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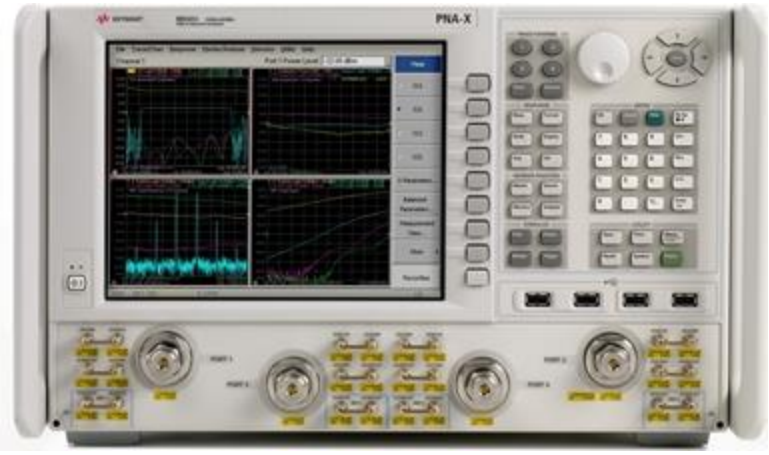
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# Keysight 2-Port and 4-Port PNA-X Network Analyzer

N5249A - 10 MHz to 8.5 GHz
N5241A - 10 MHz to 13.5 GHz
N5242A - 10 MHz 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 N5241A, N5242A, and N5249A with the following options:

Option 029, adds hardware and firmware for high-accuracy noise figure measurements. It requires one of option 219, 224, 419, or 423. See the block diagram.

Option 200, 2-port standard test set (includes six front-panel access loops) and power range. See the block diagram.

Option 219, adds 2-port extended power range, source and receiver attenuators, and bias-tees (requires Option 200). See the block diagram.

Option 224, adds an internal second source, a combiner, and mechanical switches to the 2-port analyzer (requires Option 200, 219, and 080). See the block diagram.

Option 400, 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 419, adds 4-port extended power range, source and receiver attenuators, and bias-tees (requires Option 400). See the block diagram.

Option 423, adds an internal combiner, and mechanical switches to the 4-port analyzer (requires Option 400, 419, and 080). See the block diagram.

**NOTE**

Specifications for the N5241AS, N5242AS, and N5249AS Option H85, when configured in standard configuration, are the same as those of closest N5241A, N5242A, and N5249A option configuration.

The Corrected System Performance with Cal Kits and Dynamic Accuracy Charts apply ONLY N5241A, N5242A, and N5249A 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.

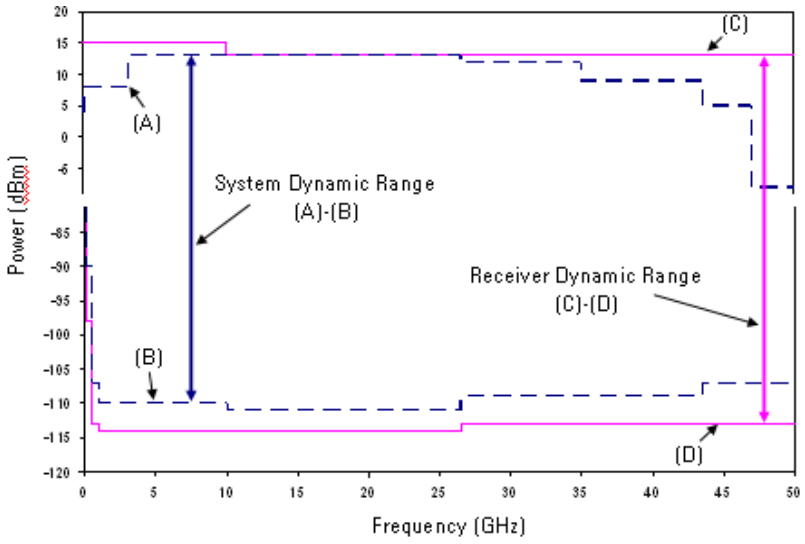
## Corrected System Performance

The specifications in this section apply for measurements made with the N5241A, N5242A, and N5249A 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 and Receiver Dynamic Range

- System Dynamic Range is defined as the max leveled output power (spec) minus the noise floor (spec).
- Extended Dynamic Range at Direct Access Input is defined as the specified source maximum output power (typical) minus the direct receiver access input noise floor (typical).
- Receiver Dynamic Range is defined as the test port compression at 0.1 dB (typical) minus the noise floor (typical).




NOTE

The effective dynamic range must take measurement uncertainties and interfering signals into account.

The direct receiver access input extended dynamic range is calculated as the difference between the direct receiver access input noise floor and the source maximum output power. This set-up should only be used when the receiver input will never exceed its maximum receiver input. When the analyzer is in segment sweep mode, it can have predefined frequency segments which will output a higher power level when the extended dynamic range is required (i.e. devices with high insertion loss), and reduced power when the maximum receiver input level will occur (i.e. devices with low insertion loss). The extended range is only available in one-path transmission measurements.

It may typically be degraded at particular frequencies below 500 MHz due to spurious receiver residuals.

Table 1. System Dynamic Range, Options 200 or 400, and Receiver Dynamic Range, All Options

| Description | Specification, Options 200, 400 | | | Typical, All Options | | |
|---|---|---|---|---|---|---|
| | System Dynamic Range (dB) (A)-(B) | Max Leveled Output Power (dBm) (A) | Test Port Noise Floor (dBm) (B) | Receiver Dynamic Range (dB) (C)-(D) | Test Port Compression at 0.1 dB (dBm) (C) | Test Port Noise Floor (dBm) (D) |
| | Ports 1,3[1] | Ports 1,3[1] | All Ports | All Ports | All Ports | All Ports |
| 10 MHz to 50 MHz | 93 | 13 | -80 | -- | -- | -87 |
| 50 MHz to 100 MHz | 103 | 13 | -90 | -- | -- | -95 |
| 100 MHz to 500 MHz | 117 | 13 | -104 | 125 | 15 | -110 |
| 500 MHz to 3.2 GHz | 124 | 10 | -114 | 130 | 13 | -117 |
| 3.2 GHz to 8.5 GHz | 127 | 13 | -114 | 130 | 13 | -117 |
| 8.5 GHz to 13.5 GHz | 127 | 13 | -114 | 130 | 13 | -117 |
| 13.5 GHz to 16 GHz | 127 | 13 | -114 | 130 | 13 | -117 |
| 16 GHz to 20 GHz | 127 | 13 | -114 | 129 | 12 | -117 |
| 20 GHz to 24 GHz | 122 | 12 | -110 | 125.5 | 10.5 | -115 |
| 24 GHz to 26.5 GHz | 112 | 5 | -107 | 123 | 10 | -113 |

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

Table 2a. System Dynamic Range at Test Port (dB), Options 200 or 400

| Description | Specification | | Typical | |
|---|---|---|---|---|
| | Ports 1, 31 | Ports 2, 41 | Ports 1, 31 | Ports 2, 41 |
| 10 MHz to 50 MHz | 93 | 93 | 106 | 104 |
| 50 MHz to 100 MHz | 103 | 103 | 116 | 115 |
| 100 MHz to 500 MHz | 117 | 117 | 131 | 130 |
| 500 MHz to 3.2 GHz | 124 | 127 | 130 | 135 |
| 3.2 GHz to 8.5 GHz | 127 | 127 | 137 | 136 |
| 8.5 GHz to 10 GHz | 127 | 127 | 137 | 136 |
| 10 GHz to 13.5 GHz | 127 | 127 | 134 | 133 |
| 13.5 GHz to 16 GHz | 127 | 127 | 134 | 133 |
| 16 GHz to 20 GHz | 127 | 124 | 133 | 129 |
| 20 GHz to 24 GHz | 122 | 117 | 130 | 126 |
| 24 GHz to 26.5 GHz | 112 | 109 | 124 | 120 |

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

Table 2b. System Dynamic Range at Test Port (dB), Options 219 or 419

| Description | Specification | | Typical | |
|---|---|---|---|---|
| | Ports 1, 3[1] | Ports 2, 4[1] | Ports 1, 3[1] | Ports 2, 4[1] |
| 10 MHz to 50 MHz | 93 | 93 | 106 | 104 |
| 50 MHz to 100 MHz | 103 | 103 | 115 | 114 |
| 100 MHz to 500 MHz | 117 | 117 | 130 | 129 |
| 500 MHz to 3.2 GHz | 124 | 127 | 130 | 135 |
| 3.2 GHz to 8.5 GHz | 127 | 127 | 135 | 134 |
| 8.5 GHz to 10 GHz | 127 | 127 | 135 | 134 |
| 10 GHz to 13.5 GHz | 126 | 125 | 132 | 131 |
| 13.5 GHz to 16 GHz | 126 | 125 | 132 | 131 |
| 16 GHz to 20 GHz | 124 | 122 | 130 | 127 |
| 20 GHz to 24 GHz | 118 | 117 | 127 | 124 |
| 24 GHz to 26.5 GHz | 110 | 106 | 121 | 117 |

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

Table 2c. System Dynamic Range at Test Port (dB), Option 224

| Description | Specification | | Typical | |
|---|---|---|---|---|
| | Source 2 Out 1 | Source 2 Out 2 | Source 2 Out 1 | Source 2 Out 2 |
| 10 MHz to 50 MHz | 98 | 93 | 108 | 105 |
| 50 MHz to 100 MHz | 108 | 107 | 117 | 116 |
| 100 MHz to 500 MHz | 122 | 121 | 132 | 131 |
| 500 MHz to 3.2 GHz | 128 | 128 | 134 | 136 |
| 3.2 GHz to 8.5 GHz | 132 | 132 | 139 | 139 |
| 8.5 GHz to 10 GHz | 132 | 132 | 139 | 139 |
| 10 GHz to 13.5 GHz | 130 | 130 | 138 | 137 |
| 13.5 GHz to 16 GHz | 130 | 130 | 138 | 137 |
| 16 GHz to 20 GHz | 129 | 127 | 136 | 134 |
| 20 GHz to 24 GHz | 123 | 122 | 133 | 132 |
| 24 GHz to 26.5 GHz | 114 | 112 | 127 | 124 |

