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

N5249B - 900 Hz to 8.5 GHz - with synthesizer revision 6 or earlier

N5241B - 900 Hz to 13.5 GHz - with synthesizer revision 6 or earlier

N5242B - 900 Hz to 26.5 GHz - with synthesizer revision 6 or earlier

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This is a complete list of the technical specifications for the N5241B, N5242B, and N5249B with the following options:

Option 029, adds hardware and firmware for high-accuracy noise figure measurements. It requires option 219, 222, 224, 419, 422, or 423. [See the block diagram.](#)

Option 201, 2-port standard test set (includes six front-panel access loops), R1 receiver switch, and power range. [See the block diagram.](#)

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

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

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

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

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

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). [See the block diagram.](#)

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

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

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

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. See the block diagram.
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. See the block diagram.

NOTE

Specifications for the N5241BS, N5242BS, and N5249BS Option H85, when configured in standard configuration, are the same as those of closest N5241B, N5242B, and N5249B option configuration.

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 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.

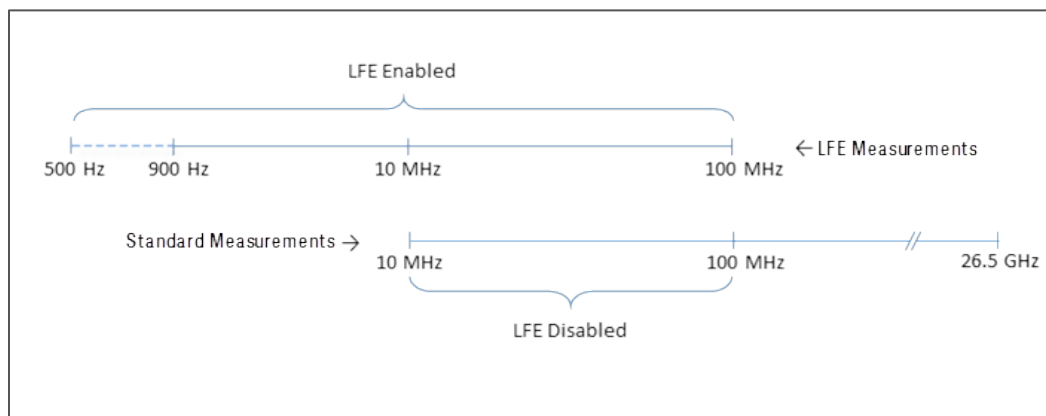
Calibration: The process of measuring known standards to characterize a network analyzer's systematic (repeatable) errors.

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.

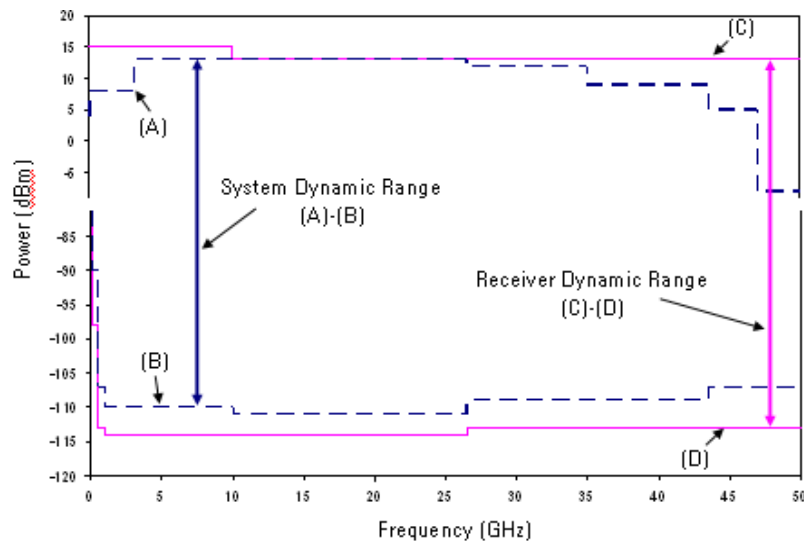
Standard and LFE measurements: With an LFE option, which adds low frequency extension (LFE) hardware, the LFE measurement range overlaps with the standard measurement range from 10 MHz to 100 MHz. With LFE Enabled, measurements from 500 Hz to 100 MHz use LFE hardware. With LFE Disabled, measurements 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 1a. System Dynamic Range at Test Port (dB), Options 201 or 401

Description	Specification ³		Typical	
	Ports ^{1,2} 1, 3	Ports ¹ 2, 4	Ports ^{1,2} 1, 3	Ports ¹ 2, 4
10 MHz to 50 MHz	106	105	112	112
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 3.2GHz	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

¹ Either port can be used as the source port. Any other port can be used as the receiver port.

² System Dynamic Range measured in High Power Mode.

³ Specification applies to new instruments. Test limit during recertification is defined by Maximum Leveled Power – Noise Floor.

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

Description	Specification ³		Typical	
	Ports ^{1,2} 1, 3	Ports ¹ 2, 4	Ports ^{1,2} 1, 3	Ports ¹ 2, 4
10 MHz to 50 MHz	104	104	111	111
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 3.2GHz	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

¹ Either port can be used as the source port. Any other port can be used as the receiver port.

² System Dynamic Range measured in High Power Mode.

³ Specification applies to new instruments. Test limit during recertification is defined by Maximum Leveled Power – Noise Floor.

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

Description	Specification ²		Typical	
	Source 2 Out 1 ¹	Source 2 Out 2	Source 2 Out 1 ¹	Source 2 Out 2
10 MHz to 50 MHz	108	105	114	114
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

¹ System Dynamic Range measured in High Power Mode.

² Specification applies to new instruments. Test limit during recertification is defined by Maximum Leveled Power – Noise Floor.

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

Description	Specification ³		Typical			
	Ports ^{1,2} 1, 3	Ports ¹ 2, 4	Ports ^{1,2} 1, 3	Ports ¹ 2, 4	Source 1 Port 1 Combine Mode	Source 2 Port 1 Combine Mode
10 MHz to 50 MHz	106	104	112	111	104	80
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

¹ Either port can be used as the source port. Any other port can be used as the receiver port.

² System Dynamic Range measured in High Power Mode.

³ Specification applies to new instruments. Test limit during recertification is defined by Maximum Leveled Power – Noise Floor.

Table 1e. System Dynamic Range at Test Port (dB), Options (21x, 22x, 41x, 422, 423) with 029

Description	Specification ²		Typical			
	Port 1 ¹	Port 2	Port 1 ¹	Port 2	Source 1 Port 1 Combine Mode	Source 2 Port 1 Combine Mode
10 MHz to 50 MHz	106	103	112	111	103	89
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

¹ System Dynamic Range measured in High Power Mode.

² Specification applies to new instruments. Test limit during recertification is defined by Maximum Leveled Power – Noise Floor.

Table 1f. System Dynamic Range at Test Port (dB), N5241B and N5242B, Option 205

Description	Specification ³		Typical	
	Ports ^{1,2} 1, 3	Ports ¹ 2, 4	Ports ^{1,2} 1, 3	Ports ¹ 2, 4
10 MHz to 50 MHz ¹	99	98	105	105
50 MHz to 100 MHz ¹	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 3.2GHz	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

¹ 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.

² Either port can be used as the source port. Any other port can be used as the receiver port.

³ Specification applies to new instruments. Test limit during recertification is defined by Maximum Leveled Power – Noise Floor.

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

Description	Specification ³		Typical			
	Ports ² 1, 3	Ports 2, 4	Ports ² 1, 3	Ports 2, 4	Source 1 Port 1 Combine Mode	Source 2 Port 1 Combine Mode
10 MHz to 50 MHz ¹	98	95	105	104	97	83
50 MHz to 100 MHz ¹	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

¹ 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 1h.

² System Dynamic Range measured in High Power Mode.

³ Specification applies to new instruments. Test limit during recertification is defined by Maximum Levelled Power – Noise Floor.

Table 1h. System Dynamic Range at Test Port (dB), All LFE Options (LFE Enabled)

Description	Specification ¹		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

¹ Specification applies to new instruments. Test limit during recertification is defined by Maximum Levelled Power – Noise Floor.

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

Description	Specification ³		Typical			
	Port 1 ²	Port 2	Port 1 ²	Port 2	Source 1 Port 1 Combine Mode	Source 2 Port 1 Combine Mode
10 MHz to 50 MHz ¹	97	97	105	105	96	82
50 MHz to 100 MHz ¹	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

¹ 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.

² System Dynamic Range measured in High Power Mode.

³ Specification applies to new instruments. Test limit during recertification is defined by Maximum Leveled Power – Noise Floor.

Extended Dynamic Range

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

Description	Options 201, 401		Options 21x, 41x	
	Ports ¹ 1, 3	Ports ¹ 2, 4	Ports ¹ 1, 3	Ports ¹ 2, 4
10 MHz to 50 MHz	156	156	155	155
50 MHz to 100 MHz	152	153	152	153
100 MHz to 500MHz	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

¹ Either port can be used as the source port. Any other port can be used as the receiver port.

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

Description	Options 22x		Options 22x, 42x	
	Source 2 Out 1	Source 2 Out 2	Source 1 Port 1 Combine Mode	Source 2 Port 1 Combine Mode
10 MHz to 50 MHz	158	158	139	115
50 MHz to 100 MHz	155	156	124	102
100 MHz to 500MHz	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 2c. Extended Dynamic Range at Direct Receiver Access Input (dB) – Typical

Description	Options 22x, 422, 423		Options 423, 029	
	Ports ¹ 1, 3	Ports ¹ 2, 4	Port 1	Port 2
10 MHz to 50 MHz	156	155	156	155
50 MHz to 100 MHz	153	153	153	153
100 MHz to 500MHz	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

¹ Either port can be used as the source port. Any other port can be used as the receiver port.

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

Description	Option 205		Options 425		Options 425, 029	
	Ports ¹ 1, 3	Ports ¹ 2, 4	Ports ¹ 1, 3	Ports ¹ 2, 4	Port 1	Port 2
10 MHz to 50 MHz	149	149	149	148	149	149
50 MHz to 100 MHz	148	149	149	150	149	150
100 MHz to 500MHz	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

¹ Either port can be used as the source port. Any other port can be used as the receiver port.

Receiver Dynamic Range

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

Description	Typical
10 MHz to 50 MHz ¹	--
50 MHz to 100 MHz ¹	--
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

¹ 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.

Table 3b. 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 Opts

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

For any S_{ii} reflection measurement:

- $S_{jj} = 0$.

For any S_{ij} transmission measurement:

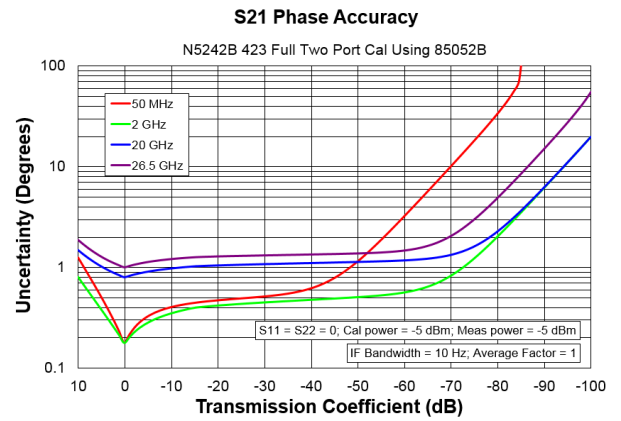
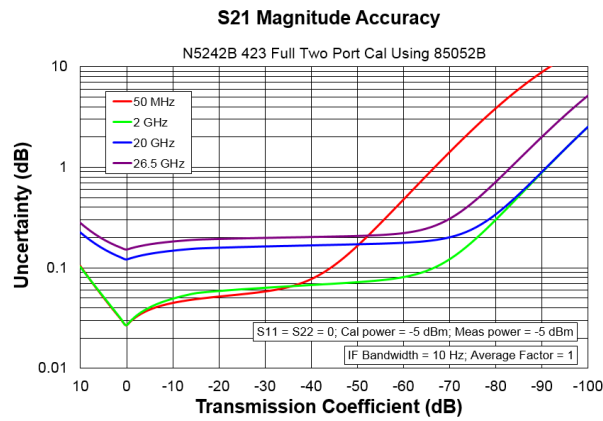
- $S_{ji} = S_{ij}$ when $S_{ij} \leq 1$
- $S_{ji} = 1/S_{ij}$ when $S_{ij} > 1$
- $S_{kk} = 0$ for all k

Please download our free Uncertainty Calculator from http://www.keysight.com/find/na_calculator for specifications for other calibration kits and measurement setups.

