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

N5249B - 900 Hz to 8.5 GHz
N5241B - 900 Hz to 13.5 GHz
N5242B – 900 Hz to 26.5 GHz

Data Sheet and Technical Specifications

KEYSIGHT TECHNOLOGIES

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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 data sheet, the specified performance at the exact frequency of a break is the degraded value of the two specifications at that frequency.

# Definitions

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

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

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

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

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

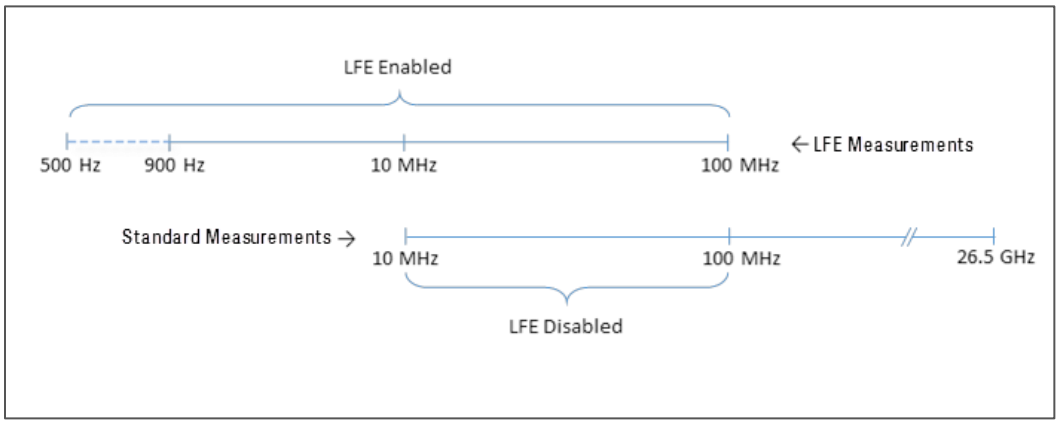
Calibration: The process of measuring known standards to characterize a network analyzer's systematic (repeatable) errors.

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

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

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

**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.

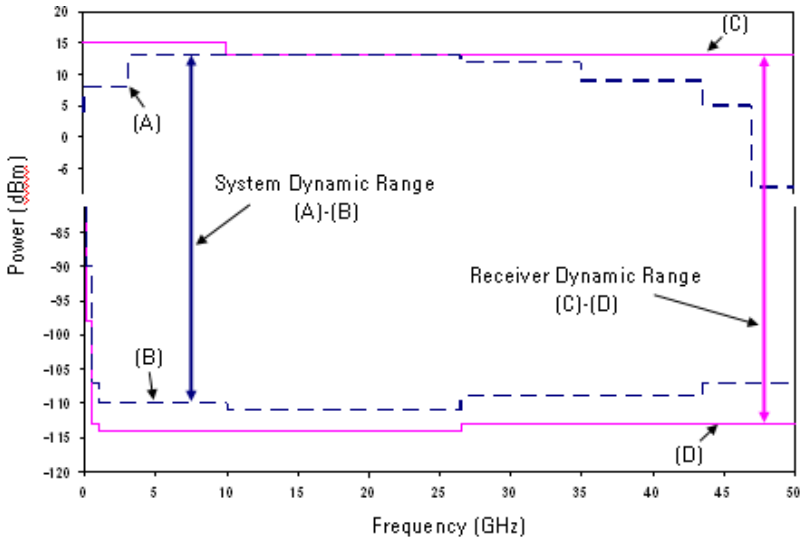


# Dynamic Range

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 | | 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.

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

| Description | Specification | | 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.

Table 1c. System Dynamic Range at Test Port (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 | 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.

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

| Description | Specification | | 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.

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

| Description | Specification | | 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.

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

| Description | Specification | | 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.

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

| Description | Specification | | 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.

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

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

Table 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 | | 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 ≤ 100 MHz. Above 100 MHz, performance is the same for both LFE enabled or disabled.
[2] System Dynamic Range measured in High Power Mode.

Extended Dynamic Range

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

| Description | Options 201, 401 | | Options 21x, 41x | |
|---|---|---|---|---|
| | Ports[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°±3°C and < 1° C deviation from the calibration temperature. Specifications assume an N4697F flexible test port cable and a full 2-port calibration. For instruments with Option 029, the port 1 noise tuner switch is set to the bypass position, and the port 2 noise receiver switch is set to the normal position.

For any Sii reflection measurement:

- Sjj = 0.

For any Sij transmission measurement:

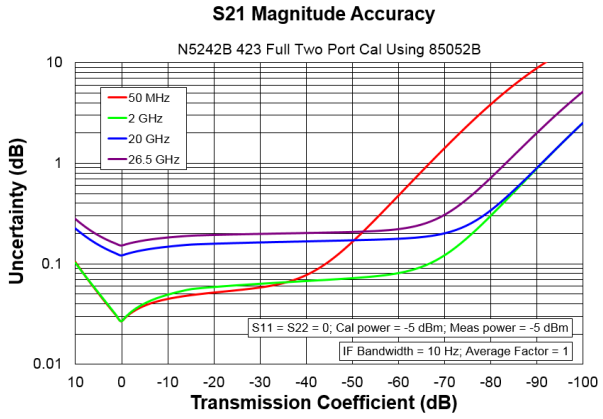
- Sji = Sij when Sij ≤ 1
- Sji = 1/Sij when Sij > 1
- Skk = 0 for all k

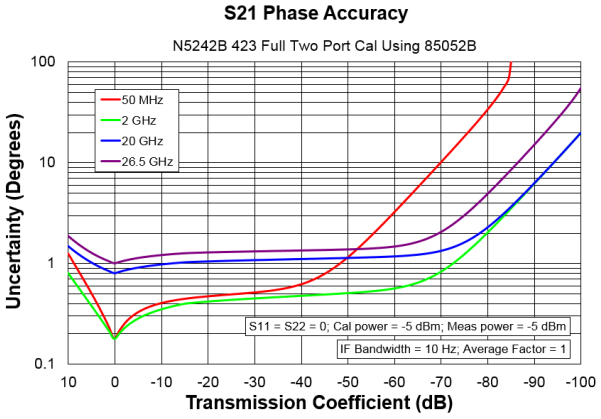
Please download our free Uncertainty Calculator from http://www.keysight.com/find/na_calculator for specifications for other calibration kits and measurement setups.

Table 4a. 85052B Calibration Kit

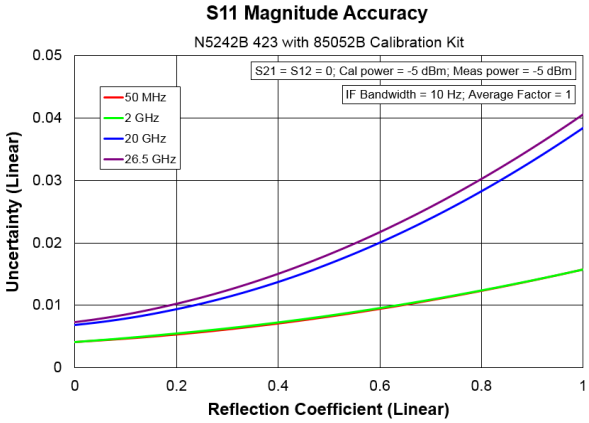
| Description | Specification (dB) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 10 MHz to 50 MHz | 50 MHz to 500 MHz | 500 MHz to 2 GHz | 2 GHz to 8.5 GHz | 8.5 GHz to 13.5 GHz | 13.5 GHz to 20 GHz | 20 GHz to 26.5 GHz |
| Directivity | 48 | 48 | 48 | 44 | 44 | 44 | 44 |
| Source Match | 40 | 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 (°) | ±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 (°) | ±0.29 | ±0.37 | ±0.37 | ±0.74 | ±0.71 | ±0.88 | ±1.1 |

## Transmission Uncertainty




## Reflection Uncertainty



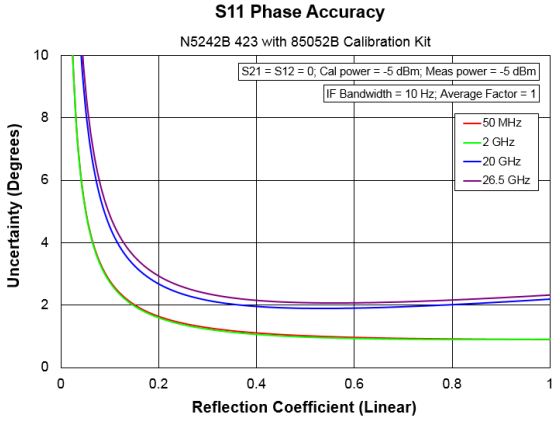
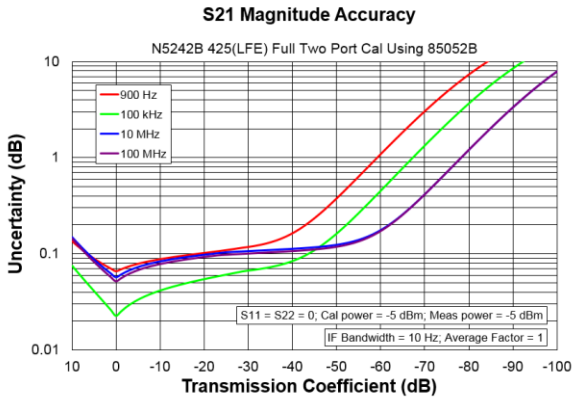
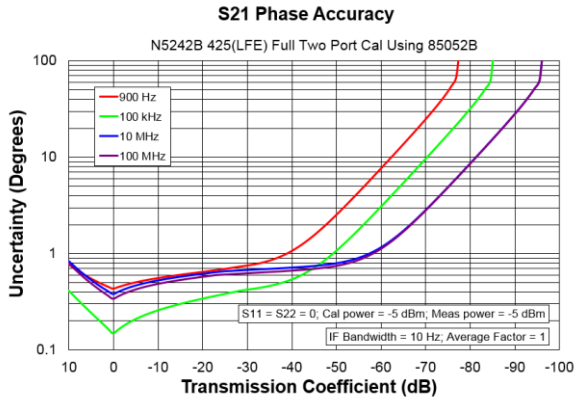



Table 4c. 85052B Calibration Kit, Option 425 (LFE Enabled)

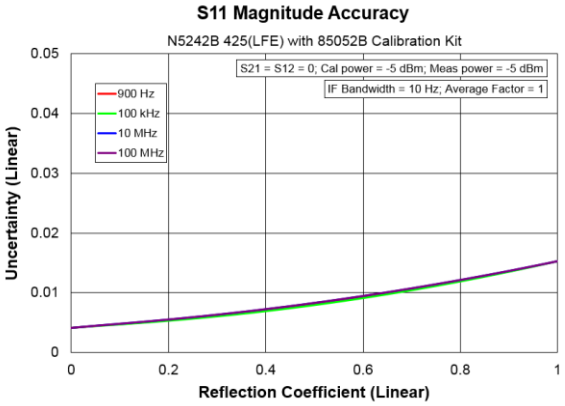
| Description | Specification (dB) | | | | |
|---|---|---|---|---|---|
| | 1 kHz to 10 kHz | 10 kHz to 1 MHz | 1 MHz to 5 MHz | 5 MHz to 50 MHz | 50 MHz to 100 MHz |
| Directivity | 48 | 48 | 48 | 48 | 48 |
| Source Match | 40 | 40 | 40 | 40 | 40 |
| Load Match | 47 | 48 | 48 | 47 | 47 |
| **Reflection 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



