

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

N5249B - 900 Hz to 8.5 GHz

N5241B - 900 Hz to 13.5 GHz

N5242B - 900 Hz to 26.5 GHz

(for synthesizer revision 7)

Technical  
Specifications



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This is a complete list of the technical specifications for the N5241B, N5242B, and N5249B with the following options (see block diagrams at the end of this document):

**Option 029**, adds hardware and firmware for high-accuracy noise figure measurements. It requires option 219, 222, 224, 419, 422, or 423.

**Option 201**, 2-port standard test set (includes six front-panel access loops) and power range.

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

**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.

**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.

**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.

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

**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).

**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.

**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.

**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.

**Table 1. Low Frequency Extension (LFE) Options**

Option	Description
2-Port Model	
205	2-port standard test set (includes six front-panel access loops), R1 receiver switch, power range, and low frequency extension (LFE) hardware.
4-Port Model	
425	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, bias tees, and low frequency extension (LFE) hardware.

## Notes

The Corrected System Performance with Cal Kits and Dynamic Accuracy Charts apply ONLY to the N5241B, N5242B, and N5249B models with serial numbers starting with MY5241/42/49, SG5241/42/49, and US5241/42/49, and above. This document provides technical specifications only for the 85052B calibration kit, the N4433A 4-Port ECal module, and the N4691B 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 document, 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  $25\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$  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):** A performance parameter that is tested on a minimal set of products during design validation. It does not include guardbands, and is not covered by the product warranty.

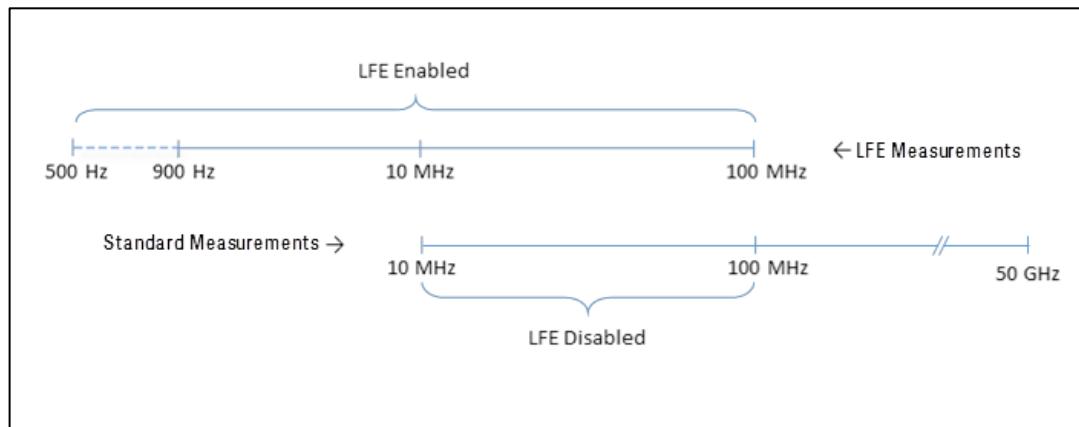
**Calibration:** The process of measuring known standards to characterize a network analyzer's systematic (repeatable) errors.

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

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

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

**Standard and LFE measurements:** With an LFE option, 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

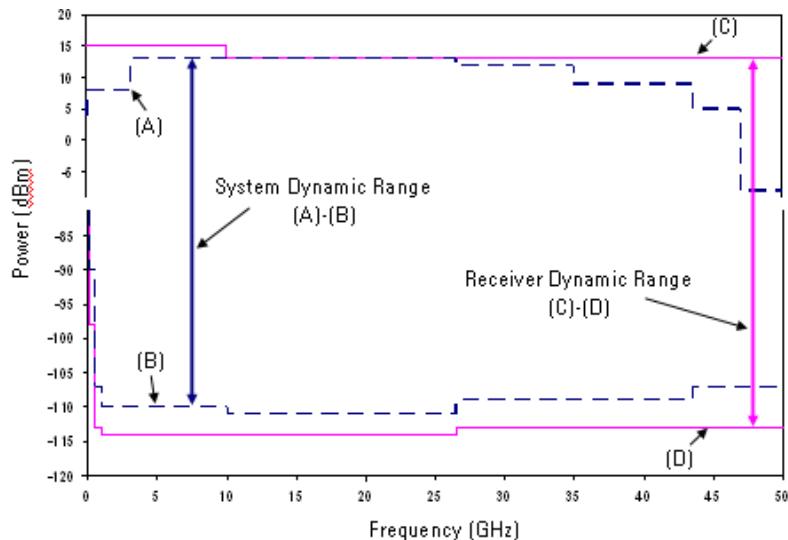
The specifications in this section apply for measurements made with the N5241B, N5242B, and N5249B analyzer with the following conditions:

- 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 2. 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	104	103	110	110
50 MHz to 100 MHz	119	120	126	127
100 MHz to 500 MHz	126	127	137	138
500 MHz to 2 GHz	132	134	140	143
2 GHz to 3.2 GHz	129	132	137	141
3.2 GHz to 8.5 GHz	133	132	141	141
8.5 GHz to 10 GHz	134	134	142	141
10 GHz to 13.5 GHz	133	133	141	140
13.5 GHz to 16 GHz	132	131	140	139
16 GHz to 20 GHz	130	129	138	136
20 GHz to 24 GHz	128	126	137	135
24 GHz to 26.5 GHz	122	121	135	132

<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 3. 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	102	102	109	109
50 MHz to 100 MHz	119	120	126	127
100 MHz to 500 MHz	126	131	137	138
500 MHz to 2 GHz	132	135	140	142
2 GHz to 3.2 GHz	128	134	137	141
3.2 GHz to 8.5 GHz	132	133	141	141
8.5 GHz to 10 GHz	132	133	141	140
10 GHz to 13.5 GHz	131	132	141	140
13.5 GHz to 16 GHz	131	132	139	139
16 GHz to 20 GHz	129	130	137	137
20 GHz to 24 GHz	128	126	138	134
24 GHz to 26.5 GHz	117	116	130	128

<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 4. 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	106	103	112	112
50 MHz to 100 MHz	123	123	129	130
100 MHz to 500 MHz	129	130	139	140
500 MHz to 2 GHz	134	138	143	145
2 GHz to 3.2 GHz	132	134	140	143
3.2 GHz to 8.5 GHz	135	135	144	144
8.5 GHz to 10 GHz	136	135	145	144
10 GHz to 13.5 GHz	136	134	145	144
13.5 GHz to 16 GHz	137	136	144	144
16 GHz to 20 GHz	135	136	143	143
20 GHz to 24 GHz	133	133	143	141
24 GHz to 26.5 GHz	126	124	138	136

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

**Table 5. 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	104	102	110	109	102	78
50 MHz to 100 MHz	120	120	127	127	112	90
100 MHz to 500 MHz	127	127	137	138	121	99
500 MHz to 2 GHz	133	135	140	142	127	112
2 GHz to 3.2 GHz	131	134	138	141	132	119
3.2 GHz to 8.5 GHz	130	133	138	141	132	119
8.5 GHz to 10 GHz	134	132	141	140	132	119
10 GHz to 13.5 GHz	134	132	141	140	128	115
13.5 GHz to 16 GHz	132	131	139	138	128	115
16 GHz to 20 GHz	130	129	137	136	125	113
20 GHz to 24 GHz	128	125	137	133	121	109
24 GHz to 26.5 GHz	119	116	130	127	115	102

<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 6. System Dynamic Range at Test Port (dB), Options (21x, 22x, 41x, 422, 423) with 029**

Description	Specification		Typical				
	Port 1 <sup>1</sup>	Port 2	Port 1 <sup>1</sup>	Port 2	Source 1 Port 1 Combine Mode	Source 2 Port 1 Combine Mode	
10 MHz to 50 MHz	104	101	110	109	101	87	
50 MHz to 100 MHz	120	120	127	127	112	99	
100 MHz to 500 MHz	127	126	137	138	127	114	
500 MHz to 2 GHz	134	136	140	142	127	113	
2GHz to 3.2 GHz	130	134	137	141	127	113	
3.2 GHz to 8.5 GHz	130	132	140	141	132	119	
8.5 GHz to 10 GHz	131	131	141	140	132	119	
10 GHz to 13.5 GHz	132	131	141	140	128	115	
13.5 GHz to 16 GHz	131	130	139	138	128	115	
16 GHz to 20 GHz	129	128	137	136	125	113	
20 GHz to 24 GHz	128	124	137	133	120	108	
24 GHz to 26.5 GHz	118	115	130	127	113	102	

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

**Table 7. System Dynamic Range at Test Port (dB), N5241B and N5242B, Option 205**

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 <sup>1</sup>	97	96	103	103
50 MHz to 100 MHz <sup>1</sup>	112	116	122	123
100 MHz to 500 MHz	119	123	133	134
500 MHz to 2 GHz	129	131	137	140
2 GHz to 3.2 GHz	126	129	134	138
3.2 GHz to 8.5 GHz	131	130	139	139
8.5 GHz to 10 GHz	132	132	140	139
10 GHz to 13.5 GHz	131	131	139	138
13.5 GHz to 16 GHz	130	129	138	137
16 GHz to 20 GHz	128	127	136	134
20 GHz to 24 GHz	126	124	135	133
24 GHz to 26.5 GHz	120	119	133	130

<sup>1</sup> With Option 205 installed and LFE disabled, applied to frequencies ≤ 100 MHz. Above 100 MHz, performance is the same for both LFE enabled or disabled.

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

**Table 8. System Dynamic Range at Test Port (dB), Option 425**

Description	Specification		Typical				
	Ports <sup>2</sup> 1, 3	Ports 2, 4	Ports <sup>2</sup> 1, 3	Ports 2, 4	Source 1 Port 1 Combine Mode	Source 2 Port 1 Combine Mode	
10 MHz to 50 MHz <sup>1</sup>	96	93	103	102	95	81	
50 MHz to 100 MHz <sup>1</sup>	117	116	123	124	107	94	
100 MHz to 500 MHz	124	123	133	134	122	109	
500 MHz to 2 GHz	133	133	139	140	122	108	
2 GHz to 3.2 GHz	130	131	137	140	122	108	
3.2 GHz to 8.5 GHz	130	131	139	139	130	117	
8.5 GHz to 10 GHz	130	130	139	138	130	117	
10 GHz to 13.5 GHz	130	129	139	138	126	113	
13.5 GHz to 16 GHz	129	128	137	136	126	113	
16 GHz to 20 GHz	128	127	136	135	123	111	
20 GHz to 24 GHz	127	122	136	132	119	107	
24 GHz to 26.5 GHz	118	114	130	127	113	100	

<sup>1</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 9.

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

**Table 9. System Dynamic Range at Test Port (dB), All LFE Options (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 10. System Dynamic Range at Test Port (dB), Option 425 and Option 425 with 029 (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 11. 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>	95	95	103	103	94	80	
50 MHz to 100 MHz <sup>1</sup>	116	117	123	124	107	94	
100 MHz to 500 MHz	123	124	133	135	122	109	
500 MHz to 2 GHz	132	134	139	141	122	108	
2 GHz to 3.2 GHz	127	132	136	141	122	108	
3.2 GHz to 8.5 GHz	126	128	137	138	130	117	
8.5 GHz to 10 GHz	126	128	138	138	130	117	
10 GHz to 13.5 GHz	128	128	138	137	126	113	
13.5 GHz to 16 GHz	130	127	138	136	126	113	
16 GHz to 20 GHz	128	126	136	134	123	111	
20 GHz to 24 GHz	126	122	136	131	118	106	
24 GHz to 26.5 GHz	115	113	128	126	111	100	

<sup>1</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.

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

## Extended Dynamic Range

**Table 12. 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	154	154	153	153
50 MHz to 100 MHz	152	153	152	153
100 MHz to 500 MHz	157	158	157	158
500 MHz to 2 GHz	155	158	155	157
2 GHz to 3.2 GHz	152	156	152	156
3.2 GHz to 8.5 GHz	156	156	156	156
8.5 GHz to 10 GHz	157	156	156	155
10 GHz to 13.5 GHz	156	155	156	155
13.5 GHz to 16 GHz	155	154	154	154
16 GHz to 20 GHz	153	151	152	152
20 GHz to 24 GHz	152	150	153	149
24 GHz to 26.5 GHz	150	147	145	143

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

**Table 13. Extended Dynamic Range at Direct Receiver Access Input (dB) – Typical**

Description	Options 22x		Options 22x or 42x	
	Source 2 Out 1	Source2 Out 2	Source 1 Port 1 Combine Mode	Source 2 Port 1 Combine Mode
10 MHz to 50 MHz	156	156	137	113
50 MHz to 100 MHz	155	156	124	102
100 MHz to 500 MHz	159	160	133	111
500 MHz to 2 GHz	158	160	139	124
2 GHz to 3.2 GHz	155	158	139	124
3.2 GHz to 8.5 GHz	159	159	144	131
8.5 GHz to 10 GHz	160	159	144	131
10 GHz to 13.5 GHz	160	159	140	127
13.5 GHz to 16 GHz	159	159	140	127
16 GHz to 20 GHz	158	158	137	125
20 GHz to 24 GHz	158	156	133	121
24 GHz to 26.5 GHz	153	151	127	114

**Table 14. Extended Dynamic Range at Direct Receiver Access Input (dB) - Typical**

Description	Options 22x, 422, 423		Options 423, 029	
	Ports <sup>1</sup> 1, 3	Ports <sup>1</sup> 2, 4	Port 1	Port 2
10 MHz to 50 MHz	154	153	154	153
50 MHz to 100 MHz	153	153	153	153
100 MHz to 500 MHz	157	158	157	158
500 MHz to 2 GHz	155	157	155	157
2 GHz to 3.2 GHz	153	156	152	156
3.2 GHz to 8.5 GHz	153	156	155	156
8.5 GHz to 10 GHz	156	155	156	155
10 GHz to 13.5 GHz	156	155	156	155
13.5 GHz to 16 GHz	154	153	154	153
16 GHz to 20 GHz	152	151	152	151
20 GHz to 24 GHz	152	148	152	148
24 GHz to 26.5 GHz	145	142	145	142

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

**Table 15. Extended Dynamic Range at Direct Receiver Access Input (dB) - Typical**

Description	Option 205		Option 425		Options 425, 029	
	Ports <sup>1</sup> 1, 3	Ports <sup>1</sup> 2, 4	Ports <sup>1</sup> 1, 3	Ports <sup>1</sup> 2, 4	Port 1	Port 2
10 MHz to 50 MHz	147	147	147	146	147	147
50 MHz to 100 MHz	148	149	149	150	149	150
100 MHz to 500 MHz	153	154	153	154	153	155
500 MHz to 2 GHz	152	155	154	155	154	156
2 GHz to 3.2 GHz	149	153	152	155	151	156
3.2 GHz to 8.5 GHz	154	154	154	154	152	153
8.5 GHz to 10 GHz	155	154	154	153	153	153
10 GHz to 13.5 GHz	154	153	154	153	153	152
13.5 GHz to 16 GHz	153	152	152	151	153	151
16 GHz to 20 GHz	151	149	151	150	151	149
20 GHz to 24 GHz	150	148	151	147	151	146
24 GHz to 26.5 GHz	148	145	145	142	143	141

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

## Receiver Dynamic Range

Table 16. Receiver Dynamic Range (dB), All Options

Description	Typical
10 MHz to 50 MHz <sup>1</sup>	--
50 MHz to 100 MHz <sup>1</sup>	--
100 MHz to 500 MHz	125
500 MHz to 3.2 GHz	130
3.2 GHz to 8.5 GHz	130
8.5 GHz to 13.5 GHz	130
13.5 GHz to 16 GHz	130
16 GHz to 20 GHz	129
20 GHz to 24 GHz	126
24 GHz to 26.5 GHz	123

<sup>1</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.

Table 17. Receiver Dynamic Range (dB), All Ports, All LFE Options (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 with 3.5mm Connectors, All Options

Specification are valid for temperatures of  $23^{\circ}\pm3^{\circ}\text{C}$  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.

For any Sii reflection measurement:

- $S_{jj} = 0$ .

For any Sij transmission measurement:

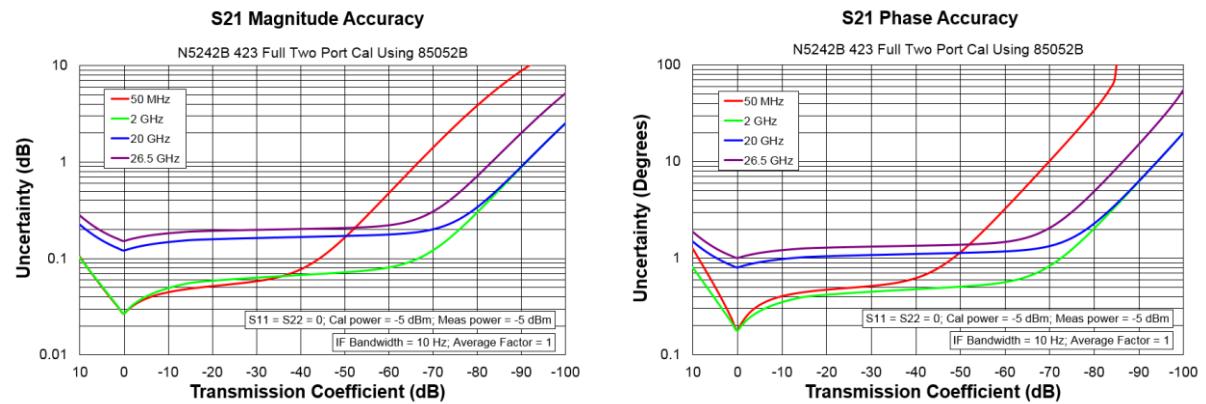
- $S_{ji} = S_{ij}$  when  $S_{ij} \leq 1$
- $S_{ji} = 1/S_{ij}$  when  $S_{ij} > 1$
- $S_{kk} = 0$  for all k

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 18. 85052B Calibration Kit**

Description	Specification (dB)						
	10 MHz to 50 MHz	50 MHz to 500 MHz	500 MHz to 2 GHz	2 GHz to 8.5 GHz	8.5 GHz to 13.5 GHz	13.5 GHz to 20 GHz	20 GHz to 26.5 GHz
Directivity	48	48	48	44	44	44	44
Source Match	40	40	40	31	31	31	31
Load Match	47	47	47	43	43	43	43
<b>Reflection Tracking</b>							
Mag	$\pm 0.0030$	$\pm 0.0030$	$\pm 0.0030$	$\pm 0.0061$	$\pm 0.0061$	$\pm 0.0061$	$\pm 0.0061$
Phase (°)	$\pm 0.020$	$\pm 0.020$	$\pm 0.020$	$\pm 0.040$	$\pm 0.040$	$\pm 0.040$	$\pm 0.040$
<b>Transmission Tracking</b>							
Mag	$\pm 0.044$	$\pm 0.055$	$\pm 0.055$	$\pm 0.12$	$\pm 0.11$	$\pm 0.14$	$\pm 0.16$
Phase (°)	$\pm 0.29$	$\pm 0.37$	$\pm 0.37$	$\pm 0.74$	$\pm 0.71$	$\pm 0.88$	$\pm 1.1$

## Transmission Uncertainty



## Reflection Uncertainty

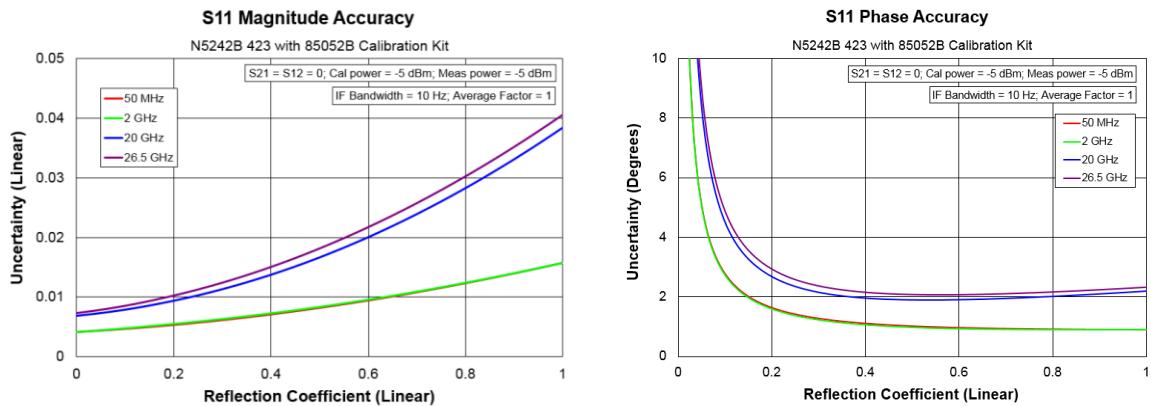
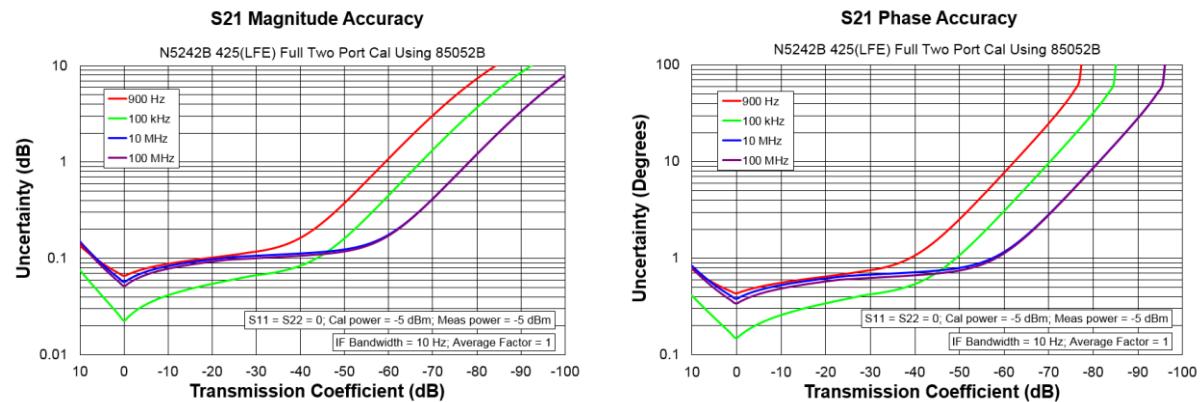