Table 4a. 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
Reflection Tracking							
Mag	± 0.0030	± 0.0030	± 0.0030	± 0.0061	± 0.0061	± 0.0061	± 0.0061
Phase ($^{\circ}$)	± 0.020	± 0.020	± 0.020	± 0.040	± 0.040	± 0.040	± 0.040
Transmission Tracking							
Mag	± 0.044	± 0.055	± 0.055	± 0.12	± 0.11	± 0.14	± 0.16
Phase ($^{\circ}$)	± 0.29	± 0.37	± 0.37	± 0.74	± 0.71	± 0.88	± 1.1

Transmission Uncertainty



Reflection Uncertainty

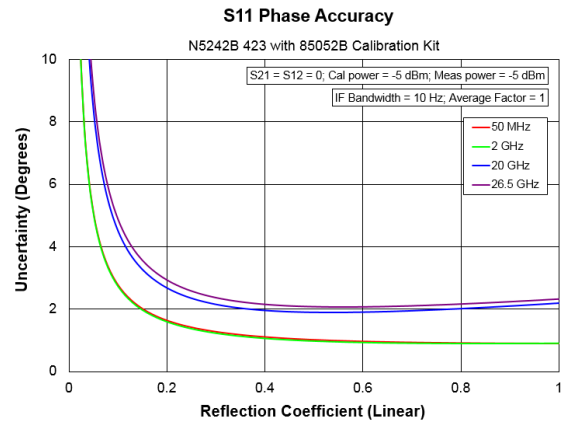
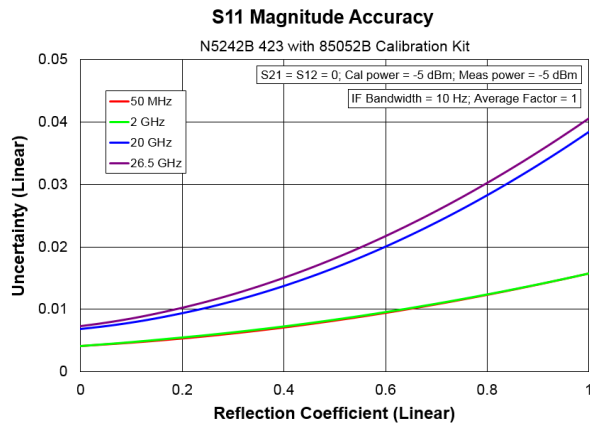
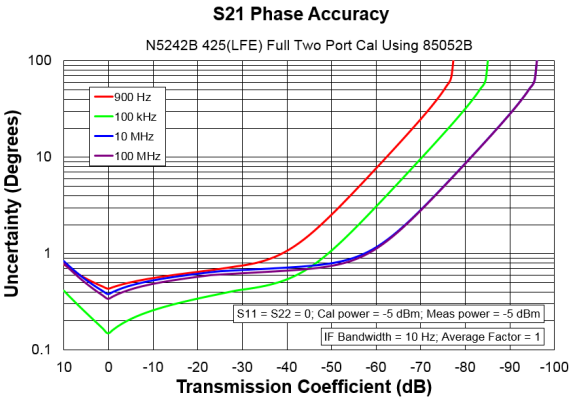
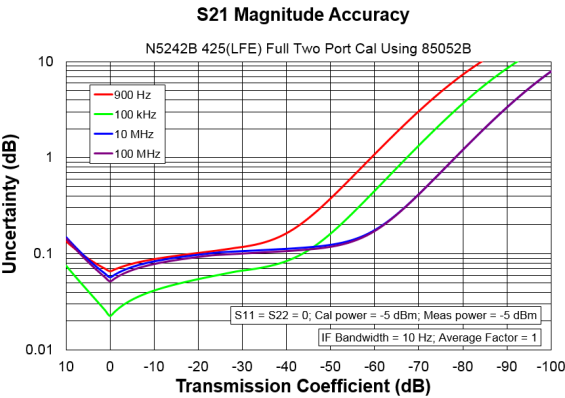


Table 4c. 85052B Calibration Kit, Option 425 (LFE Enabled)

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
Reflection Tracking					
Mag	±0.0030	±0.0030	±0.0030	±0.0030	±0.0030
Phase (°)	±0.020	±0.020	±0.020	±0.020	±0.020
Transmission Tracking					
Mag	±0.055	±0.016	±0.037	±0.051	±0.045
Phase (°)	±0.37	±0.11	±0.25	±0.34	±0.30

Transmission Uncertainty, Option 425



Reflection Uncertainty, Option 425

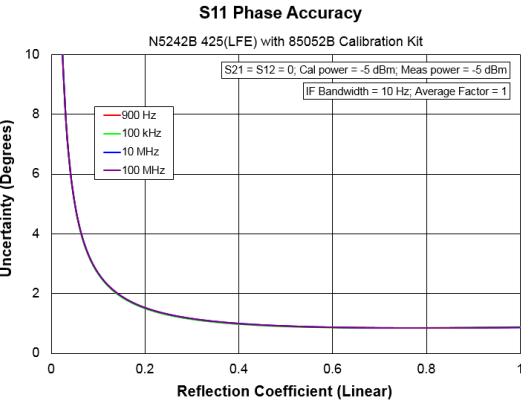
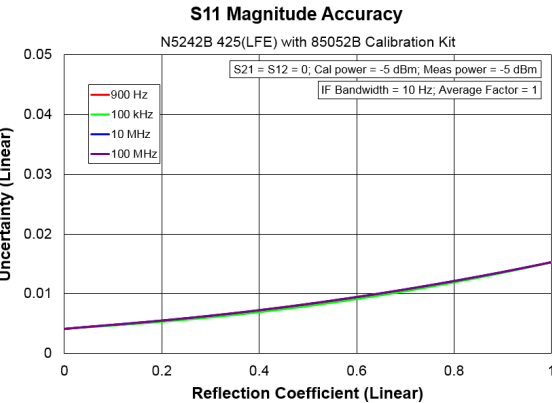
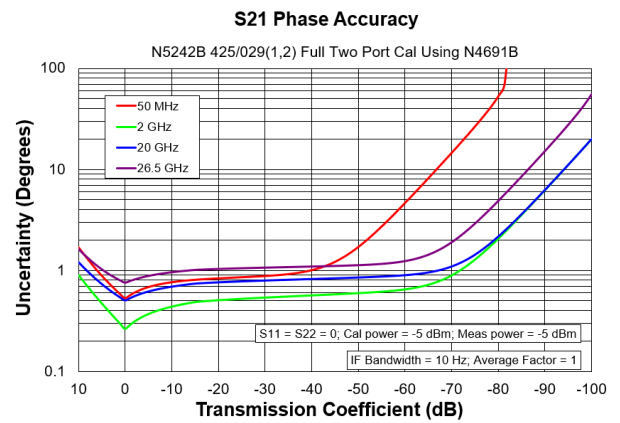
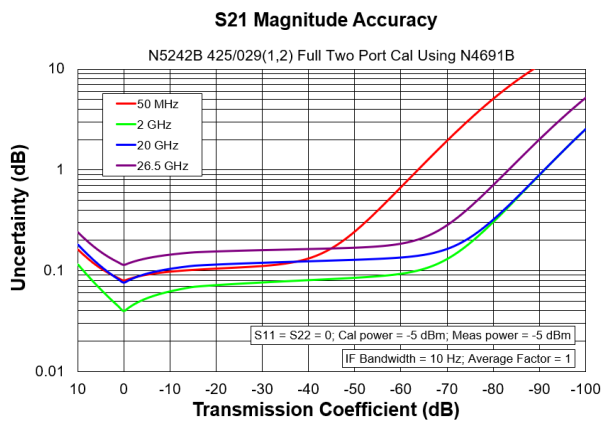


Table 5a. N4691B Calibration Kit

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
Reflection Tracking							
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
Transmission Tracking							
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

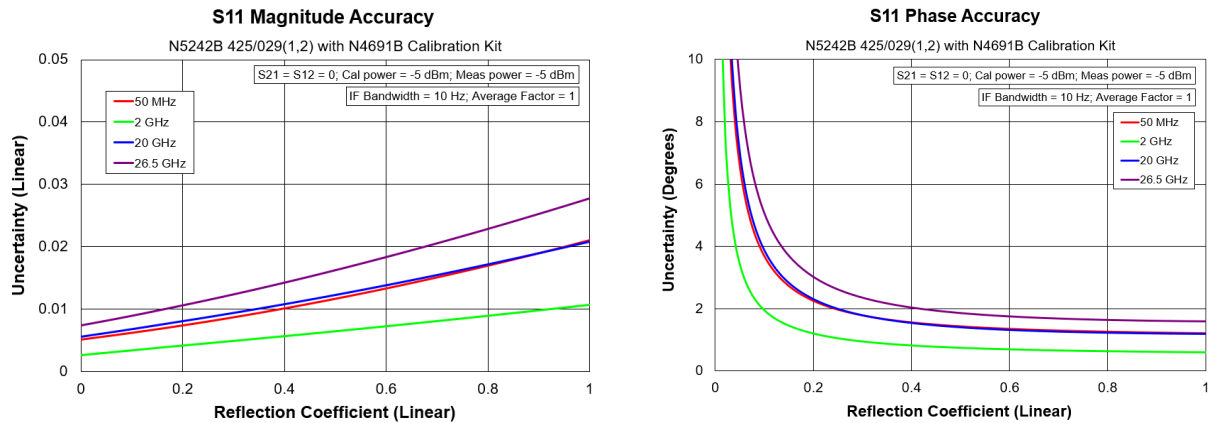
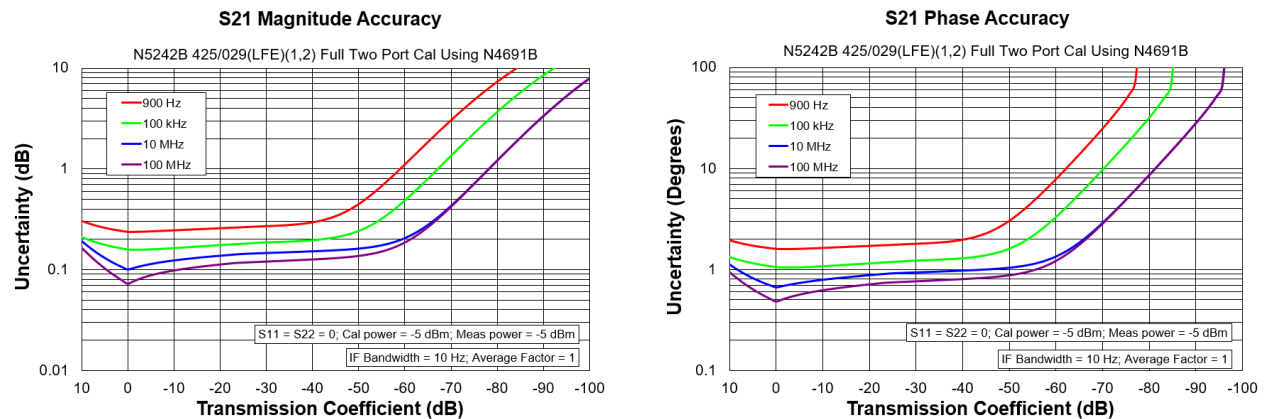


Table 5b. N4691B Calibration Kit, Option 425 with Option 029 (LFE Enabled)

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
Reflection Tracking					
Mag	±0.12	±0.12	±0.12	±0.061	±0.051
Phase (°)	±0.74	±0.74	±0.74	±0.40	±0.34
Transmission Tracking					
Mag	±0.22	±0.14	±0.18	±0.091	±0.066
Phase (°)	±1.5	±0.92	±1.2	±0.61	±0.44

Transmission Uncertainty, Option 425 with Option 029



Reflection Uncertainty, Option 425 with Option 029

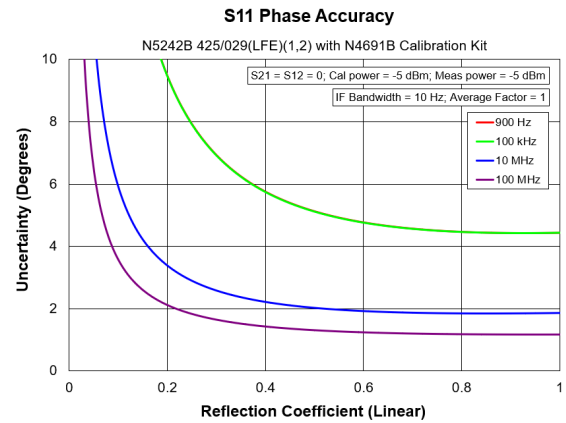
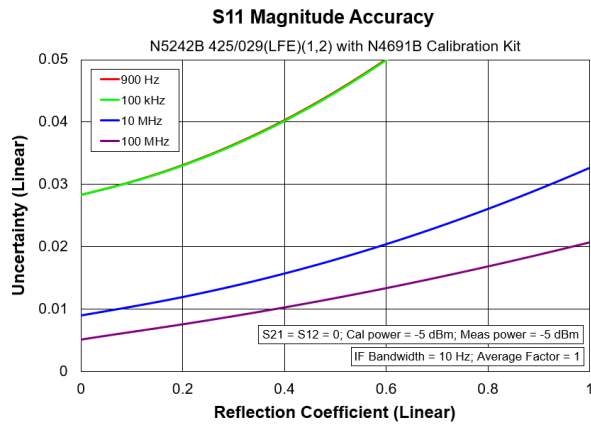
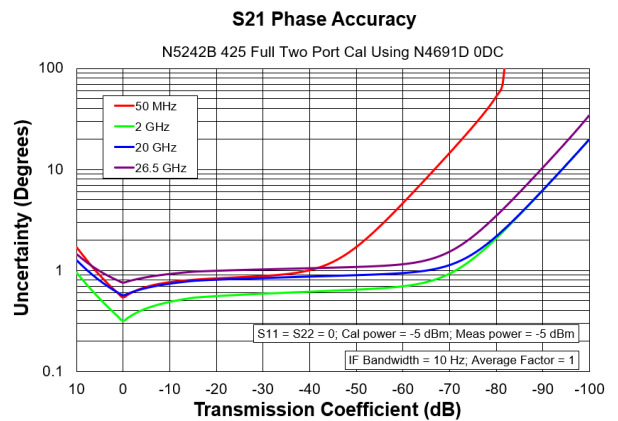
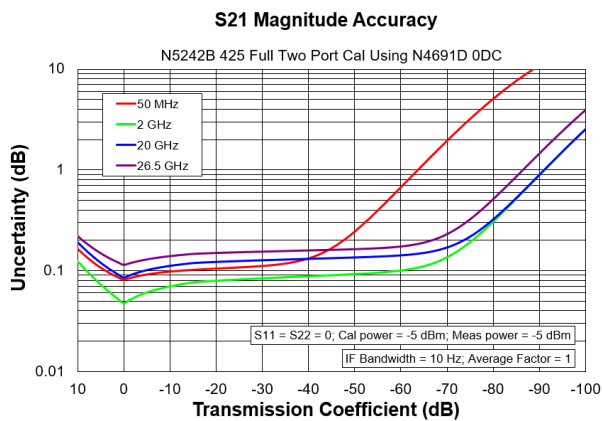


Table 5c. N4691D Calibration Kit

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
Reflection Tracking							
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
Transmission Tracking							
Mag	±0.066	±0.070	±0.038	±0.050	±0.062	±0.068	±0.089
Phase (°)	±0.44	±0.46	±0.25	±0.33	±0.41	±0.45	±0.59