Table 2d. System Dynamic Range at Test Port (dB), Options 224 or 423

| Description | Specification | | Typical | | | |
|---|---|---|---|---|---|---|
| | Ports 1, 3[1] | Ports 2, 4[1] | Ports 1, 3[1] | Ports 2, 4[1] | Source 1 Port 1 Combine Mode | Source 2 Port 1 Combine Mode |
| 10 MHz to 50 MHz | 93 | 93 | 106 | 104 | 104 | 80 |
| 50 MHz to 100 MHz | 103 | 103 | 115 | 115 | 112 | 90 |
| 100 MHz to 500 MHz | 117 | 117 | 130 | 130 | 121 | 99 |
| 500 MHz to 3.2 GHz | 124 | 127 | 130 | 134 | 127 | 112 |
| 3.2 GHz to 8.5 GHz | 127 | 127 | 136 | 134 | 132 | 119 |
| 8.5 GHz to 10 GHz | 127 | 127 | 136 | 134 | 132 | 119 |
| 10 GHz to 13.5 GHz | 126 | 124 | 132 | 131 | 128 | 115 |
| 13.5 GHz to 16 GHz | 126 | 124 | 132 | 131 | 128 | 115 |
| 16 GHz to 20 GHz | 124 | 121 | 130 | 127 | 125 | 113 |
| 20 GHz to 24 GHz | 117 | 115 | 127 | 124 | 121 | 109 |
| 24 GHz to 26.5 GHz | 107 | 105 | 121 | 117 | 115 | 102 |

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

Table 3a. Extended Dynamic Range at Direct Receiver Access Input (dB) – Typical

| Description | Options 200, 400 | | Options 219, 419 | |
|---|---|---|---|---|
| | Ports 1, 3[1] | Ports 2, 4[1] | Ports 1, 3[1] | Ports 2, 4[1] |
| 10 MHz to 50 MHz | 128 | 128 | 128 | 128 |
| 50 MHz to 100 MHz | 115 | 115 | 115 | 115 |
| 100 MHz to 500MHz | 129 | 129 | 129 | 129 |
| 500 MHz to 3.2 GHz | 136 | 139 | 136 | 139 |
| 3.2 GHz to 8.5 GHz | 139 | 139 | 139 | 139 |
| 8.5 GHz to 10 GHz | 139 | 139 | 139 | 139 |
| 10 GHz to 13.5 GHz | 139 | 139 | 138 | 137 |
| 13.5 GHz to 16 GHz | 139 | 139 | 138 | 137 |
| 16 GHz to 20 GHz | 139 | 136 | 136 | 134 |
| 20 GHz to 24 GHz | 134 | 129 | 130 | 129 |
| 24 GHz to 26.5 GHz | 124 | 121 | 122 | 118 |

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

Table 3b. Extended Dynamic Range at Direct Receiver Access Input (dB) - Typical

| Description | Option 224 | | Options 224, 423 | | | |
|---|---|---|---|---|---|---|
| | Source 2 Out 1 | Source 2 Out 2 | Ports 1, 3[1] | Ports 2, 4[1] | Source 1 Port 1 Combine Mode | Source 2 Port 1 Combine Mode |
| 10 MHz to 50 MHz | 133 | 128 | 128 | 128 | 139 | 115 |
| 50 MHz to 100 MHz | 120 | 119 | 115 | 115 | 124 | 102 |
| 100 MHz to 500MHz | 134 | 133 | 129 | 129 | 133 | 111 |
| 500 MHz to 3.2 GHz | 140 | 140 | 136 | 139 | 139 | 124 |
| 3.2 GHz to 8.5 GHz | 144 | 144 | 139 | 139 | 144 | 131 |
| 8.5 GHz to 10 GHz | 144 | 144 | 139 | 139 | 144 | 131 |
| 10 GHz to 13.5 GHz | 142 | 142 | 138 | 136 | 140 | 127 |
| 13.5 GHz to 16 GHz | 142 | 142 | 138 | 136 | 140 | 127 |
| 16 GHz to 20 GHz | 141 | 139 | 136 | 133 | 137 | 125 |
| 20 GHz to 24 GHz | 135 | 134 | 129 | 127 | 133 | 121 |
| 24 GHz to 26.5 GHz | 126 | 124 | 119 | 121 | 127 | 114 |

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

# Corrected System Performance with 3.5mm Connectors, All Opts

Specifications are valid for temperatures of 23° ±3 °C, with < 1 °C deviation from the calibration temperature.

Applies to the N5241A, N5242A, and N5249A Option 200 or 219 or 224 or 400 or 419 or 423 analyzers with serial numbers listed below, 85131F flexible test port cable set, and a full 2-port calibration.

N5241A and N5241AS: MY5241/SG5241/US5241 and above
N5242A and N5242AS: MY5242/SG5242/US5242 and above

For Tables 4, 5, and 6, 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.

This document does not present specifications for the 85052C or 85052D Calibration Kit.

For any Sii reflection measurement:

- Sjj = 0.

For any Sij transmission measurement:

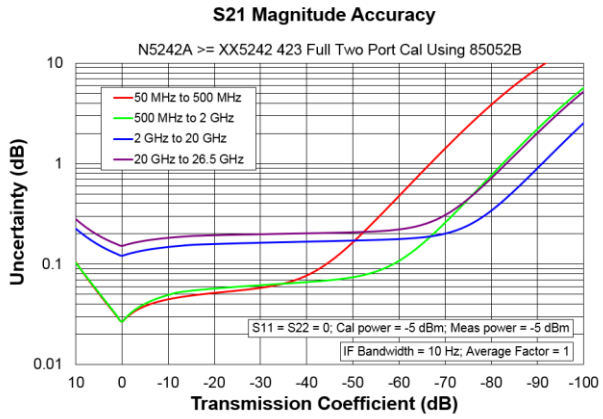
- Sji = Sij when Sij ≤ 1
- Sji = 1/Sij when Sij > 1
- Skk = 0 for all k

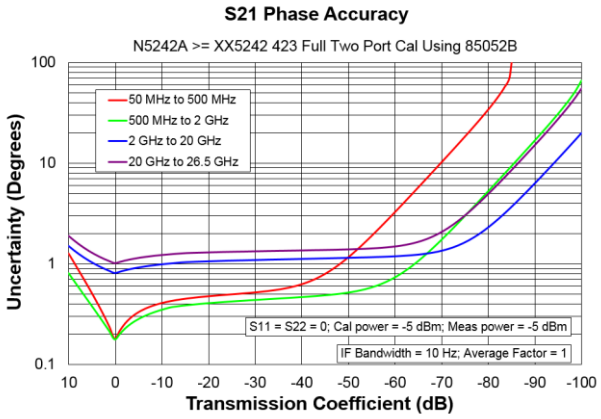
Please download our free Uncertainty Calculator from http://www.keysight.com/find/na_calculator to generate the curves for your calibration kit and PNA setup.

Table 4. 85052B Calibration Kit

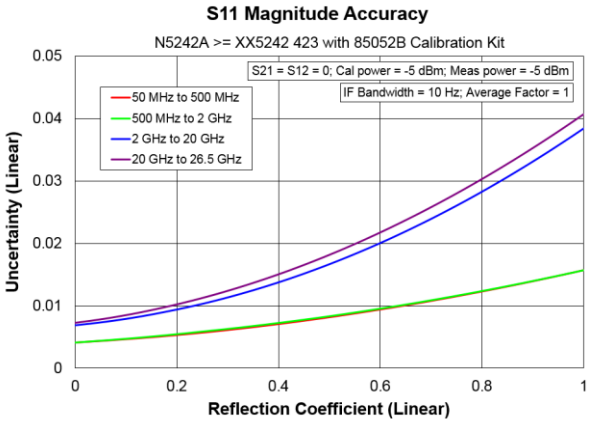
| Description | Specification (dB) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 10 MHz to 50 MHz | 50 MHz to 500 MHz | 500 MHz to 2 GHz | 2 GHz to 8.5 GHz | 8.5 GHz to 13.5 GHz | 13.5 GHz to 20 GHz | 20 GHz to 26.5 GHz |
| Directivity | 48 | 48 | 48 | 44 | 44 | 44 | 44 |
| Source Match | 40 | 40 | 40 | 31 | 31 | 31 | 31 |
| Load Match | 48 | 48 | 48 | 44 | 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 | ±0.035 | ±0.017 | ±0.017 | ±0.066 | ±0.092 | ±0.11 | ±0.12 |
| Phase (°) | ±0.23 | ±0.11 | ±0.11 | ±0.44 | ±0.61 | ±0.70 | ±0.80 |

## Transmission Uncertainty




## Reflection Uncertainty



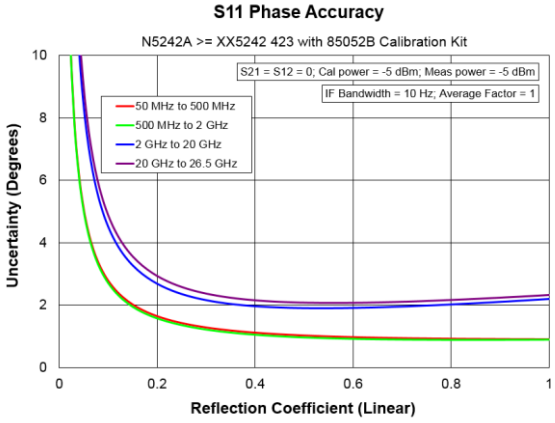
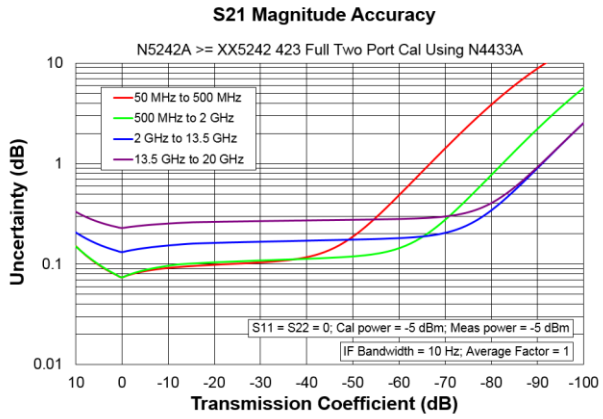



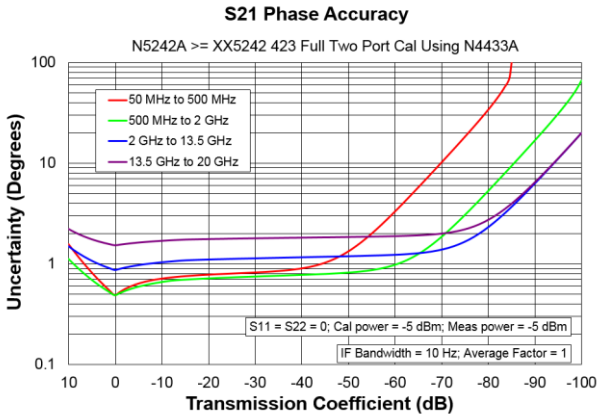
Table 5. N4433A 4-Port Electronic Calibration Module

NOTE Uncertainty curves for the N4433A are created using a 2-port calibration. Multiport uncertainties are not supported at this time.

