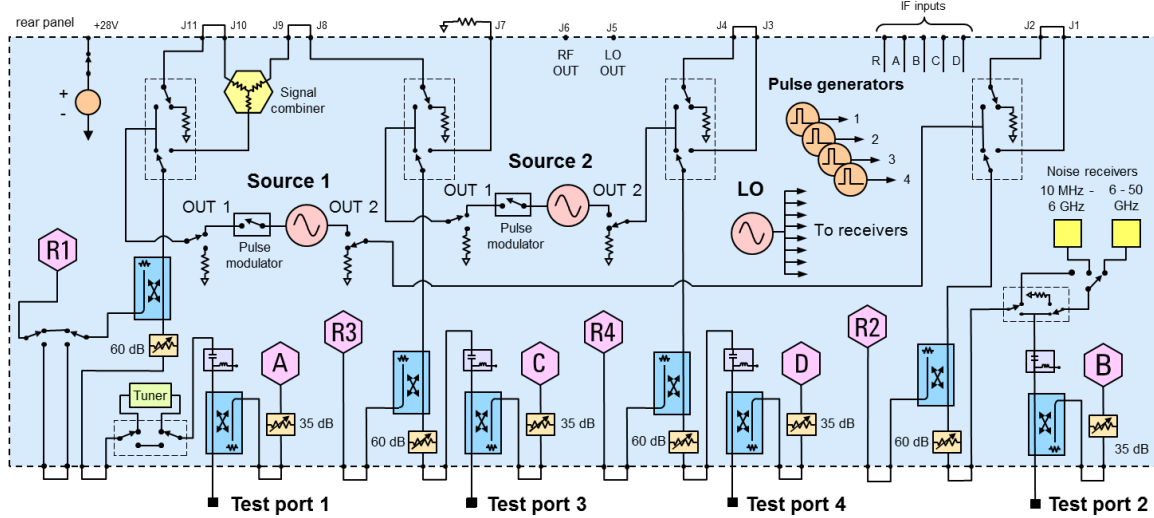


Figure 14. N5244B and N5245B LFE Options

The following LFE block diagram shows how the low-frequency hardware is configured for a single test port. The other ports are configured similarly.

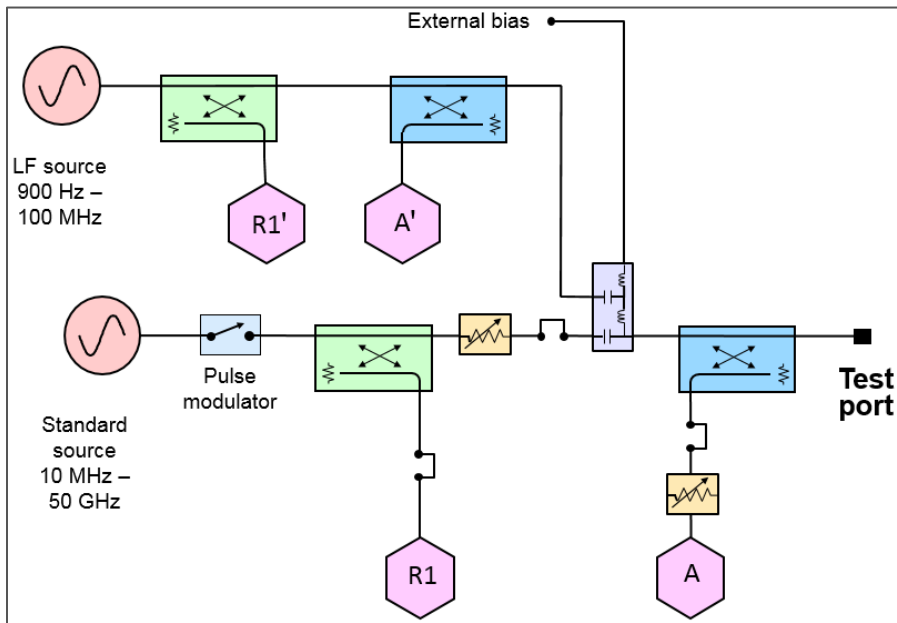
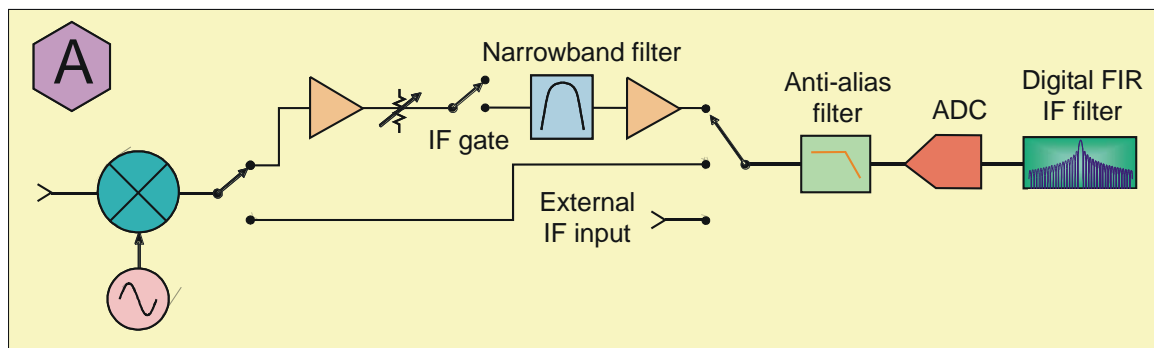


Figure 15. Receiver Block Diagram





This information is subject to change without notice.

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