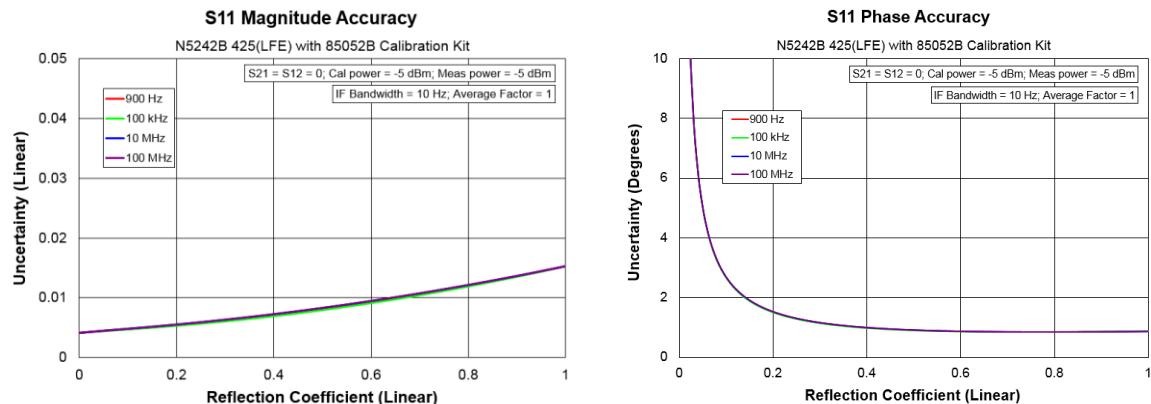
Table 19. 85052B Calibration Kit, Option 425 (LFE Enabled)

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	48	48	48	48	48
Source Match	40	40	40	40	40
Load Match	47	48	48	47	47
<b>Reflection Tracking</b>					
Mag	$\pm 0.0030$	$\pm 0.0030$	$\pm 0.0030$	$\pm 0.0030$	$\pm 0.0030$
Phase (°)	$\pm 0.020$	$\pm 0.020$	$\pm 0.020$	$\pm 0.020$	$\pm 0.020$
<b>Transmission Tracking</b>					
Mag	$\pm 0.055$	$\pm 0.016$	$\pm 0.037$	$\pm 0.051$	$\pm 0.045$
Phase (°)	$\pm 0.37$	$\pm 0.11$	$\pm 0.25$	$\pm 0.34$	$\pm 0.30$

### Transmission Uncertainty, Option 425



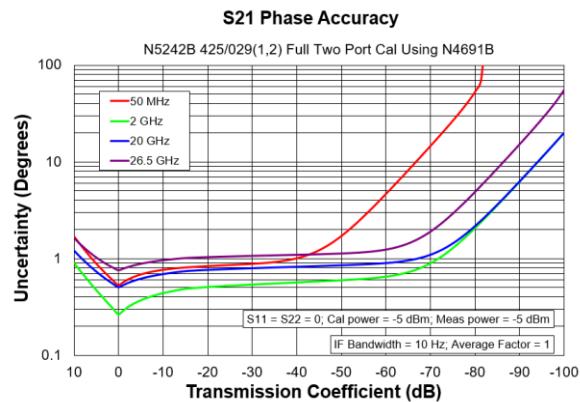
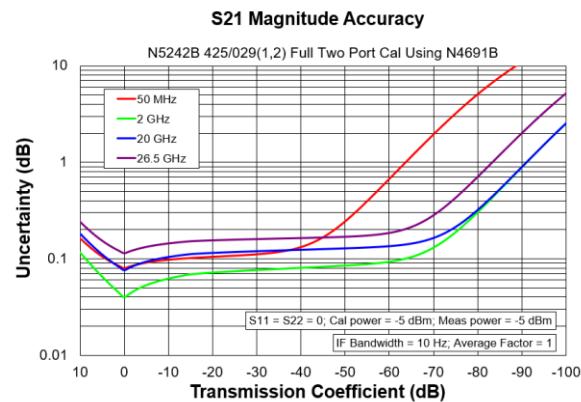
### Reflection Uncertainty, Option 425



**Table 20. N4691B Calibration Kit**

Description	Specification (dB)							
	10 MHz to 50 MHz	50 MHz to 500 MHz	500 MHz to 2 GHz	2 GHz to 8.5 GHz	8.5 GHz to 13.5 GHz	13.5 GHz to 20 GHz	20 GHz to 26.5 GHz	
Directivity	46	46	52	48	46	46	44	
Source Match	41	41	47	45	42	42	40	
Load Match	39	38	45	42	40	39	37	
<b>Reflection Tracking</b>								
Mag	±0.051	±0.051	±0.020	±0.031	±0.041	±0.041	±0.051	
Phase (°)	±0.34	±0.34	±0.14	±0.20	±0.27	±0.27	±0.34	
<b>Transmission Tracking</b>								
Mag	±0.066	±0.070	±0.030	±0.046	±0.056	±0.060	±0.078	
Phase (°)	±0.44	±0.46	±0.20	±0.31	±0.37	±0.40	±0.52	

### Transmission Uncertainty



### Reflection Uncertainty

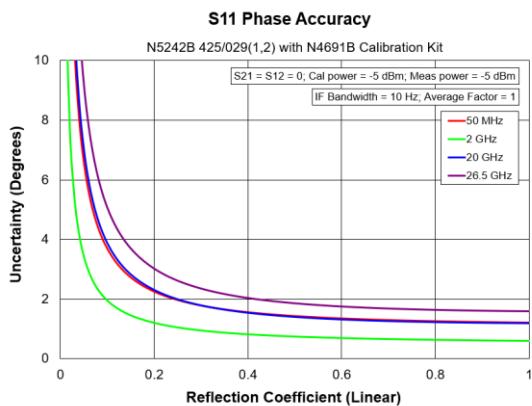
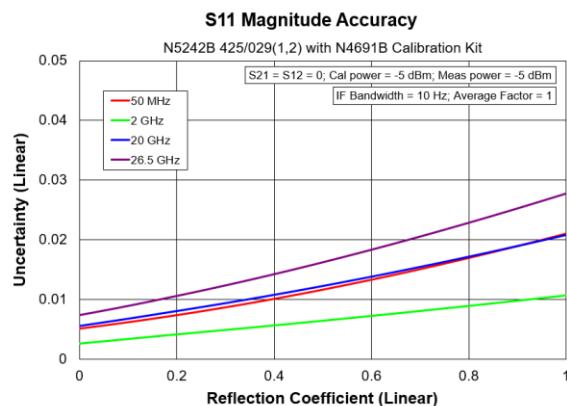
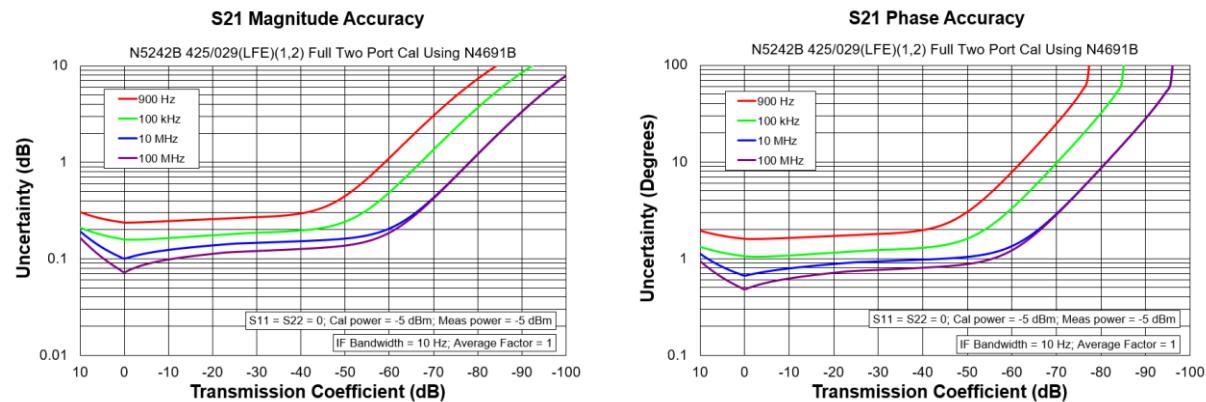


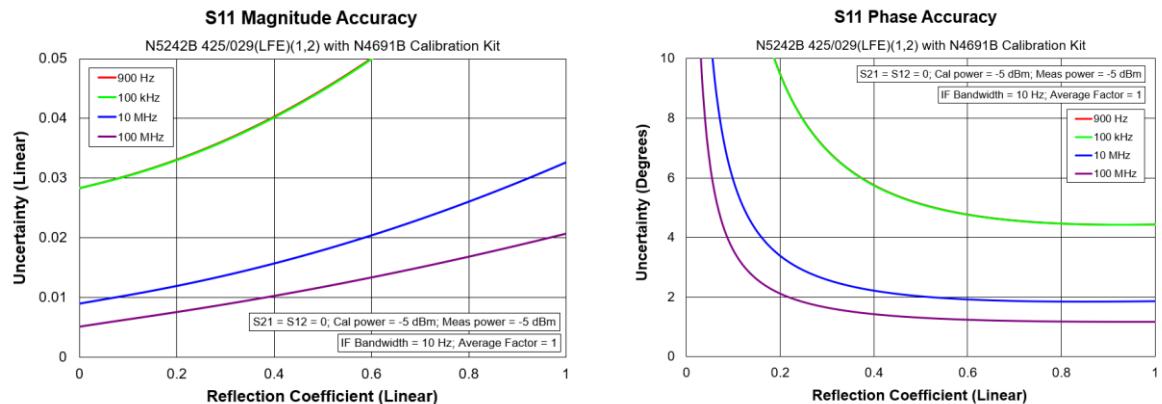
Table 21. N4691B Calibration Kit, Option 425 with Option 029 (LFE Enabled)

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	31	31	31	41	46
Source Match	29	29	29	36	41
Load Match	27	28	28	34	39
<b>Reflection Tracking</b>					
Mag	$\pm 0.12$	$\pm 0.12$	$\pm 0.12$	$\pm 0.061$	$\pm 0.051$
Phase (°)	$\pm 0.74$	$\pm 0.74$	$\pm 0.74$	$\pm 0.40$	$\pm 0.34$
<b>Transmission Tracking</b>					
Mag	$\pm 0.22$	$\pm 0.14$	$\pm 0.18$	$\pm 0.091$	$\pm 0.066$
Phase (°)	$\pm 1.5$	$\pm 0.92$	$\pm 1.2$	$\pm 0.61$	$\pm 0.44$

### Transmission Uncertainty, Option 425 with Option 029



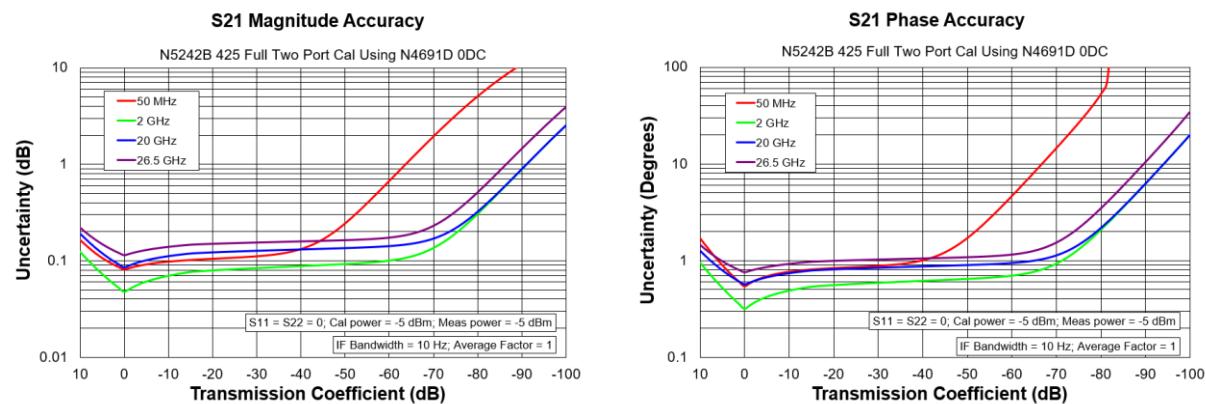
### Reflection Uncertainty, Option 425 with Option 029



**Table 22. N4691D Calibration Kit**

Description	Specification (dB)							
	10 MHz to 50 MHz	50 MHz to 500 MHz	500 MHz to 2 GHz	2 GHz to 8.5 GHz	8.5 GHz to 13.5 GHz	13.5 GHz to 20 GHz	20 GHz to 26.5 GHz	
Directivity	46	46	47	46	43	43	41	
Source Match	41	41	47	45	42	42	40	
Load Match	39	38	45	42	40	39	37	
<b>Reflection Tracking</b>								
Mag	$\pm 0.051$	$\pm 0.051$	$\pm 0.020$	$\pm 0.031$	$\pm 0.041$	$\pm 0.041$	$\pm 0.051$	
Phase (°)	$\pm 0.34$	$\pm 0.34$	$\pm 0.14$	$\pm 0.20$	$\pm 0.27$	$\pm 0.27$	$\pm 0.34$	
<b>Transmission Tracking</b>								
Mag	$\pm 0.066$	$\pm 0.070$	$\pm 0.038$	$\pm 0.050$	$\pm 0.062$	$\pm 0.068$	$\pm 0.089$	
Phase (°)	$\pm 0.44$	$\pm 0.46$	$\pm 0.25$	$\pm 0.33$	$\pm 0.41$	$\pm 0.45$	$\pm 0.59$	

### Transmission Uncertainty



### Reflection Uncertainty

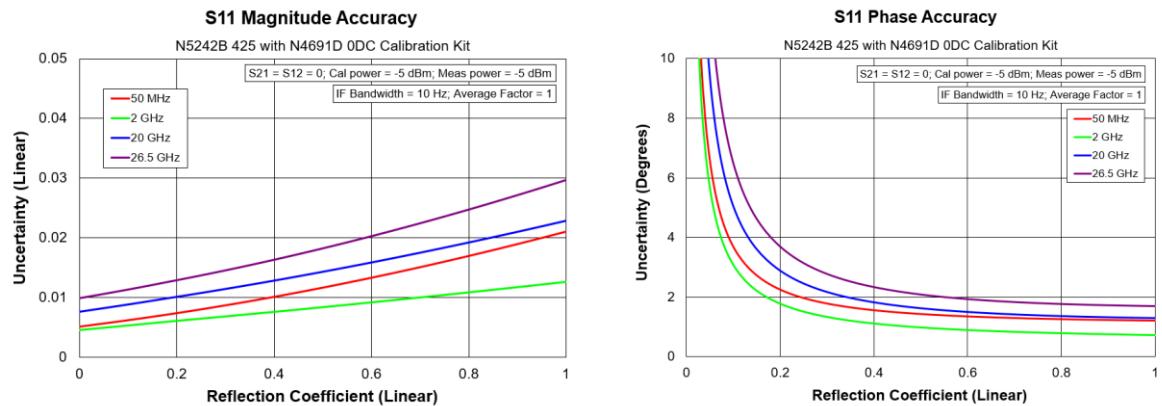
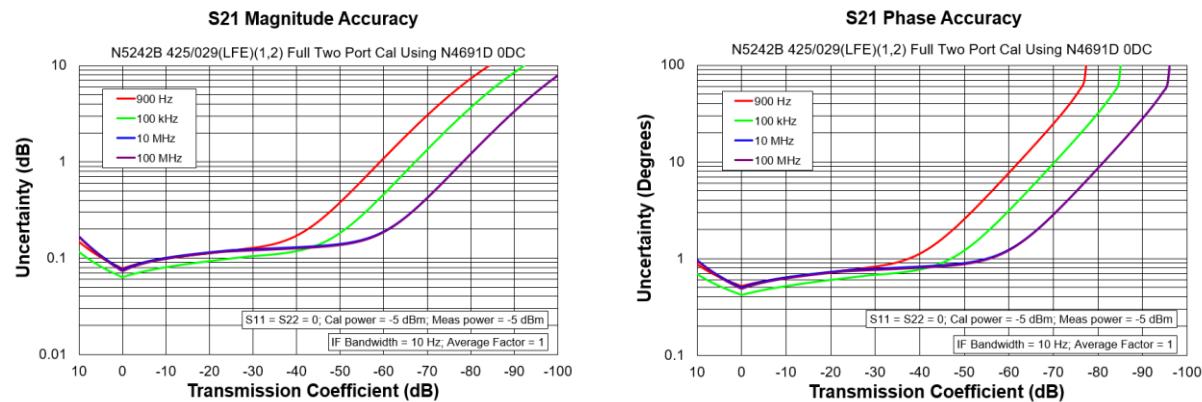


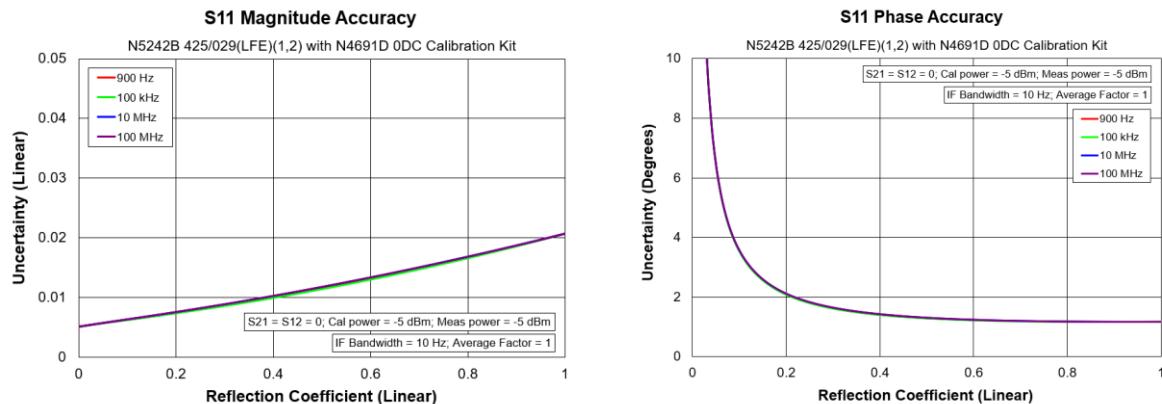
Table 23. N4691D Calibration Kit, Option 425 with Option 029 (LFE Enabled)

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	46	46	46	46	46
Source Match	41	41	41	41	41
Load Match	38	40	39	39	39
<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	±0.070	±0.055	±0.063	±0.068	±0.066
Phase (°)	±0.46	±0.37	±0.42	±0.45	±0.44

#### Transmission Uncertainty, Option 425 with Option 029



#### Reflection Uncertainty, Option 425 with Option 029



## 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 external position and port 2 noise receiver switch is in noise receiver position unless specified. Refer to Options 201, 21x, 22x, 401, 41x, 42x for performance of Option 029 Port 1 with impedance tuner switch in internal position, Port 2 noise receiver switch in normal position, Ports 3 and 4.

**Table 24. Directivity (dB), Option 2xx, 4xx**

Description	Specification		Typical	
	Without Option 029	With Option 029	Without Option 029	With Option 029
	All Ports	Ports 1, 2	All Ports	Ports 1, 2
10 MHz to 50 MHz <sup>1</sup>	16 (16)	16 (16)	23	22
50 MHz to 500 MHz <sup>1</sup>	24 (24)	24 (24)	28	28
500 MHz to 3.2 GHz	24 (24)	24 (24)	32	32
3.2 GHz to 8.5 GHz	23 (23)	23 (23)	25	25
8.5 GHz to 10 GHz	23 (22)	23 (22)	25	25
10 GHz to 13.5 GHz	16 (16)	16 (16)	22	20
13.5 GHz to 16 GHz	16 (16)	16 (16)	22	20
16 GHz to 20 GHz	16 (16)	15 (15)	22	20
20 GHz to 24 GHz	16 (16)	15 (15)	22	20
24 GHz to 26.5 GHz	16 (16)	15 (15)	22	20

( ) With an LFE option installed.

<sup>1</sup> With an LFE option 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 28 and Table 29.

**Table 25. Source Match (dB), Option 2xx, 4xx**

Description	Specification			Typical		
	Without Option 029	With Option 029		Without Option 029	With Option 029	
	All Ports	Ports 1	Port 2	All Ports	Port 1	Port 2
10 MHz to 50 MHz <sup>1</sup>	11 (9)	9 (9)	9 (9)	14 (11)	13 (11)	12 (12)
50 MHz to 500 MHz <sup>1</sup>	18 (7)	18 (7)	13 (7)	28 (8)	28 (8)	15 (8)
500 MHz to 3.2 GHz	18 (7)	17 (7)	9 (7)	22 (8)	22 (8)	12 (8)
3.2 GHz to 8.5 GHz	14 (9)	12 (9)	6 (5)	18 (14)	18 (14)	7 (6)
8.5 GHz to 10 GHz	14 (9)	12 (9)	6 (5)	18 (14)	18 (14)	7 (6)
10 GHz to 13.5 GHz	12 (9)	11 (9)	6 (5)	16 (14)	16 (14)	8 (7)
13.5 GHz to 16 GHz	12 (10)	11 (10)	6 (6)	16 (16)	16 (16)	8 (8)
16 GHz to 20 GHz	10 (8)	9 (8)	7 (7)	15 (13)	13 (13)	9 (9)
20 GHz to 24 GHz	10 (6)	8 (6)	6 (6)	14 (11)	13 (11)	9 (9)
24 GHz to 26.5 GHz	8 (6)	7 (6)	6 (6)	12 (11)	12 (11)	9 (9)

( ) With an LFE option installed.