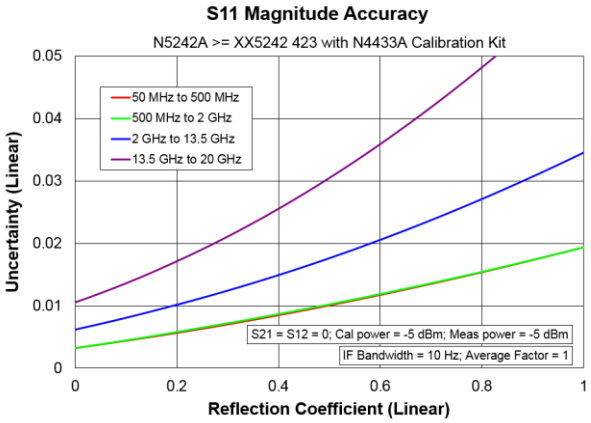
| Description | Specification (dB) | | | | | |
|---|---|---|---|---|---|---|
| | 10 MHz to 50 MHz | 50 MHz to 500 MHz | 500 MHz to 2 GHz | 2 GHz to 8.5 GHz | 8.5 GHz to 13.5 GHz | 13.5 GHz to 20 GHz |
| Directivity | 50 | 50 | 50 | 47 | 45 | 40 |
| Source Match | 42 | 42 | 42 | 39 | 37 | 31 |
| Load Match | 50 | 50 | 50 | 47 | 40 | 35 |
| Reflection Tracking | | | | | | |
| Mag | ±0.061 | ±0.061 | ±0.061 | ±0.091 | ±0.11 | ±0.18 |
| Phase (°) | ±0.40 | ±0.40 | ±0.40 | ±0.60 | ±0.67 | ±1.2 |
| Transmission Tracking | | | | | | |
| Mag | ±0.028 | ±0.014 | ±0.014 | ±0.030 | ±0.059 | ±0.14 |
| Phase (°) | ±0.18 | ±0.088 | ±0.088 | ±0.20 | ±0.39 | ±0.89 |

## Transmission Uncertainty




## Reflection Uncertainty



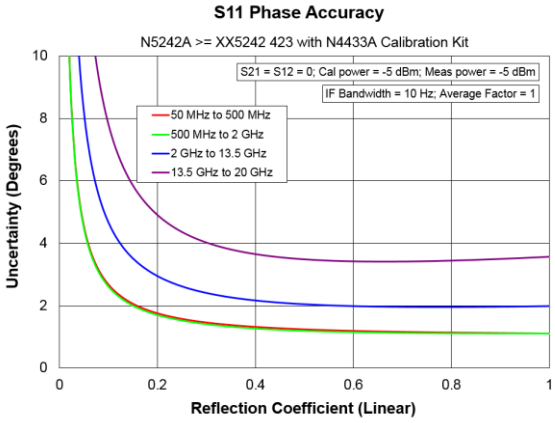
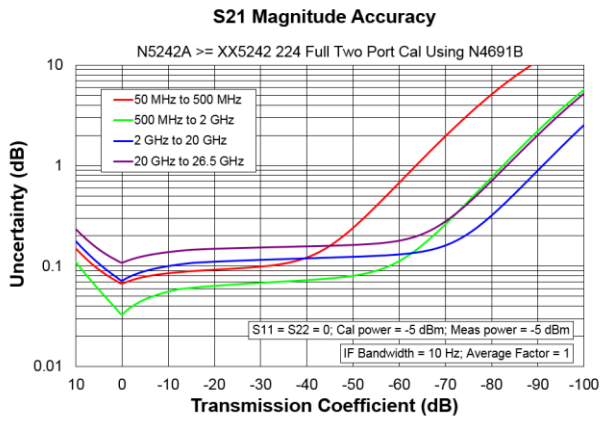
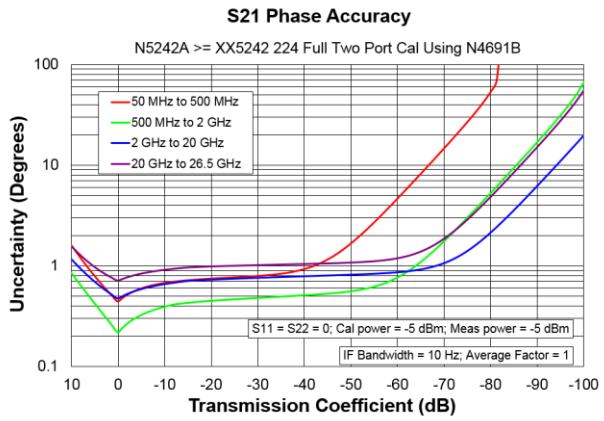



Table 6. N4691B 2-Port Electronic Calibration Module

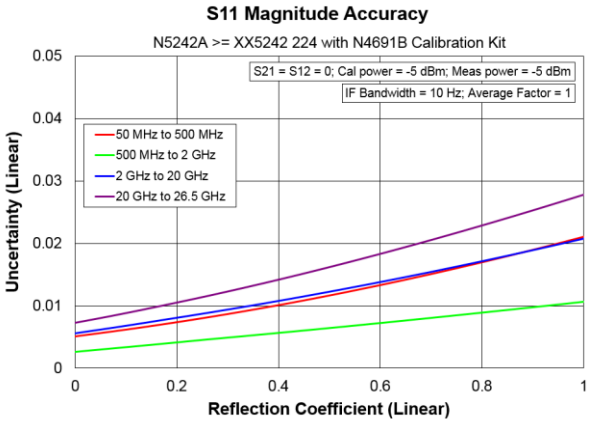
| Description | Specification (dB) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 10 MHz to 50 MHz | 50 MHz to 500 MHz | 500 MHz to 2 GHz | 2 GHz to 8.5 GHz | 8.5 GHz to 13.5 GHz | 13.5 GHz to 20 GHz | 20 GHz to 26.5 GHz |
| Directivity | 46 | 46 | 52 | 48 | 46 | 46 | 44 |
| Source Match | 41 | 41 | 47 | 45 | 42 | 42 | 40 |
| Load Match | 46 | 46 | 52 | 48 | 43 | 43 | 41 |
| 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 | ±0.035 | ±0.017 | ±0.0083 | ±0.018 | ±0.036 | ±0.043 | ±0.065 |
| Phase (°) | ±0.23 | ±0.11 | ±0.055 | ±0.12 | ±0.24 | ±0.29 | ±0.43 |

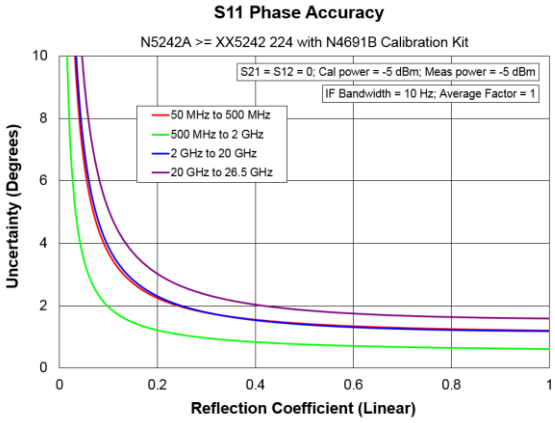
## Transmission Uncertainty




## Reflection Uncertainty



## 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 200, 219, 224, 400, 419, 423 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 7a. Directivity (dB)

| Description | Specification | | Typical | |
|---|---|---|---|---|
| | Options 200, 219, 224, 400, 419, 423 | Option 029 | Options 200, 219, 224, 400, 419, 423 | Option 029 |
| | All Ports | Ports 1, 2 | All Ports | Ports 1, 2 |
| 10 MHz to 50 MHz | 16 | 16 | 23 | 22 |
| 50 MHz to 500 MHz | 24 | 24 | 28 | 28 |
| 500 MHz to 3.2 GHz | 24 | 24 | 32 | 32 |
| 3.2 GHz to 8.5 GHz | 23 | 23 | 25 | 25 |
| 8.5 GHz to 10 GHz | 23 | 23 | 25 | 25 |
| 10 GHz to 13.5 GHz | 16 | 16 | 22 | 20 |
| 13.5 GHz to 16 GHz | 16 | 16 | 22 | 20 |
| 16 GHz to 20 GHz | 16 | 15 | 22 | 20 |
| 20 GHz to 24 GHz | 16 | 15 | 22 | 20 |
| 24 GHz to 26.5 GHz | 16 | 15 | 22 | 20 |

Table 7b. Source Match (dB)

| Description | Specification | | | Typical | | |
|---|---|---|---|---|---|---|
| | Options 200, 219, 224, 400, 419, 423 | Option 029 | | Options 200, 219, 224, 400, 419, 423 | Option 029 | |
| | All Ports | Port 1 | Port 2 | All Ports | Port 1 | Port 2 |
| 10 MHz to 50 MHz | 11 | 9 | 9 | 14 | 13 | 12 |
| 50 MHz to 500 MHz | 18 | 18 | 13 | 28 | 28 | 15 |
| 500 MHz to 3.2 GHz | 18 | 17 | 9 | 22 | 22 | 12 |
| 3.2 GHz to 8.5 GHz | 14 | 12 | 6 | 18 | 18 | 7 |
| 8.5 GHz to 10 GHz | 14 | 12 | 6 | 18 | 18 | 7 |
| 10 GHz to 13.5 GHz | 12 | 11 | 6 | 16 | 16 | 8 |
| 13.5 GHz to 16 GHz | 12 | 11 | 6 | 16 | 16 | 8 |
| 16 GHz to 20 GHz | 10 | 9 | 7 | 15 | 13 | 9 |
| 20 GHz to 24 GHz | 10 | 8 | 6 | 14 | 13 | 9 |
| 24 GHz to 26.5 GHz | 8 | 7 | 6 | 12 | 12 | 9 |

Table 7c. Load Match (dB)

| Description | Specification | | | Typical | | |
|---|---|---|---|---|---|---|
| | Options 200, 219, 224, 400, 419, 423 | Option 029 | | Options 200, 219, 224, 400, 419, 423 | Option 029 | |
| | All Ports | Port 1 | Port 2 | All Ports | Port 1 | Port 2 |
| 10 MHz to 50 MHz | 11 | 11 | 9 | 18 | 18 | 12 |
| 50 MHz to 500 MHz | 17 | 17 | 13 | 25 | 24 | 15 |
| 500 MHz to 3.2 GHz | 17 | 15 | 9 | 22 | 19 | 12 |
| 3.2 GHz to 8.5 GHz | 13 | 10 | 5.5 | 17 | 15 | 7.5 |
| 8.5 GHz to 10 GHz | 13 | 10 | 5.5 | 17 | 15 | 7.5 |
| 10 GHz to 13.5 GHz | 10 | 9 | 5.5 | 15 | 15 | 7.5 |
| 13.5 GHz to 16 GHz | 10 | 9 | 5.5 | 15 | 15 | 7.5 |
| 16 GHz to 20 GHz | 9 | 8 | 5.5 | 14 | 13 | 7.5 |
| 20 GHz to 24 GHz | 9 | 7 | 5.5 | 14 | 13 | 7.5 |
| 24 GHz to 26.5 GHz | 8 | 7 | 5.5 | 13 | 11 | 7.5 |