Transmission Uncertainty



Reflection Uncertainty

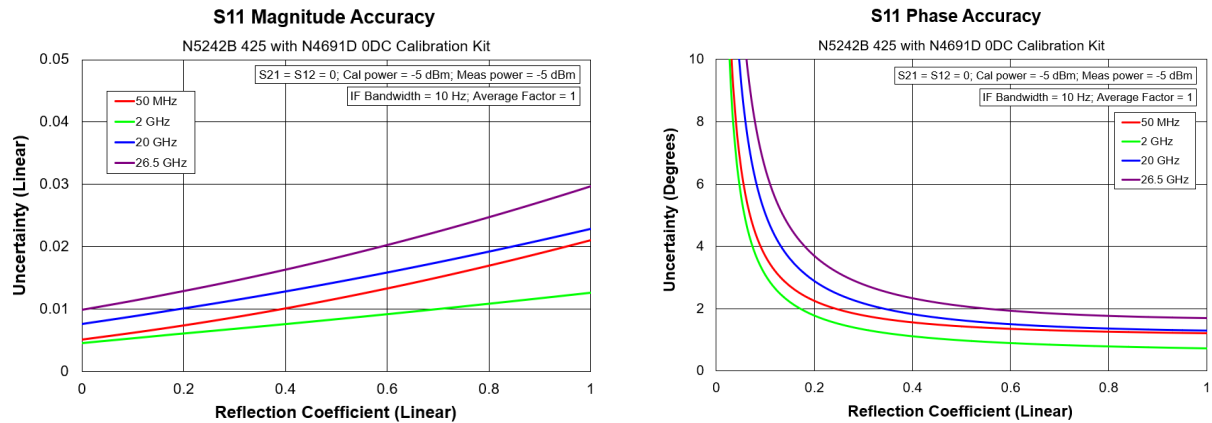
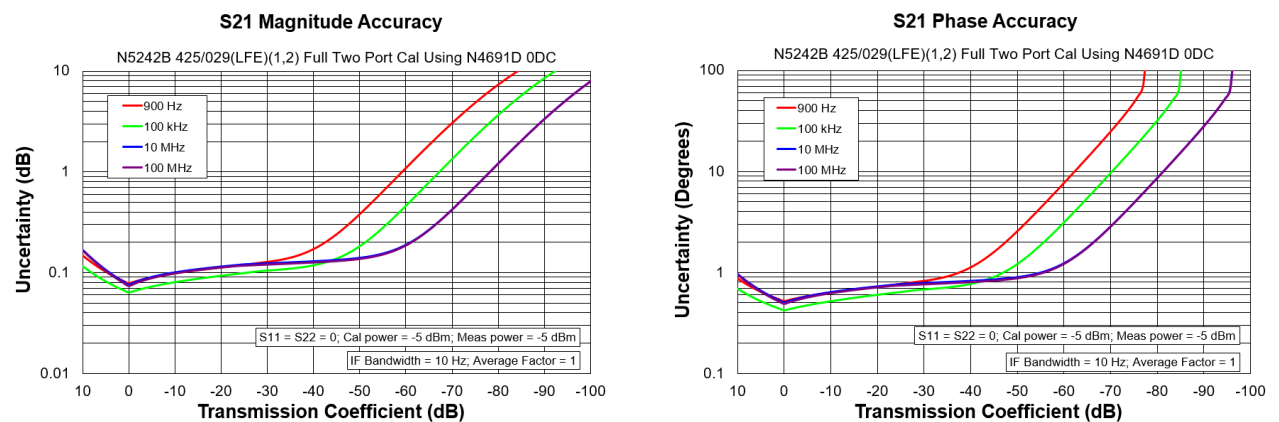


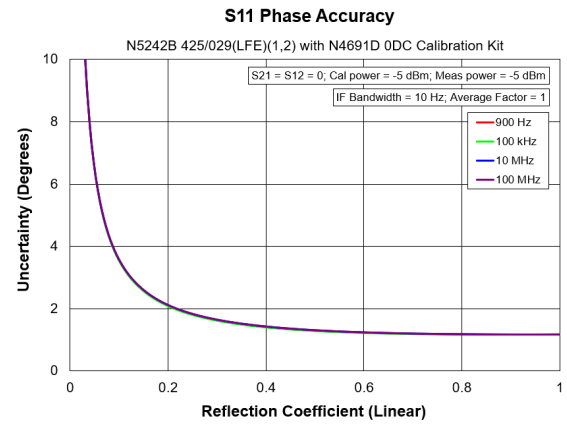
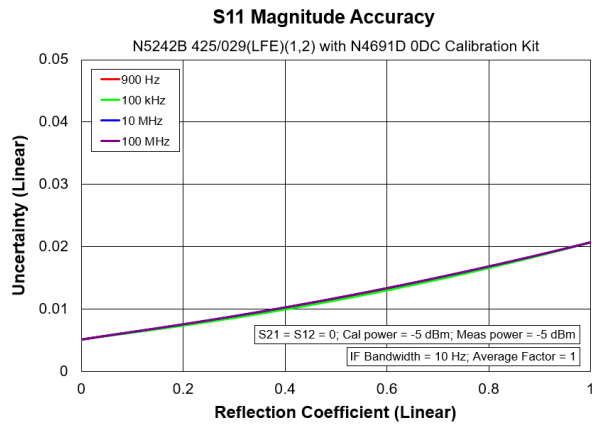
Table 5d. N4691D Calibration Kit, Option 425 with Option 029 (LFE Enabled)

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
Reflection Tracking					
Mag	±0.051	±0.051	±0.051	±0.051	±0.051
Phase (°)	±0.34	±0.34	±0.34	±0.34	±0.34
Transmission Tracking					
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 6a. 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 ¹	16 (16)	16 (16)	23	22
50 MHz to 500 MHz ¹	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.

¹ 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 6e and 6f.

Table 6b. Source Match (dB), Option 2xx, 4xx

Description	Specification			Typical		
	Without Option 029	With Option 029		Without Option 029	With Option 029	
	All Ports	Port 1	Port 2	All Ports	Port 1	Port 2
10 MHz to 50 MHz ¹	11 (9)	9 (9)	9 (9)	14 (11)	13 (11)	12 (12)
50 MHz to 500 MHz ¹	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.

¹ 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 6e and 6f.

Table 6c. Load Match (dB), Option 2xx, 4xx

Description	Specification			Typical		
	Without Option 029	With Option 029		Without Option 029	With Option 029	
	All Ports	Port 1	Port 2	All Ports	Port 1	Port 2
10 MHz to 50 MHz ¹	11 (9)	11 (9)	9 (9)	18 (10)	18 (10)	12 (10)
50 MHz to 500 MHz ¹	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 an LFE option installed.

¹ 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 6e and 6f.

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

	Transmission Tracking	Reflection Tracking	Crosstalk
10 MHz to 50 MHz ¹	± 1.5	± 1.5	-84
50 MHz to 100 MHz ¹	± 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

¹ 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 6e and 6f.

Table 6e. 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 6f. 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

Test Port Output

See Block diagrams 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 7. Frequency Information, All Options

Description	Specification (dB)	Typical (dB)
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	± 1 ppm	--
Frequency Stability	--	± 0.05 ppm, -10° to 70° C ¹ ± 0.1 ppm/yr maximum ²

¹ Assumes no variation in time.

² Assumes no variation in temperature.

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

Description	Specification			Typical	
	Ports ¹ 1, 3		Ports ¹ 2, 4	Ports ¹ 1, 3	Ports ¹ 2, 4
	Filtered Mode ²	Hi Power Mode ²		Filtered Mode ²	Hi Power Mode ²
10 MHz to 50 MHz	8	13	13	10	19
50 MHz to 500 MHz	10	13	13	11	21
500 MHz to 3.2 GHz	10	10	13	12	13
3.2 GHz to 8.5 GHz	13	13	13	20	20
8.5 GHz to 10 GHz	13	13	13	20	20
10 GHz to 13.5 GHz	13	13	13	17	17
13.5 GHz to 16 GHz	13	13	13	17	17
16 GHz to 20 GHz	13	13	10	16	16
20 GHz to 24 GHz	12	12	7	15	15
24 GHz to 26.5 GHz	5	5	2	11	11

¹ Either port can be used as the source port.

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

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

Description	Specification			Typical		
	Ports ¹ 1, 3		Ports ¹ 2, 4	Ports ¹ 1, 3		Ports ¹ 2, 4
	Filt. Mode ²	Hi Pwr Mode ²		Filt. Mode ²	Hi Pwr Mode ²	
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

¹ Either port can be used as the source port.

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

Table 8c. Maximum Levelled Power (dBm), Option 21x or 41x with 029¹

Description	Specification			Typical		
	Port 1		Port 2	Port 1		Port 2
	Filt. Mode ²	Hi Pwr Mode ²		Filt. Mode ²	Hi Pwr Mode ²	
10 MHz to 50 MHz	7	12	13	9	18	17
50 MHz to 500 MHz	9	12	13	10	19	19
500 MHz to 3.2 GHz	9	9	13	10	12	18
3.2 GHz to 8.5 GHz	12	12	13	17	17	17
8.5 GHz to 10 GHz	12	12	13	17	17	17
10 GHz to 13.5 GHz	12	12	9	15	15	12
13.5 GHz to 16 GHz	12	12	9	15	15	12
16 GHz to 20 GHz	10	10	5	13	13	7
20 GHz to 24 GHz	8	8	2	12	12	4
24 GHz to 26.5 GHz	3	3	-2	8	8	3

¹ Option 029 affects port 1 and port 2 maximum leveled power. Refer to Table 8b for other ports.

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

Table 8d. Maximum Levelled Power (dBm), Options 22x, 422, or 423

Description	Specification			Typical		
	Port ¹ s 1, 3		Ports ¹ 2, 4	Ports ¹ 1, 3		Ports ¹ 2, 4
	Filtered Mode ²	Hi Power Mode ²		Filtered Mode ²	Hi Power Mode ²	
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

¹ Either port can be used as the source port.

² 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 8e. Maximum Levelled Power (dBm), Options 22x, 422, or 423 Combine Mode - Typical

Description	Source 1 Port 1		Source 2 Port 1	
	Filtered Mode ¹	Hi Power Mode ¹	Filtered Mode ¹	Hi Power Mode ¹
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

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

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

Description	Specification			Typical		
	Source 2 Out 1		Source 2 Out 2	Source 2 Out 1		Source 2 Out 2
	Filt. Mode ²	Hi Pwr Mode ²		Filt. Mode ²	Hi Pwr Mode ²	
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

¹ 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 8g. Maximum Levelled Power (dBm), Options 22x, 422, or 423 with 029¹

Description	Specification			Typical		
	Port 1		Port 2	Port 1		Port 2
	Filt. Mode ²	Hi Pwr Mode ²		Filt. Mode ²	Hi Pwr Mode ²	
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

¹ Option 029 only affects port 1 and port 2 maximum leveled power. Refer to Table 8d for ports 3 and 4.

² 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 8h. Maximum Levelled Power (dBm), Options 22x, 422, or 423 with 029¹, Combine Mode – Typical

Description	Source 1 Port 1		Source 2 Port 1	
	Filtered Mode ²	Hi Power Mode ²	Filtered Mode ²	Hi Power Mode ²
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

¹ Option 029 affects port 1 and port 2 maximum leveled power.

² 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 8i. Maximum Levelled Power (dBm), N5241B and N5242B, Port 1 and 2, Option 205

Description	Specification			Typical		
	Port 1		Port 2	Port 1		Port 2
	Filt. Mode ¹	Hi Pwr Mode ¹		Filt. Mode ¹	Hi Pwr Mode ¹	
10 MHz to 50 MHz ²	1	6	6	3	12	10
50 MHz to 500 MHz ²	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

¹ 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.

² 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. For LFE enabled performance ≤ 100 MHz, see Table 8o.

Table 8j. Maximum Leveled Power (dBm), Port 1 and 2, Option 425 with 029¹

Description	Specification			Typical		
	Port 1		Port 2	Port 1		Port 2
	Filt. Mode ²	Hi Pwr Mode ²		Filt. Mode ²	Hi Pwr Mode ²	
10 MHz to 50 MHz ³	-2	5	5	0	11	9
50 MHz to 500 MHz ³	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

¹ Option 029 only affects port 1 and port 2 maximum leveled power. Refer to Table 8j for ports 3 and 4.

² 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.

³ 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 8o.

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

Description	Specification			Typical		
	Ports 1, 3		Ports 2, 4	Ports 1, 3		Ports 2, 4
	Filt. Mode ¹	Hi Pwr Mode ¹		Filt. Mode ¹	Hi Pwr Mode ¹	
10 MHz to 50 MHz ²	-1	5	5	1	11	9
50 MHz to 500 MHz ²	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

¹ 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.

² 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 8o.

Table 8l. Maximum Levelled Power (dBm), Options 425 with 029, Combine Mode - Typical

Description	Source 1 Port 1		Source 2 Port 1	
	Filtered Mode ¹	Hi Power Mode ¹	Filtered Mode ¹	Hi Power Mode ¹
10 MHz to 50 MHz ²	-1	9	-15	-5
50 MHz to 500 MHz ²	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

¹ 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.

² 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 8o.

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

Description	Source 1 Port 1		Source 2 Port 1	
	Filtered Mode ¹	Hi Power Mode ¹	Filtered Mode ¹	Hi Power Mode ¹
10 MHz to 50 MHz ²	0	10	-14	-4
50 MHz to 500 MHz ²	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

¹ 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.

² 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 8o.

Table 8n. 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 8a. Maximum Power (dBm), All Ports – All LFE Options (LFE Enabled)

Description	Specification	Typical ¹
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

¹ Values apply to all ports. Ports 2 and 4 typically 1 dB higher.

Table 9a. Power Level Accuracy (dB) at Nominal Power¹, All Options

Description	Specification		Typical	
	Ports ² 1, 2, 3, 4	Source 2 Out 1 Source 2 Out 2	Ports ² 1, 2, 3, 4	Source 2 Out 1 Source 2 Out 2
10 MHz to 50 MHz ³	±1.5	±2.5	±0.40	±0.55
50 MHz to 500 MHz ³	±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

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

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

³ 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 9b.

Table 9b. Power Level Accuracy (dB), All Ports, All LFE Options (LFE Enabled)

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

Table 10a. Power Level Linearity¹ (dB), All Options – Specification

Description	Ports ² 1, 3 -25 dBm ≤ P < -20 dBm	Ports ² 1, 3 -20 dBm ≤ P < -15 dBm	Ports ² 1, 3 P ≥ -15 dBm
10 MHz to 50 MHz ³	±2.0	±1.5	±1.0
50 MHz to 500 MHz ³	±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

¹ Referenced to nominal power.

² Either port can be used as the source port. Source in filtered mode.

³ 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 10d.