<sup>1</sup> With an LFE option 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 28 and Table 29.**Table 26. Load Match (dB), Option 2xx, 4xx**

Description	Specification			Typical		
	Without Option 029	With Option 029		Without Option 029	With Option 029	
	All Ports	Ports 1	Port 2	All Ports	Port 1	Port 2
10 MHz to 50 MHz <sup>1</sup>	11 (9)	11 (9)	9 (9)	18 (10)	18 (10)	12 (10)
50 MHz to 500 MHz <sup>1</sup>	17 (7)	17 (7)	13 (7)	25 (8)	24 (8)	15 (8)
500 MHz to 3.2 GHz	17 (7)	15 (7)	9 (7)	22 (8)	19 (8)	12 (8)
3.2 GHz to 8.5 GHz	13 (9)	10 (9)	5.5 (5.5)	17 (14)	15 (14)	7.5 (7.5)
8.5 GHz to 10 GHz	13 (9)	10 (9)	5.5 (5.5)	17 (12)	15 (12)	7.5 (7.5)
10 GHz to 13.5 GHz	10 (9)	9 (9)	5.5 (5.5)	15 (14)	15 (14)	7.5 (7.5)
13.5 GHz to 16 GHz	10 (9)	9 (9)	5.5 (5.5)	15 (14)	15 (14)	7.5 (7.5)
16 GHz to 20 GHz	9 (7)	8 (7)	5.5 (5.5)	14 (12)	13 (12)	7.5 (7.5)
20 GHz to 24 GHz	9 (6)	7 (6)	5.5 (5.5)	14 (11)	13 (11)	7.5 (7.5)
24 GHz to 26.5 GHz	8 (6)	7 (6)	5.5 (5.5)	13 (11)	11 (11)	7.5 (7.5)

( ) With and LFE option installed.

<sup>1</sup> With an LFE option 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 28 and Table 29.

**Table 27. Transmission Tracking, Reflection Tracking, Crosstalk (dB), All Options, All Ports-Typical**

Description	Transmission Tracking	Reflection Tracking	Crosstalk
10 MHz to 50 MHz <sup>1</sup>	±1.5	±1.5	-84
50 MHz to 100 MHz <sup>1</sup>	±1.5	±1.5	-90
100 MHz to 500 MHz	±1.5	±1.5	-110
500 MHz to 3.2 GHz	±1.5	±1.5	-120
3.2 GHz to 8.5 GHz	±1.5	±1.5	-122
8.5 GHz to 13.5 GHz	±1.5	±1.5	-122
13.5 GHz to 20 GHz	±1.5	±1.5	-122
20 GHz to 24 GHz	±1.5	±1.5	-117
24 GHz to 26.5 GHz	±1.5	±1.5	-114

<sup>1</sup> With an LFE option 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 28 and Table 29.

**Table 28. Uncorrected System Performance (dB), All Ports, All LFE Options (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 29. Uncorrected System Performance (dB), All Ports, All LFE Options (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 <sup>1</sup>

<sup>1</sup> At 100 MHz, crosstalk is -106.

## Test Port Output

See the block diagrams at the end of this document for all models and options.

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

**Table 30. Frequency Information, All Options**

Description	Specification	Typical
N5249B Frequency Range	10 MHz to 8.5 GHz	--
N5241B Frequency Range	10 MHz to 13.5 GHz	--
N5242B Frequency Range	10 MHz to 26.5 GHz	--
N5242B Frequency Range (Option 425)	900 Hz to 26.5 GHz	500 Hz 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° to 70° 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.

**Table 31. 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	8	13	13	10	19	17
50 MHz to 500 MHz	10	13	13	11	21	20
500 MHz to 3.2 GHz	10	10	13	12	13	18
3.2 GHz to 8.5 GHz	13	13	13	20	20	19
8.5 GHz to 10 GHz	13	13	13	20	20	19
10 GHz to 13.5 GHz	13	13	13	17	17	16
13.5 GHz to 16 GHz	13	13	13	17	17	16
16 GHz to 20 GHz	13	13	10	16	16	12
20 GHz to 24 GHz	12	12	7	15	15	11
24 GHz to 26.5 GHz	5	5	2	11	11	7

<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 32. 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	8	13	13	10	19	17
50 MHz to 500 MHz	10	13	13	11	20	19
500 MHz to 3.2 GHz	10	10	13	11	13	18
3.2 GHz to 8.5 GHz	13	13	13	18	18	17
8.5 GHz to 10 GHz	13	13	13	18	18	17
10 GHz to 13.5 GHz	12	12	11	15	15	14
13.5 GHz to 16 GHz	12	12	11	15	15	14
16 GHz to 20 GHz	10	10	8	13	13	10
20 GHz to 24 GHz	8	8	7	12	12	9
24 GHz to 26.5 GHz	3	3	-1	8	8	4

<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 33. Maximum Leveled Power (dBm), Option 21x or 41x 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	8	13	13	10	19	17
50 MHz to 500 MHz	10	13	13	11	20	19
500 MHz to 3.2 GHz	10	10	13	11	13	18
3.2 GHz to 8.5 GHz	13	13	13	18	18	17
8.5 GHz to 10 GHz	13	13	13	18	18	17
10 GHz to 13.5 GHz	12	12	11	15	15	14
13.5 GHz to 16 GHz	12	12	11	15	15	14
16 GHz to 20 GHz	10	10	8	13	13	10
20 GHz to 24 GHz	8	8	7	12	12	9
24 GHz to 26.5 GHz	3	3	-1	8	8	4

<sup>1</sup> Option 029 affects port 1 and port 2 maximum leveled power. Refer to Table 32 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 34. 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	7	13	13	9	19	17
50 MHz to 500 MHz	8	13	13	11	20	20
500 MHz to 3.2 GHz	8	10	13	11	13	17
3.2 GHz to 8.5 GHz	13	13	13	19	19	17
8.5 GHz to 10 GHz	13	13	13	19	19	17
10 GHz to 13.5 GHz	12	12	10	15	15	14
13.5 GHz to 16 GHz	12	12	10	15	15	14
16 GHz to 20 GHz	10	10	7	13	13	10
20 GHz to 24 GHz	7	7	5	12	12	9
24 GHz to 26.5 GHz	0	0	-2	8	8	4

<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 35. Maximum Leveled 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	7	17	-7	3
50 MHz to 500 MHz	9	17	-5	4
500 MHz to 3.2 GHz	9	10	-5	-4
3.2 GHz to 8.5 GHz	15	15	2	2
8.5 GHz to 10 GHz	15	15	2	2
10 GHz to 13.5 GHz	11	11	-2	-2
13.5 GHz to 16 GHz	11	11	-2	-2
16 GHz to 20 GHz	8	8	-4	-4
20 GHz to 24 GHz	6	6	-6	-6
24 GHz to 26.5 GHz	2	2	-11	-11

<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 36. Maximum Leveled 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	9	18	13	12	21	18
50 MHz to 500 MHz	11	18	17	13	22	21
500 MHz to 3.2 GHz	10	14	14	13	17	19
3.2 GHz to 8.5 GHz	18	18	18	22	22	22
8.5 GHz to 10 GHz	18	18	18	22	22	22
10 GHz to 13.5 GHz	16	16	16	21	21	20
13.5 GHz to 16 GHz	16	16	16	21	21	20
16 GHz to 20 GHz	15	15	13	19	19	17
20 GHz to 24 GHz	13	13	12	18	18	17
24 GHz to 26.5 GHz	7	7	5	14	14	11

<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 37. 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	6	12	13	8	18	17
50 MHz to 500 MHz	8	13	13	11	20	20
500 MHz to 3.2 GHz	8	10	12	11	13	16
3.2 GHz to 8.5 GHz	13	13	13	19	19	17
8.5 GHz to 10 GHz	13	13	13	19	19	17
10 GHz to 13.5 GHz	12	12	10	15	15	14
13.5 GHz to 16 GHz	12	12	10	15	15	14
16 GHz to 20 GHz	10	10	6	13	13	9
20 GHz to 24 GHz	6	6	4	11	11	8
24 GHz to 26.5 GHz	0	0	-2	8	8	4

<sup>1</sup> Option 029 affects port 1 and port 2 maximum leveled power. Refer to Table 34 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 38. Maximum Leveled Power (dBm), Options 22x or 422, or 423 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	6	16	-8	2
50 MHz to 500 MHz	9	17	-5	4
500 MHz to 3.2 GHz	9	10	-5	-4
3.2 GHz to 8.5 GHz	15	15	2	2
8.5 GHz to 10 GHz	15	15	2	2
10 GHz to 13.5 GHz	11	11	-2	-2
13.5 GHz to 16 GHz	11	11	-2	-2
16 GHz to 20 GHz	8	8	-4	-4
20 GHz to 24 GHz	5	5	-7	-7
24 GHz to 26.5 GHz	0	0	-11	-11

<sup>1</sup> Option 029 affects port 1 and port 2 maximum leveled power. Refer to Table 34 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 39. Maximum Leveled Power (dBm), N5241B and N5242B, Port 1 and 2, Option 205**

Description	Specification			Typical		
	Port 1		Port 2	Port 1		Port 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 <sup>2</sup>	1	6	6	3	12	10
50 MHz to 500 MHz <sup>2</sup>	3	6	9	7	17	16
500 MHz to 3.2 GHz	7	7	10	9	10	15
3.2 GHz to 8.5 GHz	11	11	11	18	18	17
8.5 GHz to 10 GHz	11	11	11	18	18	17
10 GHz to 13.5 GHz	11	11	11	15	15	14
13.5 GHz to 16 GHz	11	11	11	15	15	14
16 GHz to 20 GHz	11	11	8	14	14	10
20 GHz to 24 GHz	10	10	5	13	14	9
24 GHz to 26.5 GHz	3	3	0	9	9	5

<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 205 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 45.

**Table 40. Maximum Leveled Power (dBm), Port 1 and 2, Option 425 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 <sup>3</sup>	-2	5	5	0	11	9
50 MHz to 500 MHz <sup>3</sup>	3	8	7	6	15	14
500 MHz to 3.2 GHz	3	5	7	6	8	11
3.2 GHz to 10 GHz	11	11	11	17	17	15
10 GHz to 16 GHz	10	10	8	13	13	12
16 GHz to 20 GHz	8	8	4	11	11	7
20 GHz to 24 GHz	4	4	2	9	9	6
24 GHz to 26.5 GHz	-2	-2	-4	6	6	2

<sup>1</sup> Option 029 only affects port 1 and port 2 maximum leveled power. Refer to Table 41 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 ≤ 100 MHz. Above 100 MHz, performance is the same for both LFE enabled or disabled. For LFE enabled performance ≤ 100 MHz, see Table 45.

**Table 41. Maximum Leveled Power (dBm), Option 425**

Description	Specification			Typical		
	Ports 1, 3		Ports 2, 4	Ports 1, 3		Ports 2, 4
	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	5	5	1	11	9
50 MHz to 500 MHz <sup>2</sup>	3	8	8	6	15	15
500 MHz to 3.2 GHz	3	5	8	6	8	12
3.2 GHz to 10 GHz	11	11	11	17	17	15
10 GHz to 16 GHz	10	10	8	13	13	12
16 GHz to 20 GHz	8	8	5	11	11	8
20 GHz to 24 GHz	5	5	3	10	10	7
24 GHz to 26.5 GHz	-2	-2	-4	6	6	2

<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 ≤ 100 MHz. Above 100 MHz, performance is the same for both LFE enabled or disabled. For LFE enabled performance ≤ 100 MHz, see Table 45.

**Table 42. Maximum Leveled 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>	0	10	-14	-4
50 MHz to 500 MHz <sup>2</sup>	4	12	-10	-1
500 MHz to 3.2 GHz	4	5	-10	-9
3.2 GHz to 10 GHz	13	13	0	0
10 GHz to 16 GHz	9	9	-4	-4
16 GHz to 20 GHz	6	6	-6	-6
20 GHz to 24 GHz	4	4	-8	-8
24 GHz to 26.5 GHz	0	0	-13	-13

<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 ≤ 100 MHz. Above 100 MHz, performance is the same for both LFE enabled or disabled. For LFE enabled performance ≤ 100 MHz, see Table 45.

**Table 43. 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>2</sup>	-1	9	-15	-5
50 MHz to 500 MHz <sup>2</sup>	4	12	-10	-1
500 MHz to 3.2 GHz	4	5	-10	-9
3.2 GHz to 10 GHz	13	13	0	0
10 GHz to 16 GHz	9	9	-4	-4
16 GHz to 20 GHz	6	6	-6	-6
20 GHz to 24 GHz	3	3	-9	-9
24 GHz to 26.5 GHz	-2	-2	-13	-13

<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 ≤ 100 MHz. Above 100 MHz, performance is the same for both LFE enabled or disabled. For LFE enabled performance ≤ 100 MHz, see Table 45.

**Table 44. 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 45. Maximum Power (dBm), All Ports – All LFE Options (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 46. Typical Output Power Range of SRC3 on Rear Panel (dBm) - Option XSB<sup>1</sup>**

Description	Power Range
10 MHz to 6 GHz	-65 to 9
6 GHz to 7.6 GHz	-65 to 8.5
7.6 GHz to 9.6 GHz	-65 to 8.5
9.6 GHz to 12 GHz	-65 to 6.5
12 GHz to 13.5 GHz	-65 to 7.5

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

**Table 47. 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	±0.40	±0.55
50 MHz to 500 MHz <sup>3</sup>	±1.0	±2.0	±0.20	±0.25
500 MHz to 3.2 GHz	±1.0	±2.0	±0.25	±0.25
3.2 GHz to 8.5 GHz	±1.0	±2.0	±0.40	±0.25
8.5 GHz to 10 GHz	±1.0	±2.0	±0.40	±0.25
10 GHz to 13.5 GHz	±1.2	±2.0	±0.60	±0.25
13.5 GHz to 18 GHz	±2.0	±2.5	±0.60	±1.00
18 GHz to 26.5 GHz	±2.5	±2.5	±0.80	±0.90

<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 an LFE option 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 48.

**Table 48. Power Level Accuracy (dB), All Ports, All LFE Options (LFE Enabled)**

Description	Specification	Typical <sup>1</sup>
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 49. 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 MHz <sup>3</sup>	±2.0	±1.5	±1.0
50 MHz to 500 MHz <sup>3</sup>	±1.5	±1.0	±1.0
500 MHz to 8.5 GHz	±1.0	±1.0	±1.0
8.5 GHz to 13.5 GHz	±1.0	±1.0	±1.0
13.5 GHz to 26.5 GHz	±1.0	±1.0	±1.0

<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 an LFE option 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 52.**Table 50. 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 MHz <sup>3</sup>	±5.0	±2.0	±1.5
50 MHz to 500 MHz <sup>3</sup>	±4.0	±2.0	±1.5
500 MHz to 3.2 GHz	±2.5	±1.0	±1.0
3.2 GHz to 8.5 GHz	±2.0	±1.0	±1.0
8.5 GHz to 10 GHz	±2.0	±1.0	±1.0
10 GHz to 13.5 GHz	±1.5	±1.5	±1.5
13.5 GHz to 16 GHz	±1.5	±1.5	±1.5
16 GHz to 26.5 GHz	±1.0	±1.0	±1.0

<sup>1</sup> Referenced to nominal power.<sup>2</sup> Either port can be used as the source port.<sup>3</sup> With an LFE option 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 52.**Table 51. 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 500 MHz <sup>3</sup>	±1.0	±1.5	±1.0
500 MHz to 8.5 GHz	±1.0	±1.0	±1.0
8.5 GHz to 13.5 GHz	±1.0	±1.0	±1.0
13.5 GHz to 26.5 GHz	±1.0	±1.0	±1.0

<sup>1</sup> Referenced to nominal power.<sup>2</sup> Source in filtered mode.<sup>3</sup> With an LFE option 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 52.

**Table 52. Power Level Linearity<sup>1</sup> (dB), All Ports, All LFE Options (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 53. 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	33	38	46	44
50 MHz to 500 MHz	35	38	48	47
500 MHz to 3.2 GHz	35	38	40	45
3.2 GHz to 8.5 GHz	38	38	47	46
8.5 GHz to 10 GHz	38	38	47	46
10 GHz to 13.5 GHz	38	38	44	43
13.5 GHz to 16 GHz	38	38	44	43
16 GHz to 20 GHz	38	35	43	39
20 GHz to 24 GHz	37	32	42	38
24 GHz to 26.5 GHz	30	27	38	34

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

**Table 54. 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	33	38	46	44
50 MHz to 500 MHz	35	38	47	46
500 MHz to 3.2 GHz	35	38	40	45
3.2 GHz to 8.5 GHz	38	38	45	44
8.5 GHz to 10 GHz	38	38	45	44
10 GHz to 13.5 GHz	37	36	42	41
13.5 GHz to 16 GHz	37	36	42	41
16 GHz to 20 GHz	35	33	40	37
20 GHz to 24 GHz	33	32	39	36
24 GHz to 26.5 GHz	28	24	35	31

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

**Table 55. Power Sweep Range (dB), Options 21x, 41x with 029<sup>1</sup>**

Description	Specification		Typical	
	Port 1 <sup>2</sup>	Port 2 <sup>2</sup>	Port 1 <sup>2</sup>	Port 2 <sup>2</sup>
10 MHz to 50 MHz	32	38	45	44
50 MHz to 500 MHz	34	38	46	46
500 MHz to 3.2 GHz	34	38	39	45
3.2 GHz to 8.5 GHz	37	38	44	44
8.5 GHz to 10 GHz	37	38	44	44
10 GHz to 13.5 GHz	37	34	42	39
13.5 GHz to 16 GHz	37	34	42	39
16 GHz to 20 GHz	35	30	40	34
20 GHz to 24 GHz	33	27	39	31
24 GHz to 26.5 GHz	28	23	35	30

<sup>1</sup> Option 029 affects port 1 and port 2 power sweep ranges. Refer to Table 54 for ports 3 and 4.<sup>2</sup> Source in filtered mode where applicable.**Table 56. 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	32	38	46	44
50 MHz to 500 MHz	33	38	47	47
500 MHz to 3.2 GHz	33	38	40	44
3.2 GHz to 8.5 GHz	38	38	46	44
8.5 GHz to 10 GHz	38	38	46	44
10 GHz to 13.5 GHz	37	35	42	41
13.5 GHz to 16 GHz	37	35	42	41
16 GHz to 20 GHz	35	32	40	37
20 GHz to 24 GHz	32	30	39	36
24 GHz to 26.5 GHz	25	23	35	31

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

**Table 57. 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	24	28	38	35
50 MHz to 500 MHz	26	32	39	38
500 MHz to 3.2 GHz	25	29	34	36
3.2 GHz to 8.5 GHz	33	33	39	39
8.5 GHz to 10 GHz	33	33	39	39
10 GHz to 13.5 GHz	31	31	38	37
13.5 GHz to 16 GHz	31	31	38	37
16 GHz to 20 GHz	30	28	36	34
20 GHz to 24 GHz	28	27	35	34
24 GHz to 26.5 GHz	22	20	31	28

<sup>1</sup> Source in filtered mode where applicable.

**Table 58. Power Sweep Range (dB), Options 22x, 422, or 423 with 029<sup>1</sup>**

Description	Specification		Typical	
	Port 1 <sup>2</sup>	Port 2 <sup>2</sup>	Port 1 <sup>2</sup>	Port 2 <sup>2</sup>
10 MHz to 50 MHz	31	38	45	44
50 MHz to 500 MHz	33	38	47	47
500 MHz to 3.2 GHz	33	37	40	43
3.2 GHz to 8.5 GHz	38	38	46	44
8.5 GHz to 10 GHz	38	38	46	44
10 GHz to 13.5 GHz	37	35	42	41
13.5 GHz to 16 GHz	37	35	42	41
16 GHz to 20 GHz	35	31	39	36
20 GHz to 24 GHz	31	29	37	35
24 GHz to 26.5 GHz	25	23	35	31

<sup>1</sup> Option 029 affects port 1 and port 2 power sweep ranges. Refer to Table 56 for ports 3 and 4.

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

**Table 59. Power Sweep Range (dB), Option 205**

Description	Specification (dBm)		Typical (dBm)	
	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 <sup>2</sup>	25	31	39	37
50 MHz to 500 MHz <sup>2</sup>	28	34	44	43
500 MHz to 3.2 GHz	32	35	37	42
3.2 GHz to 8.5 GHz	36	36	45	44
8.5 GHz to 10 GHz	36	36	45	44
10 GHz to 13.5 GHz	36	36	42	41
13.5 GHz to 16 GHz	36	36	42	41
16 GHz to 20 GHz	36	33	41	37
20 GHz to 24 GHz	35	30	40	36
24 GHz to 26.5 GHz	28	25	36	32

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

<sup>2</sup> With Option 205 installed and LFE disabled, applied to frequencies  $\leq$  100 MHz. Above 100 MHz, performance is the same for both LFE enabled or disabled.

**Table 60. Power Sweep Range (dB), Option 425**

Description	Specification (dBm)		Typical (dBm)	
	Ports 1, 3	Ports 2, 4	Ports 1, 3	Ports 2, 4
10 MHz to 50 MHz <sup>1</sup>	30	30	38	36
50 MHz to 500 MHz <sup>1</sup>	33	33	42	42
500 MHz to 3.2 GHz	30	33	35	39
3.2 GHz to 10 GHz	36	36	44	42
10 GHz to 16 GHz	35	33	40	39
16 GHz to 20 GHz	33	30	38	35
20 GHz to 24 GHz	30	28	37	34
24 GHz to 26.5 GHz	23	21	33	29

<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 61. Power Sweep Range (dB), Option 425 with 029**

Description	Specification (dBm)		Typical (dBm)	
	Port 1	Port 2	Port 1	Port 2
10 MHz to 50 MHz <sup>1</sup>	30	30	38	36
50 MHz to 500 MHz <sup>1</sup>	33	32	42	41
500 MHz to 3.2 GHz	30	32	35	38
3.2 GHz to 10 GHz	36	36	44	42
10 GHz to 16 GHz	35	33	40	39
16 GHz to 20 GHz	33	29	38	34
20 GHz to 24 GHz	29	27	36	33
24 GHz to 26.5 GHz	23	21	33	29

<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 62.