Table 7d. Transmission Tracking, Reflection Tracking, Crosstalk (dB), All Options, All Ports - Typical

| | Transmission Tracking | Reflection Tracking | Crosstalk |
|---|---|---|---|
| 10 MHz to 50 MHz | +/-1.5 | +/-1.5 | -84 |
| 50 MHz to 100 MHz | +/-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 |

## 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 8. Frequency Information, All Options

| Description | Specification (dB) | Typical (dB) |
|---|---|---|
| N5249A Frequency Range | 10 MHz to 8.5 GHz | -- |
| N5241A Frequency Range | 10 MHz to 13.5 GHz | -- |
| N5242A Frequency Range | 10 MHz to 26.5 GHz | -- |
| 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 9a. Maximum Leveled Power (dBm), Options 200 or 400

| Description | Specification | | | Typical | | |
|---|---|---|---|---|---|---|
| | Ports 1, 3[1] | | Ports 2, 4[1] | Ports 1, 3[1] | | Ports 2, 4[1] |
| | 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 9b. Maximum Leveled Power (dBm), Options 219 or 419

| Description | Specification | | | Typical | | |
|---|---|---|---|---|---|---|
| | Ports 1, 3[1] | | Ports 2, 4[1] | Ports 1, 3[1] | | Ports 2, 4[1] |
| | 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 9c. Maximum Leveled Power (dBm), Option 219 or 419 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 9b 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 9d. Maximum Leveled Power (dB), Options 224 or 423

| Description | Specification | | | Typical | | |
|---|---|---|---|---|---|---|
| | Ports 1, 3[1] | | Ports 2, 4[1] | Ports 1, 3[1] | | Ports 2, 4[1] |
| | 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 9e. Maximum Leveled Power (dBm), Options 224 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 9f. Maximum Leveled Power (dBm), Option 224

| Description | Specification | | | Typical | | |
|---|---|---|---|---|---|---|
| | Source 2 Out 1 | | Source 2 Out 2 | Source 2 Out 1 | | Source 2 Out 2 |
| | Filt. Mode2 | Hi Pwr Mode2 | | Filt. Mode2 | Hi Pwr Mode2 | |
| 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 9g. Maximum Leveled Power (dB), Options 224 or 423 with 029[1]

| Description | Specification | | | Typical | | |
|---|---|---|---|---|---|---|
| | Port 1 | | Ports 2 | Port 1 | | Ports 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 affects port 1 and port 2 maximum leveled power. Refer to Table 9c 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 9h. Maximum Leveled Power (dBm), Options 224 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 10. Power Level Accuracy (dB) at Nominal Power[1], All Options

| Description | Specification | | Typical | |
|---|---|---|---|---|
| | Ports 1, 2, 3, 4[2] | Source 2 Out 1<br>Source 2 Out 2 | Ports 1, 2, 3, 4[2] | Source 2 Out 1<br>Source 2 Out 2 |
| 10 MHz to 50 MHz | +/-1.5 | +/-2.5 | +/-0.40 | +/-0.55 |
| 50 MHz to 500 MHz | +/-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.

Table 11a. Power Level Linearity[1] (dB), All Options - Specification

| Description | Ports 1, 3[2]<br>-25 dBm ≤ P <-20 dBm | Ports 1, 3[2]<br>-20 dBm ≤ P <-15 dBm | Ports 1, 3[2]<br>P ≥-15 dBm |
|---|---|---|---|
| 10 MHz to 50 MHz | +/-2.0 | +/-1.5 | +/-1.0 |
| 50 MHz to 500 MHz | +/-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.

Table 11b. Power Level Linearity[1] (dB), All Options - Specification

| Description | Ports 2, 4[2]<br>-25 dBm ≤ P <-20 dBm | Ports 2, 4[2]<br>-20 dBm ≤ P <-15 dBm | Ports 2, 4[2]<br>P ≥-15 dBm |
|---|---|---|---|
| 10 MHz to 50 MHz | +/-5.0 | +/-2.0 | +/-1.5 |
| 50 MHz to 500 MHz | +/-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.

Table 11c. Power Level Linearity[1] (dB), Option 224 - 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 | +/-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.

Table 12a. Power Sweep Range (dB), Options 200 or 400

| Description | Specification | | Typical | |
|---|---|---|---|---|
| | Ports 1, 3[1] | Ports 2, 4[1] | Ports 1, 3[1] | Ports 2, 4[1] |
| 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 12b. Power Sweep Range (dB), Options 219 or 419

| Description | Specification | | Typical | |
|---|---|---|---|---|
| | Ports 1, 3[1] | Ports 2, 4[1] | Ports 1, 3[1] | Ports 2, 4[1] |
| 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 12c. Power Sweep Range (dB), Options 219 or 419 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 affects port 1 and port 2 power sweep ranges. Refer to Table 12b for other ports.

[2] Source in filtered mode where applicable.

Table 12d. Power Sweep Range (dB), Options 224 or 423

| Description | Specification | | Typical | |
|---|---|---|---|---|
| | Ports 1, 3[1] | Ports 2, 4[1] | Ports 1, 3[1] | Ports 2, 4[1] |
| 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 12e. Power Sweep Range (dB), Option 224

| 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 12f. Power Sweep Range (dB), Options 224 or 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 12d for other ports.

[2] Source in filtered mode where applicable.

Table 13. Nominal Power (Preset Power, dBm)

| Description | Options 200, 400 | Options 219, 224, 419, 423 | Option 224 | | Options 224, 423 | |
|---|---|---|---|---|---|---|
| | 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 |
| N5241A | 0 | -5 | -5 | -5 | -5 | -5 |
| N5242A | 0 | -5 | -5 | -5 | -5 | -5 |
| N5249A | 0 | -5 | -5 | -5 | -5 | -5 |

[1] Any port can be used as the source port.

Table 14. Power Resolution and Maximum/Minimum Settable Power, All Ports[1]

| Description | Specification (dB) | Typical (dBm) | | |
|---|---|---|---|---|
| | All Options | All Options | Options 200, 400 | Options 219, 419, 224, 423 |
| Power Resolution | 0.01 | -- | -- | -- |
| Maximum Settable Power | -- | 30 | -- | -- |
| Minimum Settable Power | -- | -- | -30 | -95 |

[1] Any port can be used as the source port.

Table 15. Harmonics at Max Specified Power (dBc), All Options - Typical

| Description[1] | 2nd and 3rd Harmonics | | 1/2 and 1/4 Sub-Harmonics | |
|---|---|---|---|---|
| | Ports 1, 3[2] Source 2 Out 1[3] | Ports 2, 4[2] Source 2 Out 2 | Ports 1 3[2] Source 2 Out 1[3] | Ports 2, 4[2] Source 2 Out 2 |
| 10 MHz to 2 GHz | -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.

Table 16. Non-Harmonic Spurs (dBc) at Nominal Power, All Options, All Ports – Typical

| Description | Based on 8 kHz offset Frac-N |
|---|---|
| 10 MHz to 500 MHz | -50 |
| 500 MHz to 2 GHz | -60 |
| 2 GHz to 4 GHz | -57 |
| 4 GHz to 8 GHz | -51 |
| 8 GHz to 8.5 GHz | -45 |
| 8.5 GHz to 13.5 GHz | -45 |
| 13.5 GHz to 16 GHz | -45 |
| 16 GHz to 24 GHz | -39 |
| 24 GHz to 26.5 GHz | -33 |

Table 17. 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 | -85 | -85 | -85 | -120 |
| 500 MHz to 1 GHz | -105 | -115 | -110 | -127 |
| 1 GHz to 2 GHz | -100 | -110 | -105 | -121 |
| 2 GHz to 4 GHz | -95 | -105 | -100 | -115 |
| 4 GHz to 8 GHz | -89 | -100 | -94 | -110 |
| 8 GHz to 8.5 GHz | -83 | -94 | -88 | -105 |
| 8.5 GHz to 13.5 GHz | -83 | -94 | -88 | -105 |
| 13.5 GHz to 16 GHz | -83 | -94 | -88 | -105 |
| 16 GHz to 26.5 GHz | -78 | -89 | -82 | -100 |

## Test Port Input

Table 18. 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] May typically be degraded at particular frequencies below 500 MHz due to spurious receiver residuals.

Table 19. 0.1 dB Compression at Test Port (dBm), All Options, All Ports - Typical

| Description | Typical |
|---|---|
| 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] Test port receiver compression at specified input levels below 500 MHz is negligible due to coupler roll.

Table 20. Test Port Compression (dB) at 8 dBm Test Port Power, All Options, All Ports, - Specification

| 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] Test port receiver compression at specified input levels below 500 MHz is negligible due to coupler roll.

Table 21a. Trace Noise[1] 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 | 0.007 | 0.0039 | 0.040 | 0.140 |
| 100 MHz to 8.5 GHz | 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] Ratioed measurement, nominal power at test port.

Table 21b. Trace Noise[1] 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 | 0.051 | 0.0261 | 0.266 | 1.053 |
| 100 MHz to 8.5 GHz | 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] Ratioed measurement, nominal power at test port.

Table 22. Reference Level – Specification

| Description | Magnitude (dB) | Phase (°) |
|---|---|---|
| Range | +/-500 | +/-500 |
| Resolution | 0.001 | 0.01 |

Table 23. Stability[1] – Typical

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

Table 24. Damage Input Level – Specification

| Description | RF (dBm) | DC (V) |
|---|---|---|
| Test Port 1, 2, 3, 4 (All Options) | > +30 | 40 |
| Source 2 Out 1, Source 2 Out 2 (Option 224 only) | > +30 | 0 |
| Test Port 2, Noise Mode[1] (Option 029 only) | > +27 | 40 |

[1] Noise mode sets port 2 noise receiver switch to noise receiver position.

# Noise Receiver Input (Option 029 only)

Table 25. 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 26. 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 27. 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 28. 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 29. 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 30. 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:

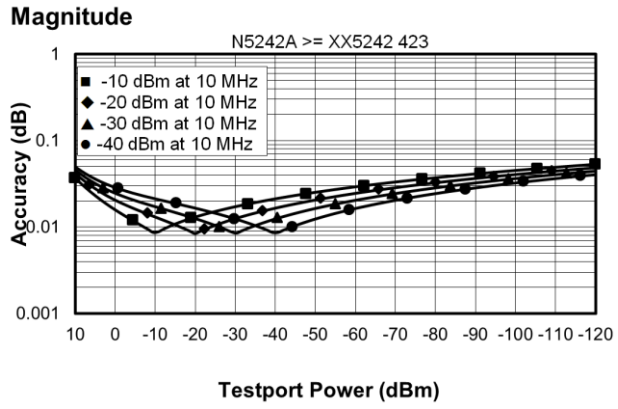
- Compression over frequency
- IF linearity at a single frequency of 1.998765 GHz using a reference level of -20 dBm for an input power range of 0 to -60 dBm. For value below -60 dBm, refer to "VNA Receiver Dynamic Accuracy Specifications and Uncertainties".