Table 10b. Power Level Linearity¹ (dB), All Options – Specification

Description	Ports ² 2, 4 -25 dBm ≤ P < -20 dBm	Ports ² 2, 4 -20 dBm ≤ P < -15 dBm	Ports ² 2, 4 P ≥ -15 dBm
10 MHz to 50 MHz ³	±5.0	±2.0	±1.5
50 MHz to 500 MHz ³	±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

¹ Referenced to nominal power.

² Either port can be used as the source port.

³ 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 10d.

Table 10c. Power Level Linearity¹ (dB), Option 22x – Specification

Description	Source 2 Out 1 ² P ≥ -15 dBm	Source 2 Out 2 -15 dBm ≤ P < -10 dBm	Source 2 Out 2 P ≥ -10 dBm
10 MHz to 500 MHz ³	±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

¹ Referenced to nominal power.

² Source in filtered mode.

³ 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 10d.

Table 10d. Power Level Linearity¹ (dB), All Ports, All LFE Options (LFE Enabled)

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

¹ Referenced to nominal power, from -25 dBm to max power.

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

Description	Specification		Typical	
	Ports ¹ 1, 3	Ports ¹ 2, 4	Ports ¹ 1, 3	Ports ¹ 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

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

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

Description	Specification		Typical	
	Ports ¹ 1, 3	Ports ¹ 2, 4	Ports ¹ 1, 3	Ports ¹ 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

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

Table 11c. Power Sweep Range (dB), Options 21x or 41x with 029¹

Description	Specification		Typical	
	Port 1 ²	Port 2 ²	Port 1 ²	Port 2 ²
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

¹ Option 029 only affects port 1 and port 2 power sweep ranges. Refer to Table 13b for ports 3 and 4.

² Source in filtered mode where applicable.

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

Description	Specification		Typical	
	Ports ¹ 1, 3	Ports ¹ 2, 4	Ports ¹ 1, 3	Ports ¹ 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

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

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

Description	Specification		Typical	
	Source 2 Out 1 ¹	Source 2 Out 2	Source 2 Out 1 ¹	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

¹ Source in filtered mode where applicable.

Table 11f. Power Sweep Range (dB), Options 22x or 422, 423 with 029¹

Description	Specification		Typical	
	Port 1 ²	Port 2 ²	Port 1 ²	Port 2 ²
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

¹ Option 029 affects port 1 and port 2 power sweep ranges. Refer to Table 11d for other ports.

² Source in filtered mode where applicable.

Table 11g. Power Sweep Range (dB), Option 205

Description	Specification		Typical	
	Ports ¹ 1, 3	Ports ¹ 2, 4	Ports ¹ 1, 3	Ports ¹ 2, 4
10 MHz to 50 MHz ²	25	31	39	37
50 MHz to 500 MHz ²	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

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

² 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.

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

Description	Specification		Typical	
	Port 1, 3	Port 2, 4	Port 1, 3	Port 2, 4
10 MHz to 50 MHz ¹	30	30	38	36
50 MHz to 500 MHz ¹	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

¹ 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.

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

Description	Specification		Typical	
	Port 1	Port 2	Port 1	Port 2
10 MHz to 50 MHz ¹	30	30	38	36
50 MHz to 500 MHz ¹	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

¹ 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 11j.

Table 11j. Power Sweep Range (dB) – All LFE Options (LFE Enabled)

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

Table 12. Nominal Power (Preset Power, dBm)

Description	Options 201, 401, 205	Options 21x, 22x, 41x, 42x	Option 22x		Options 22x, 42x	
	All Ports ¹	Ports 1, 2, 3, 4 ¹	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

¹ Any port can be used as the source port.

Table 13. Power Resolution and Maximum/Minimum Settable Power, All Ports¹

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

¹ Any port can be used as the source port.

Table 14a. Harmonics at Max Specified Power (dBc), All Options – Typical

Description ¹	2 nd and 3 rd Harmonics		1/2 and 1/4 Sub-Harmonics	
	Ports ² 1, 3 Source 2 Out 1 ³	Ports ² 2, 4 Source 2 Out 2	Ports ² 1 3 Source 2 Out 1 ³	Ports ² 2, 4 Source 2 Out 2
10 MHz to 2 GHz ⁴	-51	-13	-73	-73
2 GHz to 3.2 GHz	-60	-21	-73	-73
3.2 GHz to 8.5 GHz	-60	-21	-66	-63
8.5 GHz to 13.5 GHz	-60	-21	-66	-63
13.5 GHz to 20 GHz	-60	-21	-66	-63
20 GHz to 26.5 GHz	-60	-21	-61	-52

¹ Listed frequency is fundamental frequency; test at max specified power

² Any port can be used as the source port. Source in Filtered mode where applicable.

³ At port 1 max specified power.

⁴ 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 14b.

Table 14b. 2nd and 3rd 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	2 nd Harmonic	3 rd Harmonic
500 Hz to 900 Hz	-32	-31
900 Hz to 1 kHz	-22	-23
1 kHz to 10 kHz	-22	-23
10 kHz to 100 kHz	-22	-23
100 kHz to 1 MHz	-25	-22
1 MHz to 5 MHz	-28	-24
5 MHz to 10 MHz	-27	-22
10 MHz to 33 MHz	-28	-21
33 MHz to 50 MHz	-28	--

Table 15. Non-Harmonic Spurs (dBc) at Nominal Power, All Options, All Ports – Typical

Description	Based on 100kHz offset Frac-N
10 MHz to 500 MHz ¹	-50
500 MHz to 2 GHz	-42
2 GHz to 4 GHz	-45
4 GHz to 8 GHz	-39
8 GHz to 16 GHz	-33
16 GHz to 26.5 GHz	-27

¹ Non-harmonic spurs are negligible with an LFE option installed and LFE enabled.

Table 16a. Phase Noise (dBc/Hz), All Options, All Ports – Typical

Description	1 kHz Offset	10 kHz Offset	100 kHz Offset	1 MHz Offset
10 MHz to 500 MHz ¹	-100	-95	-95	-120
500 MHz to 1 GHz	-107	-117	-112	-127
1 GHz to 2 GHz	-101	-111	-106	-121
2 GHz to 4 GHz	-95	-105	-100	-115
4 GHz to 8 GHz	-89	-99	-94	-109
8 GHz to 8.5 GHz	-83	-93	-88	-103
8.5 GHz to 13.5 GHz	-83	-93	-88	-103
13.5 GHz to 16 GHz	-83	-93	-88	-103
16 GHz to 26.5 GHz	-77	-87	-82	-97

¹ 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 16b.

Table 16b. Phase Noise (dBc/Hz), All Ports, All LFE Options (LFE Enabled) – Typical

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

Test Port Input

Table 17a. Noise Floor¹ (dBm) at 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 ²	-80	--	-87	-130
50 MHz to 100 MHz ²	-90	--	-95	-128
100 MHz to 500 MHz ²	-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

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

² 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 17b.

Table 17b. 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

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

Description	Test Port Power (dBm)
10 MHz to 500 MHz ¹	--
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

¹ 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 18b.

Table 18b. 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 19a. Test Port Compression (dB) at 8 dBm Test Port Power, All Options, All Ports

Description	Specification
10 MHz to 500 MHz ¹	--
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

¹ 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.

Table 19b. 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
1 kHz to 10 kHz	12	0.2
10 kHz to 100 kHz	12	0.2
100 kHz to 1 MHz	12	0.2
1 MHz to 5 MHz	10	0.2
5 MHz to 10 MHz	9	0.2
10 MHz to 50 MHz	8	0.2
50 MHz to 100 MHz	8	0.2

Table 20a. Trace Noise² 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 ¹	0.007	0.0039	0.040	0.140
100 MHz to 8.5 GHz ¹	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

¹ 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 20b.

² Ratioed measurement, nominal power at test port.

Table 20b. Trace Noise¹ 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

¹ Ratioed measurement, nominal power at test port.

Table 20c. Trace Noise^{1,2} 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 ¹	0.051		0.0261	0.266	1.053
100 MHz to 8.5 GHz ¹	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

¹ 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 20d.

² Ratioed measurement, nominal power at test port.

Table 20d. Trace Noise² 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

² Ratioed measurement, nominal power at test port.

Table 21. Reference Level - Specification

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

Table 22a. Stability¹, All Options - Typical

Description	Magnitude (dB/°C)	Phase (°/°C)
10 MHz to 50 MHz ²	0.01	0.29
50 MHz to 500 MHz ²	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

¹ Stability is defined as a ratio measurement made at the test port.

² 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 22b.

Table 22b. Stability¹, 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

¹ Stability is defined as a ratio measurement made at the test port.

Table 23. 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 ¹ (Option 029 without Option 425 and option 205)	> +25	>40
Test Ports (Options 205, 425)	> +20	>50

¹ 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 24. Noise Receiver Bandwidth

Description	Bandwidth
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 ¹
150 MHz to 26.5 GHz	800 kHz, 2/4/8/24 MHz ¹

¹ 8 and 24 MHz bandwidths are available only with calibration using noise source.

Table 25a. 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 ¹	--

¹ Degraded by 1.5 dB with 24 MHz BW.

Table 25b. 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 ¹	16

¹ Degraded by 1.5 dB with 24 MHz BW.

Table 26. Noise Figure Trace Noise¹ (dB rms) at 4 MHz BW

Frequency	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

¹ 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 27. 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 28. Noise Receiver Input Range - Specification

Description	Max DUT NF + Gain (dB) ¹			Max Input Power (dBm) for <0.1 dB Compression ²		
	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

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

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

Dynamic Accuracy

Table 29. Dynamic Accuracy - Specification

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

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

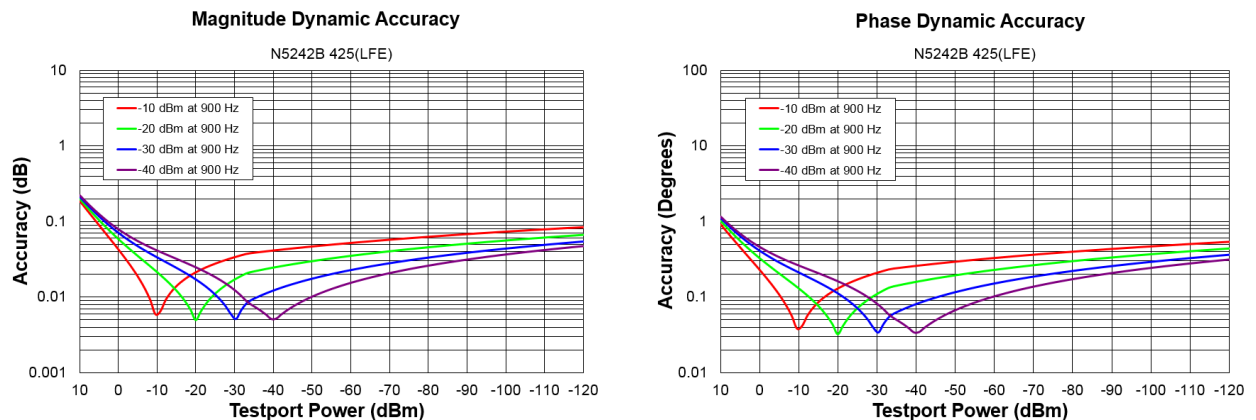
Applies to N5249B (all serial numbers) and N5241B, N5242B with following serial numbers:

N5241B and N5241BS: MY5241/SG5241/US5241 and above

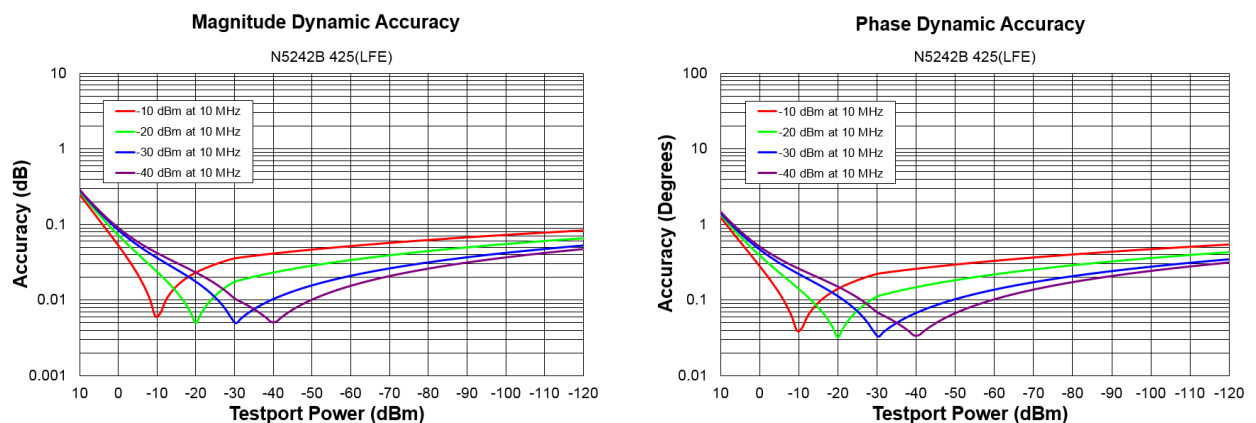
N5242B and N5242BS: MY5242/SG5242/US5242 and above

Please download our free Uncertainty Calculator from http://www.keysight.com/find/na_calculator to generate the curves for your PNA.