**Table 62. Power Sweep Range (dB) –All LFE Options (LFE Enabled)**

Description	Specification	Typical <sup>1</sup>
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 63. Nominal Power (Preset Power, dBm)**

Description	Options 201, 401, 205	Options 21x, 22x, 41x, 42x	Option 22x		Options 22x, 42x	
	All Ports <sup>1</sup>	Ports 1, 2, 3, 4 <sup>1</sup>	Source 2 Out 1	Source 2 Out 2	Source 1 Port 1 Combine Mode	Source 2 Port 1 Combine Mode
N5241B	0	-5	-5	-5	-5	-5
N5242B	0	-5	-5	-5	-5	-5
N5249B	0	-5	-5	-5	-5	-5

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

**Table 64. Power Resolution and Maximum/Minimum Settable Power, All Ports<sup>1</sup>**

Description	Specification (dB)	Typical (dBm)			Options 21x, 41x, 22x, 42x
		All Options	All Options	Options 201, 401	
Power Resolution	0.01	--	--	--	--
Maximum Settable Power <sup>2</sup>	--	30	--	--	--
Minimum Settable Power <sup>2</sup>	--	--	-30	-95	

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

<sup>2</sup> For Option XSB power range, see Table 46.

**Table 65. 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	2nd Harmonic		3rd 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>	-42	-14	-47	-13
50 MHz to 2 GHz <sup>3</sup>	-56	-21	-60	-15
2 GHz to 8.85 GHz	-60	-18	-65	-18
8.85 GHz to 13.25 GHz	-60	-18	--	--

<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 66.

**Table 66. 2<sup>nd</sup> and 3<sup>rd</sup> Harmonics at Max Specified Power (dBc), All Ports, All LFE Options (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	--

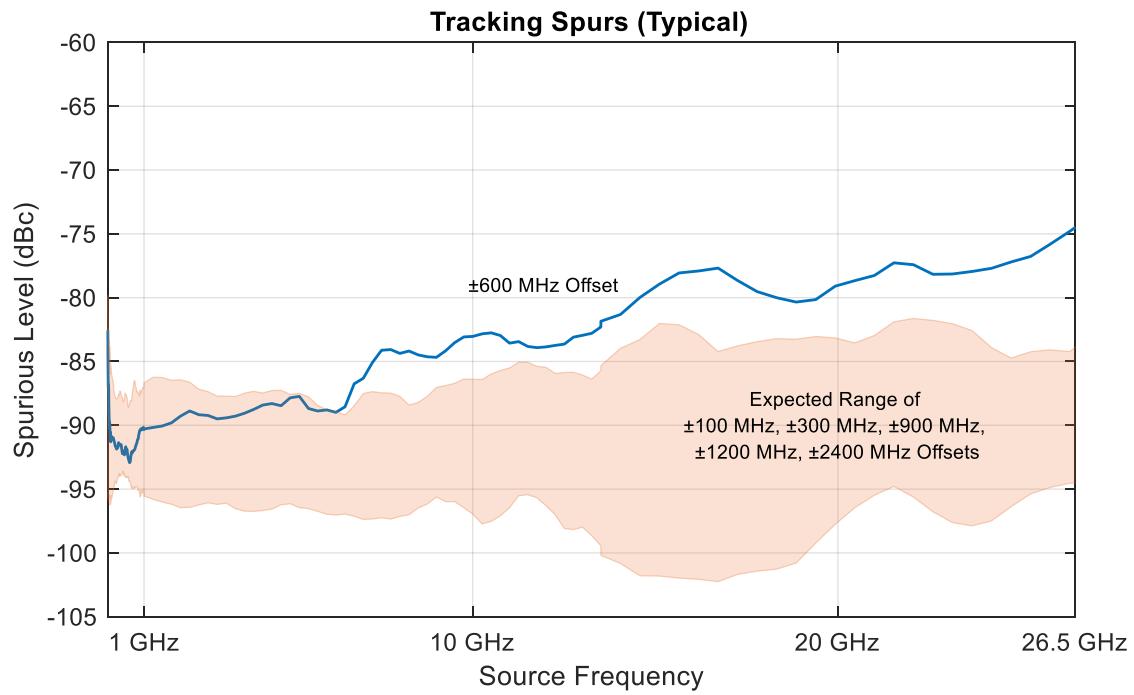
**Table 67. Non-Harmonic Spurs<sup>1</sup> at Nominal Power (dBc), All Options, All Ports – Typical**

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

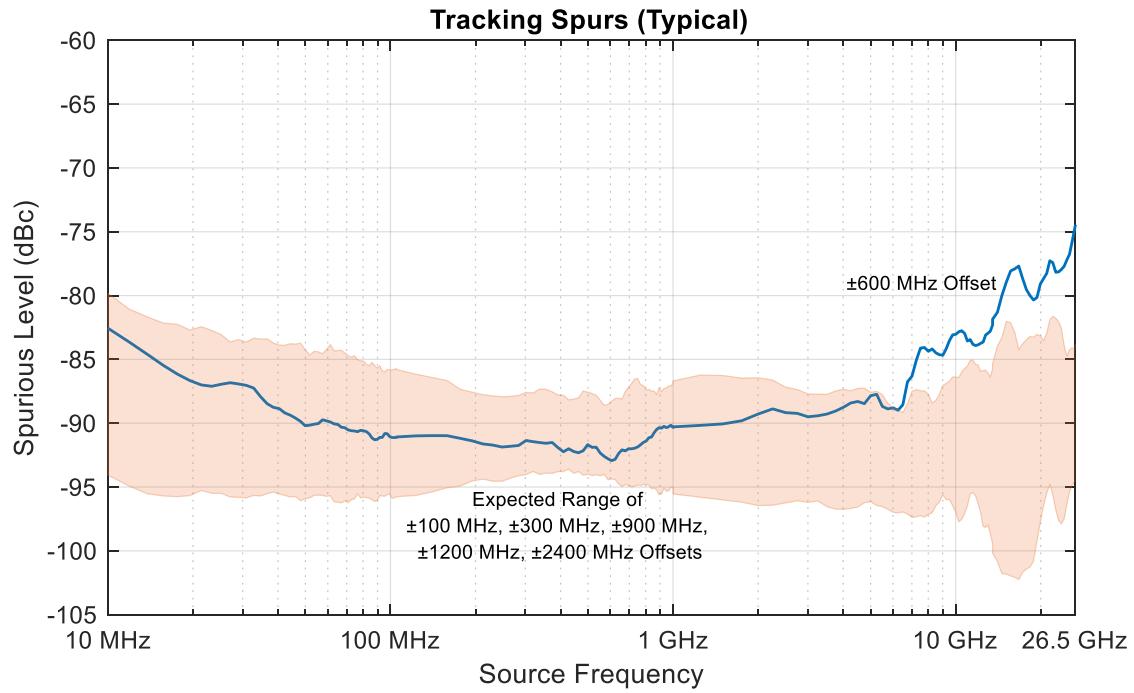
Description	Non-Harmonic	±600 MHz Tracking Spur
10 MHz to 1 GHz	-80	-80
1 GHz to 10 GHz	-85	-81
10 GHz to 20 GHz	-82	-75
20 GHz to 26.5 GHz	-80	-70

<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)



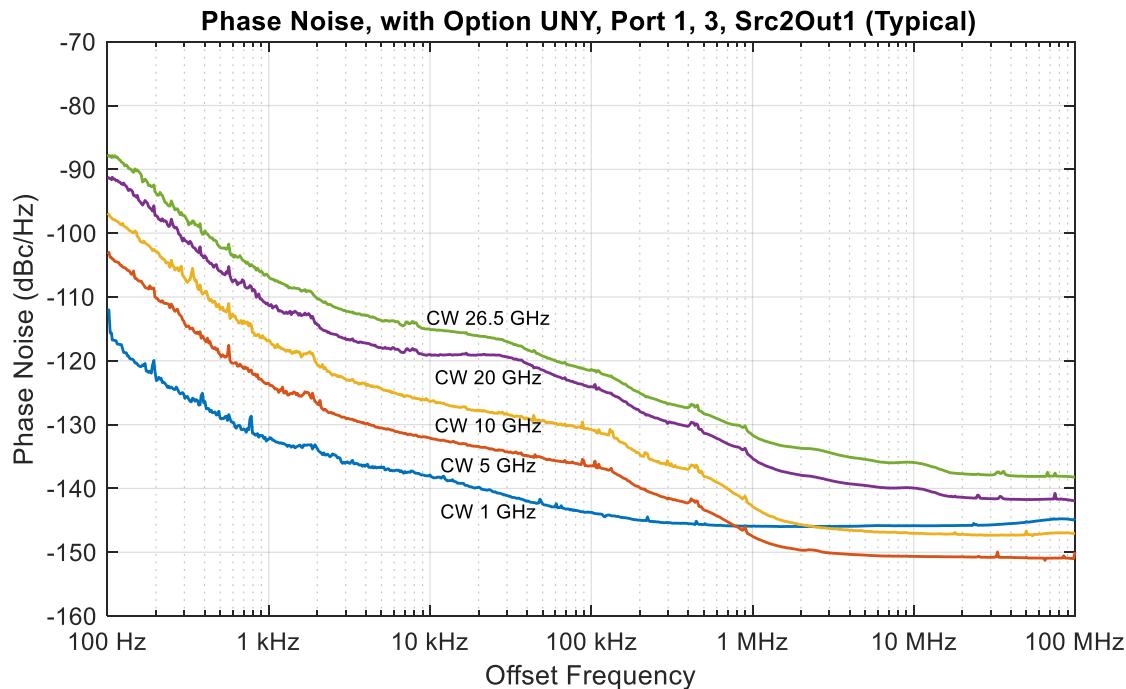
**Table 68. Phase Noise (dBc/Hz), All Options, with UNY, Port 1, 3, Src2Out1 - Typical**

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	-102	-123	-132	-135	-147	-149
10 GHz	-96	-116	-126	-130	-142	-146
20 GHz	-91	-111	-118	-123	-135	-139
26.5 GHz	-87	-106	-115	-121	-131	-136

**Table 69. 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

#### Phase Noise with Option UNY



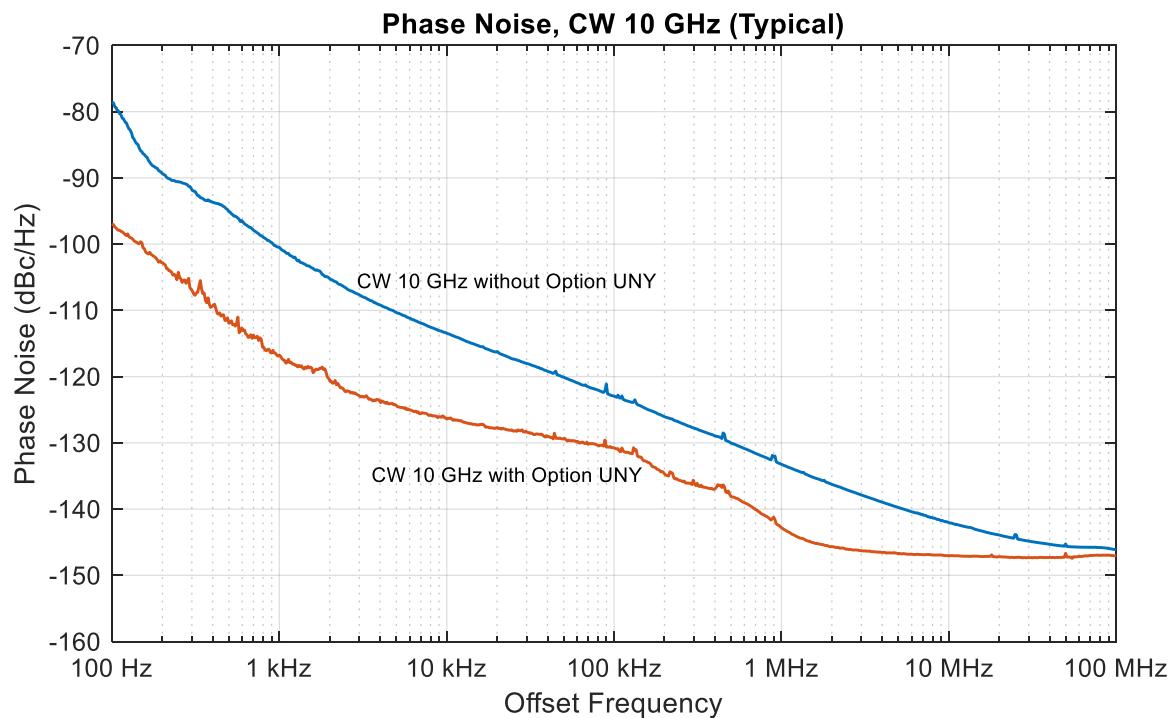
**Table 70. Phase Noise (dBc/Hz), All LFE Options (LFE Enabled), with UNY, All Ports - Typical**

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

**Table 71. 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	-144
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

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



## Test Port Input

**Table 72. 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</sup>	-80	--	-87	-130
50 MHz to 100 MHz <sup>2</sup>	-90	--	-95	-128
100 MHz to 500 MHz <sup>2</sup>	-104	--	-110	-132
500 MHz to 2 GHz	-114	--	-117	-133
2 GHz to 8.5 GHz	-114	--	-117	-129
8.5 GHz to 13.5 GHz	-114	--	-117	-129
13.5 GHz to 20 GHz	-114	--	-117	-129
20 GHz to 24 GHz	-110	--	-115	-122
24 GHz to 26.5 GHz	-107	--	-113	-119

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

<sup>2</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 73.

**Table 73. Noise Floor (dBm) @ 10 Hz IFBW, All LFE Options (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 74. 0.1 dB Compression, All Options, All Ports - Typical**

Description	Test Port Power (dBm)
10 MHz to 500 MHz <sup>1</sup>	--
500 MHz to 8.5 GHz	13
8.5 GHz to 13.5 GHz	13
13.5 GHz to 16 GHz	13
16 GHz to 20 GHz	12
20 GHz to 24 GHz	10.5
24 GHz to 26.5 GHz	10

<sup>1</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 Table 75.

**Table 75. 0.1 dB Compression, All Ports, All LFE Options (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 76. Compression (dB) at 8 dBm Test Port Power, All Options, All Ports**

Description	Specification
10 MHz to 500 MHz <sup>1</sup>	--
500 MHz to 8.5 GHz	<0.17
8.5 GHz to 13.5 GHz	<0.17
13.5 GHz to 16 GHz	<0.17
16 GHz to 24 GHz	<0.23
24 GHz to 26.5 GHz	<0.29

<sup>1</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.

**Table 77. Compression, All Ports, All LFE Options (LFE Enabled)- Specification**

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

**Table 78. Trace Noise<sup>1</sup> Magnitude (dB rms), All Options, All Ports**

Description	Specification	Typical			
		1 kHz IFBW	1 kHz IFBW	100 kHz IFBW	600 kHz IFBW
10 MHz to 100 MHz <sup>2</sup>	0.007	0.0039	0.040	0.140	
100 MHz to 8.5 GHz <sup>2</sup>	0.002	0.0005	0.005	0.011	
8.5 GHz to 13.5 GHz	0.002	0.0005	0.005	0.011	
13.5 GHz to 16 GHz	0.002	0.0005	0.005	0.011	
16 GHz to 22.5 GHz	0.002	0.0006	0.005	0.012	
22.5 GHz to 24 GHz	0.003	0.0014	0.008	0.020	
24 GHz to 26.5 GHz	0.005	0.0020	0.008	0.020	

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

<sup>2</sup> With an LFE option 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 79.

**Table 79. Trace Noise<sup>1</sup> Magnitude (dB rms), All Ports, All LFE Options (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> Ratioed measurement, nominal power at test port.

**Table 80. 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 100 MHz <sup>2</sup>	0.051		0.0261	0.266	1.053
100 MHz to 8.5 GHz <sup>2</sup>	0.015		0.0041	0.030	0.075
8.5 GHz to 13.5 GHz	0.015		0.0041	0.030	0.075
13.5 GHz to 16 GHz	0.042		0.0124	0.030	0.075
16 GHz to 22.5 GHz	0.042		0.0135	0.033	0.082
22.5 GHz to 26.5 GHz	0.054		0.0225	0.057	0.139

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

<sup>2</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 81.

**Table 81. Trace Noise<sup>1</sup> Phase (deg rms), All Ports, All LFE Options (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> Ratioed measurement, nominal power at test port.

**Table 82. Reference Level - Specification**

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

**Table 83. Stability<sup>1</sup>, All Options - Typical**

Description	Magnitude (dB/°C)	Phase (°/°C)
10 MHz to 50 MHz <sup>2</sup>	0.01	0.29
50 MHz to 500 MHz <sup>2</sup>	0.01	0.06
500 MHz to 3.2 GHz	0.01	0.07
3.2 GHz to 8.5 GHz	0.02	0.13
8.5 GHz to 10 GHz	0.02	0.13
10 GHz to 13.5 GHz	0.02	0.13
13.5 GHz to 16 GHz	0.02	0.13
16 GHz to 20 GHz	0.03	0.40
20 GHz to 24 GHz	0.03	0.54
24 GHz to 26.5 GHz	0.04	0.56

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

<sup>2</sup> With an LFE option 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 84.

**Table 84. 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 85. Damage Input Level, All Options - 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 224)	> +30	>0
Test Port 2, Noise Mode <sup>1</sup> (Option 029 without Option 425 and option 205)	> +25	>40
Test Ports (Options 205, 425)	> +20	>50

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

## Noise Receiver Input (Option 029 only)

**NOTE** Option 029 operation does not apply with LFE enabled.

**Table 86. 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 26.5 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 87. Receiver Noise Figure (dB), Port 2, at All BW, High Gain Setting**

Description	Specification	Typical
10 MHz to 200 MHz	11.0	--
200 MHz to 1.3 GHz	12.0	--
1.3 GHz to 2.0 GHz	14.0	--
2.0 GHz to 8.5 GHz	14.5	--
8.5 GHz to 13.5 GHz	14.5	--
13.5 GHz to 20 GHz	14.5	--
20 GHz to 26.5 GHz	17.0 <sup>1</sup>	--

<sup>1</sup> Degraded by 1.5 dB with 24 MHz BW.

**Table 88. Receiver Noise Figure (dB), Port 2, at All BW, High Gain Setting, Option 425**

Description	Specification	Typical
10 MHz to 200 MHz	18.5	15
200 MHz to 1.3 GHz	17.5	14
1.3 GHz to 2.0 GHz	16	14
2.0 GHz to 8.5 GHz	17	14
8.5 GHz to 13.5 GHz	17	13
13.5 GHz to 20 GHz	17.5	14
20 GHz to 26.5 GHz	19.5 <sup>1</sup>	16

<sup>1</sup> Degraded by 1.5 dB with 24 MHz BW.

**Table 89. Noise Figure Trace Noise<sup>1</sup> (dB rms) at 4 MHz BW**

Description	Specification			Typical		
	Low Gain Setting	Medium Gain Setting	High Gain Setting	Low Gain Setting	Medium Gain Setting	High Gain Setting
10 MHz to 15 MHz	0.30	0.30	0.10	0.15	0.15	0.07
15 MHz to 3 GHz	0.10	0.10	0.10	0.07	0.07	0.07
3 GHz to 8.5 GHz	0.11	0.10	0.10	0.07	0.07	0.07
8.5 GHz to 13.5 GHz	0.11	0.10	0.10	0.07	0.07	0.07
13.5 GHz to 26.5 GHz	0.11	0.10	0.10	0.07	0.07	0.07

<sup>1</sup> Trace noise magnitude performance on noise figure trace or sometime called noise jitter, 201 points, 1 noise average, port 2 terminated. May typically be degraded at frequencies below 500 MHz due to spurious noise receiver residuals.

**Table 90. Noise Receiver Linearity (dB) at 4 MHz BW - Specification**

Power Range (dBm)			Specification
Low Gain Setting Reference to -60 dBm	Medium Gain Setting Reference to -70 dBm	High Gain Setting Reference to -80 dBm	
-36 to -64	-48 to -76	-58 to -84	±0.05
-64 to -70	-76 to -86	-84 to -92	±0.10

**Table 91. 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 3 GHz	32	44	55	≤-57	≤-45	≤-34
3 GHz to 8.5 GHz	46	57	68	≤-43	≤-32	≤-21
8.5 GHz to 13.5 GHz	46	57	68	≤-43	≤-32	≤-21
13.5 GHz to 26.5 GHz	46	57	68	≤-43	≤-32	≤-21

<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.