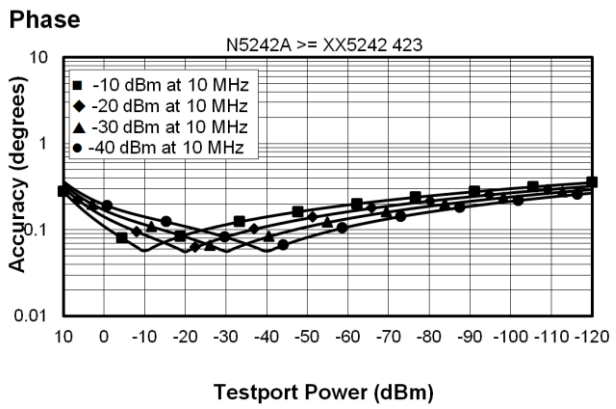
Applies to N5249A (all serial numbers) and N5241A, N5242A with following serial numbers:

N5241A and N5241AS: MY5241/SG5241/US5241 and above
N5242A and N5242AS: MY5242/SG5242/US5242 and above

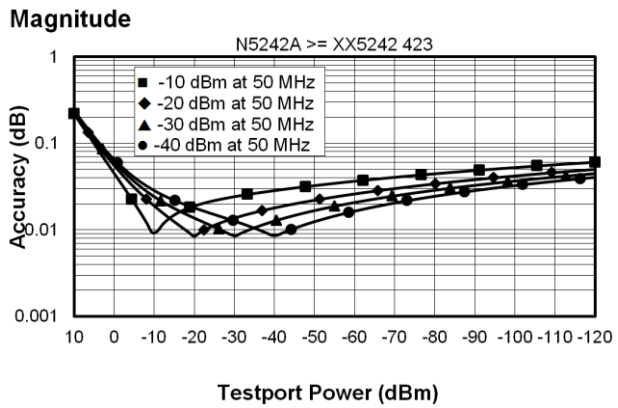
Please download our free Uncertainty Calculator from http://www.keysight.com/find/na_calculator to generate the curves for your PNA.