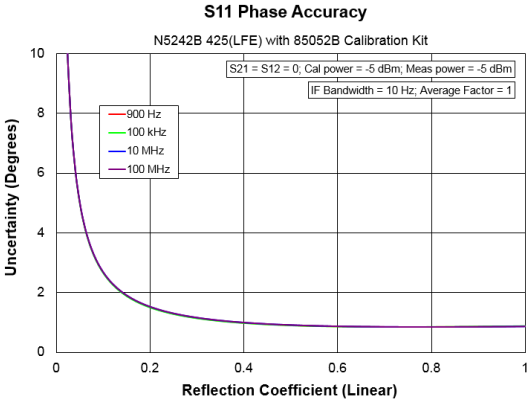
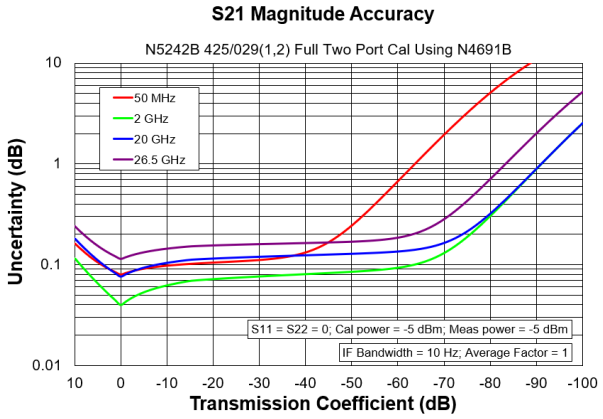
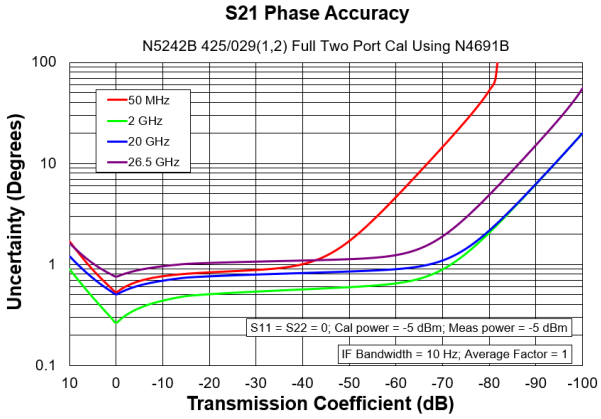



Table 5a. N4691B Calibration Kit

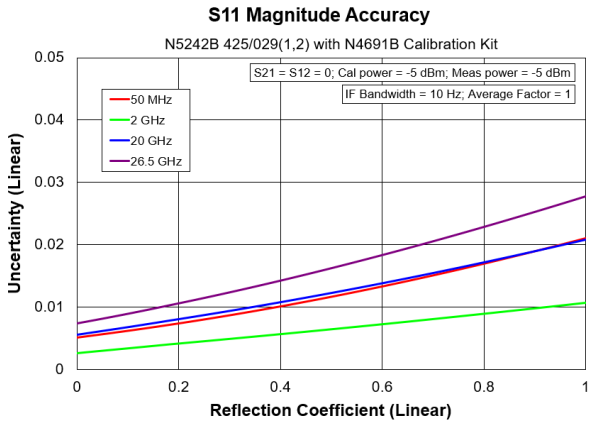
| Description | Specification (dB) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 10 MHz to 50 MHz | 50 MHz to 500 MHz | 500 MHz to 2 GHz | 2 GHz to 8.5 GHz | 8.5 GHz to 13.5 GHz | 13.5 GHz to 20 GHz | 20 GHz to 26.5 GHz |
| Directivity | 46 | 46 | 52 | 48 | 46 | 46 | 44 |
| Source Match | 41 | 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



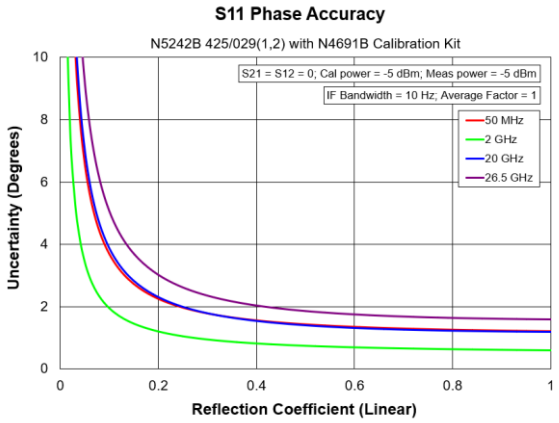
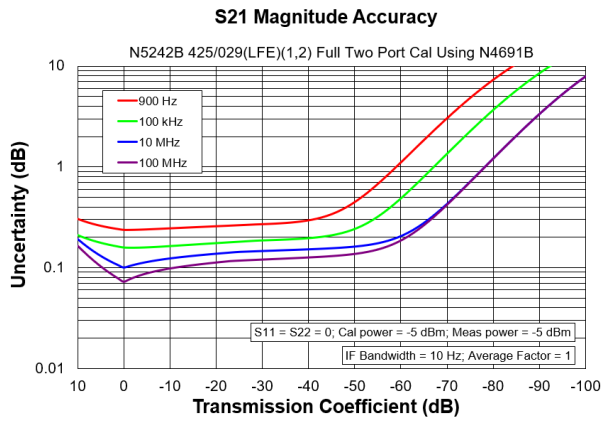
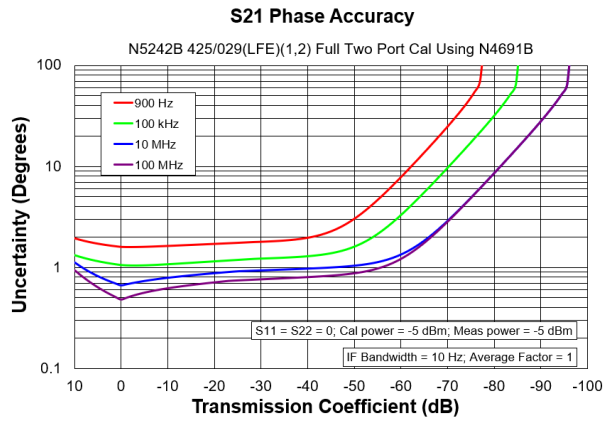




Table 5b. N4691B Calibration Kit, Option 425 with Option 029 (LFE Enabled)

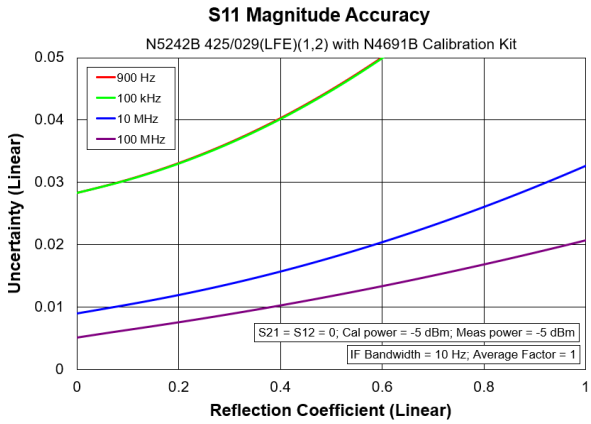
| Description | Specification (dB) | | | | |
|---|---|---|---|---|---|
| | 1 kHz to 10 kHz | 10 kHz to 1 MHz | 1 MHz to 5 MHz | 5 MHz to 50 MHz | 50 MHz to 100 MHz |
| Directivity | 31 | 31 | 31 | 41 | 46 |
| Source Match | 29 | 29 | 29 | 36 | 41 |
| Load Match | 27 | 28 | 28 | 34 | 39 |
| **Reflection 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



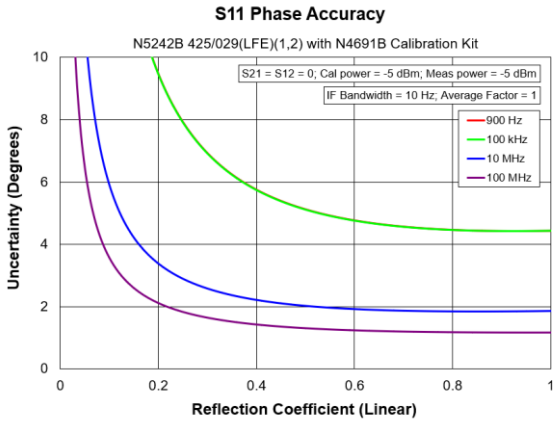
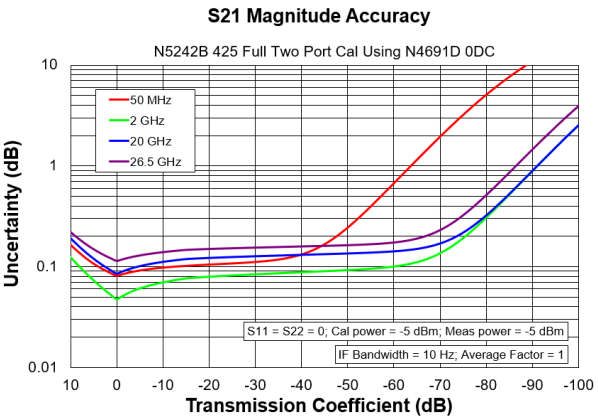
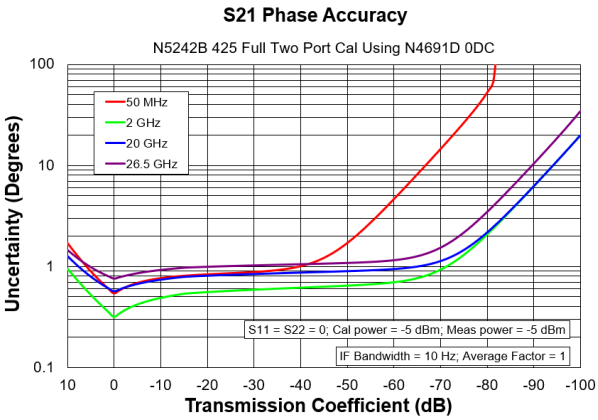