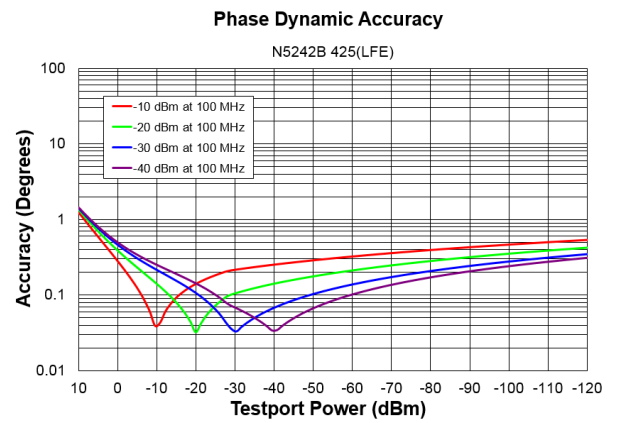
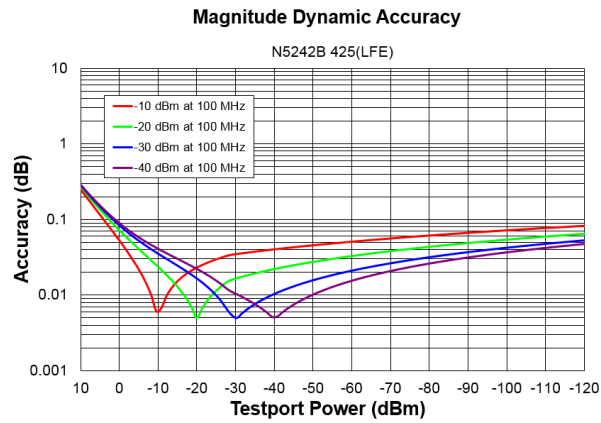
Dynamic Accuracy, 900 Hz, All LFE Options (LFE Enabled) - Specification



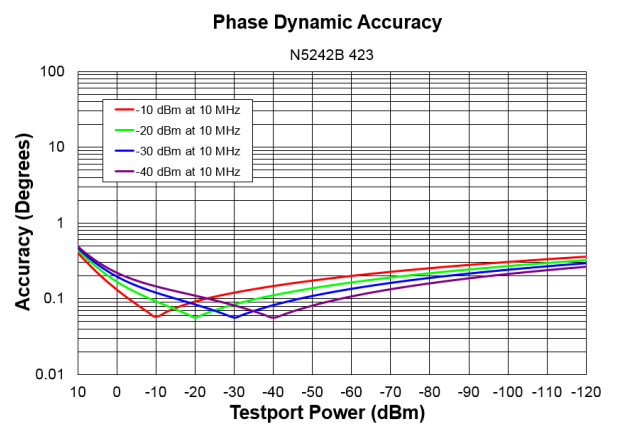
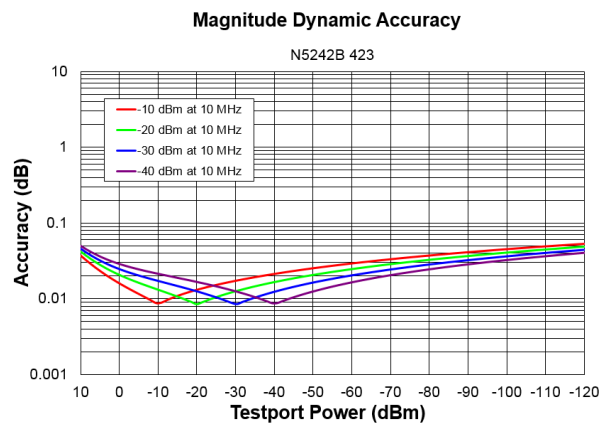
Dynamic Accuracy, 10 MHz, All LFE Options (LFE Enabled) - Specification



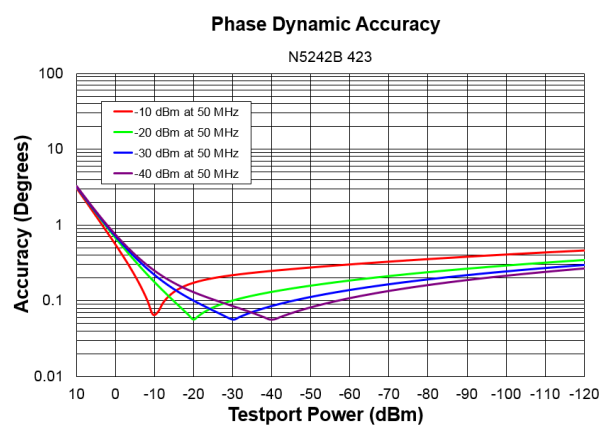
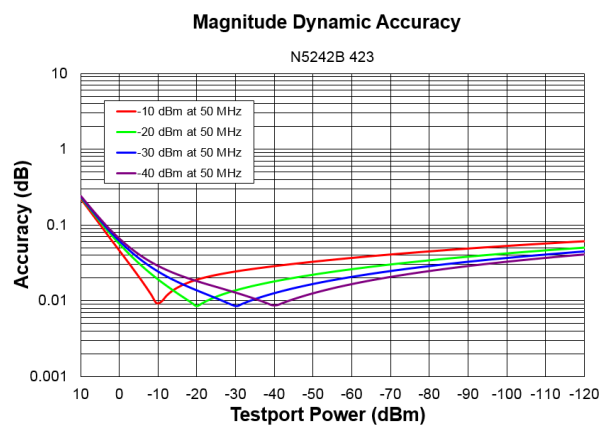
Dynamic Accuracy, 100 MHz, All LFE Options (LFE Enabled) - Specification



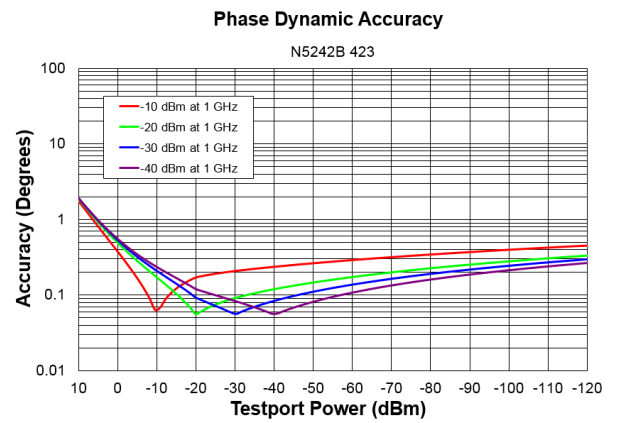
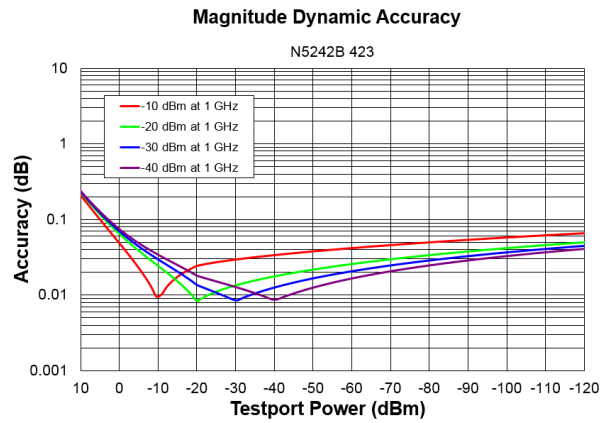
Dynamic Accuracy, 10 MHz



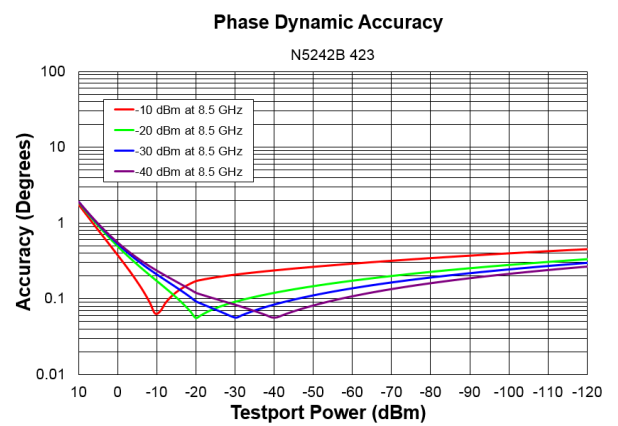
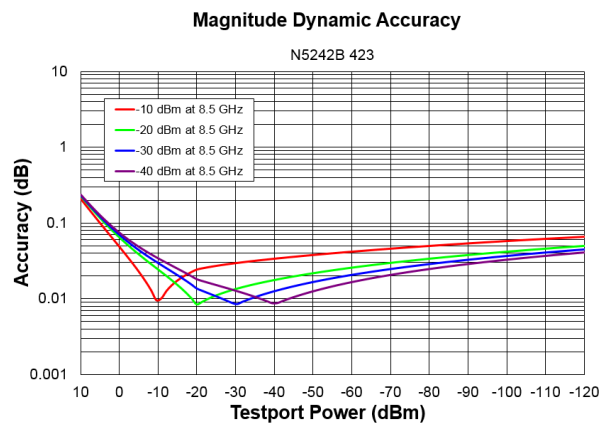
Dynamic Accuracy, 50 MHz



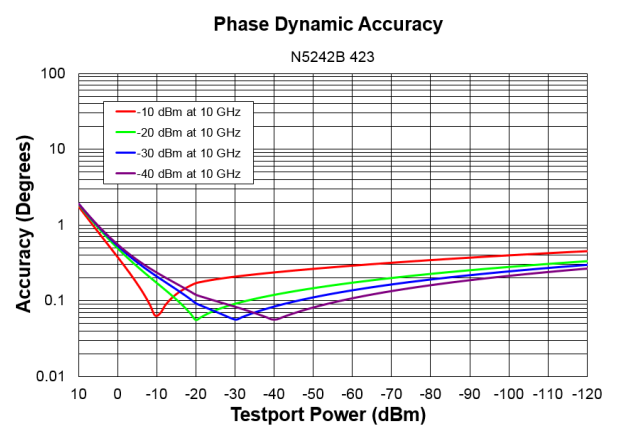
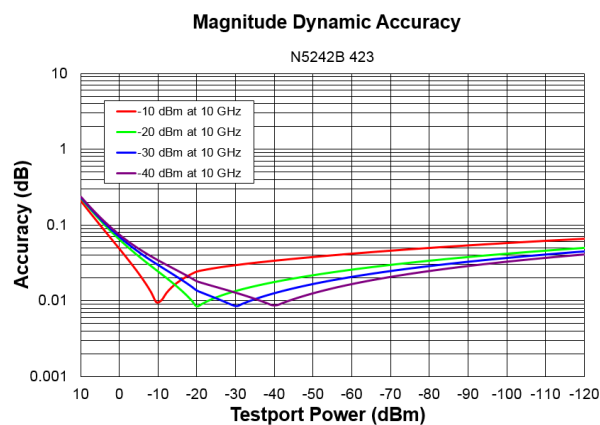
Dynamic Accuracy, 1 GHz



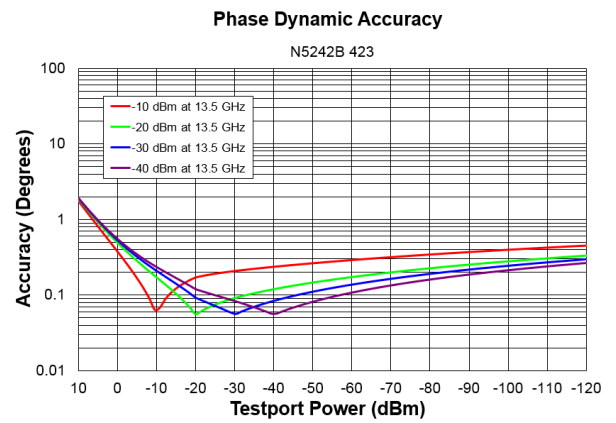
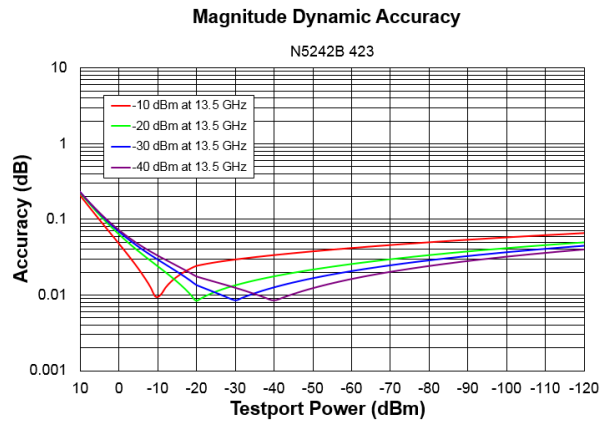
Dynamic Accuracy, 8.5 GHz



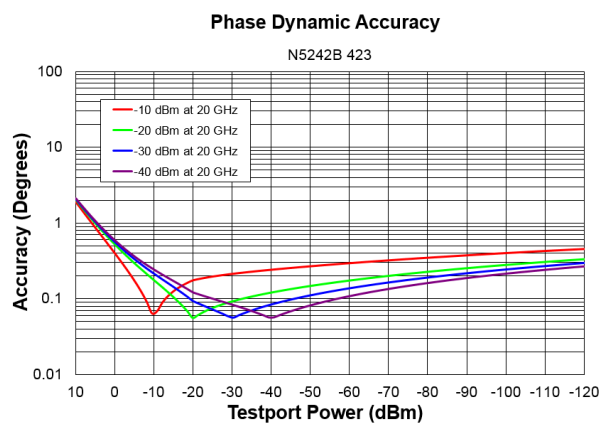
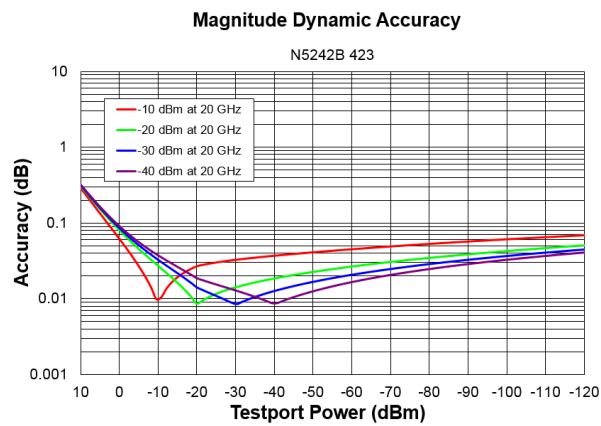
Dynamic Accuracy, 10 GHz