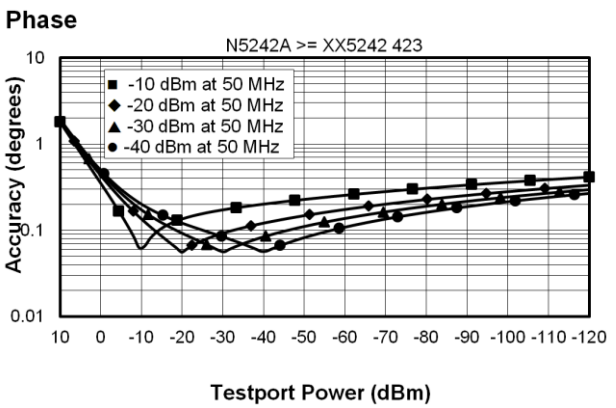
## Dynamic Accuracy, 0.010 GHz



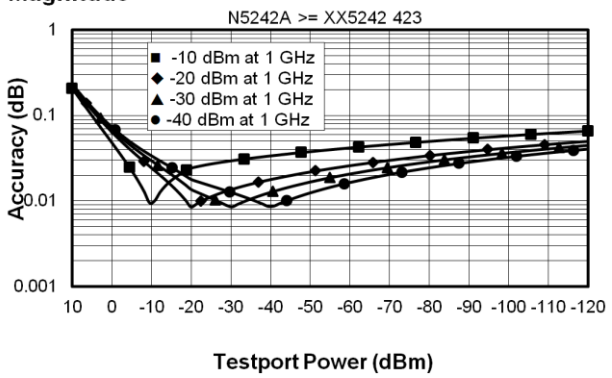

## Dynamic Accuracy, 0.050 GHz



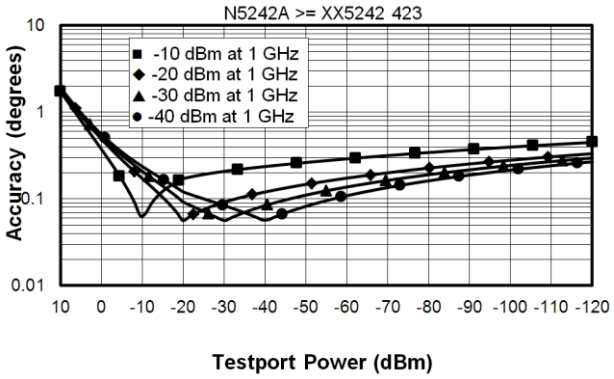



## Dynamic Accuracy, 1 GHz

**Magnitude**

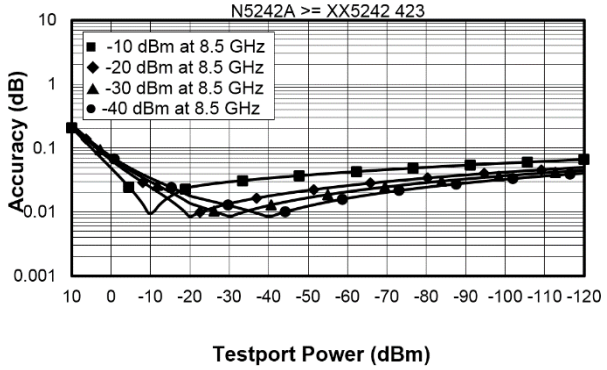



**Phase**

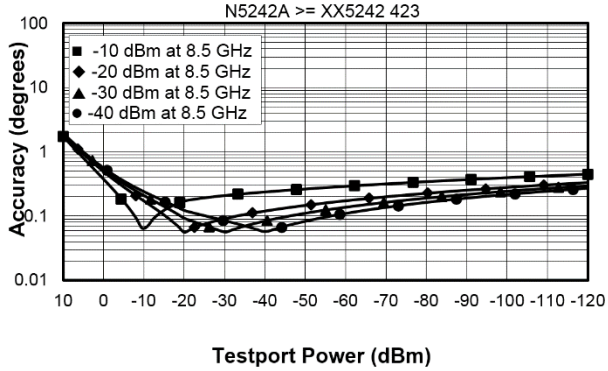



## Dynamic Accuracy, 8.5 GHz

**Magnitude**

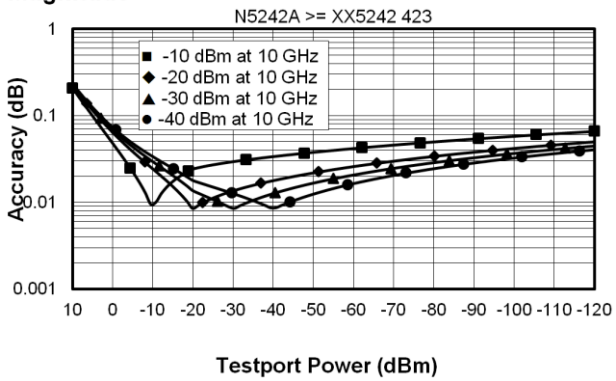



**Phase**

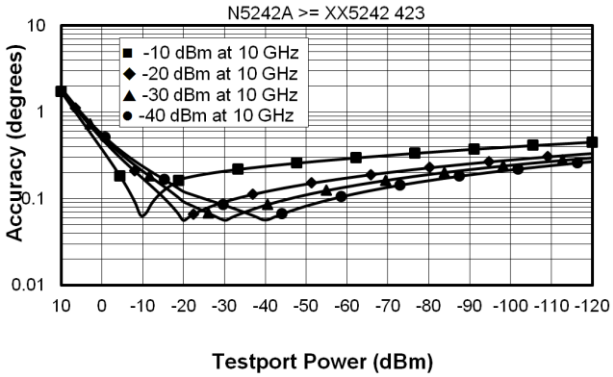



## Dynamic Accuracy, 10 GHz

**Magnitude**

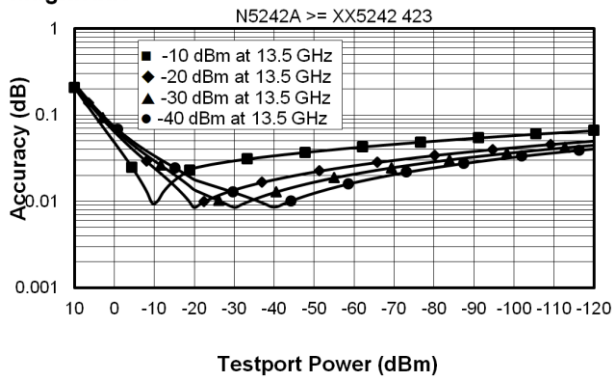



**Phase**

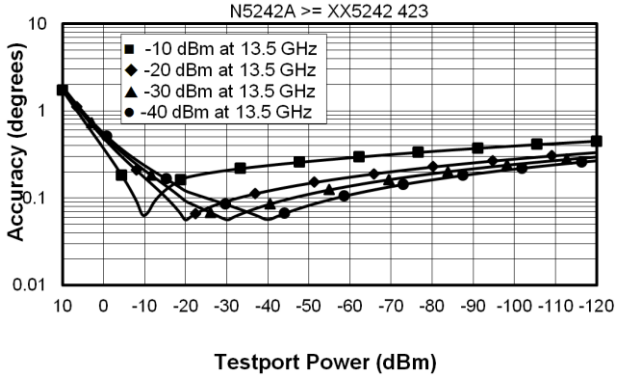


## Dynamic Accuracy, 13.5 GHz

**Magnitude**

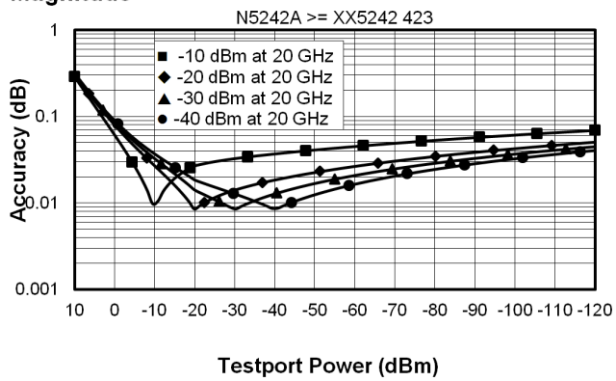



**Phase**

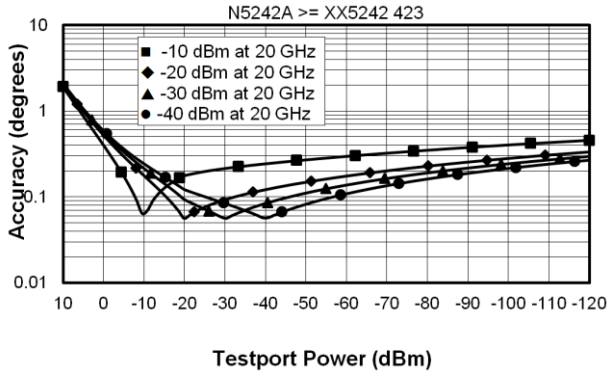



## Dynamic Accuracy, 20 GHz

**Magnitude**

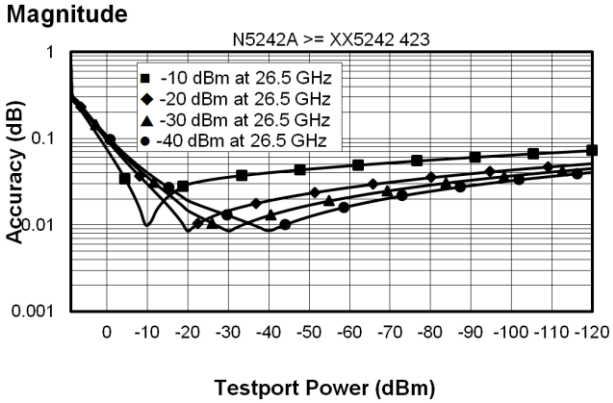



**Phase**




## Dynamic Accuracy, 26.5 GHz

**Magnitude**




**Phase**

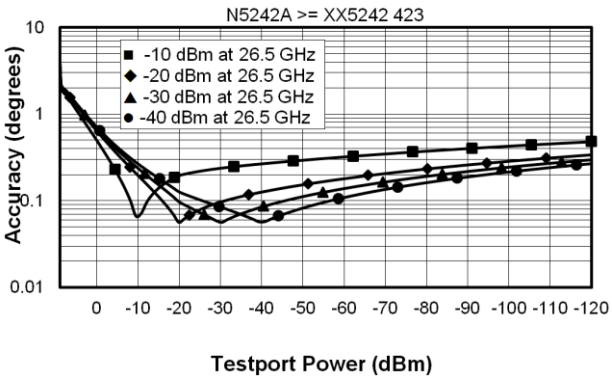
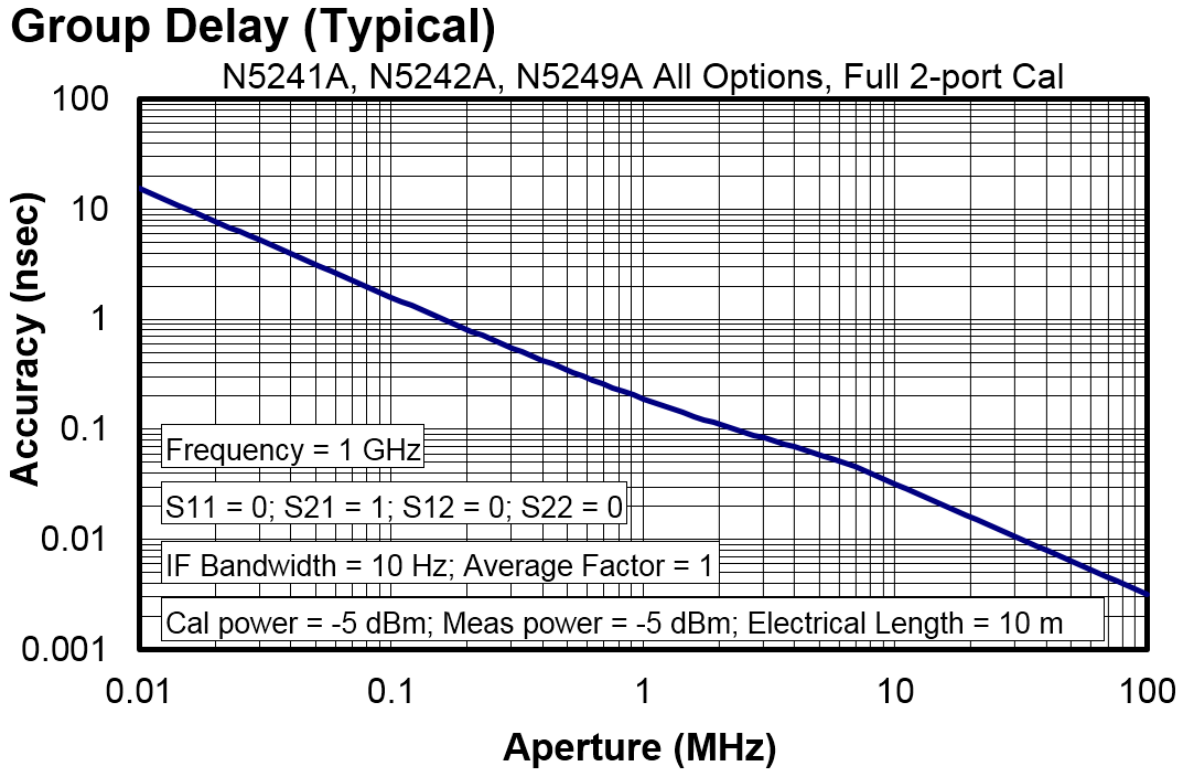


Table 31. Test Port Input (Group Delay)[1]

| 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 32. 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 N5241A, N5242A, and N5249A models that are shipped with firmware revision A.08.20 and higher) |

Table 33. 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 | 26.3 cm (10.4 in) diagonal color active matrix LCD; 1024 (horizontal) X 768 (vertical) resolution |
| Refresh Rate | Vertical 60 Hz; Horizontal 46.08 kHz |
| Pixels | • A display is considered faulty if:<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” “dark” pixels are less than 6.5 mm apart (excluding consecutive pixels) |

Table 33. (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 34. 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 34. (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 34. (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] | 1.7 to 13.5 GHz (N5241A)<br>1.7 to 26.5 GHz (N5242A) | |
| **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. (N5241A), 12.535 MHz to 26.5 GHz. (N5242A)

Table 34. (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 35. Analyzer Dimensions and Weight

All N5241A, N5242A, and N5249A 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.

Table 36a. Cycle Time (ms) for Measurement Completion, All Options - Typical

| Sweep Range | IF Bandwidth | | Number of Points | | | |
|---|---|---|---|---|---|---|
| | | | 201 | 401 | 1601 | 16001 |
| 7 GHz to 8 GHz | 600 kHz | Uncorrected | 6 | 6.3 | 9.6 | 56 |
| | | 2-Port cal | 20 | 21 | 28 | 134 |
| | 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 | 6 | 6.3 | 9.6 | 56 |
| | | 2-Port cal | 20 | 21 | 28 | 134 |
| | 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 | 26 | 33 | 54 | 85 |
| | | 2-Port cal | 62 | 77 | 121 | 190 |
| | 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 |
| 13.5 GHz to 20 GHz | 600 kHz | Uncorrected | 26 | 33 | 54 | 85 |
| | | 2-Port cal | 62 | 77 | 121 | 190 |
| | 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 36b. 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 | 59 | 69 | 118 | 350 |
| | 2-Port cal | 125 | 147 | 244 | 707 |
| 10 kHz | Uncorrected | 94 | 156 | 480 | 2333 |
| | 2-Port cal | 196 | 320 | 968 | 4674 |
| 1 kHz | Uncorrected | 277 | 504 | 1873 | 17950 |
| | 2-Port cal | 561 | 1015 | 3756 | 35900 |

Table 37. 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 | 5.00 | 0.009 |
| 100,000 | 6.84 | 0.003 |
| 30,000 | 11.6 | 0.002 |
| 10,000 | 29.0 | 0.001 |
| 3,000 | 71.8 | 0.0007 |
| 1,000 | 222 | 0.0004 |
| 300 | 640 | 0.0003 |
| 100 | 1826 | 0.0002 |
| 30 | 5982 | <0.0002 |
| 10 | 17830 | <0.0002 |
| 3 | 60000 | <0.0002 |

Table 38. 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 | 7.7 | 5.44 | 5.7 | 5.4 |
| 11 | 16.6 | 7.90 | 5.9 | 5.4 |
| 51 | 60 | 10.7 | 6.5 | 5.5 |
| 101 | 115 | 16.8 | 8.2 | 5.6 |
| 201 | 222 | 29.0 | 11.8 | 5.9 |
| 401 | 436 | 53.0 | 18.8 | 6.3 |
| 801 | 860 | 102 | 32.8 | 7.2 |
| 1,601 | 1,700 | 199 | 60.5 | 9.6 |
| 6,401 | 6,700 | 780 | 228 | 25 |
| 16,001 | 16,000 | 1950 | 566 | 56 |

Table 39. 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.

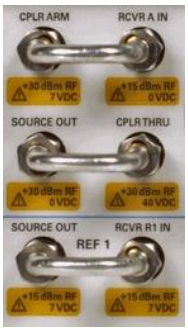
[2] Measured when using the SCPI command DISPlay: VISible OFF.

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

**NOTE** Specifications for Recall & Sweep Speed are not provided for the N5241A, N5242A, and N5249A analyzers.

# 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 40. 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 41a. Reference Receiver Inputs and Reference Source Outputs (dBm) - Typical

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

| Description | Options 200, 400 | | Options 219, 419 | | Options 224, 423 | |
|---|---|---|---|---|---|---|
| | Filtered Mode1 | Hi Power Mode1 | Filtered Mode1 | Hi Power Mode1 | Filtered Mode1 | Hi Power Mode1 |
| 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 41b. 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 400 | | Options 200, 400 | Option 419 | | Options 219, 419 |
|---|---|---|---|---|---|---|
| | 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 Mode1 | Hi Power Mode1 | | Filtered Mode1 | Hi Power Mode1 | |
| 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 41c. 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 423 | | Options 224, 423 |
|---|---|---|---|
| | RCVR R3 IN, REF 3 SOURCE OUT | RCVR R3 IN, REF 3 SOURCE OUT | RCVR R2, R4 IN, REF 2, 4 SOURCE OUT |
| | Filtered Mode1 | Hi Power Mode1 | |
| 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 42a. Source Outputs (dBm) - Typical

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

| Description | Options 200, 400 | | | Options 219, 419 | | |
|---|---|---|---|---|---|---|
| | PORT 1, 3 SOURCE OUT | | PORT 2, 4 SOURCE OUT | PORT 1, 3 SOURCE OUT | | PORT 2, 4 SOURCE OUT |
| | Filtered Mode1 | Hi Power Mode1 | | Filtered Mode1 | Hi Power Mode1 | |
| 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 42b. Source Outputs (dBm) – Typical

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

| Description | Options 224, 423 | | |
|---|---|---|---|
| | PORT 1, 3 SOURCE OUT | | PORT 2, 4 SOURCE OUT |
| | Filtered Mode1 | Hi Power Mode1 | |
| 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 43. Coupler Inputs (dB) – Typical

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

| Description | Options 200, 400 | Options 219, 419, 224, 423 |
|---|---|---|
| 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 44. Damage Level – Typical

| Description | RF (dBm) | DC (V) |
|---|---|---|
| RCVR A, B, C, D IN | 15 | 0 |
| RCVR R1 IN | 15 | 7 |
| RCVR R2, R3, R4 IN | 15 | 15 |
| REF 1 SOURCE OUT | 15 | 7 |
| REF 2, 3, 4 SOURCE OUT | 30 | 0 |
| PORT 1, 2, 3, 4 SOURCE OUT | 15 | 0 |
| PORT 1, 2, 3, 4 CPLR THRU | 30 | 40 |
| PORT 1, 2, 3, 4 CPLR ARM | 30 | 7 |