Table 5c. N4691D Calibration Kit

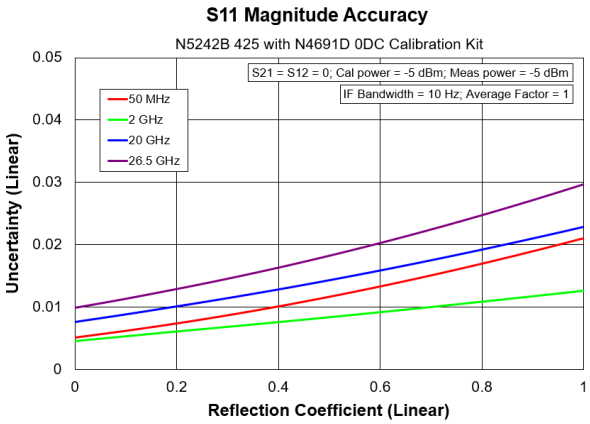
| Description | Specification (dB) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 10 MHz to 50 MHz | 50 MHz to 500 MHz | 500 MHz to 2 GHz | 2 GHz to 8.5 GHz | 8.5 GHz to 13.5 GHz | 13.5 GHz to 20 GHz | 20 GHz to 26.5 GHz |
| Directivity | 46 | 46 | 47 | 46 | 43 | 43 | 41 |
| Source Match | 41 | 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



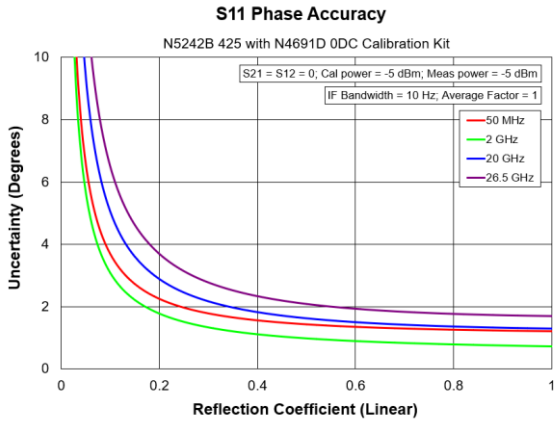
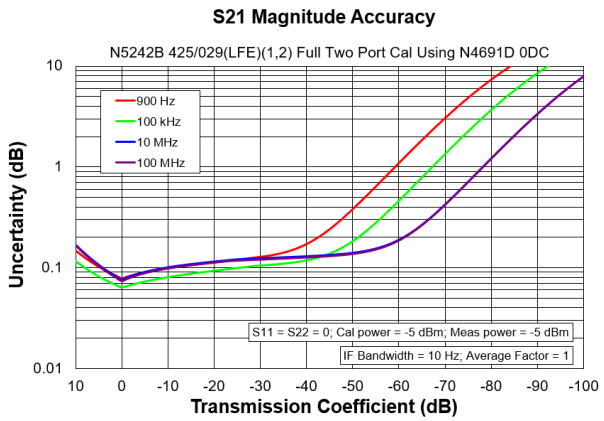
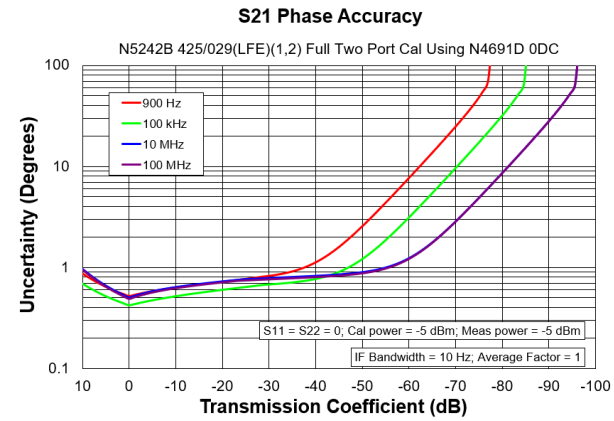




Table 5d. N4691D Calibration Kit, Option 425 with Option 029 (LFE Enabled)

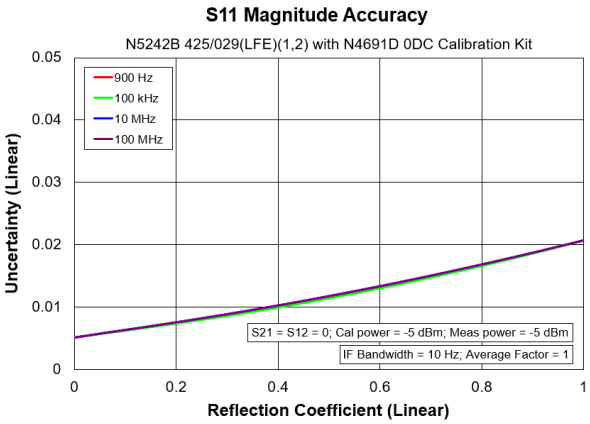
| Description | Specification (dB) | | | | |
|---|---|---|---|---|---|
| | 1 kHz to 10 kHz | 10 kHz to 1 MHz | 1 MHz to 5 MHz | 5 MHz to 50 MHz | 50 MHz to 100 MHz |
| Directivity | 46 | 46 | 46 | 46 | 46 |
| Source Match | 41 | 41 | 41 | 41 | 41 |
| Load Match | 38 | 40 | 39 | 39 | 39 |
| **Reflection 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 |

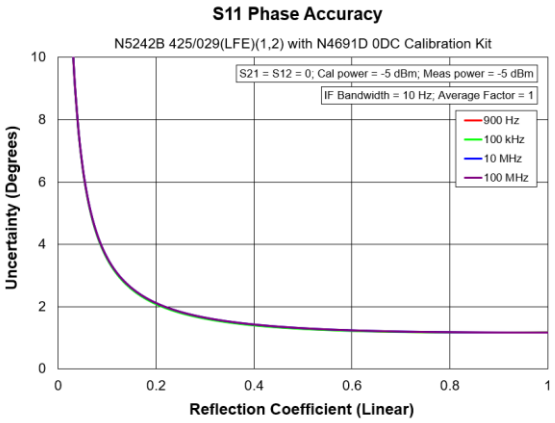
## Transmission Uncertainty, Option 425 with Option 029



## 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]<br>±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 | 17 |
| 50 MHz to 500 MHz | 10 | 13 | 13 | 11 | 21 | 20 |
| 500 MHz to 3.2 GHz | 10 | 10 | 13 | 12 | 13 | 18 |
| 3.2 GHz to 8.5 GHz | 13 | 13 | 13 | 20 | 20 | 19 |
| 8.5 GHz to 10 GHz | 13 | 13 | 13 | 20 | 20 | 19 |
| 10 GHz to 13.5 GHz | 13 | 13 | 13 | 17 | 17 | 16 |
| 13.5 GHz to 16 GHz | 13 | 13 | 13 | 17 | 17 | 16 |
| 16 GHz to 20 GHz | 13 | 13 | 10 | 16 | 16 | 12 |
| 20 GHz to 24 GHz | 12 | 12 | 7 | 15 | 15 | 11 |
| 24 GHz to 26.5 GHz | 5 | 5 | 2 | 11 | 11 | 7 |

[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 Leveled 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 Leveled Power (dBm), Option 21x or 41x with 029[1]

| 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 Leveled 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 Leveled 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 Leveled 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 Leveled Power (dBm), Options 22x, 422, or 423 with 029[1]

| 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 Leveled Power (dBm), Options 22x, 422, or 423 with 029[1], 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 Leveled 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 029[1]

| 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 Leveled 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 Leveled 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 Leveled 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 8o. 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 Power[1], All Options

| Description | Specification | | Typical | |
|---|---|---|---|---|
| | Ports[2] 1, 2, 3, 4 | Source 2 Out 1<br>Source 2 Out 2 | Ports[2] 1, 2, 3, 4 | Source 2 Out 1<br>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 Linearity[1] (dB), All Options - Specification

| Description | Ports[2] 1, 3<br>-25 dBm ≤ P <-20 dBm | Ports[2] 1, 3<br>-20 dBm ≤ P <-15 dBm | Ports[2] 1, 3<br>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 Linearity[1] (dB), All Options – Specification

| Description | Ports[2] 2, 4<br>-25 dBm ≤ P <-20 dBm | Ports[2] 2, 4<br>-20 dBm ≤ P <-15 dBm | Ports[2] 2, 4<br>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 Linearity[1] (dB), Option 22x – Specification

| Description | Source 2 Out 1[2]<br>P ≥-15 dBm | Source 2 Out 2<br>-15 dBm ≤ P <-10 dBm | Source 2 Out 2<br>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 Linearity[1] (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 029[1]

| 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 029[1]

| 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 Ports[1]

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

Table 15. Non-Harmonic Spurs (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 Floor[1] (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 Noise[2] 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 Noise[1] 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 Noise[2] 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. Stability[1], 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. Stability[1], 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 Noise[1] (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:

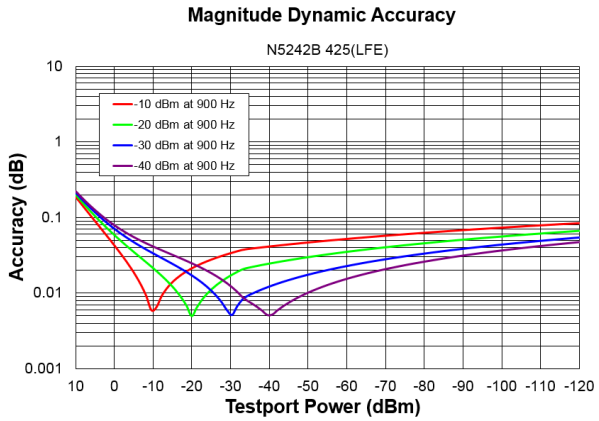
- Compression over frequency
- IF linearity at a single frequency of 1.998765 GHz using a reference level of -20 dBm for an input power range of 0 to -60 dBm. For value below -60 dBm, refer to “VNA Receiver Dynamic Accuracy Specifications and Uncertainties”.

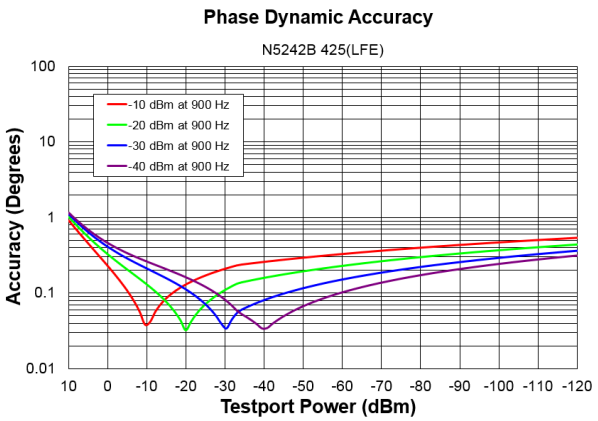
Applies to N5249B (all serial numbers) and N5241B, N5242B with following serial numbers:

N5241B and N5241BS: MY5241/SG5241/US5241 and above
N5242B and N5242BS: MY5242/SG5242/US5242 and above

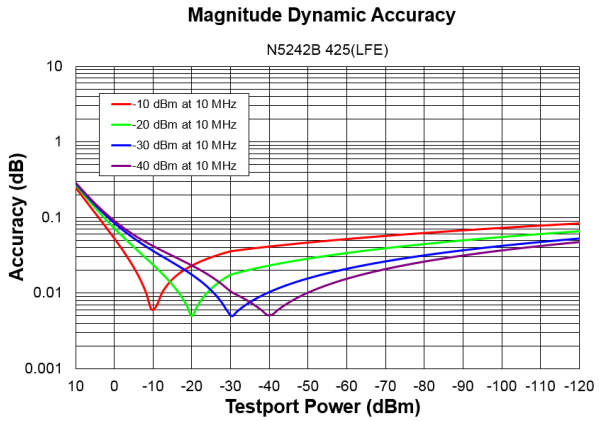
Please download our free Uncertainty Calculator from http://www.keysight.com/find/na_calculator to generate the curves for your PNA.