Dynamic Accuracy, 13.5 GHz



Dynamic Accuracy, 20 GHz



Dynamic Accuracy, 26.5 GHz

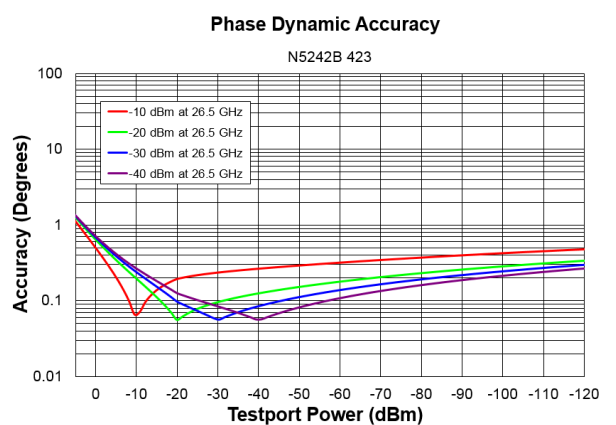
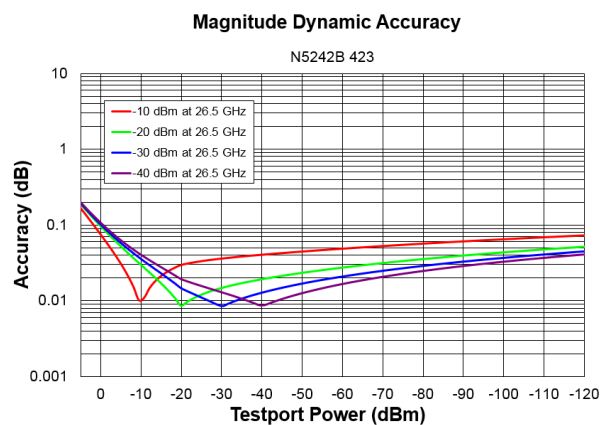


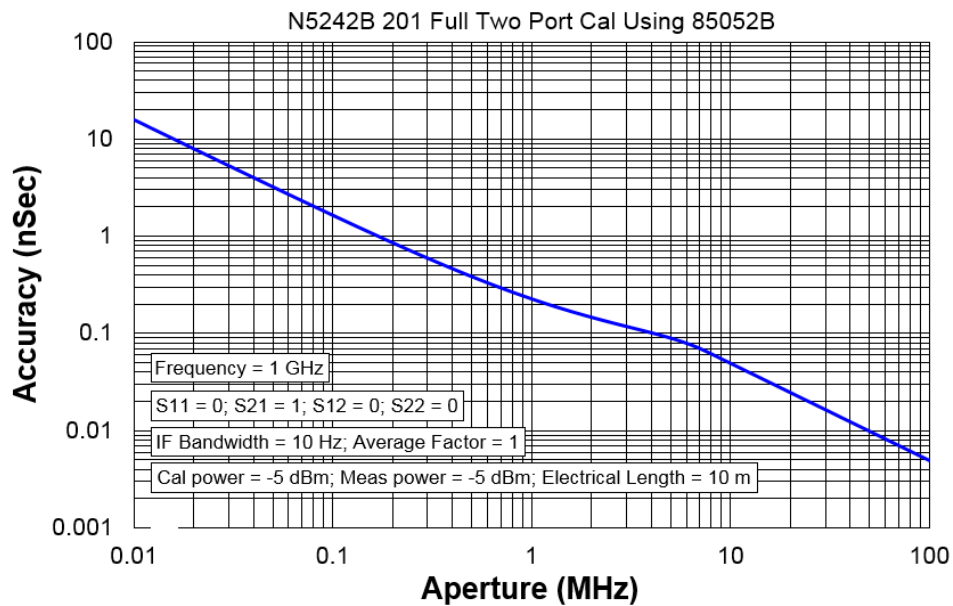
Table 30. Test Port Input (Group Delay)¹

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

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

For any S_{ij} Group Delay measurement, $S_{ii} = 0$, $S_{ij} = 1$, $S_{ji} = 0$, $S_{kl} = 0$ for all $kl \neq ij$

Group Delay Accuracy (Typical)



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

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

¹ Group delay is computed by measuring the phase change within a specified frequency step (determined by the frequency span and the number of points per sweep).

General Information

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

Table 31. Miscellaneous Information

Description	Supplemental Information
System IF Bandwidth Range	1 Hz to 15 MHz, nominal (7 MHz, 10 MHz, and 15 MHz IFBW are available ONLY with FW A.09.42 and later, and with DSP version 5)
CPU	For the latest information on CPUs and associated hard drives, visit: http://na.support.keysight.com/pna/hdnumbers.html
LXI	Class C (only applies to N5241B, N5242B, and N5249B models that are shipped with firmware revision A.08.20 and higher)

Table 32. Front Panel Information, All Options

Description	Typical Performance
RF Connectors	
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
USB 2.0 Ports - Master (4 ports)	
Standard	Compatible with USB 2.0
Connector	USB Type-A female
Display	
Size	31 cm (12.1 in) diagonal color active matrix LCD; 1280 (horizontal) X 800 (vertical) resolution
Refresh Rate	Vertical 60 Hz; Horizontal 49.31 kHz
Pixels	Any of the following would cause a display to be considered faulty: • A complete row or column consists of “stuck” or “dark” pixels. • 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. • 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. • 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). • “Stuck on” pixels or more than two “dark” pixels less than 6.5 mm apart (excluding consecutive pixels).

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

Description	Typical Performance
Display Range	
Magnitude	± 2500 dB (at 500 dB/div), max
Phase	$\pm 2500^\circ$ (at 500 degrees/div), max
Polar	10 pUnits, min 10,000 Units, max
Display Resolution	
Magnitude	0.001 dB/div, min
Phase	0.01°/div, min
Marker Resolution	
Magnitude	0.001 dB, min
Phase	0.01°, min
Polar	10 pUnit, min

Table 33. Rear Panel Information, All Options

Description	Typical Performance
10 MHz Reference In	
Connector	BNC, female
Input Frequency	10 MHz $\pm$ 10 ppm
Input Level	-15 dBm to +20 dBm
Input Impedance	200 Ω , nom.
10 MHz Reference Out	
Connector	BNC, female
Output Frequency	10 MHz $\pm$ 1 ppm
Signal Type	Sine Wave
Output Level	+10 dBm $\pm$ 4 dB into 50 Ω
Output Impedance	50 Ω , nominal
Harmonics	<-40 dBc, typical

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

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

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

Description	Typical Performance	
RF Pulse Modulator Input (Source Modulator)		
On/Off Ratio		
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	
Pulse Period		
Minimum	20 ns	
Maximum	70 s	
Pulse Outputs		
Voltage (TTL)	High: 3.3 V to 3.5 V Low: <1 V	
Impedance	50 Ohm	
External Test Set Driver		
Function	Used for driving remote mixers	
Connections	SMA (female)	
RF, LO Output Frequency Range ¹	0.01 to 13.5 GHz (N5241B) 0.01 to 26.5 GHz (N5242B)	
Rear Panel LO Power	Upper Limit (dBm)	Lower Limit (dBm)
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

¹ Full LO frequency range is: 12.535 MHz to 13.5 GHz. (N5241B), 12.535 MHz to 26.5 GHz. (N5242B)

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

Description	Typical Performance
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
Trigger Inputs/Outputs	BNC(f), TTL/CMOS compatible
Test Set IO	25-pin D-Sub connector, available for external test set control
Power IO	9-pin D-Sub, female; analog and digital IO
Handler IO	36-pin parallel I/O port; all input/output signals are default set to negative logic; can be reset to positive logic via GPIB command
Pulse I/O	15-pin D connector provides access to Pulse Modulators and Generators
GPIB	Two ports - dedicated controller and dedicated talker/listener. 24-pin D-sub (Type D-24), female; compatible with IEEE-488
PCIe	Cabled PCIe x4 connector is a 4-lane slot (not currently used)
USB Port	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
Line Power	
Frequency, Voltage	50/60/400 Hz for 100 to 120 VAC 50/60 Hz for 220 to 240 VAC
	Power supply is auto switching
Max	450 watts

Table 34. Analyzer Dimensions and Weight

All N5241B, N5242B, and N5249B 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)
Height		
Without bottom feet: EIA RU ¹ = 6	266.1	10.5
With bottom feet	279.1	11.0
Width		
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
Depth		
Without front and rear panel hardware	533.0	21.0
With front and rear panel hardware, handles	578.0	22.7
Weight (nominal)	Net	Shipping
2-port models	27 kg (60 lb)	43 kg (95 lb)
4-port models	36.7 kg (81 lb)	53 kg (117 lb)

¹ Electronics Industry Association rack units. 1 RU = 1.75 in.

Regulatory and Environmental information

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

Measurement Throughput Summary

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

Cycle time Includes sweep time, retrace time and band-crossing time. Analyzer display turned off with DISPLAY:ENABLE OFF. Add 21 ms for display on. Data for one trace (S₁₁) measurement. LF Auto BW off.

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

Sweep Range	IF Bandwidth		Number of Points			
			201	401	1601	16001
50 kHz to 100 MHz	10kHz	Uncorrected	75	141	515	4726
		2-Port cal	155	285	1050	9505
	1kHz	Uncorrected	306	599	2339	23000
		2-Port cal	611	1200	4715	46185
	100Hz	Uncorrected	2543	5085	20293	202691
		2-Port cal	5120	10200	40640	405200
7 GHz to 8 GHz	600 kHz	Uncorrected	3.4	3.4	7.2	56
		2-Port cal	7	7	15	113
	10 kHz	Uncorrected	36	53	200	1945
		2-Port cal	80	115	405	3900
	1 kHz	Uncorrected	227	444	1740	17000
		2-Port cal	460	900	3484	34000
9 GHz to 10 GHz	600 kHz	Uncorrected	3.4	3.4	7.2	56
		2-Port cal	7	7	15	113
	10 kHz	Uncorrected	36	53	200	1945
		2-Port cal	80	115	405	3900
	1 kHz	Uncorrected	227	444	1740	17000
		2-Port cal	460	900	3484	34000
10 GHz to 13.5 GHz	600 kHz	Uncorrected	9	10.5	17.6	58.3
		2-Port cal	18.4	21.6	36	117
	10 kHz	Uncorrected	61.6	102	203	1994
		2-Port cal	123	204	406	3986
	1 kHz	Uncorrected	236	459	1780	17300
		2-Port cal	400	926	3565	34600

13.5 GHz to 20 GHz	600 kHz	Uncorrected	14.6	15.8	21.5	66.4
		2-Port cal	28.6	30.9	43.3	132
	10 kHz	Uncorrected	70	118	273	1958
		2-Port cal	149	245	553	3922
	1 kHz	Uncorrected	236	459	1780	17300
		2-Port cal	400	926	3565	34600

Table 35b. 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	36.2	44.8	69.8	137
	2-Port cal	71.3	92	141	279
10 kHz	Uncorrected	73	132	481	2156
	2-Port cal	144	263	959	4515
1 kHz	Uncorrected	238	461	1780	17249
	2-Port cal	474	263	3562	34507

Table 35c. 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	49	57	81	165
	2-Port cal	96	112	166	335
10 kHz	Uncorrected	78	139	491	2254
	2-Port cal	155	276	981	4682
1 kHz	Uncorrected	243	468	1799	17419
	2-Port cal	485	935	3596	34845

Table 35d. 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	33.7	45.6	65.1	122
	2-Port cal	68.8	93.3	128	247
10 kHz	Uncorrected	71.2	129	425	2148
	2-Port cal	141	257	849	4405
1 kHz	Uncorrected	236	458	1768	17098
	2-Port cal	471	915	3533	34211

Table 36. Cycle Time vs. IF Bandwidth - Typical

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

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

Cycle time includes sweep and retrace time.

Description	Typical Performance	
IF Bandwidth (Hz)	Cycle Time (ms)	Trace Noise
600,000	2.2	0.009
100,000	3.2	0.003
30,000	6.9	0.002
10,000	26.5	0.001
3,000	69	0.0007
1,000	219	0.0004
300	637	0.0003
100	1821	0.0002
30	5979	<0.0002
10	17830	<0.0002
3	59266	<0.0002

Table 37. Cycle Time vs. Number of Points

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)			
Number of Points	1,000	10,000	30,000	600,000
3	4.8	2.3	2	1.7
11	13.7	5.6	3.4	1.6
51	57.4	7.8	3.1	1.62
101	114.5	14	4.1	1.8
201	218.8	26.5	6.9	2.2
401	432	51.5	11.9	3
801	855	101	22	4.4
1,601	1695	201	42	7.1
6,401	6683	797	162	23.4
16,001	16557	1991	402.3	56.3

Table 38. Data Transfer Time¹ (ms) – Typical

Description	Number of Points			
	201	401	1601	16,001
SCPI over GPIB (Program executed on external PC ²)				
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 SICT/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 ³ (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 ³ (Program executed on external PC)				
32-bit floating point	<1.0	1.2	2.1	13
Variant type	2.7	4.5	15	150

¹ Measured with the analyzer display off. Values will increase slightly if the analyzer display is on.

² Measured when using the SCPI command DISPlay: VISible OFF.

³ Values are for real and imaginary pairs, with the analyzer display off.

NOTE

Specifications for Recall & Sweep Speed are not provided for the N5241B, N5242B, and N5249B analyzers.