## Phase Noise Measurement Performance (with S930317B phase noise measurement application)<sup>1</sup>

- Offset frequency range: 0.1 Hz to 10 MHz
- Sweep speed (typical): 34 seconds (1 Hz to 10 MHz offset in Normal mode)

**Table 92. Absolute Phase Noise Sensitivity (dBc/Hz), in Best mode - Supplemental Performance Data**

Input Power level: +5 dBm (-5 dBm at 50 GHz)

Phase Noise	Offset Frequency								
	Input Frequency	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	300 kHz	1 MHz
1 GHz	-55	-88	-112	-127	-132	-134	-134	-134	-134
10 GHz	-36	-69	-97	-117	-124	-130	-132	-136	-137
20 GHz	-31	-64	-90	-111	-120	-124	-125	-132	-134
40 GHz	-23	-58	-84	-104	-113	-117	-123	-125	-129
50 GHz	-18	-54	-81	-100	-109	-113	-116	-121	-123

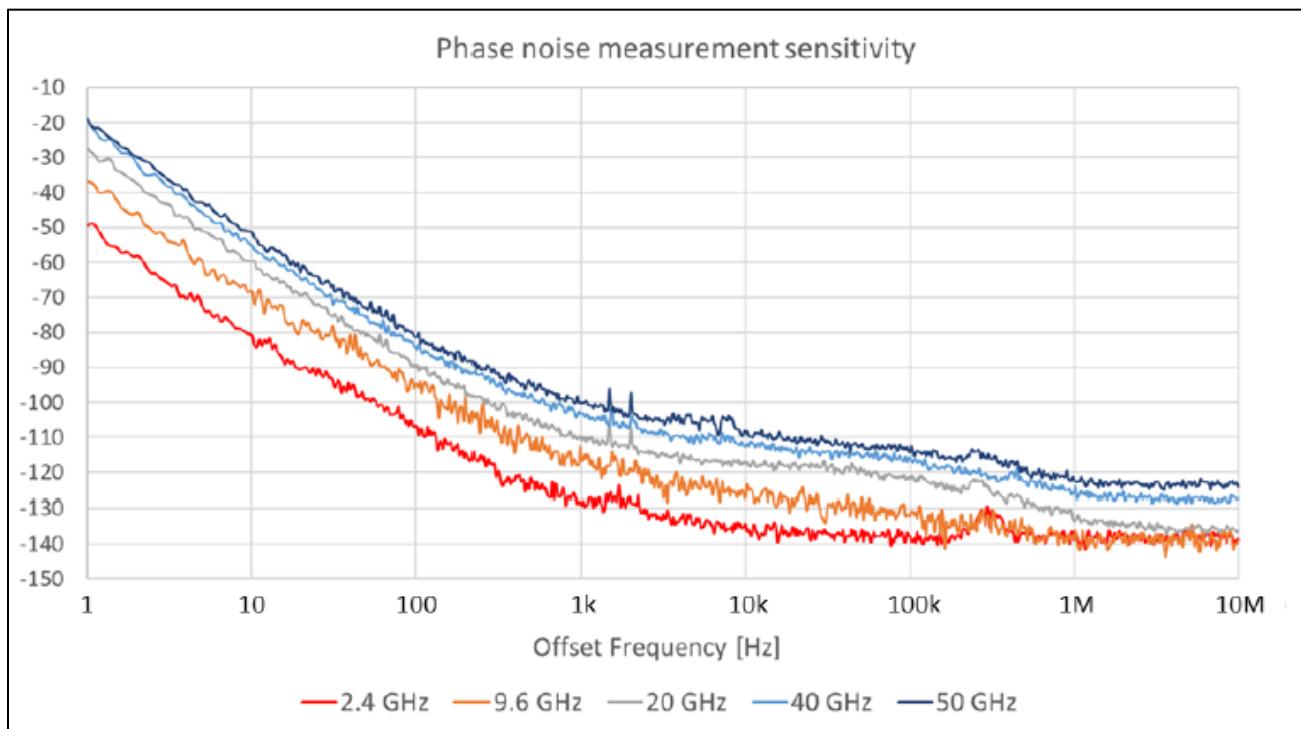
**Table 93. Absolute AM Noise Sensitivity (dBc/Hz), in Best mode - Supplemental Performance Data**

Input Power level: +5 dBm (-5 dBm at 50 GHz)

AM Noise	Offset Frequency								
	Input Frequency	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	300 kHz	1 MHz
1 GHz	-96	-104	-110	-119	-128	-132	-132	-135	-137
10 GHz	-97	-104	-110	-118	-128	-134	-135	-138	-139
20 GHz	-96	-104	-112	-116	-125	-132	-129	-136	-136
40 GHz	-93	-102	-109	-114	-123	-127	-130	-130	-132
50 GHz	-91	-96	-105	-114	-119	-122	-117	-125	-122

<sup>1</sup> The input frequency in the sensitivity tables in this section is limited to the highest frequency of the PNA-X model.

### Absolute Phase Noise Sensitivity (dBc/Hz) - Supplemental Performance Data



## Single-Channel Residual Noise Measurement for Frequency Converting Devices<sup>2</sup>

**Table 94. Single-Channel Residual Phase Noise Sensitivity (dBc/Hz), with Option UNY in Best mode - Supplemental Performance Data**

Input Power level: +10 dBm (+6 dBm at 40 GHz, -2 dBm at 50 GHz)

Residual Phase Noise	Offset Frequency								
Input Frequency	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	300 kHz	1 MHz	10 MHz
1 GHz	-102	-110	-115	-123	-131	-136	-136	-137	-137
10 GHz	-92	-99	-105	-113	-122	-131	-134	-139	-140
20 GHz	-83	-93	-100	-112	-118	-125	-124	-132	-136
40 GHz	-78	-85	-93	-106	-110	-122	-126	-128	-129
50 GHz	-75	-81	-91	-102	-110	-120	-119	-125	-125

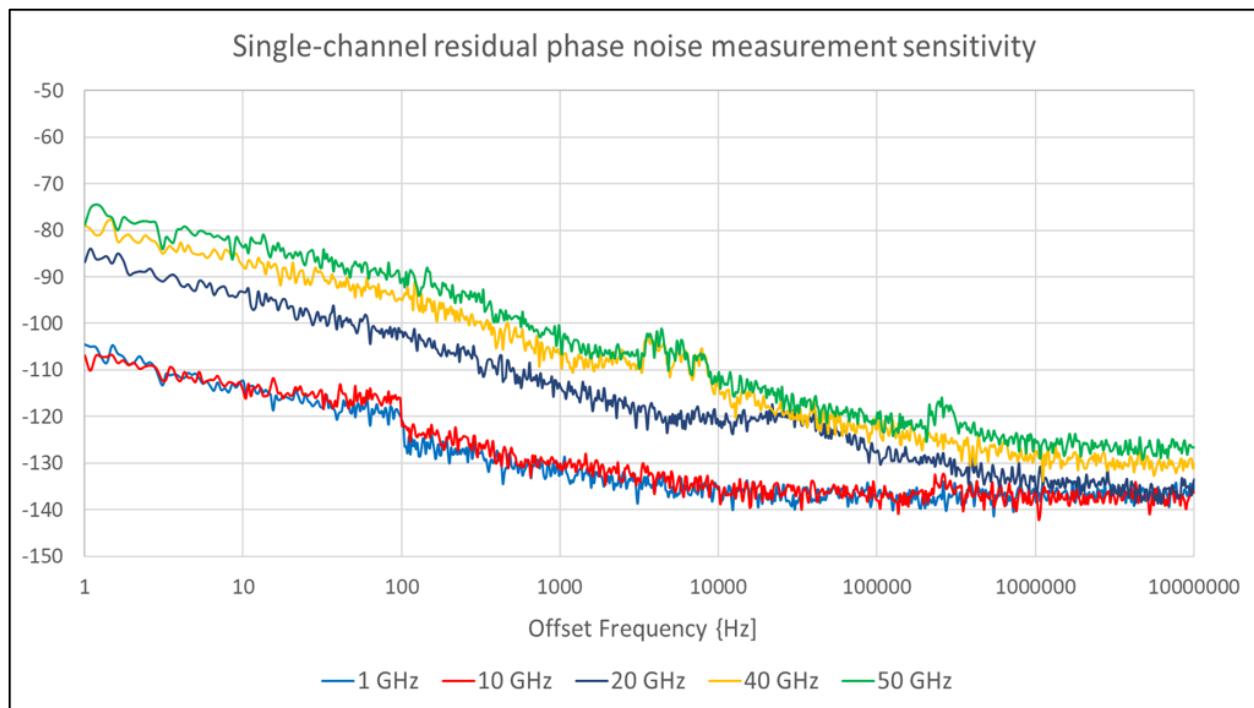
**Table 95. Single-Channel Residual AM Noise Sensitivity (dBc/Hz), with Option UNY in Best mode - Supplemental Performance Data**

Input Power level: +10 dBm (+6 dBm at 40 GHz, -2 dBm at 50 GHz)

Residual AM Noise	Offset Frequency								
Input Frequency	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	300 kHz	1 MHz	10 MHz
1 GHz	-97	-104	-112	-120	-117	-128	-130	-134	-138
10 GHz	-97	-106	-111	-120	-121	-129	-134	-137	-142
20 GHz	-99	-104	-112	-120	-123	-120	-123	-130	-136
40 GHz	-96	-102	-110	-117	-118	-128	-132	-131	-133
50 GHz	-91	-99	-109	-114	-120	-125	-118	-125	-127

<sup>2</sup> The phase or AM noise of the DUT output signal is not measured. The measurement can be done when the phase or AM noise of the signal generated by the DUT is larger than that of the DUT input signal supplied by the PNA-X internal signal source.

**Single-Channel Residual Phase Noise Sensitivity (dBc/Hz) - Supplemental Performance Data**



**Table 96. Single-Channel Residual Phase Noise Sensitivity (dBc/Hz), without Option UNY in Best mode - Supplemental Performance Data**

Input Power level: +10 dBm (+6 dBm at 40 GHz, 0 dBm at 50 GHz)

Residual Phase Noise	Offset Frequency								
Input Frequency	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	300 kHz	1 MHz	10 MHz
1 GHz	-94	-95	-100	-120	-133	-136	-138	-137	-136
10 GHz	-77	-78	-83	-102	-114	-124	-129	-135	-138
20 GHz	-70	-74	-75	-95	-109	-118	-127	-128	-133
40 GHz	-64	-67	-70	-92	-102	-112	-116	-121	-128
50 GHz	-61	-63	-66	-87	-101	-109	-113	-119	-125

**Table 97. Single-Channel Residual AM Noise Sensitivity (dBc/Hz), without Option UNY in Best mode - Supplemental Performance Data**

Input Power level: +10 dBm (+6 dBm at 40 GHz, 0 dBm at 50 GHz)

Residual AM Noise	Offset Frequency								
Input Frequency	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	300 kHz	1 MHz	10 MHz
1 GHz	-105	-110	-123	-125	-134	-138	-139	-143	-138
10 GHz	-104	-110	-116	-125	-133	-134	-133	-141	-141
20 GHz	-104	-109	-116	-127	-127	-126	-128	-133	-137
40 GHz	-103	-110	-115	-125	-120	-130	-126	-130	-132
50 GHz	-98	-106	-111	-121	-124	-125	-122	-129	-129

## 2-Channel Residual Noise Measurement for Non-Frequency Converting Devices<sup>3</sup>

**Table 98. 2-Channel Residual Phase Noise Sensitivity (dBc/Hz) in Best mode - Supplemental Performance Data**

Input Power level: +10 dBm (+6 dBm at 40 GHz, -3 dBm at 50 GHz)

Residual Phase Noise	Offset Frequency								
	Input Frequency	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	300 kHz	1 MHz
1 GHz	-107	-116	-127	-134	-132	-134	-131	-133	-132
10 GHz	-101	-110	-120	-126	-134	-135	-134	-138	-136
20 GHz	-99	-105	-113	-120	-128	-131	-129	-134	-135
40 GHz	-93	-101	-109	-115	-121	-124	-125	-126	-127
50 GHz	-90	-99	-106	-113	-117	-118	-119	-120	-120

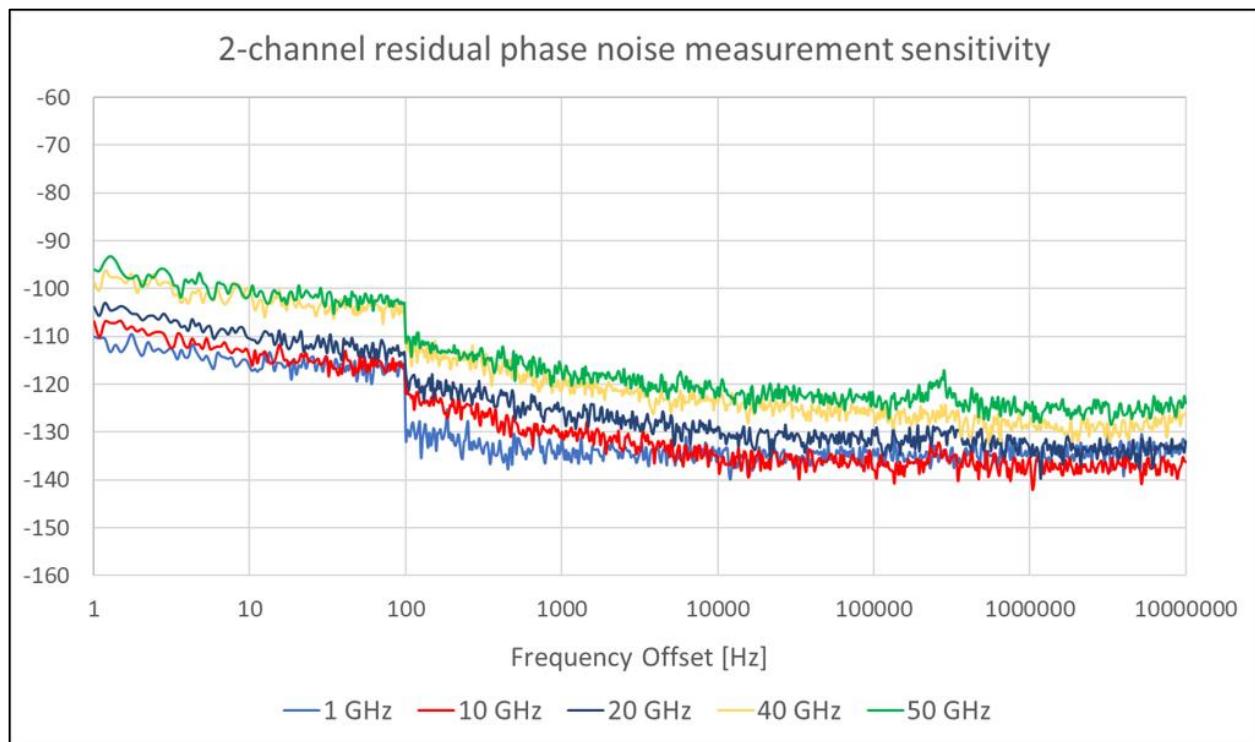
**Table 99. 2-Channel Residual AM Noise Sensitivity (dBc/Hz) in Best mode - Supplemental Performance Data**

Input Power level: +10 dBm (+6 dBm at 40 GHz, -3 dBm at 50 GHz)

Residual AM Noise	Offset Frequency								
	Input Frequency	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	300 kHz	1 MHz
1 GHz	-99	-106	-109	-120	-131	-133	-138	-137	-134
10 GHz	-95	-105	-113	-121	-130	-134	-136	-139	-139
20 GHz	-96	-104	-113	-120	-129	-128	-129	-136	-136
40 GHz	-98	-107	-112	-118	-120	-127	-129	-130	-131
50 GHz	-93	-102	-110	-115	-120	-121	-119	-122	-122

<sup>3</sup> Both the phase or AM noise of the DUT input signal and that of the DUT output signal are measured.

2-Channel Residual Phase Noise Sensitivity (dBc/Hz) - Supplemental Performance Data



## Dynamic Accuracy

Table 100. 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".

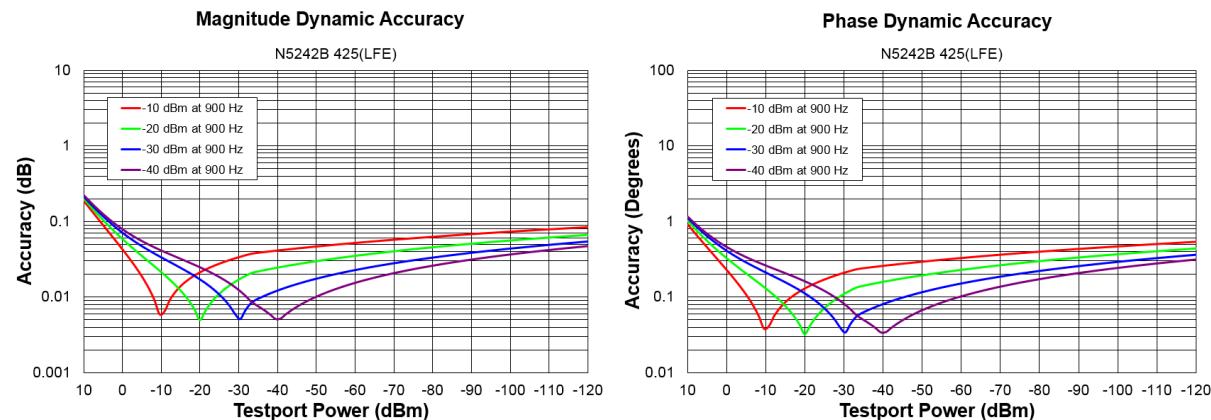
Applies to the N5249B (all serial numbers) and N5241B, N5242B with following serial numbers:

N5241B and N5241BS: MY5241/SG5241/US5241 and above

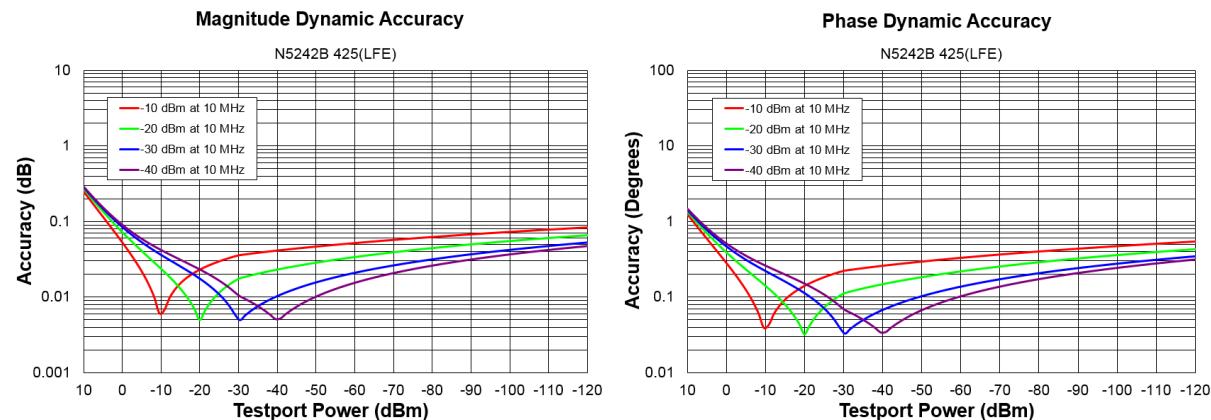
N5242B and N5242BS: MY5242/SG5242/US5242 and above

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.

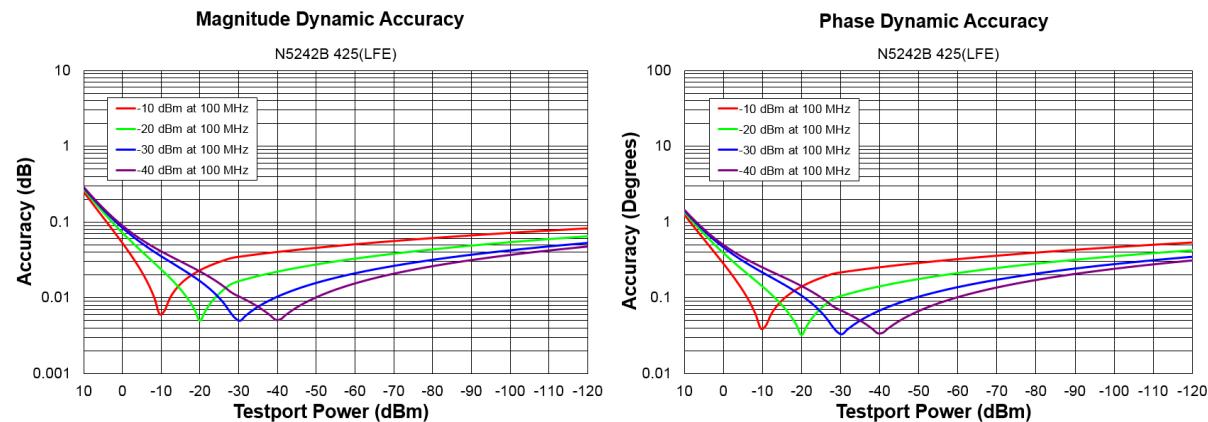
### Dynamic Accuracy, 900 Hz, All LFE Options (LFE Enabled) - Specification



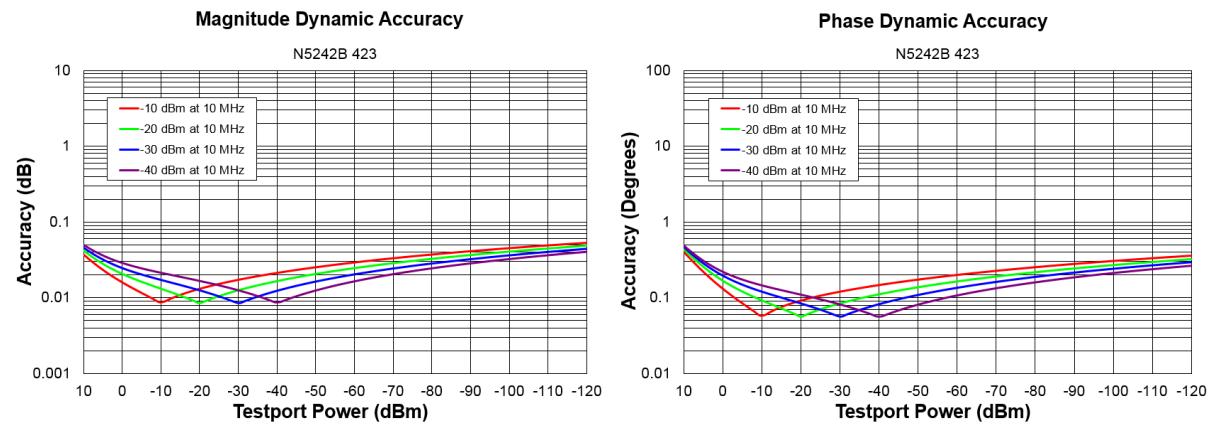
### Dynamic Accuracy, 10 MHz, All LFE Options (LFE Enabled) - Specification