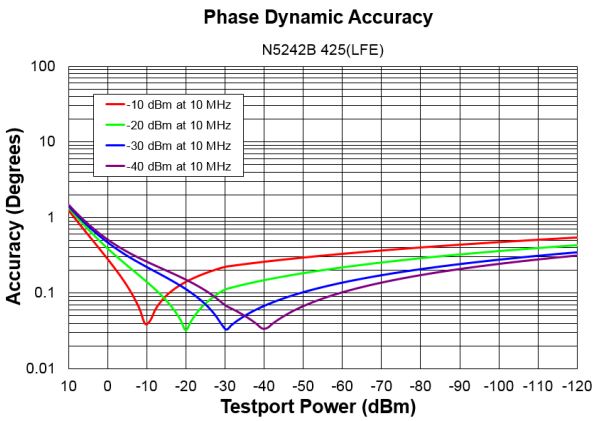
## Dynamic Accuracy, 900 Hz, All LFE Options (LFE Enabled) - Specification



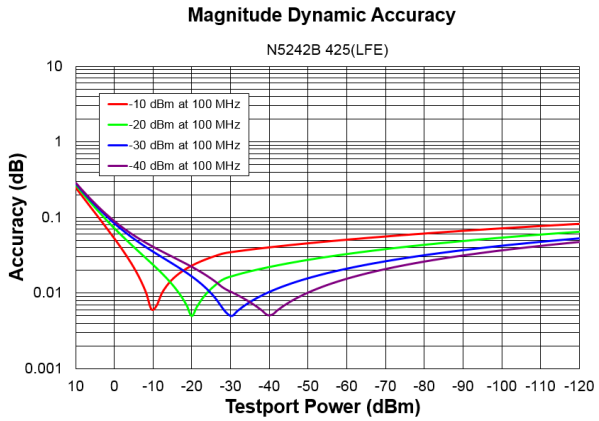



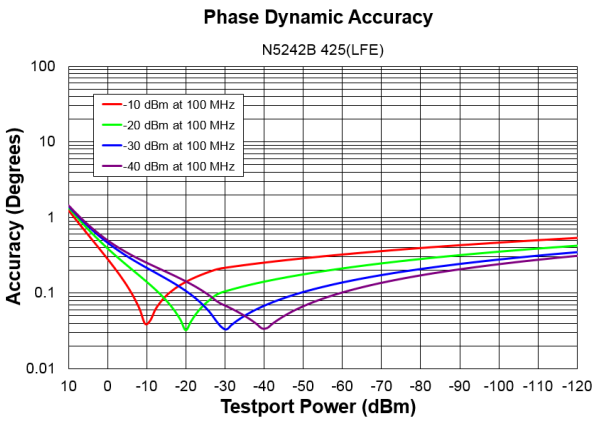

## Dynamic Accuracy, 10 MHz, All LFE Options (LFE Enabled) - Specification



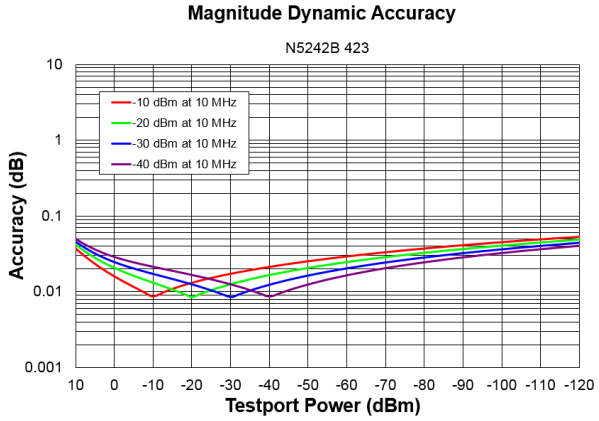



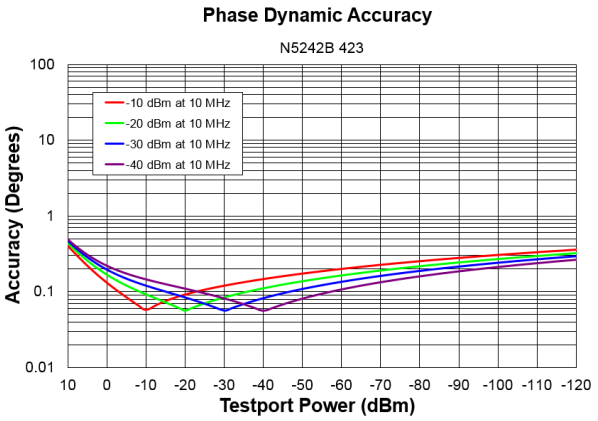
## Dynamic Accuracy, 100 MHz, All LFE Options (LFE Enabled) - Specification