# Test Set Block Diagrams

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

Legend

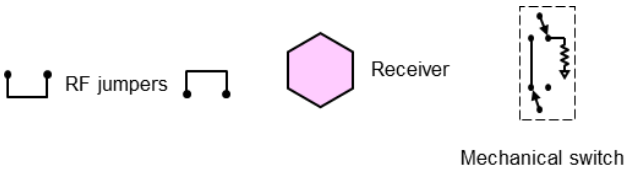



Figure 1. 2-Port N5241A, N5242A, and N5249A Base Unit Option 200

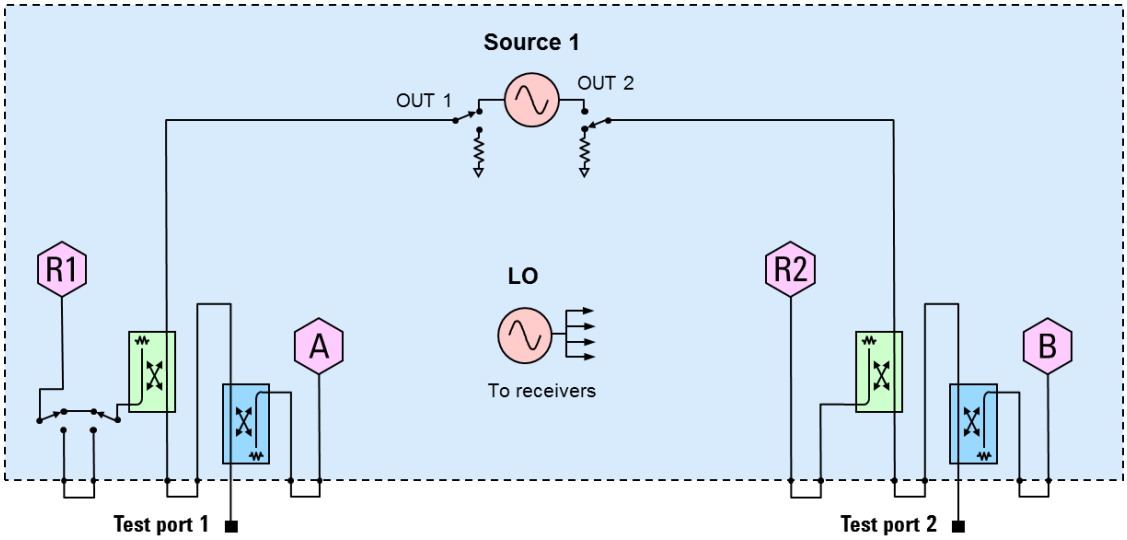



Figure 2. 2-Port N5241A, N5242A, and N5249A Option 219

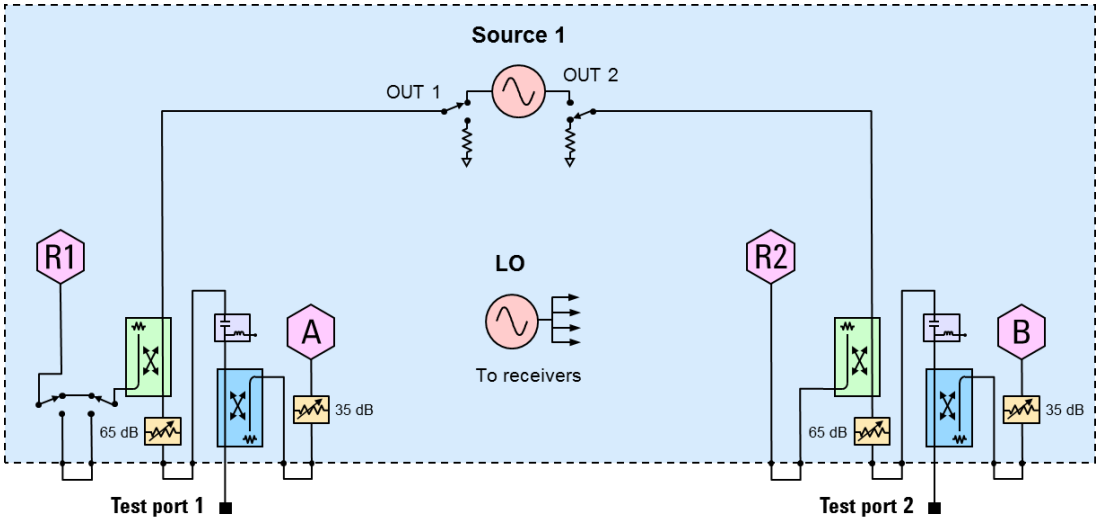


Figure 3. 2-Port N5241A, N5242A, and N5249A Option 224

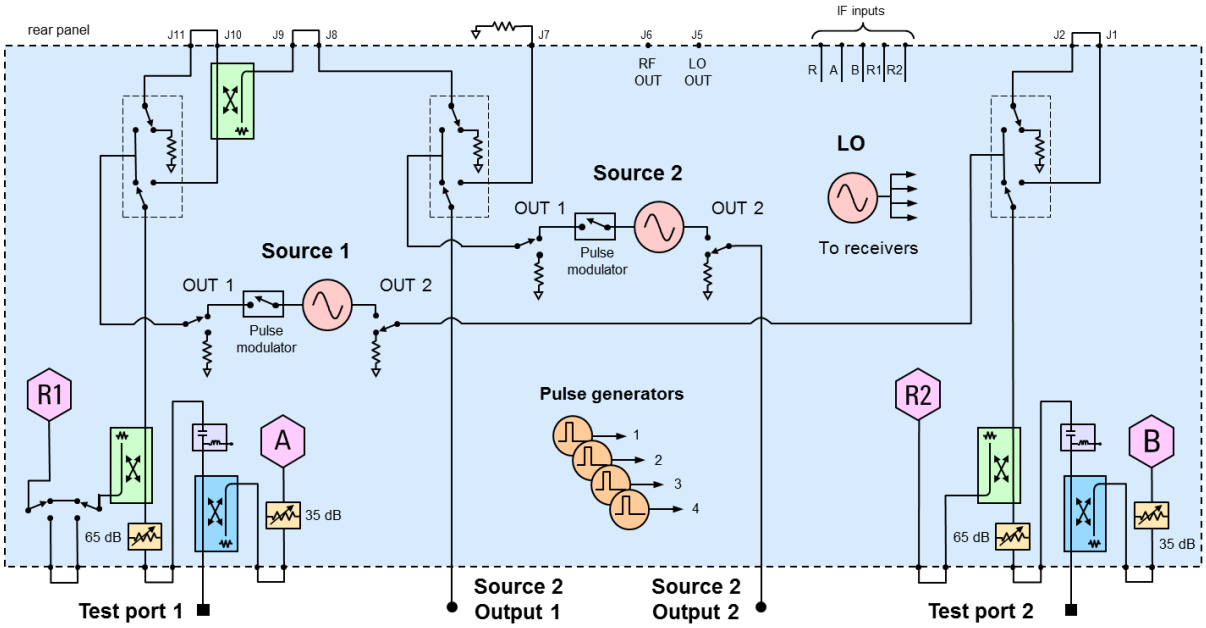



Figure 4. 2-Port N5241A, N5242A, and N5249A Option 224 with 029

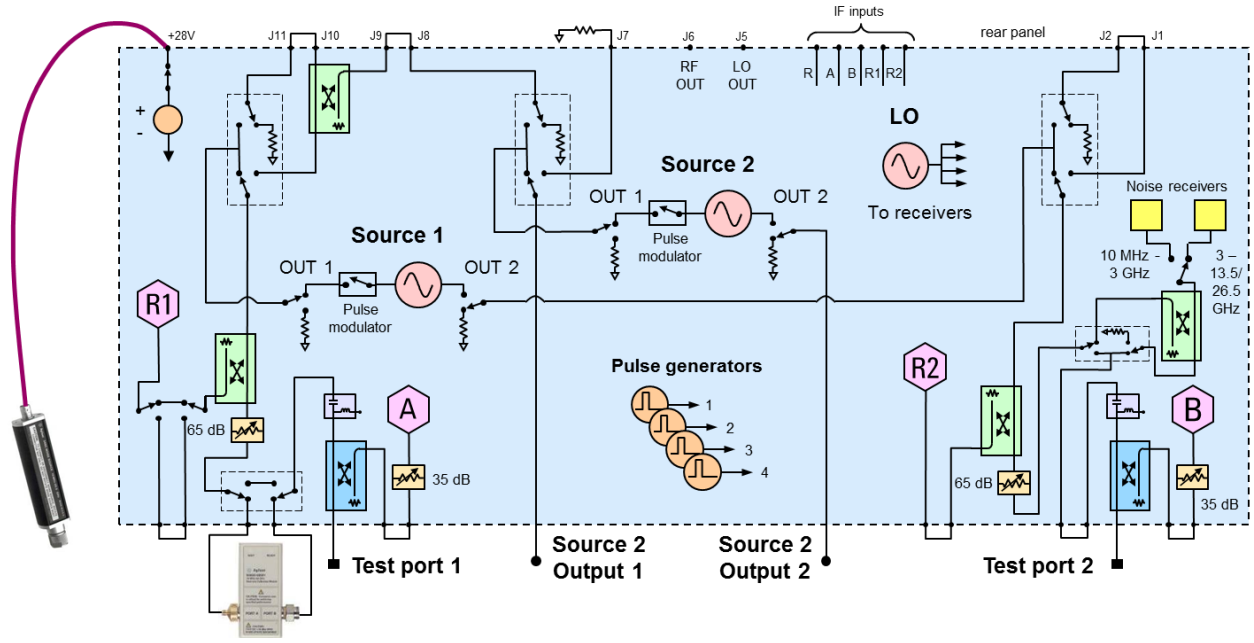