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

Conditions:

Frequency range: 4 – 6 GHz

IF bandwidth: 1 kHz

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

Impedance states for vector noise cal: 5

Other: NA application display on; correction on

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

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

Conditions:

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

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

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

Conditions:

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

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

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

Conditions:

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

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

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

Conditions:

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

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

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

Conditions:

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

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

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

Conditions:

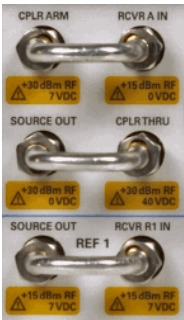
Input frequency: 3 GHz CF, 75 MHz span
 LO frequency: 2.12 GHz fixed
 Output frequency: 880 MHz CF, 75 MHz span
 Main tone IF bandwidth: 10 kHz
 IM tone IF bandwidth: 1 kHz
 Measurement parameters: PwrMain (avg), IM3 (dB relative to carrier)
 Other: NA application display on; correction on

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

Specifications: Front-Panel Jumpers

NOTE

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



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

Table 46. Measurement Receiver Inputs (dBm) – Typical
(RCVR A, B, C, D IN) @ 0.1 dB 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 47a. Reference Receiver Inputs and Reference Source Outputs (dBm) – Typical

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

Description	Options 201, 401		Options 21x, 41x		Options 22x, 42x	
	Filtered Mode ¹	Hi Power Mode ¹	Filtered Mode ¹	Hi Power Mode ¹	Filtered Mode ¹	Hi Power Mode ¹
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

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

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

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

Description	Option 401		Options 201, 401	Option 41x		Options 21x, 41x
	RCVR R3 IN, REF 3 SOURCE OUT	RCVR R3 IN, REF 3 SOURCE OUT	RCVR R2, R4 IN, REF 2, 4 SOURCE OUT	RCVR R3 IN, REF 3 SOURCE OUT	RCVR R3 IN, REF 3 SOURCE OUT	RCVR R2, R4 IN, REF 2, 4 SOURCE OUT
	Filtered Mode ¹	Hi Power Mode ¹		Filtered Mode ¹	Hi Power Mode ¹	
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

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

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

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

Description	Option 42x		Options 22x, 42x
	RCVR R3 IN, REF 3 SOURCE OUT	RCVR R3 IN, REF 3 SOURCE OUT	RCVR R2, R4 IN, REF 2, 4 SOURCE OUT
	Filtered Mode ¹	Hi Power Mode ¹	
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

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

Table 48a. Source Outputs (dBm) – Typical

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

Description	Options 201, 401			Options 21x, 41x		
	PORT 1, 3 SOURCE OUT		PORT 2, 4 SOURCE OUT	PORT 1, 3 SOURCE OUT		PORT 2, 4 SOURCE OUT
	Filtered Mode ¹	Hi Power Mode ¹		Filtered Mode ¹	Hi Power Mode ¹	
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

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

Table 48b. Source Outputs (dBm) - Typical

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

Description	Options 22x, 42x		
	PORT 1, 3 SOURCE OUT		PORT 2, 4 SOURCE OUT
	Filtered Mode ¹	Hi Power Mode ¹	
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

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

Table 49. Coupler Inputs (dB) - Typical

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

Description	Options 201, 401	Options 21x, 41x, 22x, 42x
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 50. 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

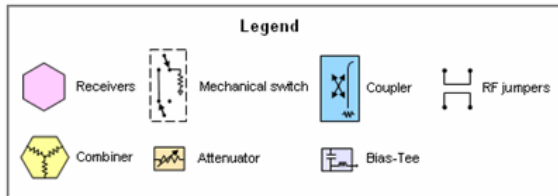


Figure 1. 2-Port N5241B, N5242B, and N5249B Base Unit Option 201

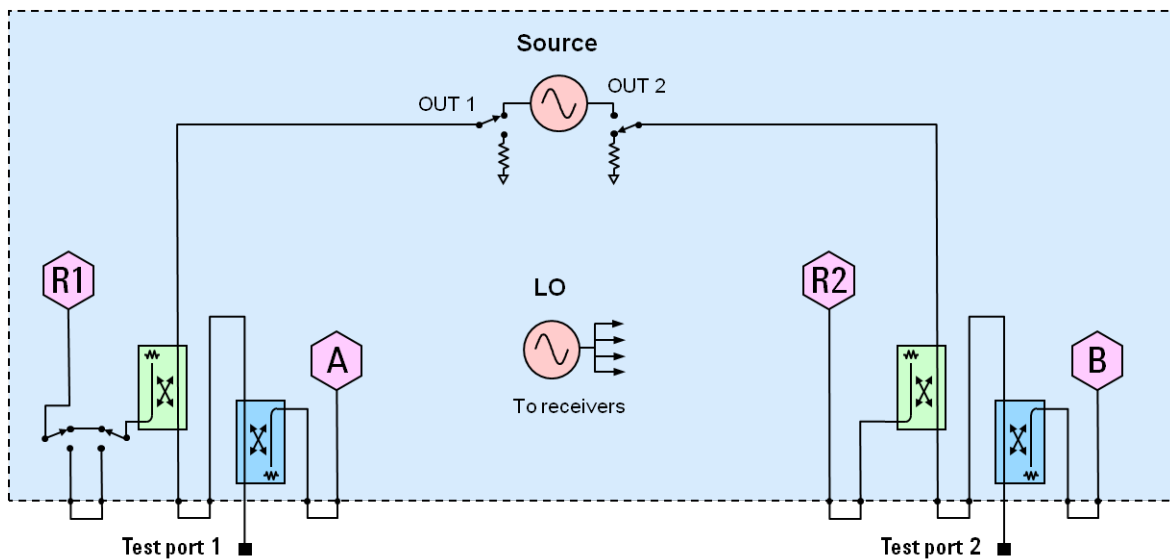


Figure 2. 2-Port N5241B, N5242B, and N5249B Option 217

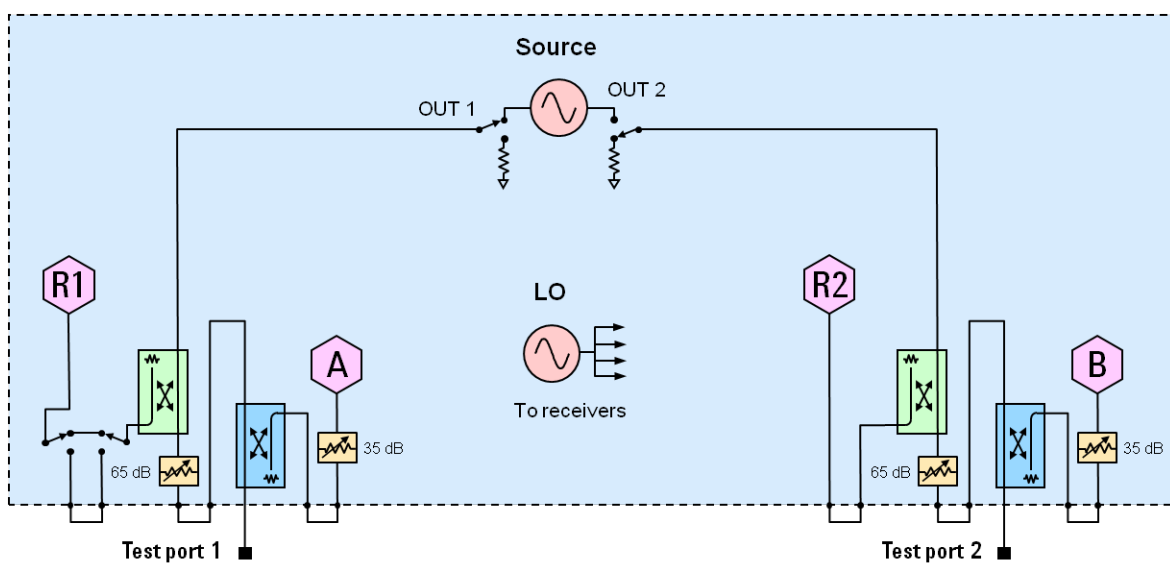


Figure 3. 2-Port N5241B, N5242B, and N5249B Option 219

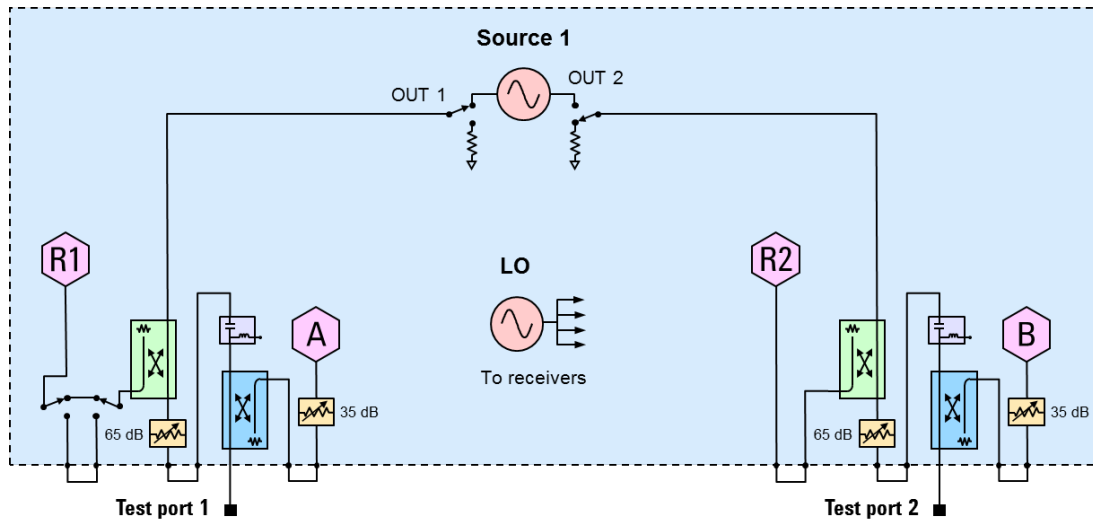
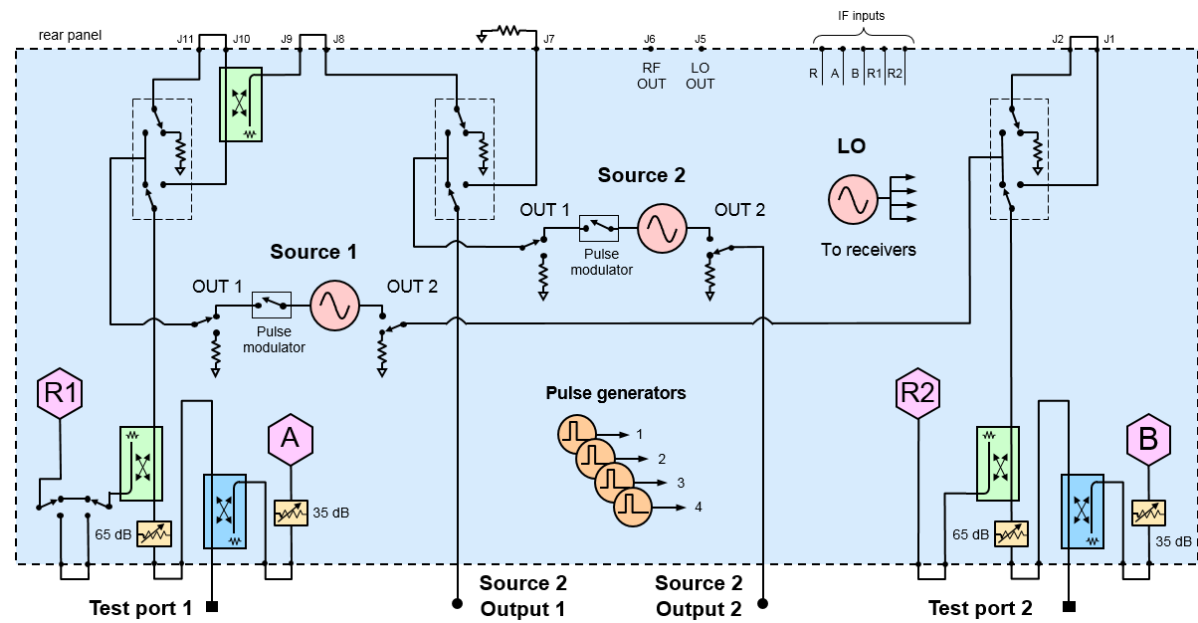


Figure 4. 2-Port N5241B, N5242B, and N5249B Option 222



The schematic diagram illustrates the internal architecture of the 28 nm CMOS 5G NR transceiver and its connection to the test setup. The transceiver is divided into a rear panel (top) and a main body (bottom). The rear panel includes connectors J1 through J19. The main body contains two signal sources, Source 1 and Source 2, each with a pulse modulator and two outputs (OUT 1 and OUT 2). A central Pulse generator provides four different pulse shapes (1, 2, 3, 4) to the test setup. A Local Oscillator (LO) is connected to the rear panel via J16-J19 and provides signals to the transceiver. The transceiver is connected to the test ports via J20-J23. The test ports are connected to the rear panel via J24-J27. The diagram also shows the internal components of the test ports, including attenuators and connectors.