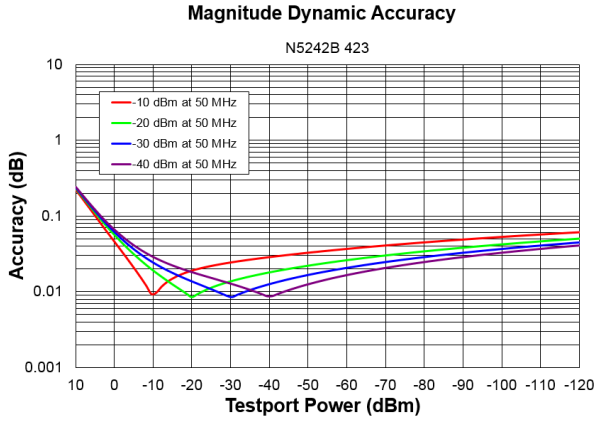



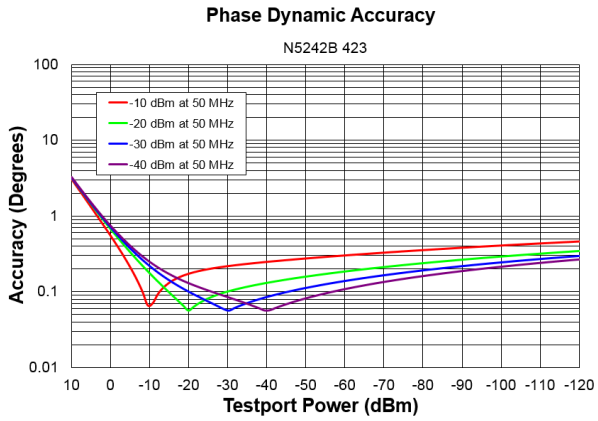

## Dynamic Accuracy, 10 MHz



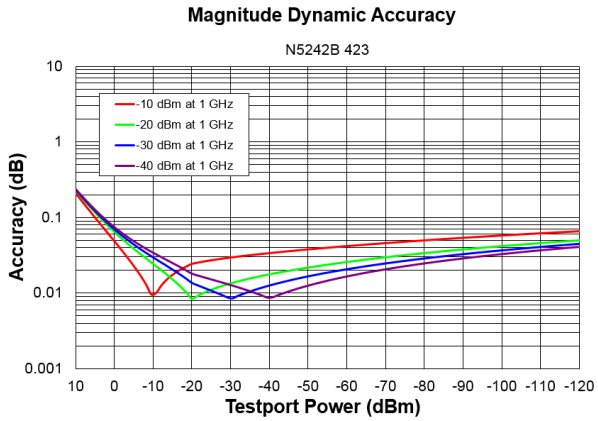



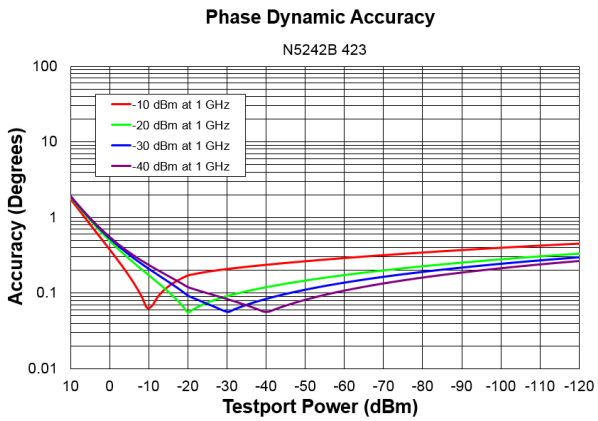

## Dynamic Accuracy, 50 MHz



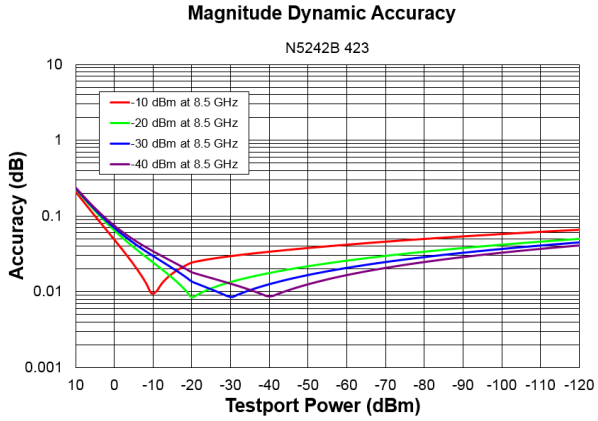



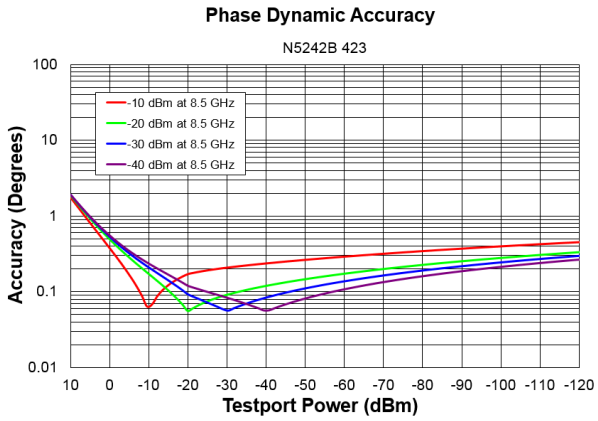
## Dynamic Accuracy, 1 GHz



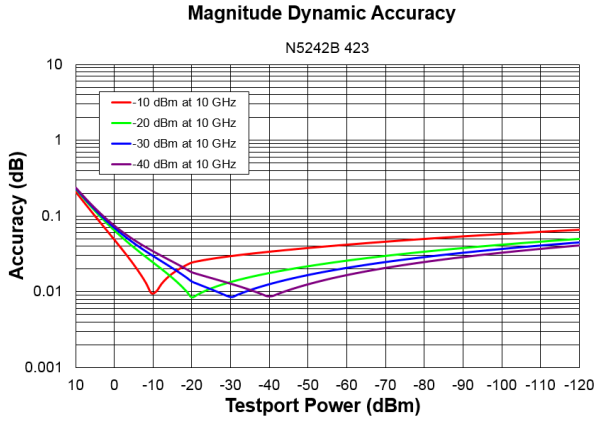



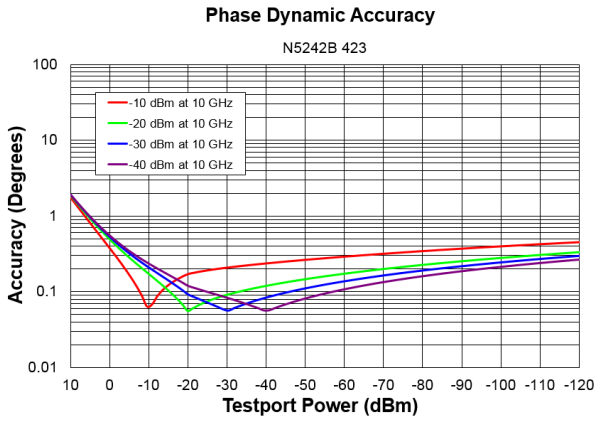

## Dynamic Accuracy, 8.5 GHz



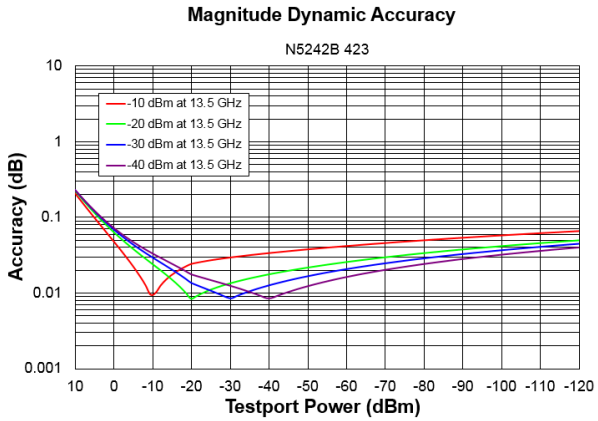



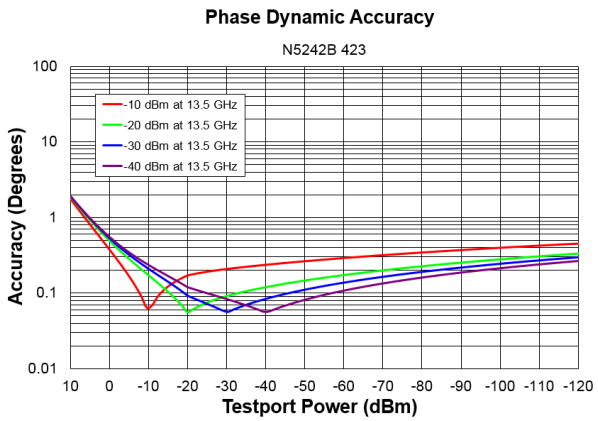

## Dynamic Accuracy, 10 GHz



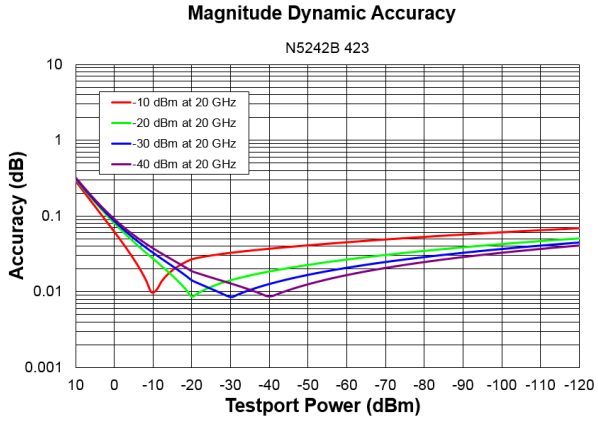



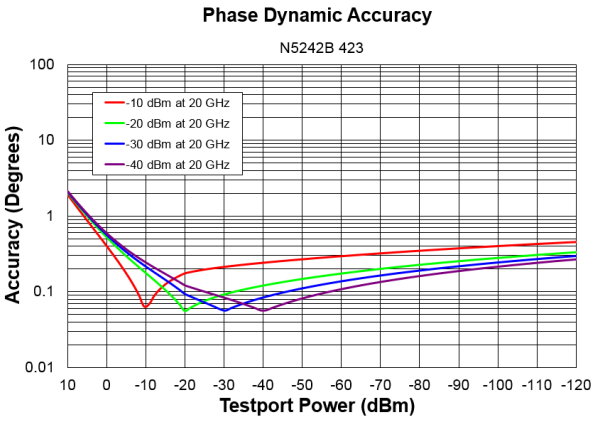
## Dynamic Accuracy, 13.5 GHz



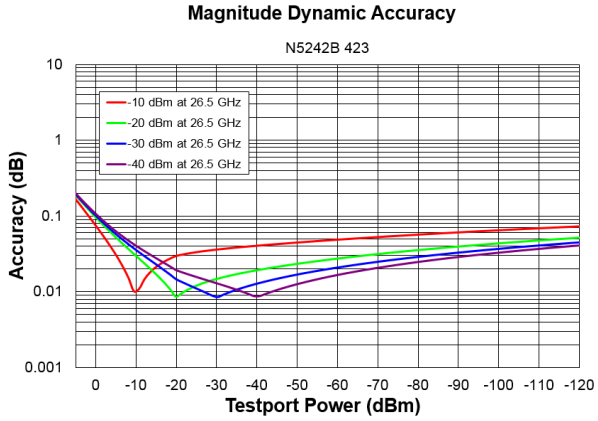




## Dynamic Accuracy, 20 GHz




## Dynamic Accuracy, 26.5 GHz



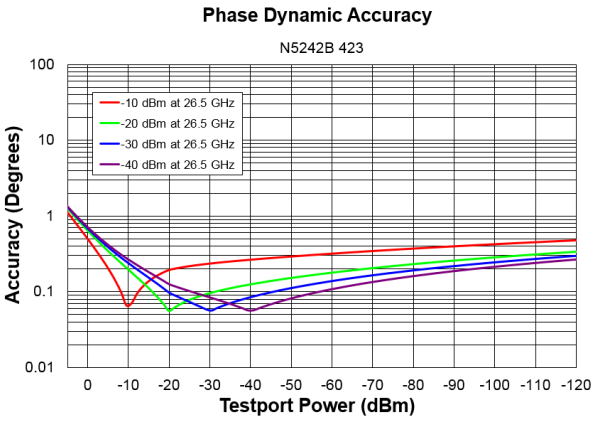
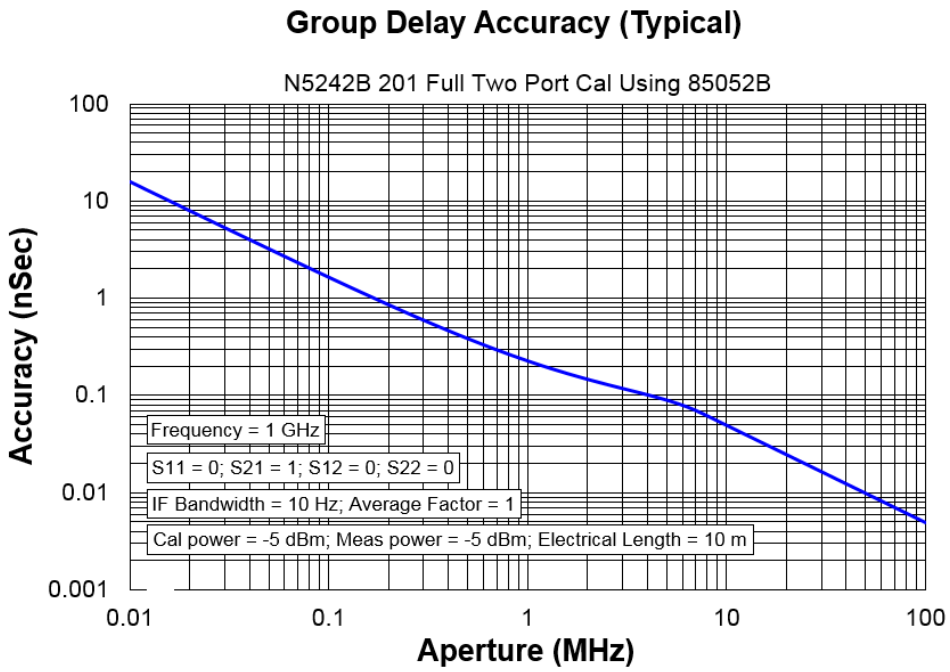



Table 30. Test Port Input (Group Delay)[1]

| 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 $kl \neq ij$




In general, the following formula can be used to determine the accuracy, in seconds, of specific group delay measurement:
±Phase Accuracy (deg)/[360 × 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 IFBWs are available ONLY with FW A.09.42 and later, and with DSP version 5) |
| CPU | For the latest information on CPUs and associated hard drives, visit: 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:<br>• A complete row or column consists of “stuck” or “dark” pixels.<br>• 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.<br>• 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.<br>• 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).<br>• “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 | ±2500° (at 500 degrees/div), max |
| Polar | 10 pUnits, min<br>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 ± 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 ± 1 ppm |
| Signal Type | Sine Wave |
| Output Level | +10 dBm ± 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 |
| | | 1 MHz | All | 7.692 MHz |
| | | 1.5 MHz | All | 7.368 MHz |
| | | 2 MHz | All | 8.450 MHz |
| | | 3 MHz | All | 8.163 MHz |
| | | 5 MHz | All | 6.897 MHz |
| | | 7 MHz | All | 10.53 MHz |
| | | 10 MHz | All | 15.38 MHz |
| | | 15 MHz | All | 22.22 MHz |
| Narrowband IF path: | 4 or 5 | All | All | 10.70 MHz |
| Input Impedance | 50 Ω | | | |
| RF Damage Level | +23 dBm | | | |
| DC Damage Level | 5.5 VDC | | | |
| 0.1 dB Compression Point | | | | |
| Normal IF path | -9.0 dBm at 7.438 MHz | | | |
| Narrowband IF path | -17 dBm at 10.70 MHz | | | |
| **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<br>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)<br>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<br>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 | 37 kg (82 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 ($S_{11}$) 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 Time[1] (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 SICL/LAN or TCP/IP Socket (Program executed in the analyzer) | | | | |
| 32-bit floating point | 0.18 | 0.21 | 0.5 | 3.6 |
| 64-bit floating point | 0.22 | 0.28 | 0.62 | 5.3 |
| ASCII | 6.3 | 12.3 | 47.3 | 470 |
| COM[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)

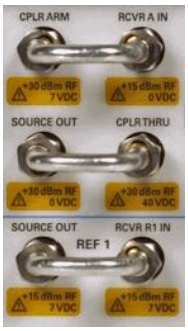
Conditions:

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

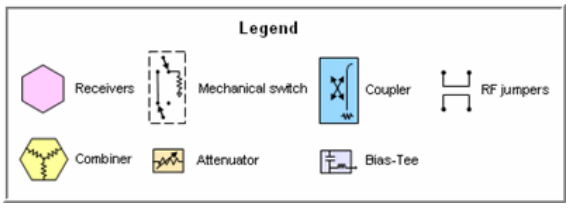



Figure 1. 2-Port N5241B, N5242B, and N5249B Base Unit Option 201

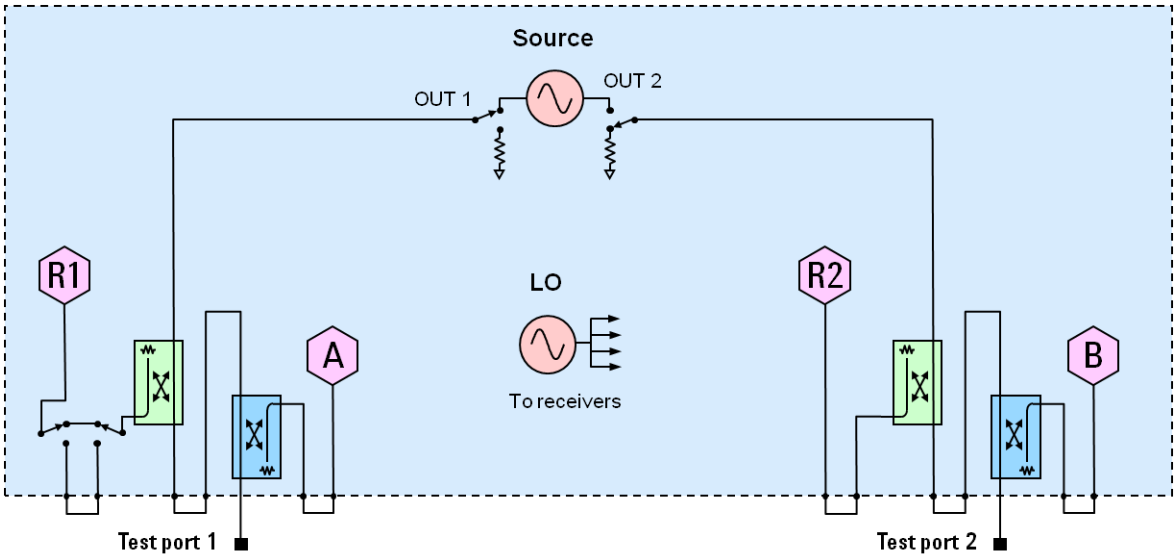



Figure 2. 2-Port N5241B, N5242B, and N5249B Option 217

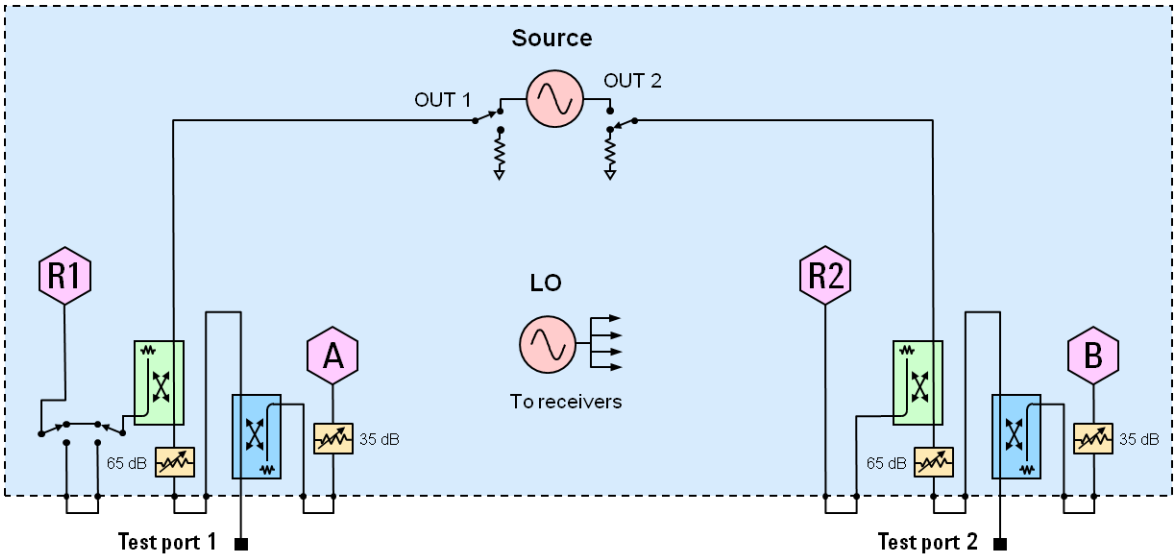


Figure 3. 2-Port N5241B, N5242B, and N5249B Option 219

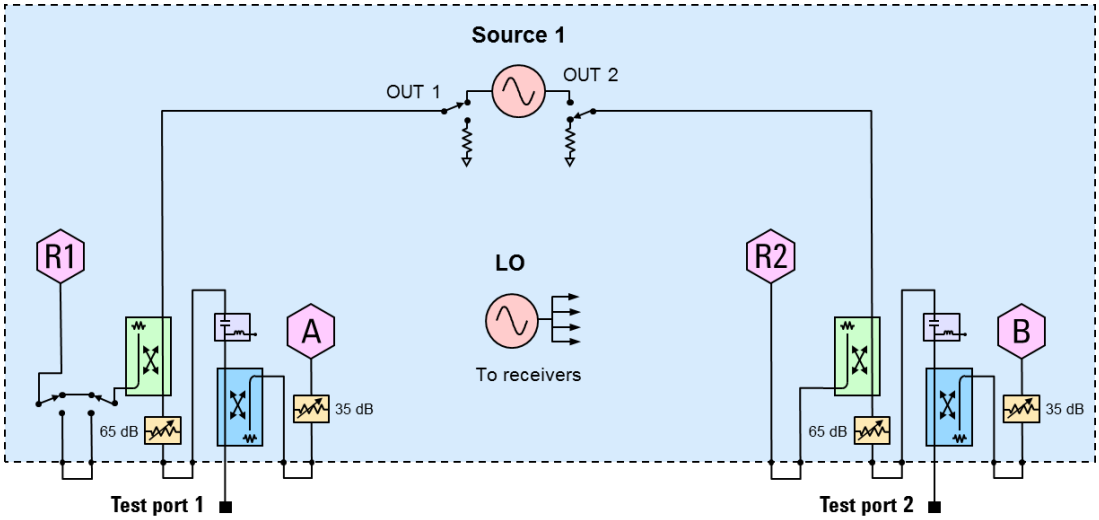



Figure 4. 2-Port N5241B, N5242B, and N5249B Option 222

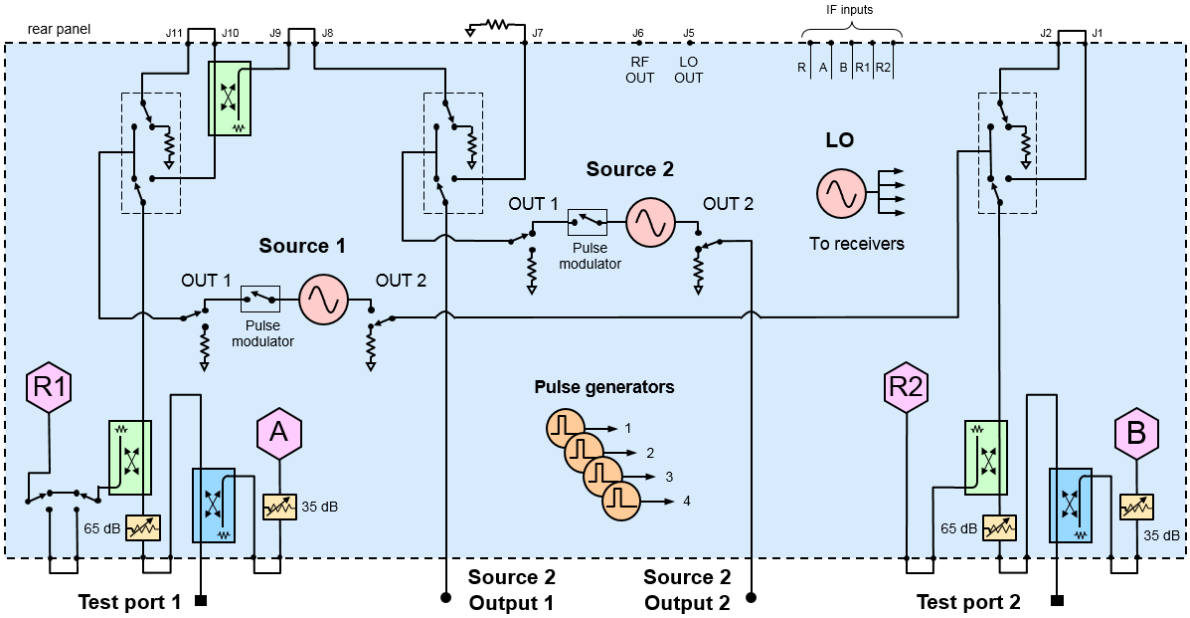