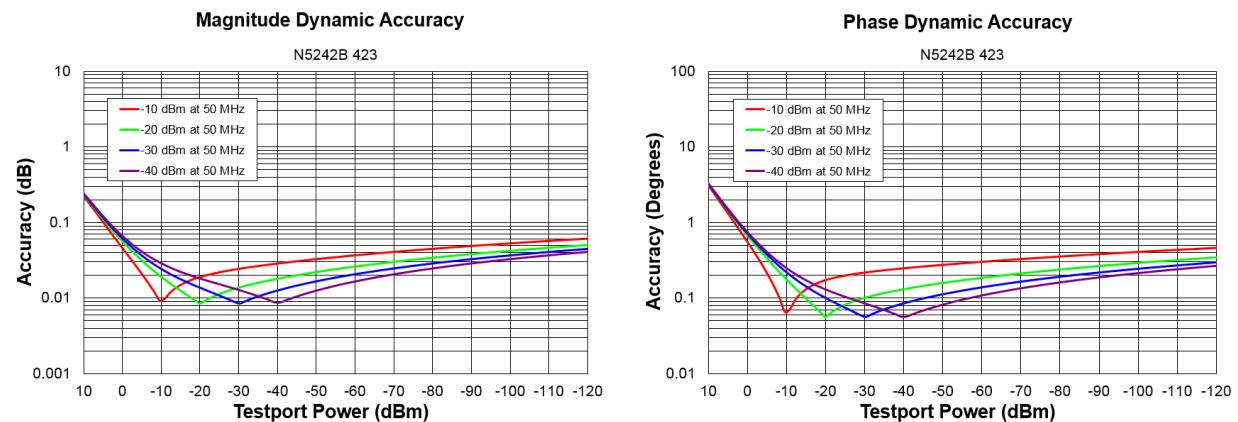
## Dynamic Accuracy, 100 MHz, All LFE Options (LFE Enabled) - Specification



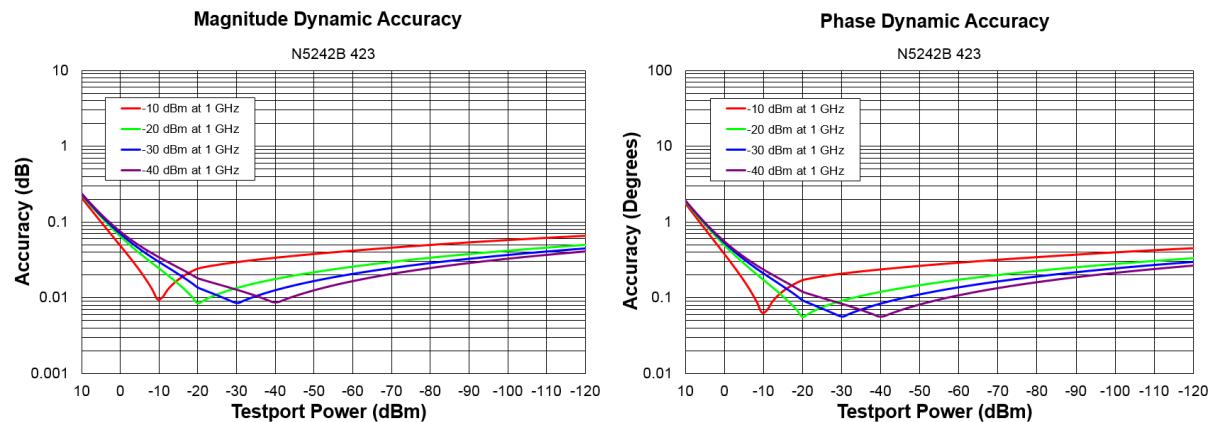
## Dynamic Accuracy, 10 MHz



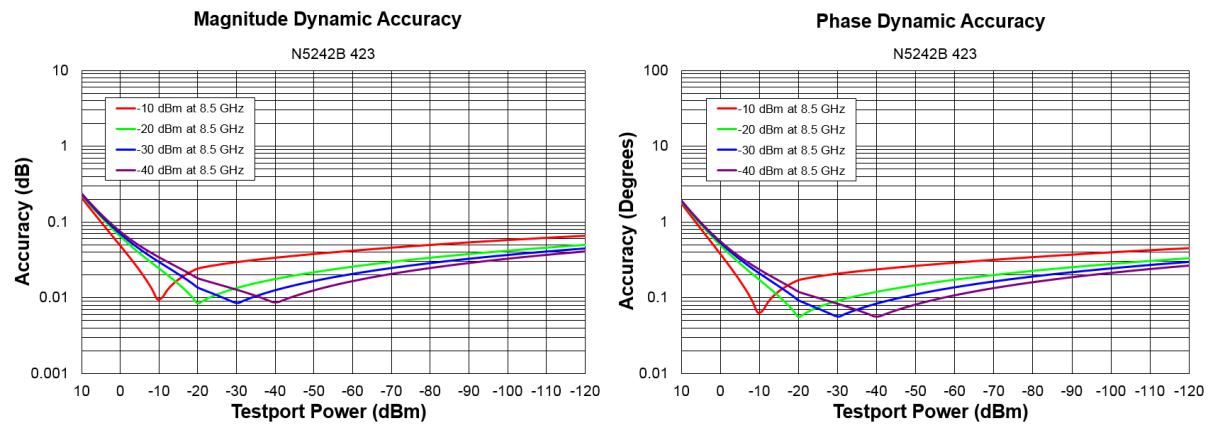
## Dynamic Accuracy, 50 MHz



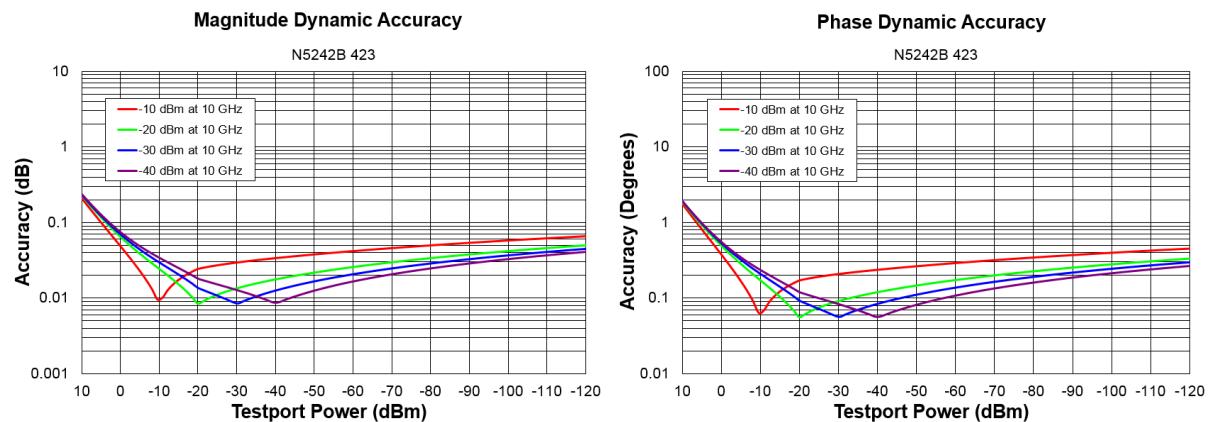
## Dynamic Accuracy, 1 GHz



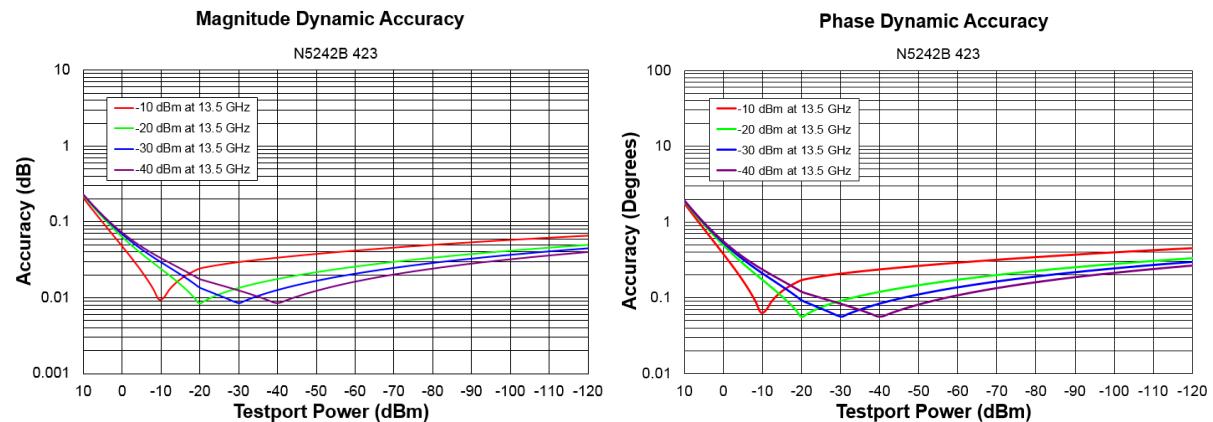
## Dynamic Accuracy, 8.5 GHz



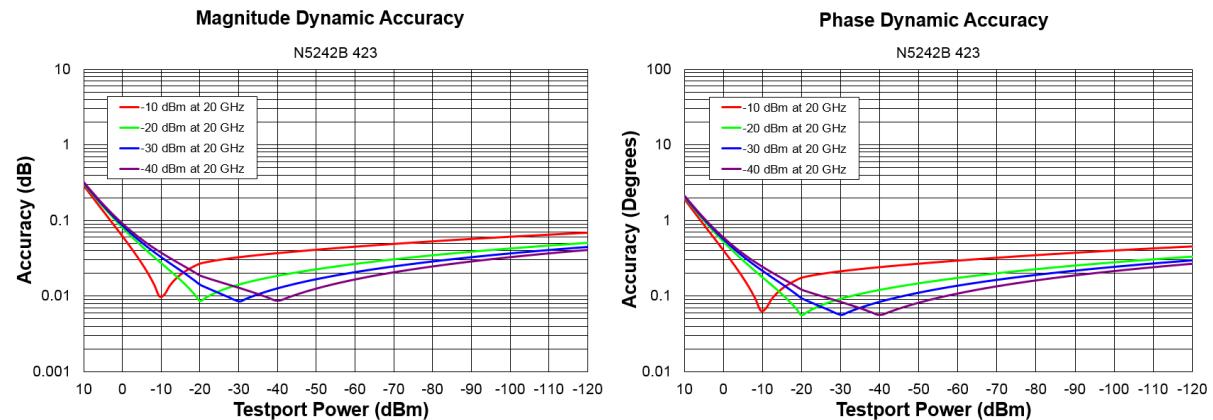
## Dynamic Accuracy, 10 GHz



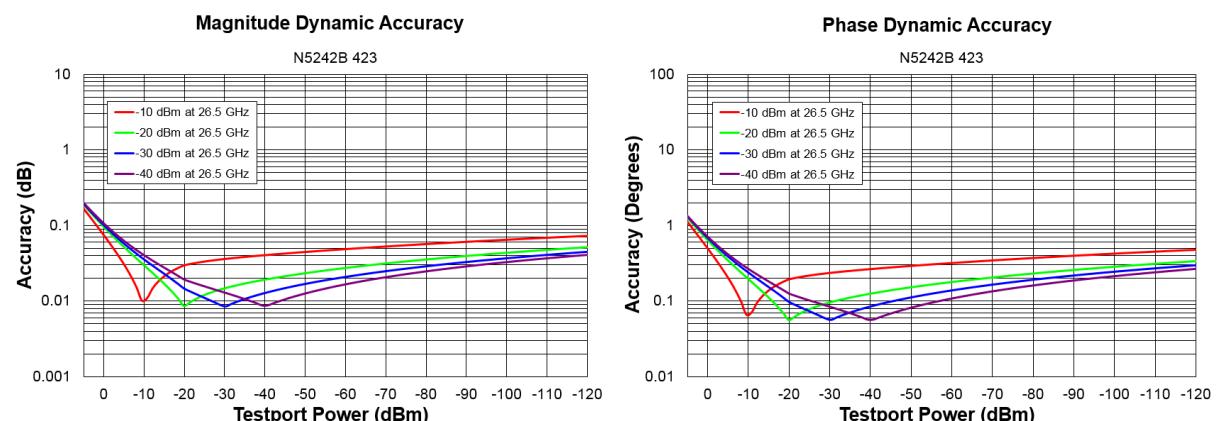
## Dynamic Accuracy, 13.5 GHz



## Dynamic Accuracy, 20 GHz



## Dynamic Accuracy, 26.5 GHz



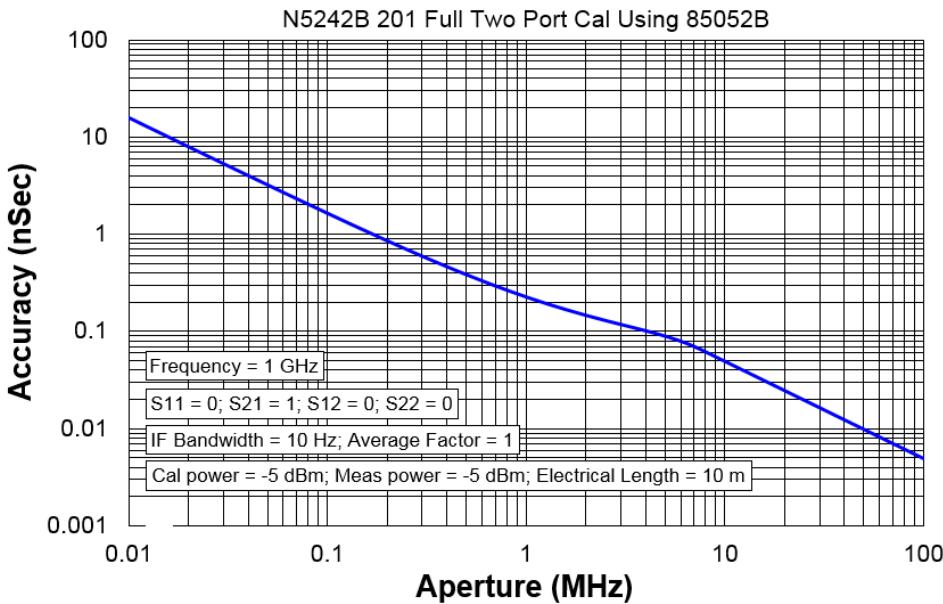
**Table 101. Test Port Input (Group Delay)<sup>1</sup>**

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:

$\pm$ Phase Accuracy (deg)/[360  $\times$  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

**Table 102. Miscellaneous Information**

Description	Supplemental Information
System IF Bandwidth Range	1 Hz to 15 MHz, nominal (7 MHz, 10 MHz, and 15 MHz IFBWs 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 (only applies to N5241B, N5242B, and N5249B models that are shipped with firmware revision A.08.20 and higher)
Maximum Number of Points	100003

**Table 103. Front Panel Information, All Options**

Description	Typical Performance
<b>RF Connectors</b>	
Test Ports	3.5 mm (male), 50 ohm (nominal), 0.002 in. Center Pin Recession (characteristic)
Jumpers	3.5 mm (female) connectors with SMA (male) jumper cables
<b>USB 2.0 Ports - Primary (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	<p>Any of the following would cause a display to be considered faulty:</p> <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>

Description	Typical Performance
<b>Display Range</b>	
Magnitude	$\pm 2500$ dB (at 500 dB/div), max
Phase	$\pm 2500^\circ$ (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 104. Rear Panel Information, All Options**

Description	Typical Performance
<b>10 MHz Reference In</b>	
Connector	BNC, female
Input Frequency	10 MHz $\pm 1$ ppm, 100 MHz $\pm 1$ ppm
Input Level	10 MHz: -15 dBm to +20 dBm 100 MHz: -10 dBm to +20 dBm
Input Impedance	50 $\Omega$ , nom.
<b>10 MHz Reference Out</b>	
Connector	BNC, female
Output Frequency	10 MHz $\pm 0.7$ ppm, 100 MHz $\pm 0.7$ ppm
Signal Type	Sine Wave
Output Level	+10 dBm $\pm 4$ dB into 50 $\Omega$
Output Impedance	50 $\Omega$ , nominal
Harmonics	< -40 dBc, typical
<b>SRC3 (Option XSB)</b>	
Connector	SMA, female
Output Frequency	10 MHz to 13.5 GHz
Typical Output Power Range	See Table 46
<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)

Description		Typical Performance					
Frequency Path Normal IF path:	DSP Version 4	IF Bandwidth All ≤ 600 kHz	RF Frequency < 53 MHz ≥ 53 MHz < 53 MHz ≥ 53 MHz 1 MHz 1.5 MHz 2 MHz 3 MHz 5 MHz 7 MHz 10 MHz 15 MHz All	IF Frequency 2.535211 MHz 7.605634 MHz 2.479339 MHz 7.438017 MHz 7.692 MHz 7.368 MHz 8.450 MHz 8.163 MHz 6.897 MHz 10.53 MHz 15.38 MHz 22.22 MHz 10.70 MHz			
Narrowband IF path:	4 or 5	All	All				
Input Impedance		50 Ω					
RF Damage Level		+23 dBm					
DC Damage Level		5.5 VDC					
0.1 dB Compression Point Normal IF path Narrowband IF path		-9.0 dBm at 7.438 MHz -17 dBm at 10.70 MHz					
Pulse I/O Connector		15-pin mini D-sub (for pin assignment information, refer to the <a href="#">PNA online help</a> )					
<b>Pulse Inputs (IF Gates)</b>							
Function		Internal receiver gates used for point-in-pulse and pulse-profile measurements					
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					
<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 8.5 GHz		-80 dB					
8.5 GHz to 13.5 GHz		-80 dB					
13.5 GHz to 26.5 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					

Description		Typical Performance			
<b>External Test Set Driver</b>					
Function	Used for driving remote mixers				
Connections	SMA (female)				
RF, LO Output Frequency Range		0.01 to 13.5 GHz (N5241B)	0.01 to 26.5 GHz (N5242B)		
Rear Panel LO Power	Upper Limit (dBm)		Lower Limit (dBm)		
10 MHz to 1.7 GHz	--		--		
1.7 GHz to 8.5 GHz	0		-10		
8.5 GHz to 13.5 GHz	0		-10		
13.5 GHz to 18 GHz	0		-10		
18 GHz to 22.5 GHz	2		-8		
22.5 GHz to 26.5 GHz	6		-5		
Rear Panel RF Power	Upper Limit (dBm)		Lower Limit (dBm)		
3.2 GHz to 13.5 GHz	-3		-8		
13.5 GHz to 20 GHz	-3		-8		
20 GHz to 26.5 GHz	-8		-14		
Devices Supported	Resolutions				
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").					
Bias Tee Inputs					
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				
Other Rear Panel Interface					
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				
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)				

Description	Typical Performance
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 100/120 VAC 50/60 Hz for 220/240 VAC
	Power supply is auto switching
Max	575 watts

**Table 105. 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>

Cabinet Dimensions	Metric (mm)	Imperial (inches)
<b>Height</b>		
Without bottom feet:EIA RU <sup>1</sup> = 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	533.0	21.0
With front and rear panel hardware, handles	578.0	22.7
<b>Weight (nominal)</b>		<b>Net</b> <b>Shipping</b>
2-port models	27 kg (60 lb)	43 kg (95 lb)
4-port models	37 kg (82 lb)	53 kg (117 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

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 (S11) measurement. LF Auto BW off.

**Table 106. Cycle Time (ms) for Measurement Completion, All Models, All Options - Typical**

Sweep Range	IF Bandwidth	Number of Points			
		201	401	1601	16001
50 kHz to 100 MHz	10 kHz	Uncorrected	67.1	127.9	493
		2-Port cal	133.1	255	986
	1 kHz	Uncorrected	290.3	574	2283
		2-Port cal	579	1149	4564
	100 Hz	Uncorrected	2529	5044	20138
		2-Port cal	5056	10087	40273
7 GHz to 8 GHz	600 kHz	Uncorrected	4.5	4.7	8.2
		2-Port cal	9.2	9.6	16.7
	10 kHz	Uncorrected	38.6	52.8	202
		2-Port cal	77.3	106	404
	1 kHz	Uncorrected	208.3	421	1586
		2-Port cal	403	798	3171
9 GHz to 10 GHz	600 kHz	Uncorrected	4.3	4.5	8.2
		2-Port cal	8.6	9	16.6
	10 kHz	Uncorrected	35.3	52.8	202.3
		2-Port cal	70.6	106.1	404
	1 kHz	Uncorrected	203.3	417	1589
		2-Port cal	403	798	3169
10 GHz to 13.5 GHz	600 kHz	Uncorrected	7.2	7.5	9
		2-Port cal	14.7	15.1	18.5
	10 kHz	Uncorrected	41.4	79.3	202.8
		2-Port cal	83.2	159	406
	1 kHz	Uncorrected	202.3	400	1585
		2-Port cal	404	800	3171
13.5 GHz to 20 GHz	600 kHz	Uncorrected	14	14.2	14.9
		2-Port cal	27.6	27.9	29.4
	10 kHz	Uncorrected	43.8	81.6	214.8
		2-Port cal	87.1	162.8	428
	1 kHz	Uncorrected	204.8	402	1588
		2-Port cal	408	804	3175

**Table 107. N5241B Cycle Time (ms) for Full-Span Measurement Completion - Typical**

10 MHz to 13.5 GHz		Number of Points			
IF Bandwidth		201	401	1601	16001
600 kHz	Uncorrected	30	41	54.4	93.7
	2-Port cal	59.1	81.1	108	188
10 kHz	Uncorrected	56.5	100.6	359	2157
	2-Port cal	111.4	204	717	4312
1 kHz	Uncorrected	217.3	421	1638	16210
	2-Port cal	432	840	3275	32416

**Table 108. N5242B Cycle Time (ms) for Full-Span Measurement Completion - Typical**

10 MHz to 26.5 GHz		Number of Points			
IF Bandwidth		201	401	1601	16001
600 kHz	Uncorrected	33.2	46.1	68.6	102.7
	2-Port cal	65.1	91.1	136.4	202.5
10 kHz	Uncorrected	58.5	100.3	345	2192
	2-Port cal	115.3	198.8	688	4382
1 kHz	Uncorrected	219.5	421	1624	16029
	2-Port cal	436	839	3246	32054

**Table 109. N5249B Cycle Time (ms) for Full-Span Measurement Completion - Typical**

10 MHz to 8.5 GHz		Number of Points			
IF Bandwidth		201	401	1601	16001
600 kHz	Uncorrected	29.2	38.3	49.1	89.3
	2-Port cal	57.2	75.5	96.8	178
10 kHz	Uncorrected	58.4	105.6	370	2152
	2-Port cal	115.3	209.3	737	4301
1 kHz	Uncorrected	219.3	426	1659	16432
	2-Port cal	436	850	3316	32860

**Table 110. 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.

Description	Typical Performance		
	IF Bandwidth (Hz)	Cycle Time (ms)	Trace Noise Magnitude (dB rms)
600,000		2.4	0.009
100,000		3.5	0.003
30,000		7	0.002
10,000		26.9	0.001
3,000		69.3	0.0007
1,000		200.8	0.0004
300		616	0.0003
100		1798	0.0002
30		5955	<0.0002
10		17803	<0.0002
3		59246	<0.0002

**Table 111. 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
Number of Points				
3	4.8	2.2	1.9	1.8
11	12.8	3.8	2.7	1.8
51	52.4	8.2	3.1	2.1
101	101.8	14.4	4.4	2
201	201	26.9	7	2.4
401	398	51.8	12.1	3.1
801	793	101.6	22.2	4.5
1,601	1584	200.8	42	6.9
6,401	6326	797	161.7	22.1
16,001	15812	1989	401	52.4

**Table 112. Data Transfer Time<sup>1</sup> (ms) - Typical**

**NOTE** The following was measured on a unit with Synthesizer 6.

Description	Number of Points			
	201	401	1601	16,001
SCPI over GPIB (Program executed on external PC <sup>2</sup> )				
32-bit floating point	5.6	10.5	39.9	400
64-bit floating point	10.5	20.3	79.2	788
ASCII	46	92.5	370	3702
SCPI over SICL/LAN or TCP/IP Socket (Program executed in the analyzer)				
32-bit floating point	0.18	0.21	0.5	3.6
64-bit floating point	0.22	0.28	0.62	5.3
ASCII	6.3	12.3	47.3	470
COM <sup>3</sup> (Program executed in the analyzer)				
32-bit floating point	<0.15	0.15	0.2	0.7
Variant type	0.75	1.2	4.5	50
DCOM over LAN <sup>3</sup> (Program executed on external PC)				
32-bit floating point	<1.0	1.2	2.1	13
Variant type	2.7	4.5	15	150

<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.