Figure 5. 4-Port N5241A, N5242A, and N5249A Base Unit Option 400

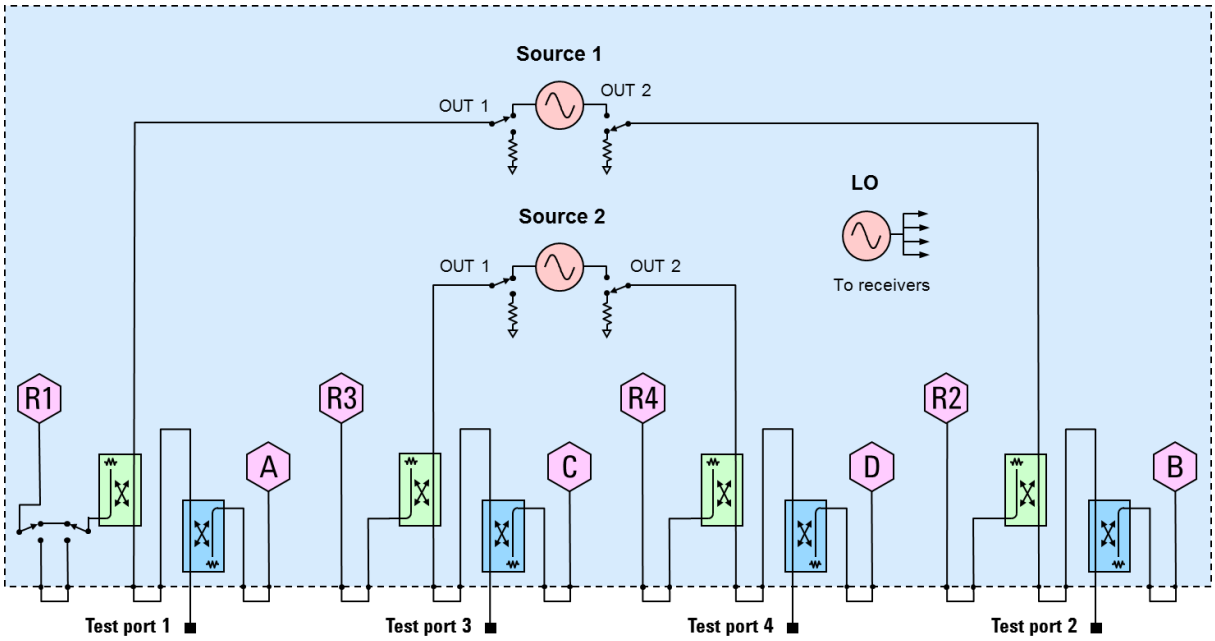



Figure 6. 4-Port N5241A, N5242A, and N5249A Option 419

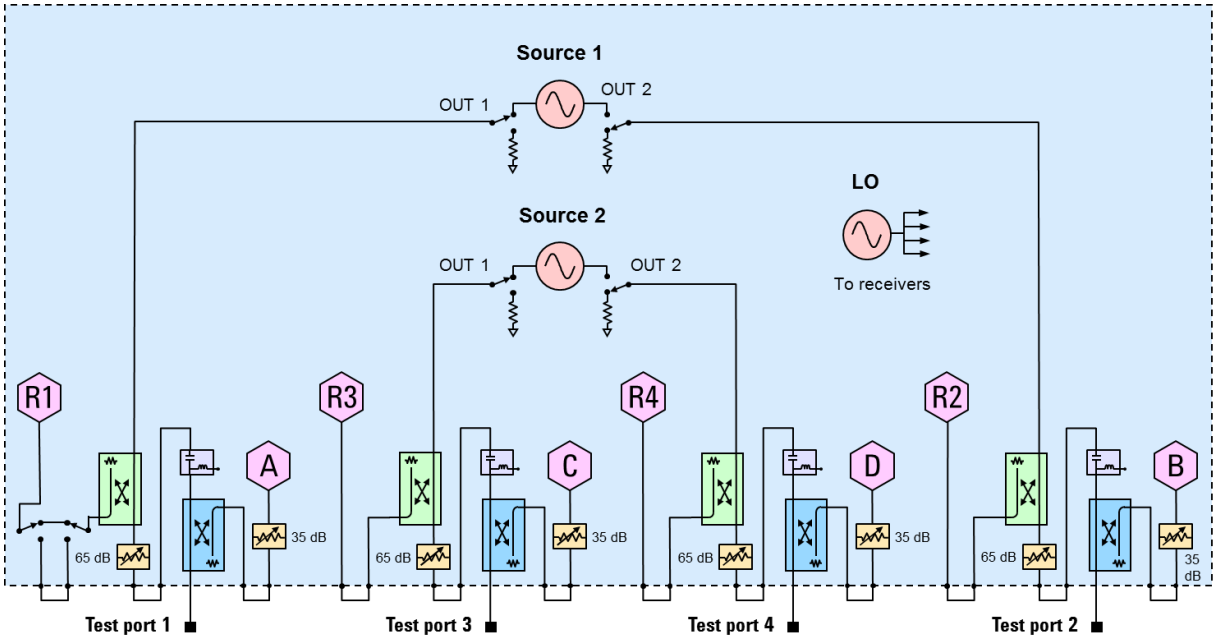


Figure 7. 4-Port N5241A, N5242A, and N5249A Option 423

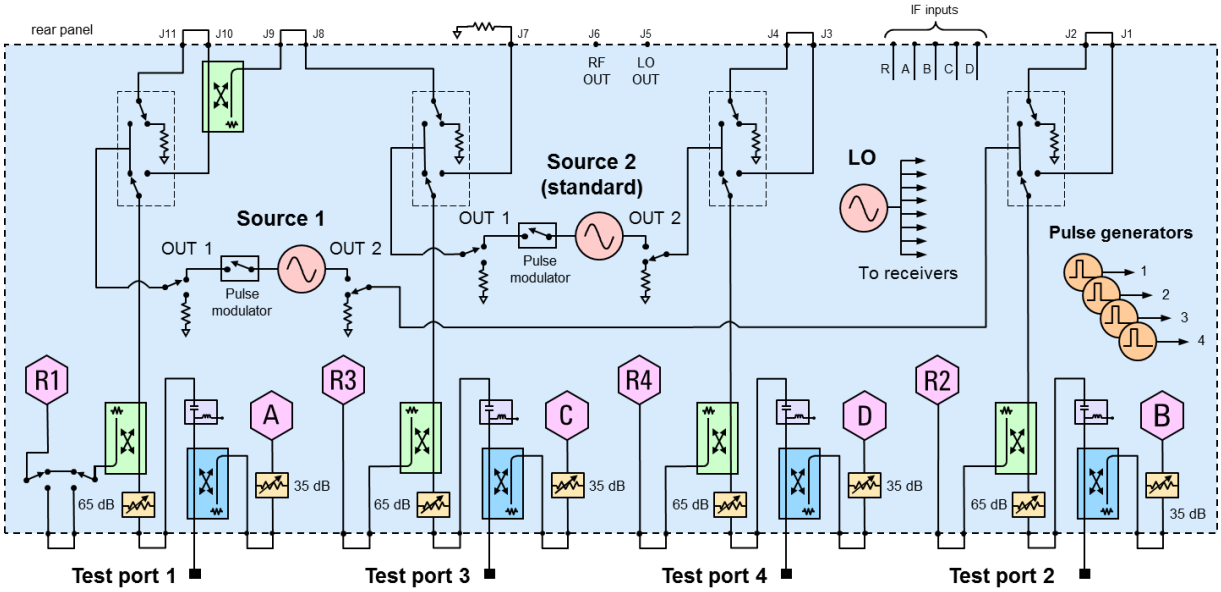



Figure 8. 4-Port N5241A, N5242A, and N5249A Option 423 with 029

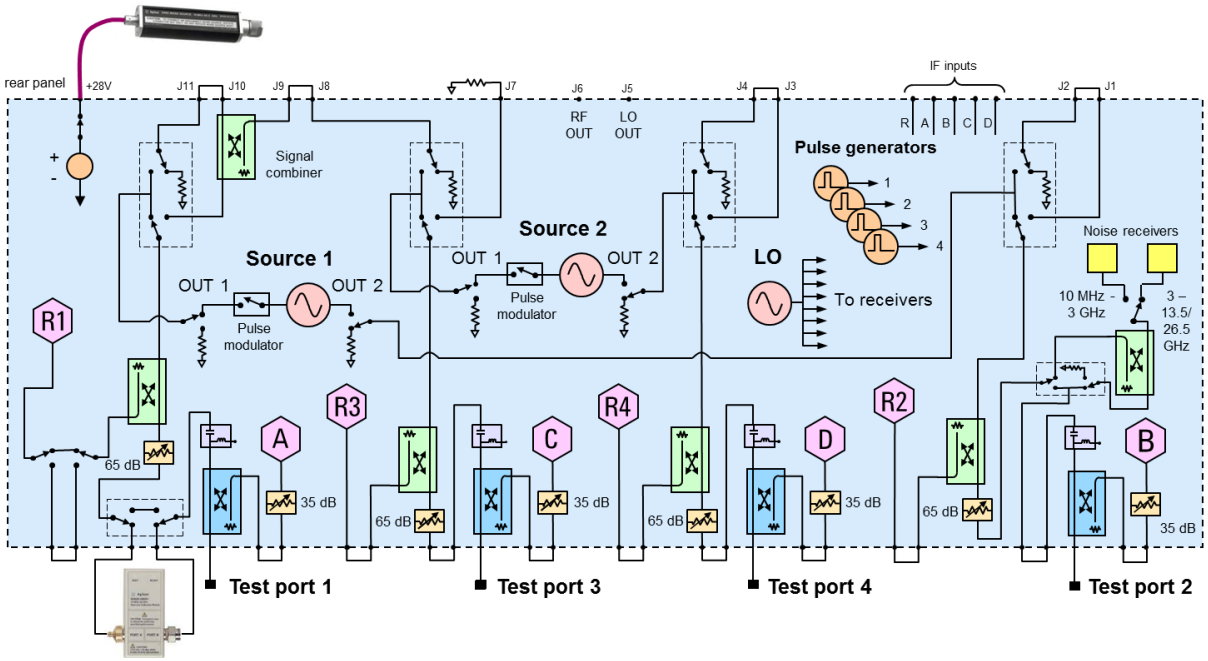
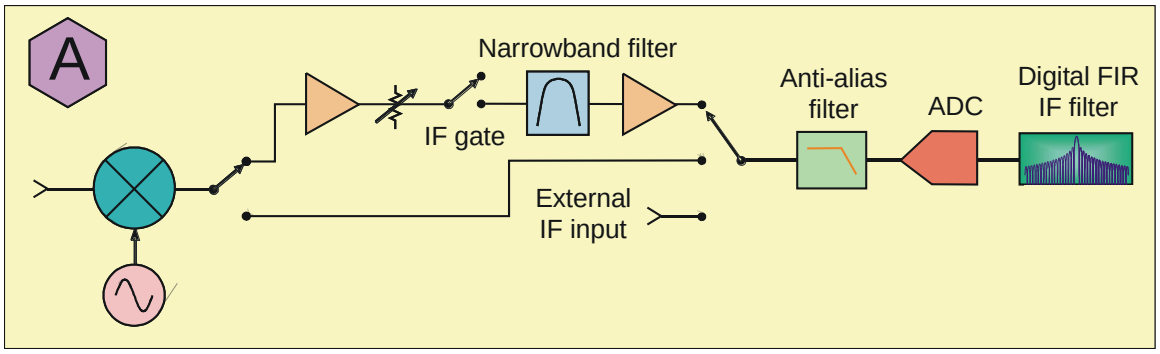


Figure 9. Receiver Block Diagram



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