Figure 5. 2-Port N5241B, N5242B, and N5249B Option 224

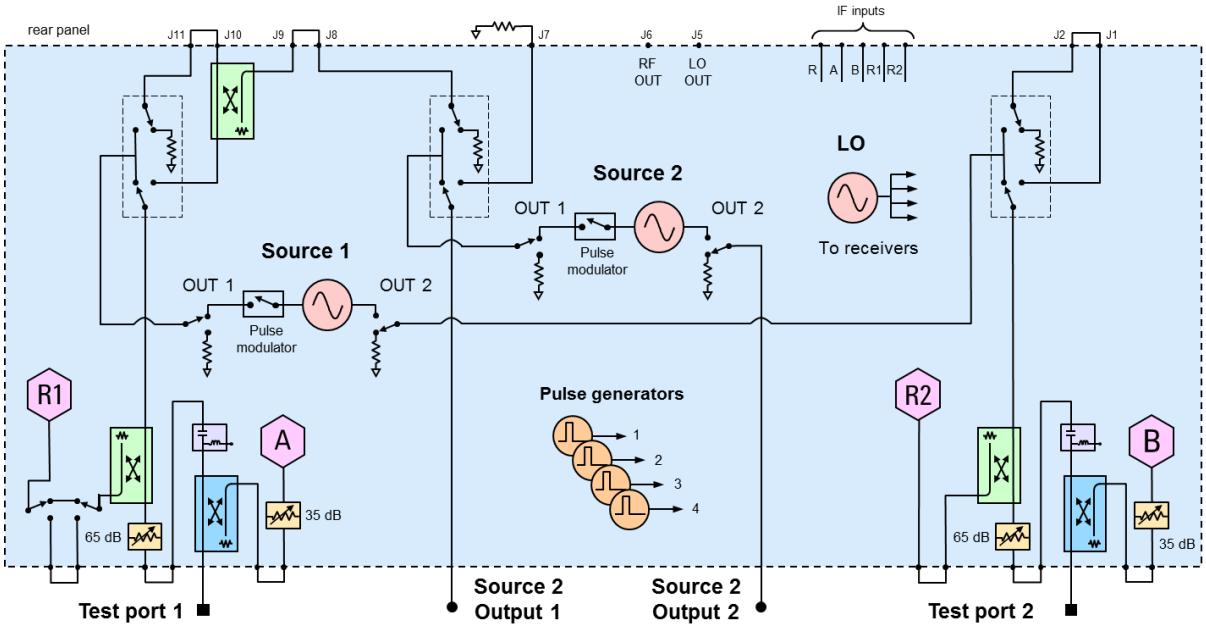



Figure 6. 2-Port N5241B, N5242B, and N5249B Option 224 with 029

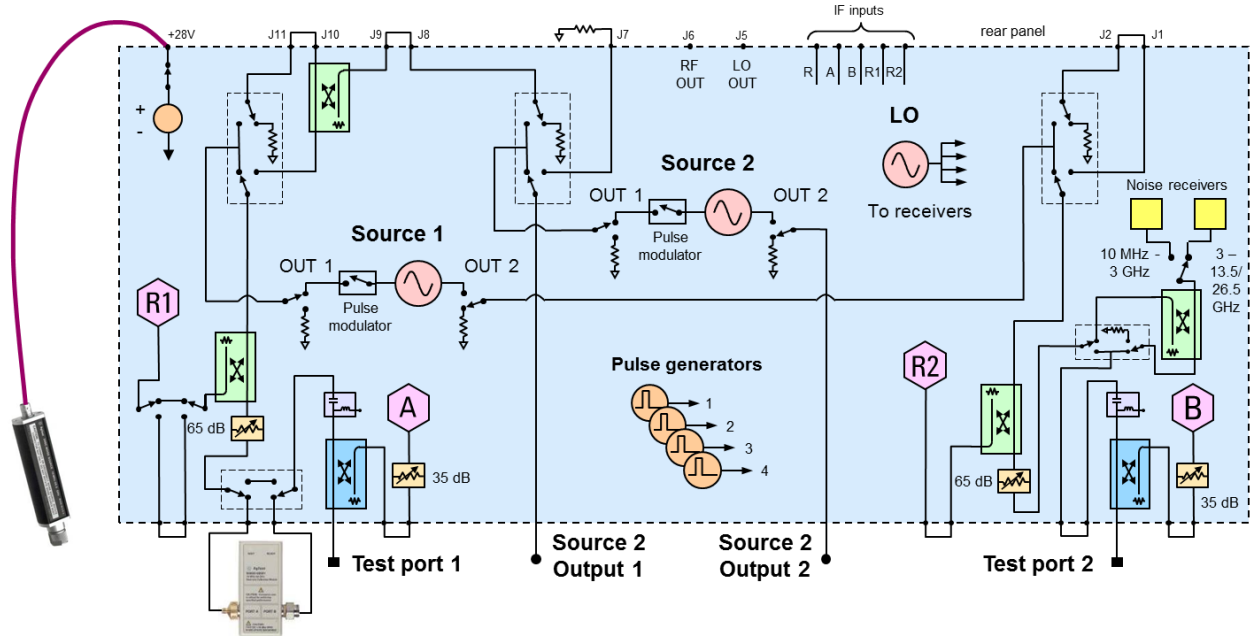


Figure 7. 4-Port N5241B, N5242B, and N5249B Base Unit Option 401

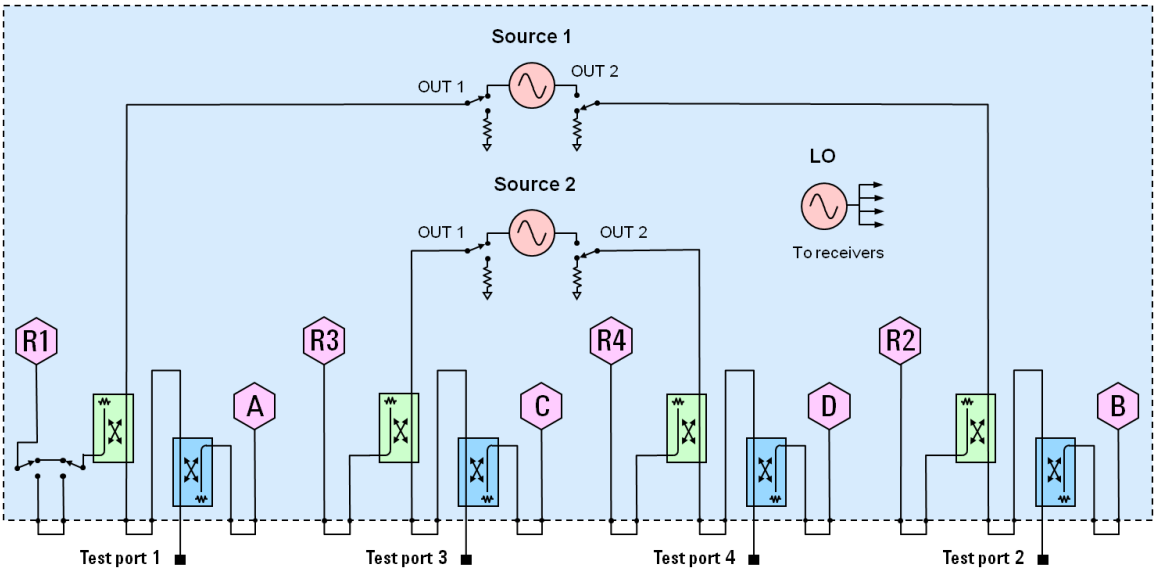



Figure 8. 4-Port N5241B, N5242B, and N5249B Option 417

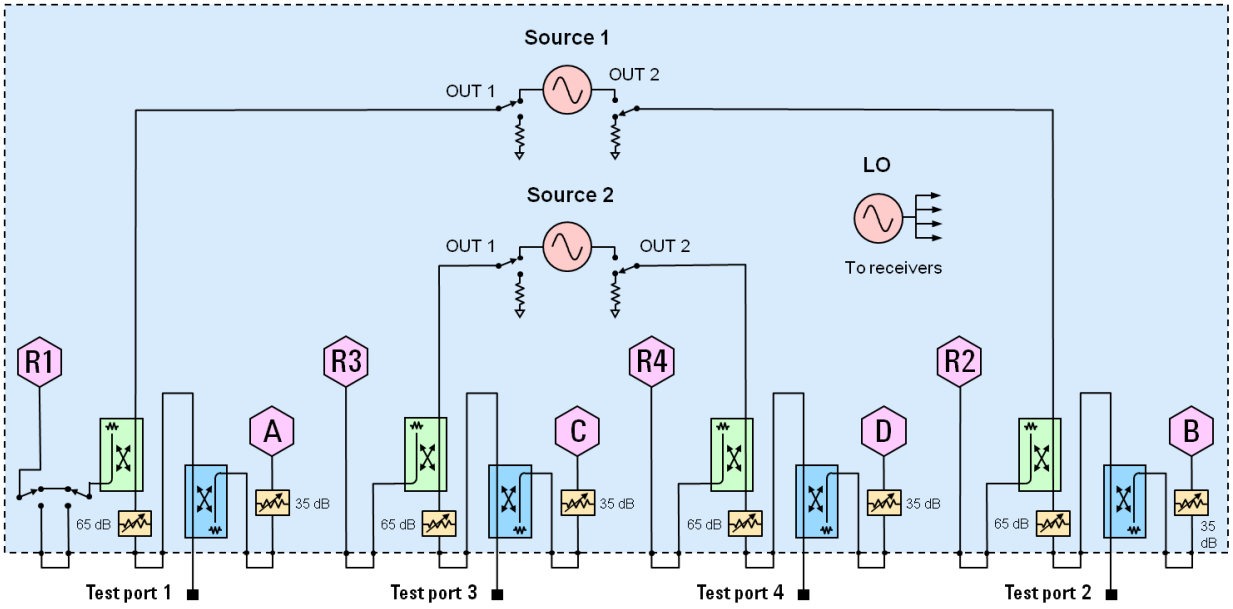


Figure 9. 4-Port N5241B, N5242B, and N5249B Option 419

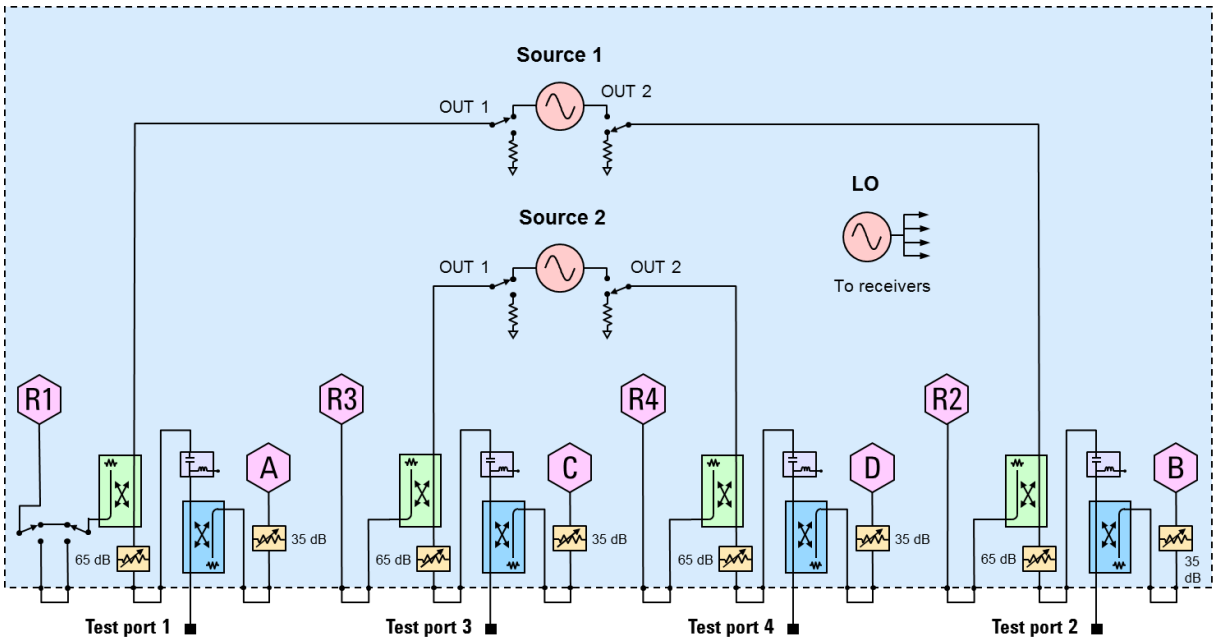



Figure 10. 4-Port N5241B, N5242B, and N5249B Option 422