**NOTE**

Specifications for Recall & Sweep Speed are not provided for the N524xB analyzers.

**Table 113. Typical Cycle Time for Amplifier Noise Figure Measurement (Option 029 and S93029B)**

**NOTE** The following was measured on a unit with Synthesizer 6.

**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 114. Typical Cycle Time for Amplifier Gain Compression Measurement (Option S93086B)**

**NOTE** The following was measured on a unit with Synthesizer 6.

**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 115. Typical Cycle Time for Amplifier Swept Intermodulation Distortion Measurement (Option S93087B)**

**NOTE** The following was measured on a unit with Synthesizer 6.

**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 116. Typical Cycle Time for Converter Noise Figure Measurement (Option 029 and S93029B)**

**NOTE** The following was measured on a unit with Synthesizer 6.

**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 117. Typical Cycle Time for Converter Measurement with SMC + Phase (Option S93083B)**

**NOTE**

The following was measured on a unit with Synthesizer 6.

**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 118. Typical Cycle Time for Converter Gain Compression Measurement (Option S93086B)**

**NOTE**

The following was measured on a unit with Synthesizer 6.

**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 119. Typical Cycle Time for Converter Swept Intermodulation Distortion Measurement (Option S93087B)**

**NOTE**

The following was measured on a unit with Synthesizer 6.

**Conditions:**

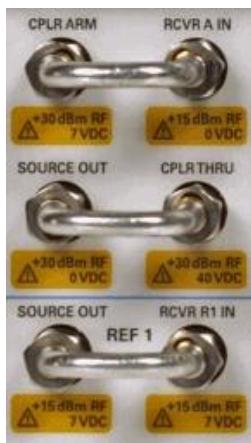
- Input frequency: 3 GHz CF, 75 MHz span
- LO frequency: 2.12 GHz fixed
- Output frequency: 880 MHz CF, 75 MHz span
- Main tone IF bandwidth: 10 kHz
- IM tone IF bandwidth: 1 kHz
- Measurement parameters: PwrMain (avg), IM3 (dB relative to carrier)
- Other: NA application display on; correction on

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.



**Table 120. Measurement Receiver Inputs (dBm) - Typical**

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

Description	All Options
10 MHz to 50 MHz	-4
50 MHz to 500 MHz	-3
500 MHz to 8.5 GHz	-2
8.5 GHz to 13.5 GHz	-2
13.5 GHz to 16 GHz	-2
16 GHz to 20 GHz	-2.5
20 GHz to 26.5 GHz	-4

**Table 121. 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	-8	-3	-8	-3	-9	-6
50 MHz to 500 MHz	-6	-3	-6	-3	-7	-5
500 MHz to 3.2 GHz	-6	-6	-5	-5	-7	-5
3.2 GHz to 8.5 GHz	-3	-3	-2	-2	-2	-2
8.5 GHz to 10 GHz	-3	-3	-2	-2	-2	-2
10 GHz to 13.5 GHz	-4	-4	-3	-3	-3	-3
13.5 GHz to 16 GHz	-4	-4	-3	-3	-3	-3
16 GHz to 20 GHz	-5	-5	-6	-6	-6	-6
20 GHz to 24 GHz	-7	-7	-8	-8	-9	-9
24 GHz to 26.5 GHz	-16	-16	-15	-15	-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.

**Table 122. 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	
	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	-1	-1	-6	-1	-1
50 MHz to 500 MHz	-4	-1	-1	-4	-1	-1
500 MHz to 3.2 GHz	-4	-4	0	-3	-3	-1
3.2 GHz to 8.5 GHz	0	0	0	1	1	0
8.5 GHz to 10 GHz	0	0	0	1	1	0
10 GHz to 13.5 GHz	1	1	0	1	1	1
13.5 GHz to 16 GHz	1	1	0	1	1	1
16 GHz to 20 GHz	1	1	-3	0	0	-3
20 GHz to 24 GHz	0	0	-6	-1	-1	-4
24 GHz to 26.5 GHz	-8	-8	-12	-7	-7	-13

<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 123. 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 42x		Options 22x, 42x RCVR R2, R4 IN, REF 2, 4 SOURCE OUT
	RCVR R3 IN, REF 3 SOURCE OUT	RCVR R3 IN, REF 3 SOURCE OUT	
	Filtered Mode <sup>1</sup>	Hi Power Mode <sup>1</sup>	
10 MHz to 50 MHz	-7	-4	-1
50 MHz to 500 MHz	-6	-4	-1
500 MHz to 3.2 GHz	-5	-3	-1
3.2 GHz to 8.5 GHz	1	1	0
8.5 GHz to 10 GHz	1	1	0
10 GHz to 13.5 GHz	1	1	-2
13.5 GHz to 16 GHz	1	1	-2
16 GHz to 20 GHz	0	0	-4
20 GHz to 24 GHz	-2	-2	-6
24 GHz to 26.5 GHz	-10	-10	-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 124. 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
	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	8	13	13	8	13	13
50 MHz to 500 MHz	10	13	13	10	13	13
500 MHz to 3.2 GHz	11	11	13	11	11	14
3.2 GHz to 8.5 GHz	14	14	14	14	14	14
8.5 GHz to 10 GHz	14	14	14	14	14	14
10 GHz to 13.5 GHz	14	14	14	14	14	13
13.5 GHz to 16 GHz	14	14	14	14	14	13
16 GHz to 20 GHz	14	14	11	12	12	10
20 GHz to 24 GHz	13	13	9	10	10	9
24 GHz to 26.5 GHz	7	7	4	5	5	2

<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 125. Source Outputs (dBm) - Typical**

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

Description	Options 22x, 42x		
	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	7	10	13
50 MHz to 500 MHz	8	10	13
500 MHz to 3.2 GHz	9	11	14
3.2 GHz to 8.5 GHz	14	14	14
8.5 GHz to 10 GHz	14	14	14
10 GHz to 13.5 GHz	14	14	12
13.5 GHZ to 16 GHz	14	14	12
16 GHZ to 20 GHz	12	12	9
20 GHZ to 24 GHz	9	9	7
24 GHZ to 26.5 GHz	2	2	4

<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 126. 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
10 MHz to 50 MHz	0	-0.5
50 MHz to 500 MHz	-0.25	-0.75
500 MHz to 3.2 GHz	-0.5	-1.0
3.2 GHz to 8.5 GHz	-0.75	-1.25
8.5 GHz to 10 GHz	-0.75	-1.25
10 GHz to 13.5 GHz	-1.0	-1.75
13.5 GHZ to 16 GHz	-1.0	-1.75
16 GHZ to 20 GHz	-1.5	-2.25
20 GHZ to 24 GHz	-1.5	-2.5
24 GHZ to 26.5 GHz	-1.75	-2.5

**Table 127. Damage Level - Typical**

Description	RF (dBm)	DC (v)
RCVR A, B, C, D IN	15	7
RCVR R1 IN	15	7
RCVR 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	30	7
PORT 1, 2, 3, 4 CPLR THRU	30 ( $20^2$ )	40 ( $7^1$ ) ( $50^2$ )
PORT 1, 2, 3, 4 CPLR ARM	30	7

1 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.

2 With an LFE option installed.

## Test Set Block Diagrams

### NOTE

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

### Legend

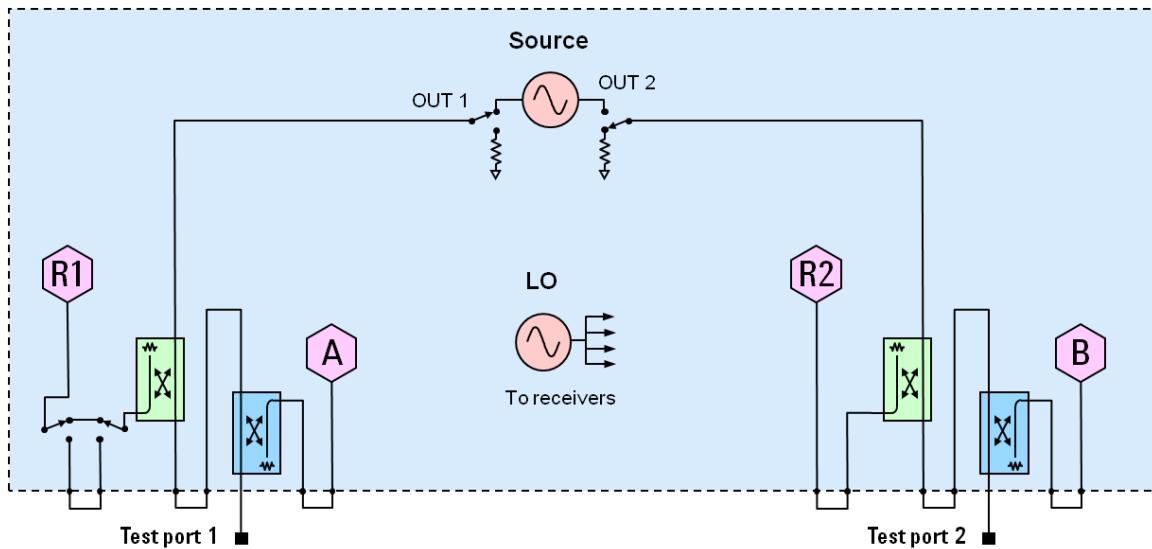
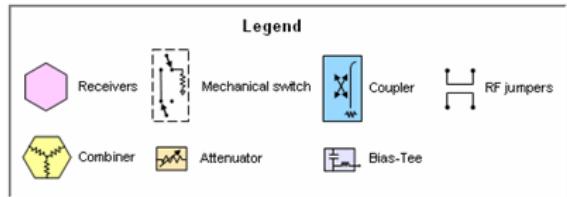