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

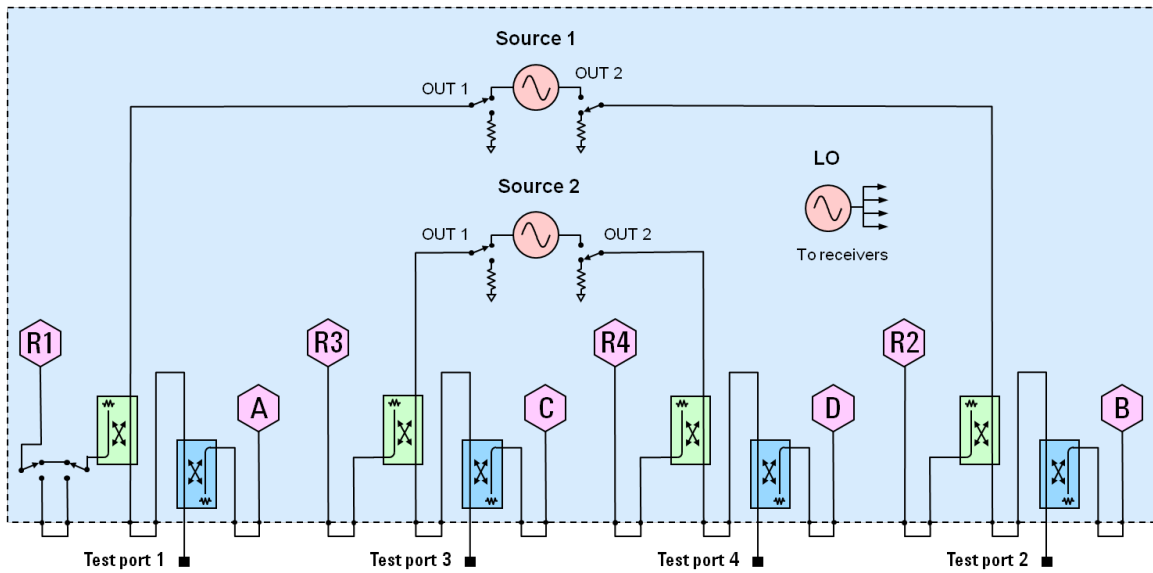


Figure 8. 4-Port N5241B, N5242B, and N5249B Option 417

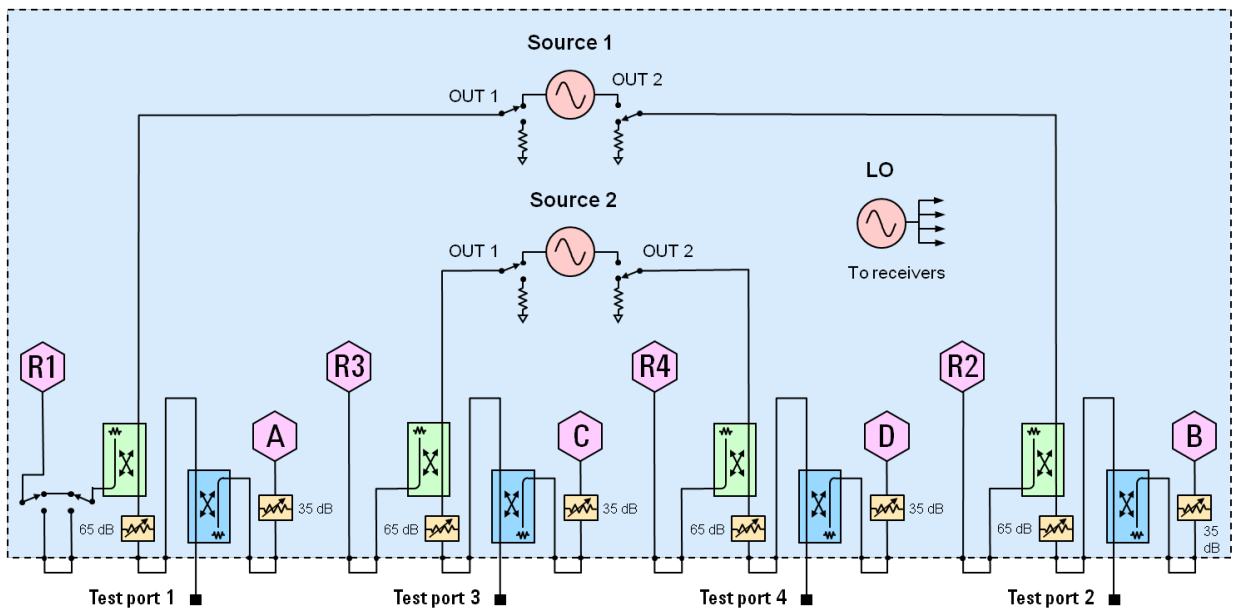


Figure 9. 4-Port N5241B, N5242B, and N5249B Option 419

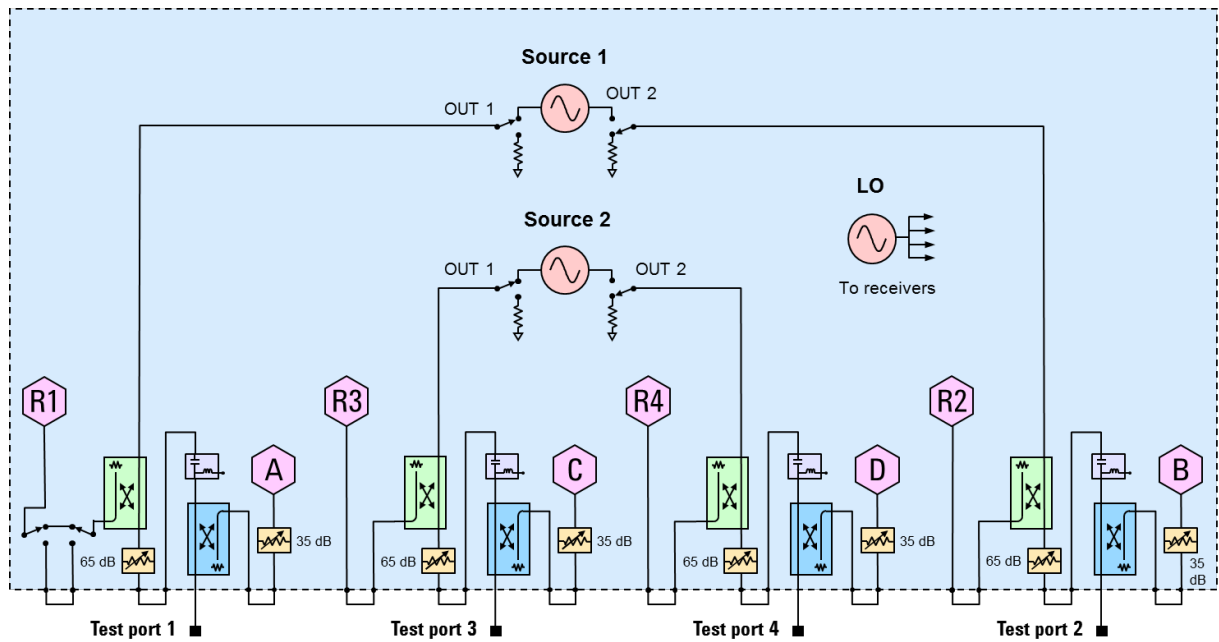


Figure 10. 4-Port N5241B, N5242B, and N5249B Option 422

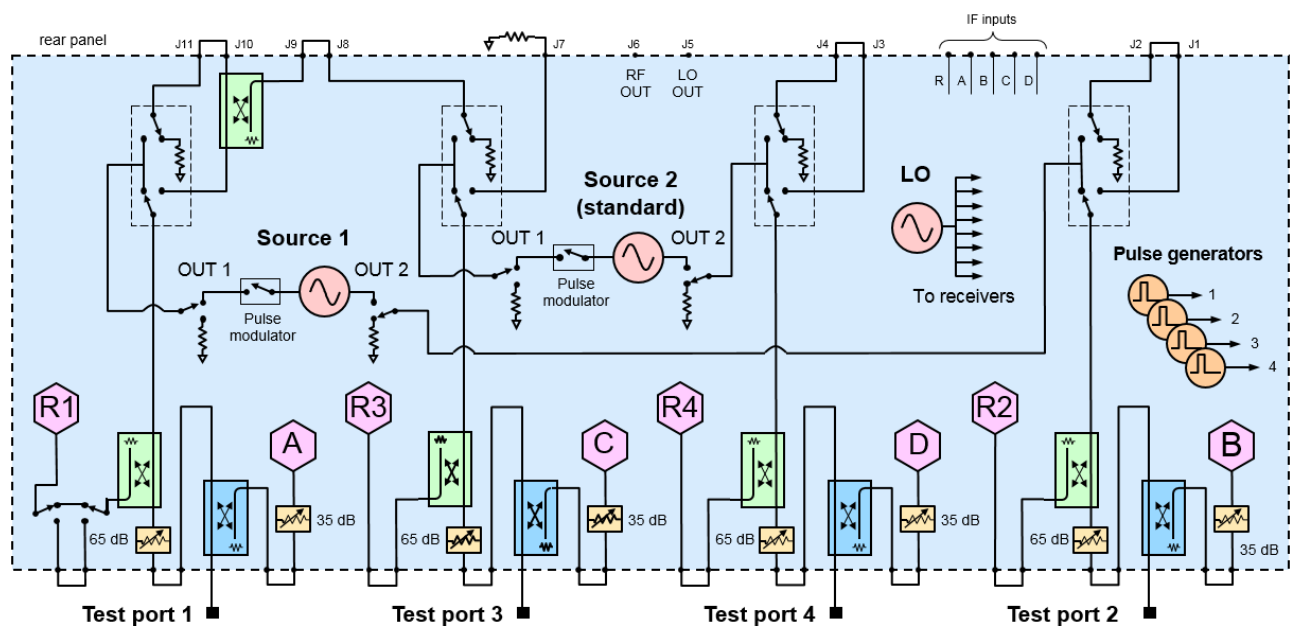


Figure 11. 4-Port N5241B, N5242B, and N5249B Option 423

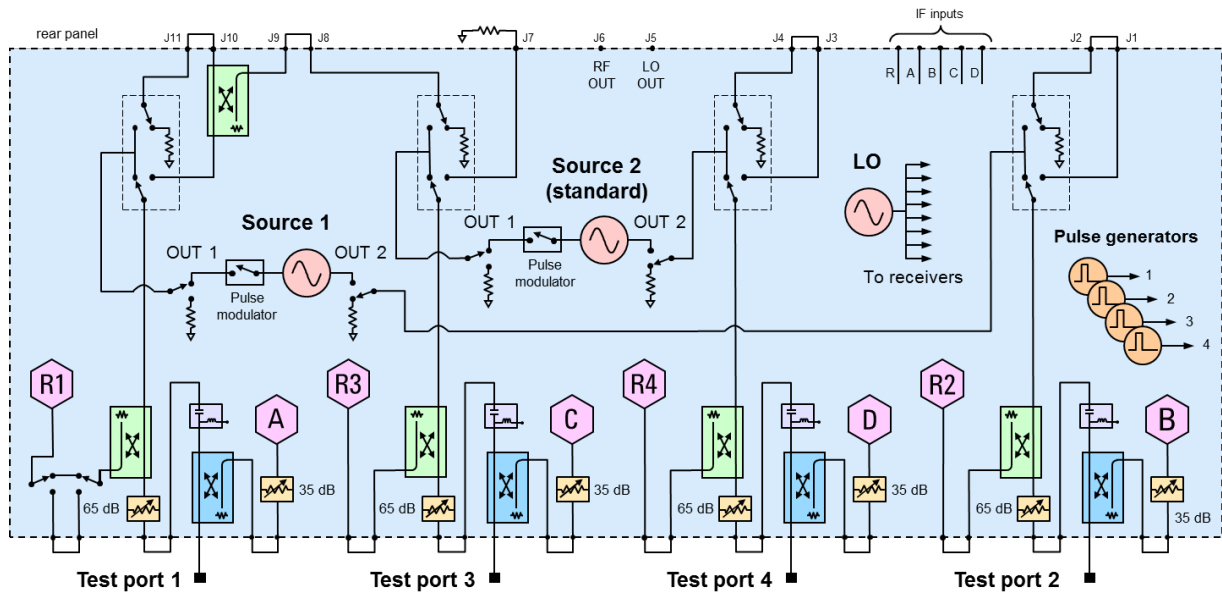


Figure 12. 4-Port N5241B, N5242B, and N5249B Option 423 with 029

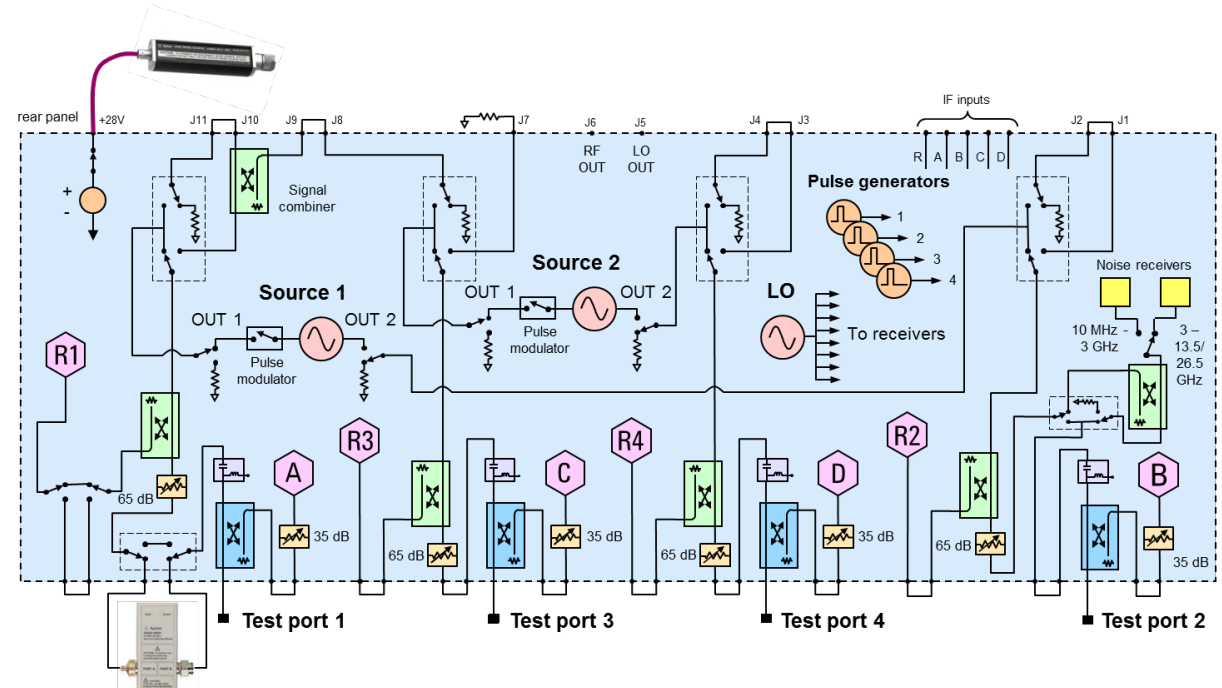


Figure 13. LFE Options

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

NOTE The attenuators do not apply to Option 205.

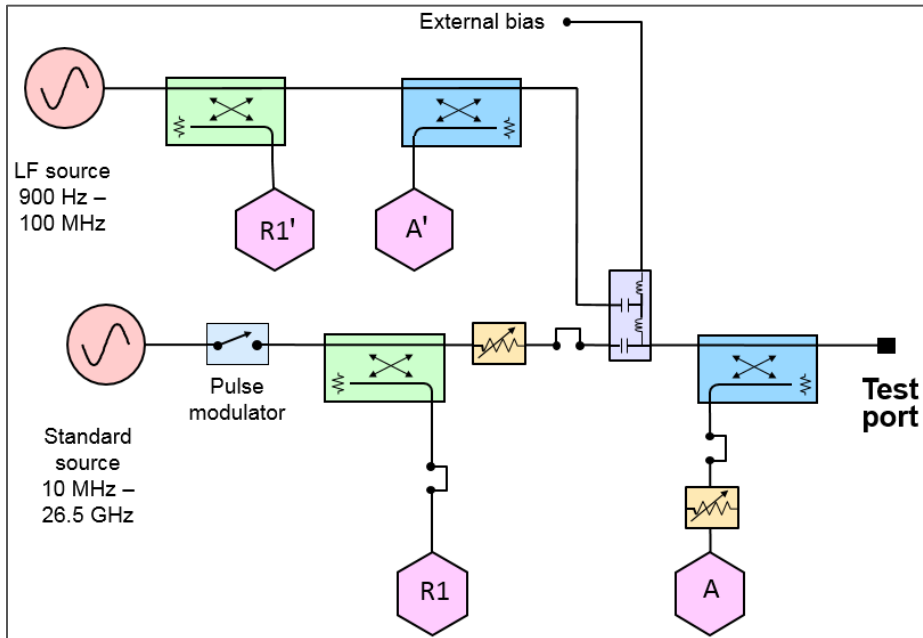


Figure 14. Receiver Block Diagram