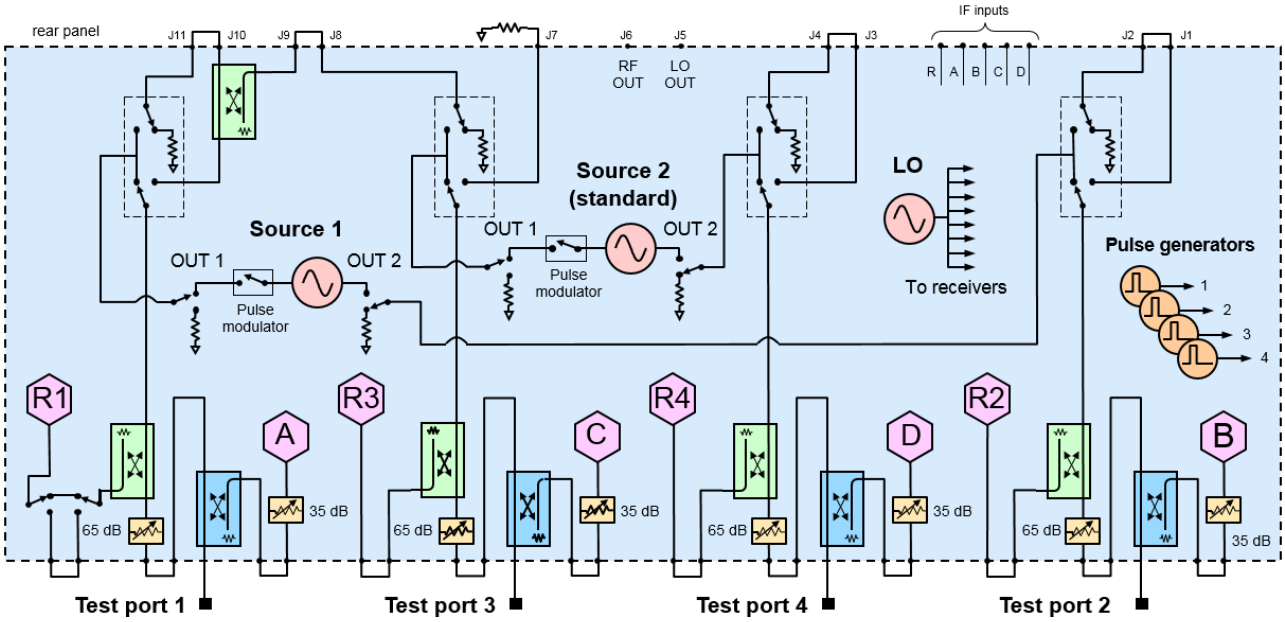


Figure 11. 4-Port N5241B, N5242B, and N5249B Option 423

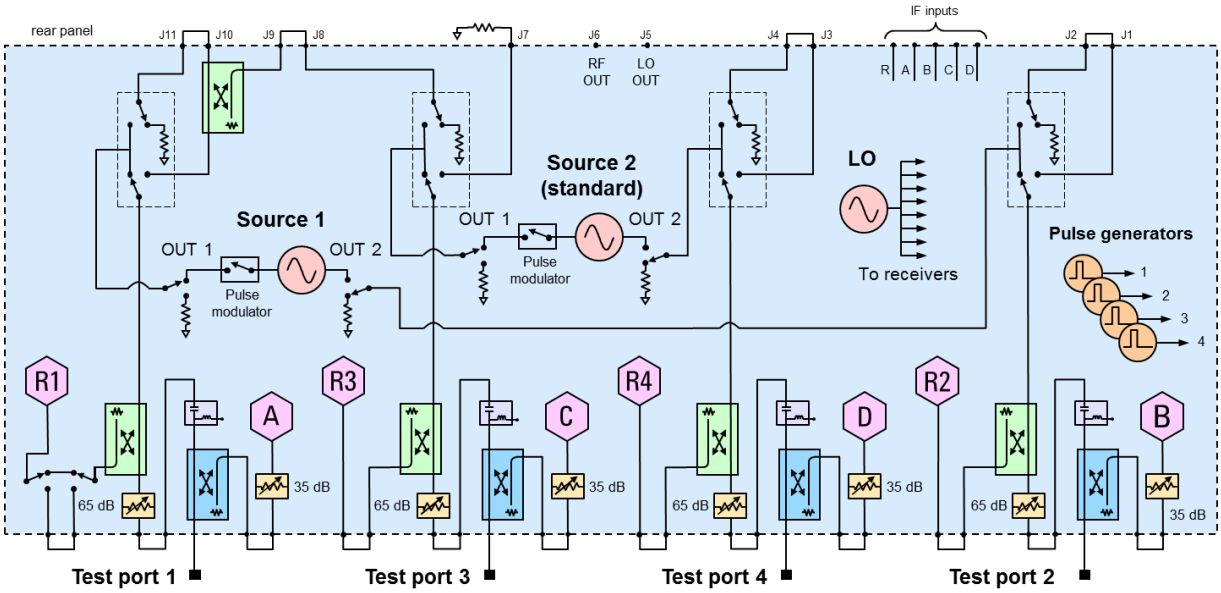



Figure 12. 4-Port N5241B, N5242B, and N5249B Option 423 with 029

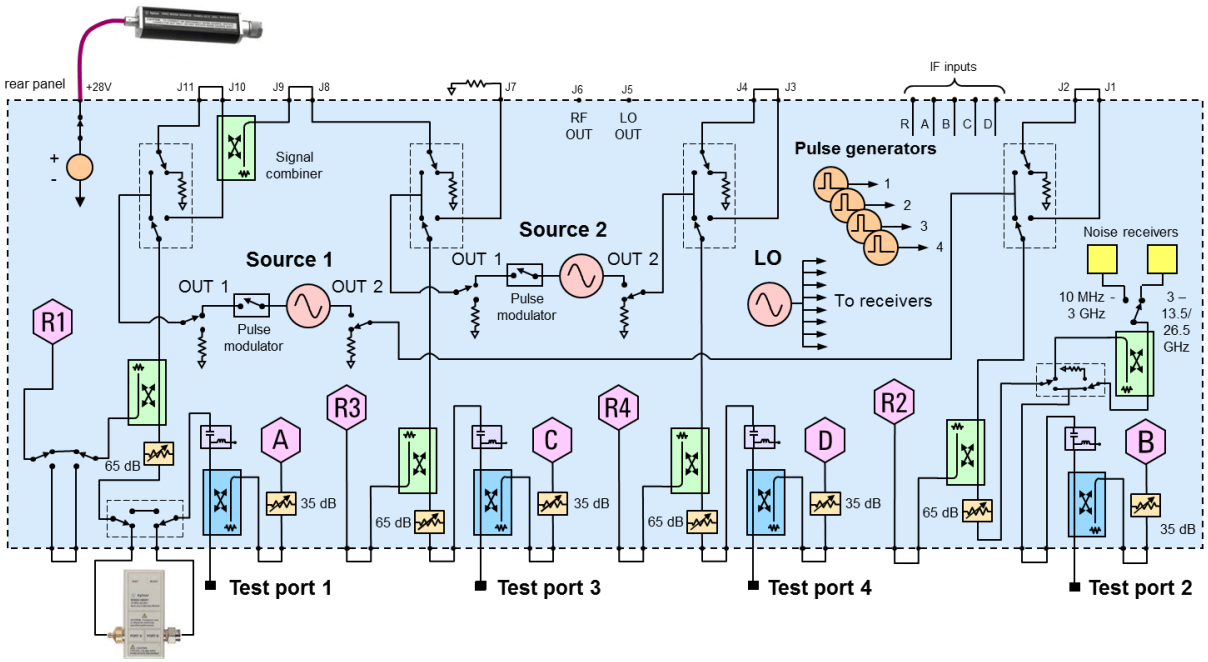


Figure 13. LFE Options

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.

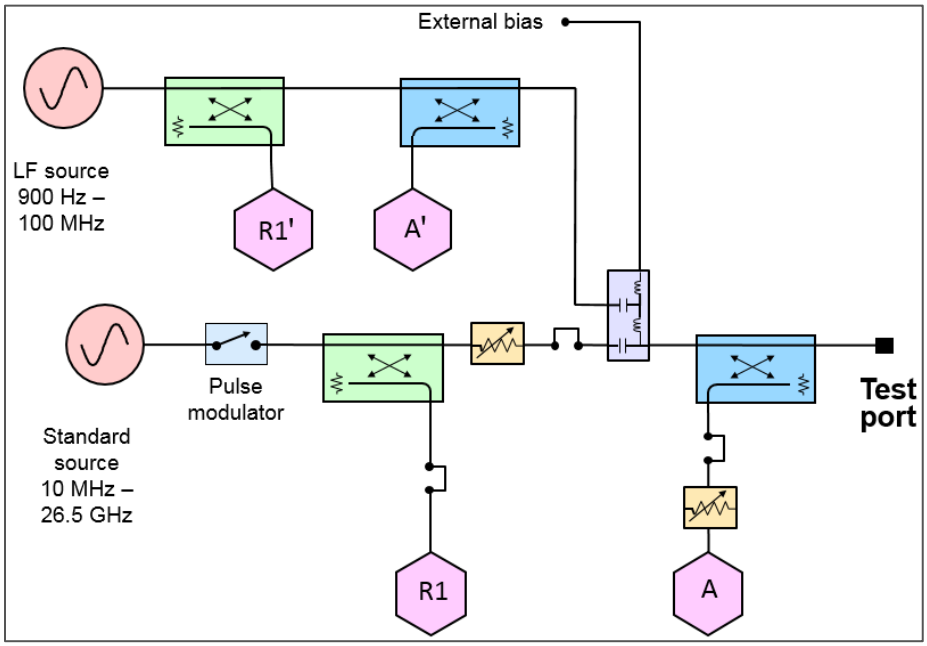
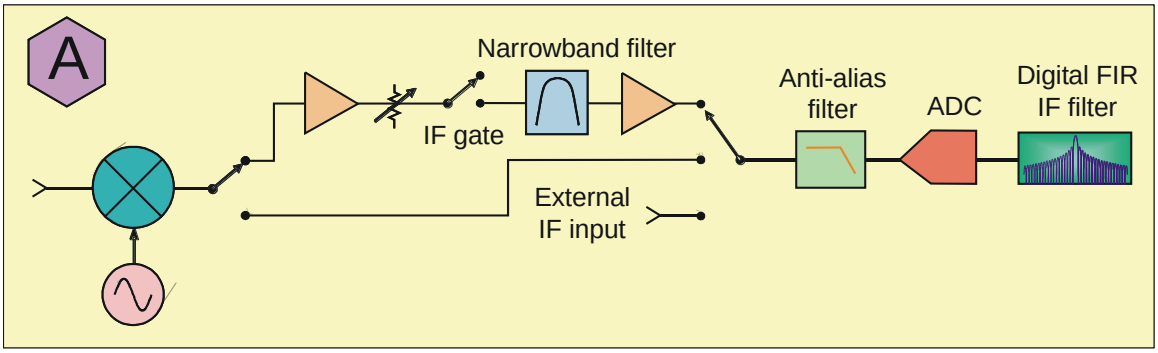



Figure 14. Receiver Block Diagram



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