Figure 1. 2-Port N5241B, N5242B, and N5249B Base Unit Option 201

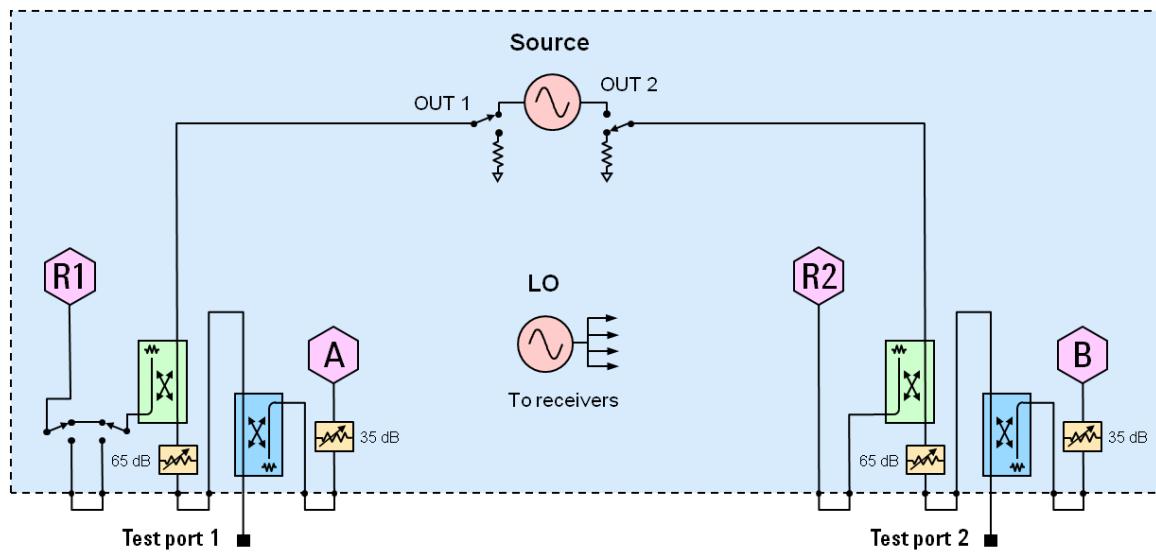


Figure 2. 2-Port N5241B, N5242B, and N5249B Option 217

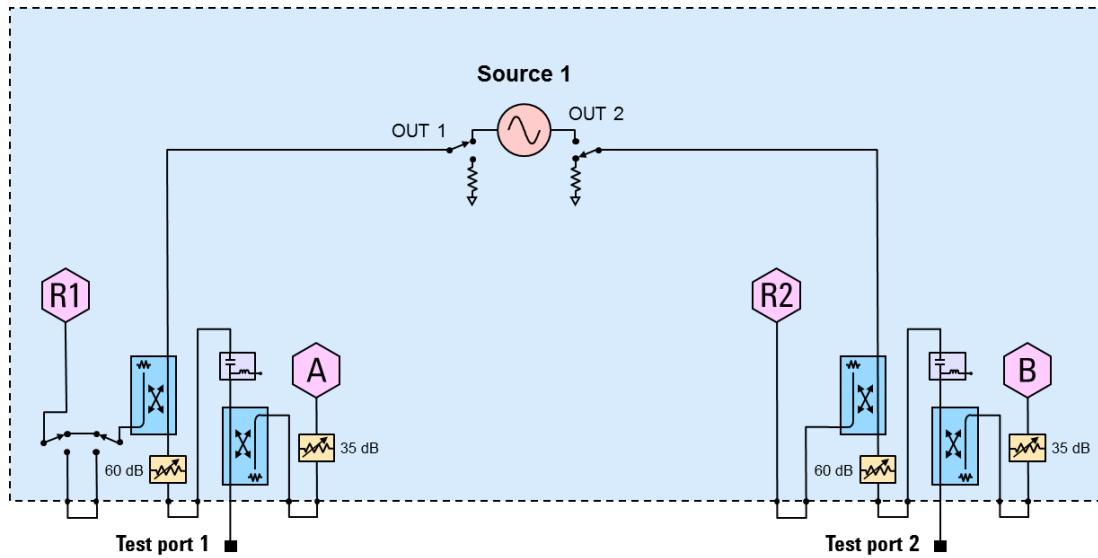


Figure 3. 2-Port N5241B, N5242B, and N5249B Option 219

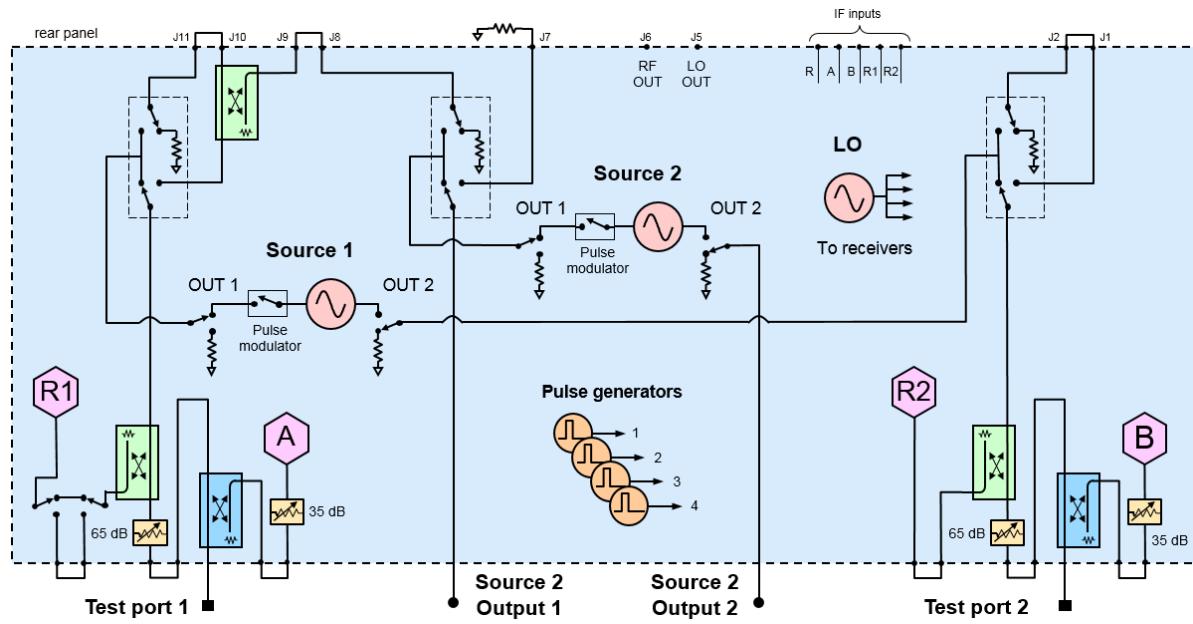


Figure 4. 2-Port N5241B, N5242B, and N5249B Option 222

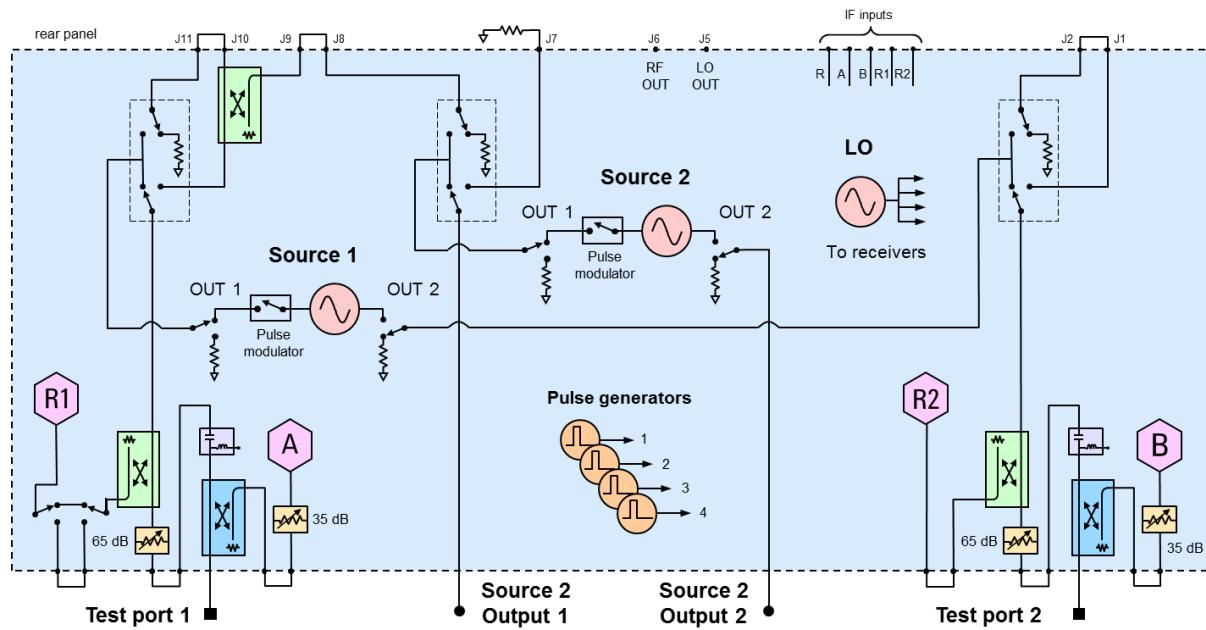


Figure 5. 2-Port N5241B, N5242B, and N5249B Option 224

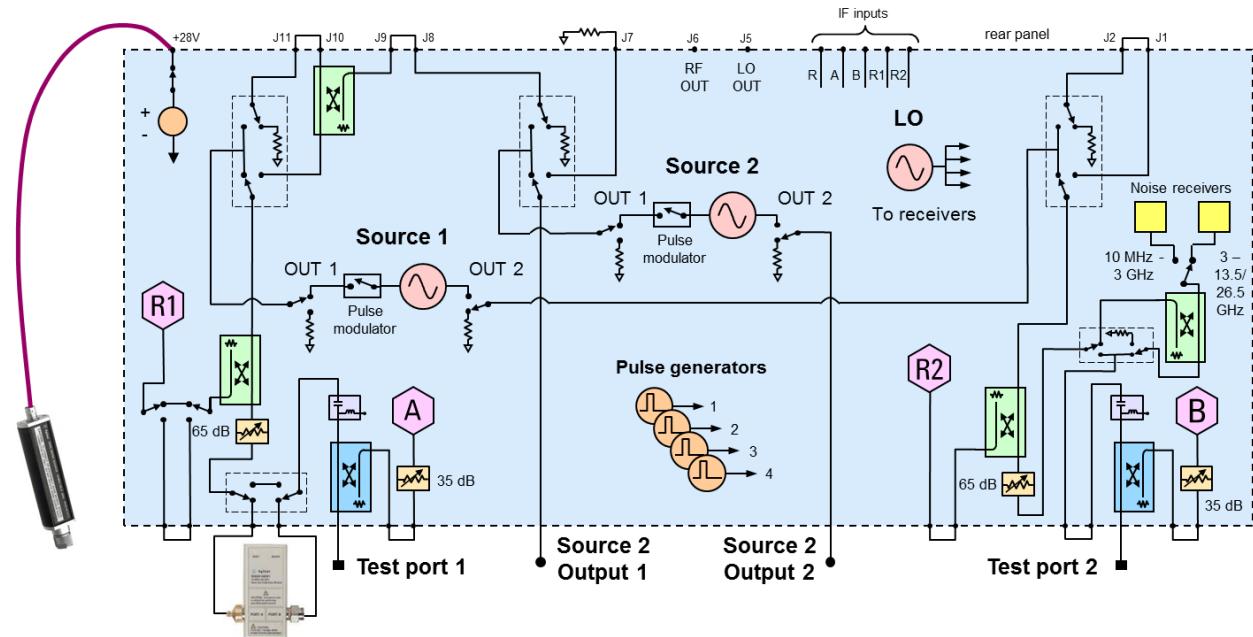


Figure 6. 2-Port N5241B, N5242B, and N5249B Option 224 with 029

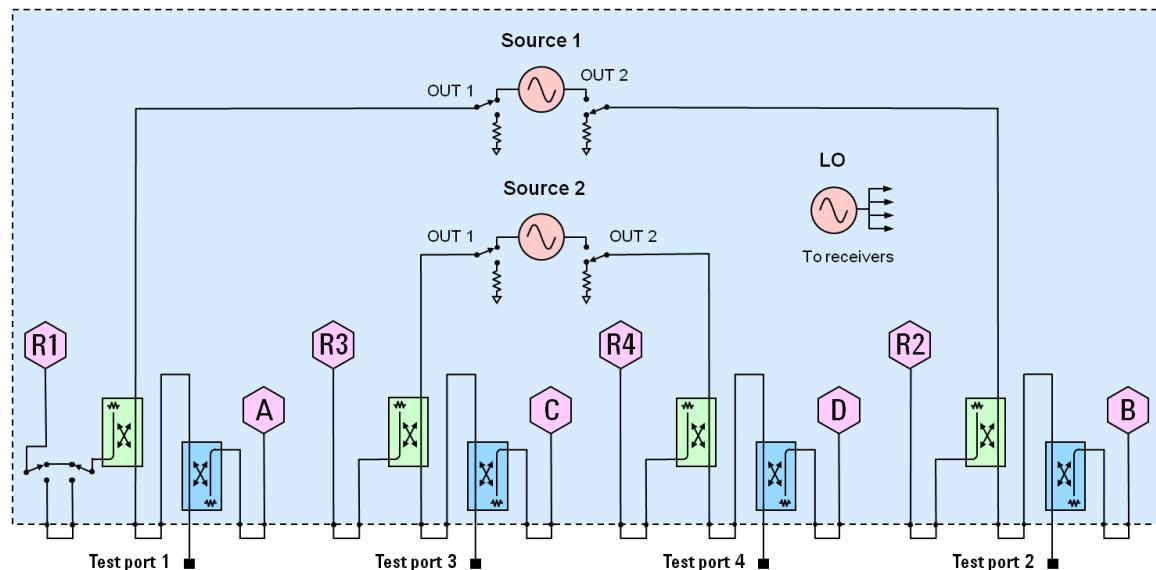


Figure 7. 4-Port N5241B, N5242B, and N5249B Base Unit Option 401

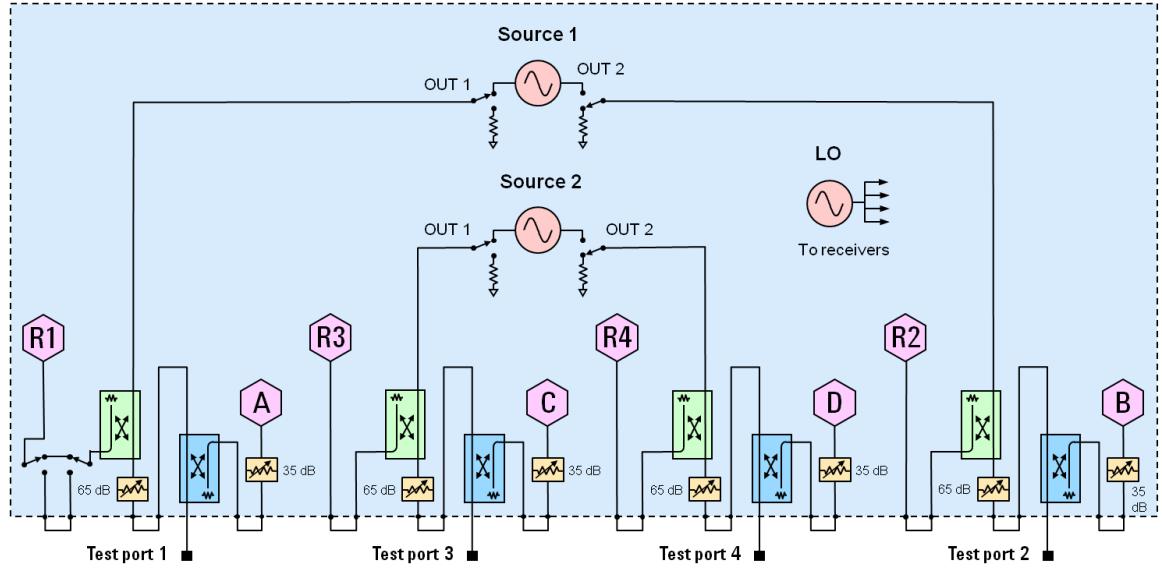


Figure 8. 4-Port N5241B, N5242B, and N5249B Option 417

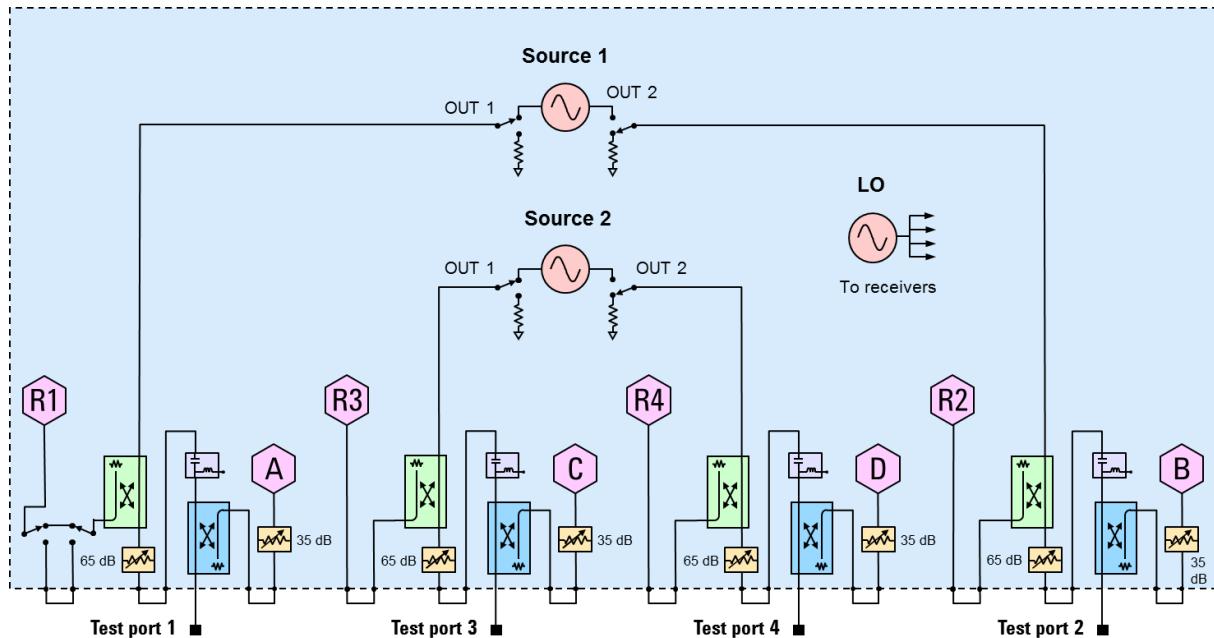


Figure 9. 4-Port N5241B, N5242B, and N5249B Option 419

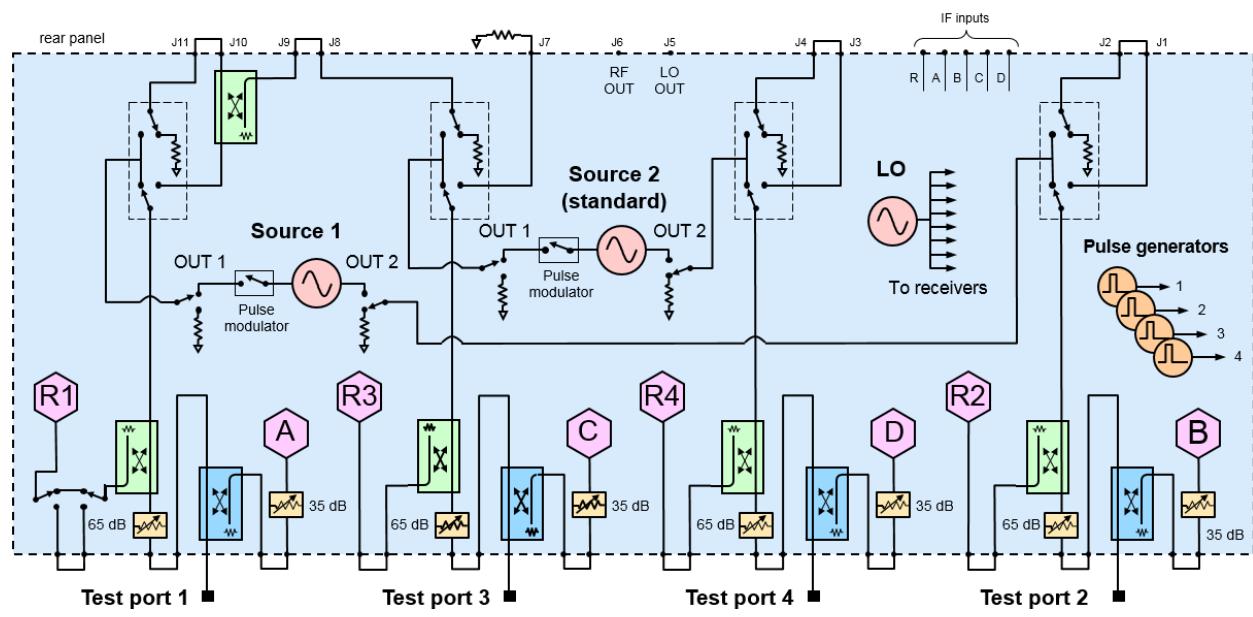


Figure 10. 4-Port N5241B, N5242B, and N5249B Option 422

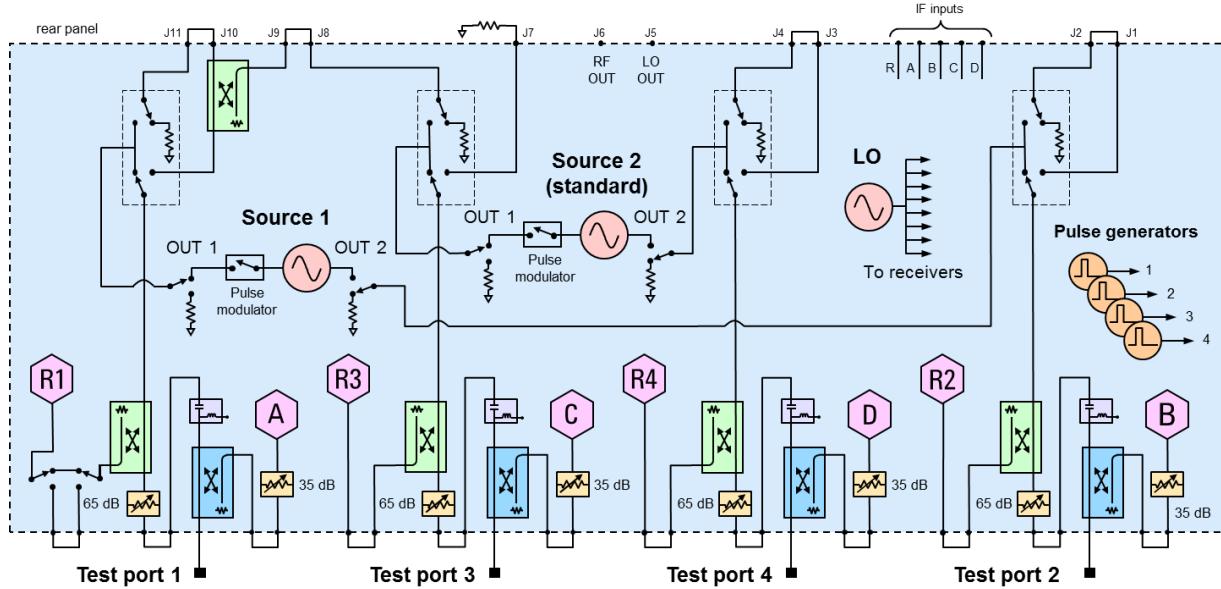


Figure 11. 4-Port N5241B, N5242B, and N5249B Option 423

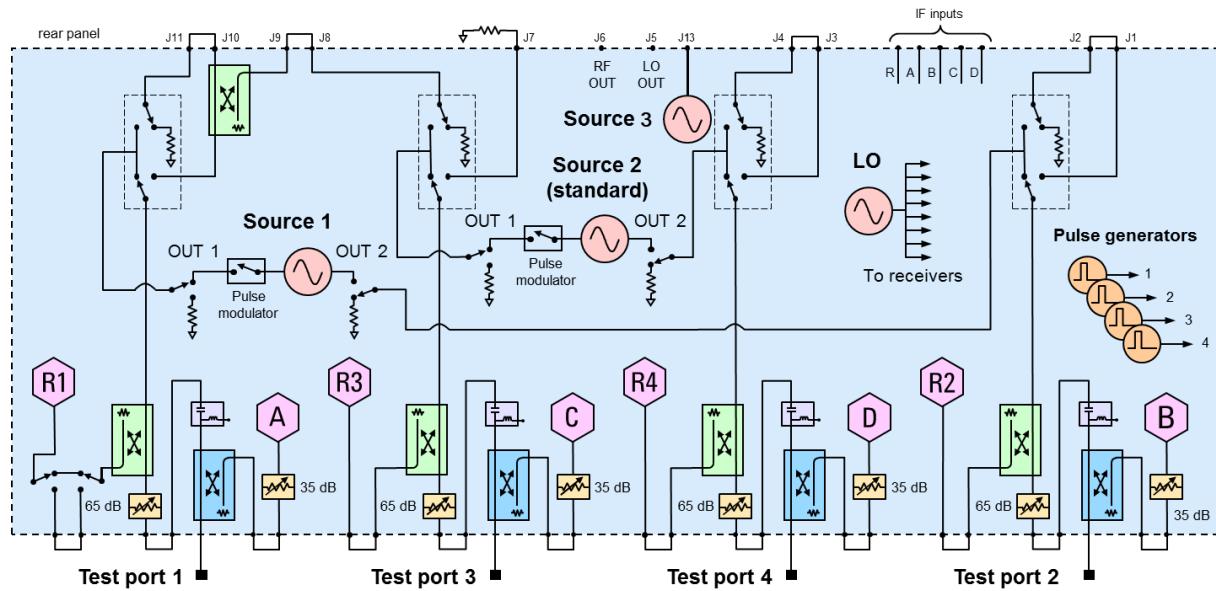


Figure 12. 4-Port N5241B, N5242B, and N5249B Option 423 with XSB

**NOTE**

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

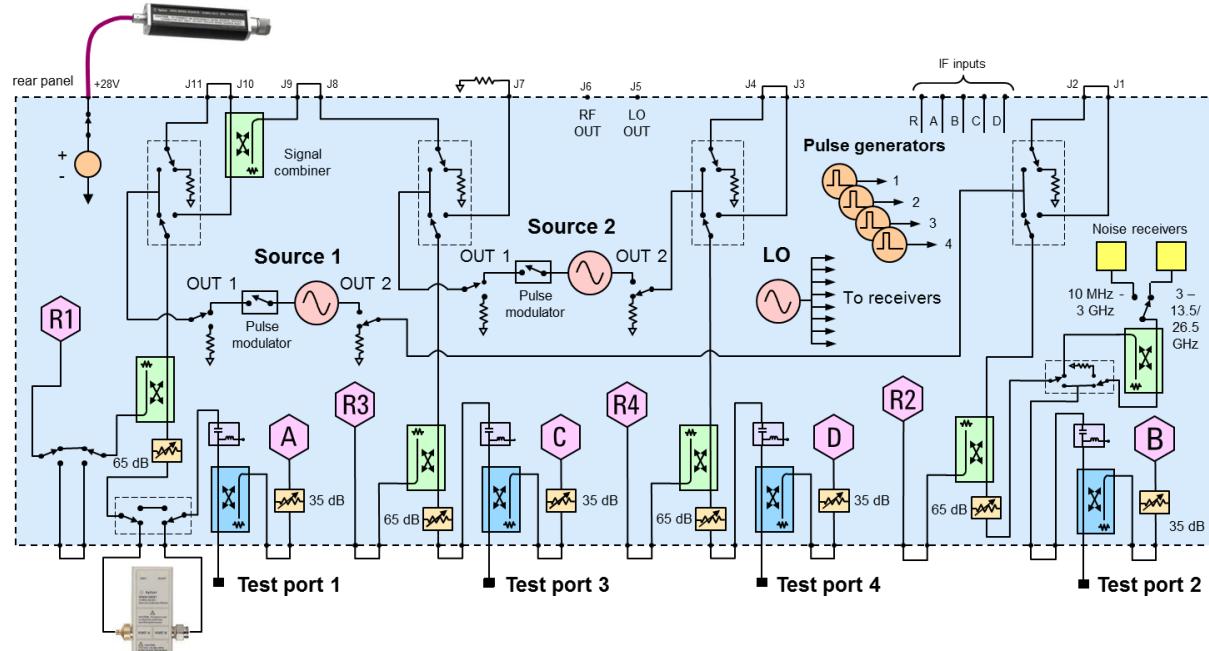


Figure 13. 4-Port N5241B, N5242B, and N5249B Option 423 with 029

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

**NOTE**

The attenuators do not apply to Option 205.

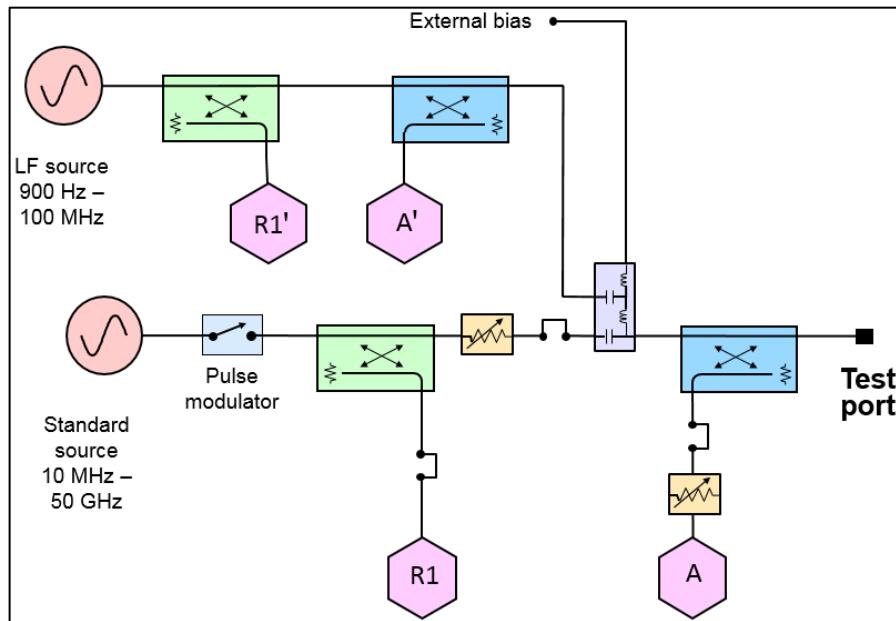


Figure 14. N5241B, N5242B, and N5249B LFE Options

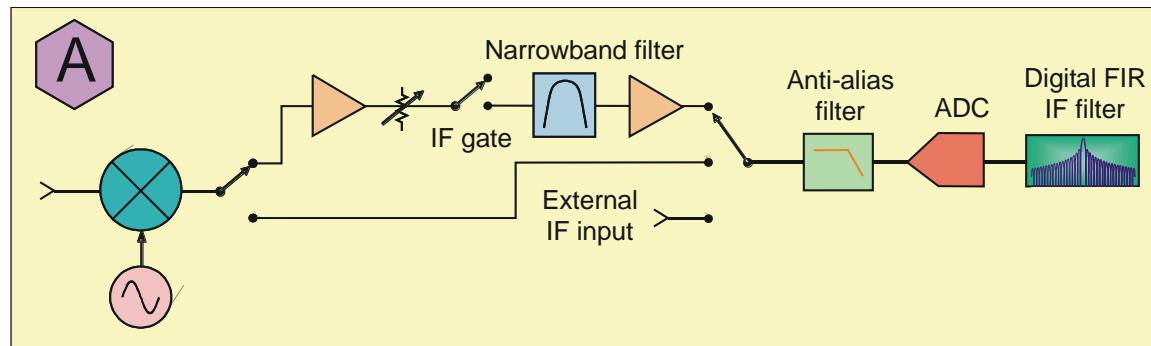


Figure 15. Receiver Block Diagram

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N5 242 - 90027