

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

N5244B - 10 MHz to 43.5 GHz

N5245B - 10 MHz to 50.0 GHz

with Option H29

Data Sheet and  
Technical  
Specifications

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Receiver Block Diagram ..... 30

This is the technical specifications for the N5244B and N5245B PNA-X network analyzer with option H29.

**Option H29**, adds 26.5 GHz low-noise receivers to N5244B/45B for fully-corrected noise figure measurements of amplifiers, frequency converters, and mixers, utilizing source-correction technique (requires option 400, 419 and 423). 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).

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

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

## Notes

In noise mode, the S-parameter measurement performance above 26.5 GHz is degraded due to the 26.5 GHz noise coupler in the port 2 source path (shown in green on the block diagram on page 30). Noise measurements are not specified above 26.5GHz.

This document provides technical specifications for the 85056A calibration kit, and the N4693A 2-Port ECal module. Please download our free Uncertainty Calculator from [http://www.keysight.com/find/na\\_calculator](http://www.keysight.com/find/na_calculator) to generate the curves for your calibration kit and PNA setup.

## Definitions

All specifications and characteristics apply over a 25 °C  $\pm$  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.

## Specifications: N5244B and N5245B Option H29

General specifications apply to Option H29 with the port 1 noise tuner switch set to the internal position except as stated below. By default, the switch is set to the external position to ensure functional compatibility with existing PNA instruments. Refer to the Help System topic “Noise Figure Application” for information on setting the switch position.

### Corrected System Performance with 3.5mm Connectors

Note: For any Sii reflection measurement:

- $S_{jj} = 0$ .

For any Sij transmission measurement:

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

**Table 1. 85056A Calibration Kit**

N5244B and N5245B Option H29

Applies to the N5244B and N5245B analyzer with Option H29, an 85056A (2.4mm) calibration kit, an 85133F flexible test port cable set, and a full 2-port calibration. S-parameter measurements were made with the analyzer in the noise figure configuration. Environmental temperature  $23^{\circ} \pm 3^{\circ} \text{C}$ , with  $< 1^{\circ} \text{C}$  deviation from calibration temperature.

| Description                                        | Specification (dB)  |                    |                    |                       |                       |                     |
|----------------------------------------------------|---------------------|--------------------|--------------------|-----------------------|-----------------------|---------------------|
|                                                    | 10 MHz to<br>45 MHz | 45 MHz to<br>2 GHz | 2 GHz to<br>20 GHz | 20 GHz to<br>26.5 GHz | 26.5 GHz to<br>40 GHz | 40 GHz to<br>50 GHz |
| Directivity                                        | 42                  | 42                 | 42                 | 38                    | 38                    | 36                  |
| Source Match                                       | 41                  | 41                 | 38                 | 33                    | 33                    | 31                  |
| Load Match                                         | 42                  | 42                 | 41                 | 37                    | 37                    | 35                  |
| Reflection Tracking <sup>1</sup>                   |                     |                    |                    |                       |                       |                     |
| Mag                                                | $\pm 0.001$         | $\pm 0.001$        | $\pm 0.008$        | $\pm 0.020$           | $\pm 0.020$           | $\pm 0.027$         |
| Phase ( $^{\circ}$ )                               | $\pm 0.009$         | $\pm 0.009$        | $\pm 0.054$        | $\pm 0.133$           | $\pm 0.133$           | $\pm 0.180$         |
| S <sub>21</sub> Transmission Tracking <sup>1</sup> |                     |                    |                    |                       |                       |                     |
| Mag                                                | $\pm 0.061$         | $\pm 0.037$        | $\pm 0.077$        | $\pm 0.144$           | $\pm 0.189$           | $\pm 0.248$         |
| Phase ( $^{\circ}$ )                               | $\pm 0.402$         | $\pm 0.246$        | $\pm 0.508$        | $\pm 0.950$           | $\pm 1.800$           | $\pm 1.636$         |
| S <sub>12</sub> Transmission Tracking <sup>1</sup> |                     |                    |                    |                       |                       |                     |
| Mag                                                | $\pm 0.051$         | $\pm 0.041$        | $\pm 0.071$        | $\pm 0.135$           | $\pm 0.183$           | $\pm 0.242$         |
| Phase ( $^{\circ}$ )                               | $\pm 0.338$         | $\pm 0.268$        | $\pm 0.468$        | $\pm 0.891$           | $\pm 1.208$           | $\pm 1.598$         |

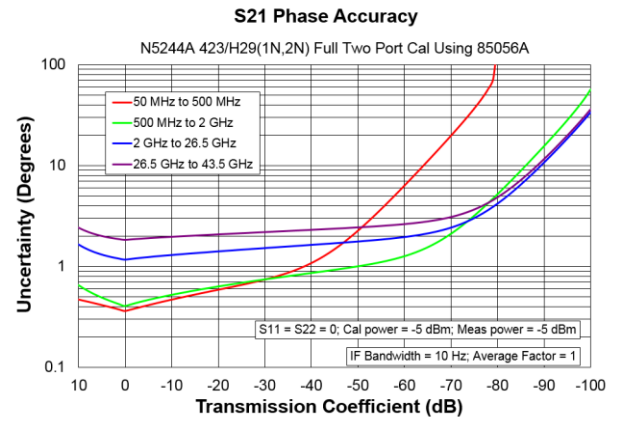
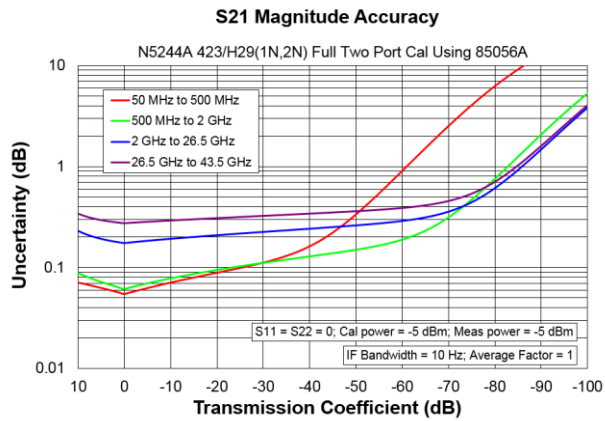
<sup>1</sup>Temperature deviation is a characteristic value.

## Specifications: N5244B and N5245B Option H29 (continued)

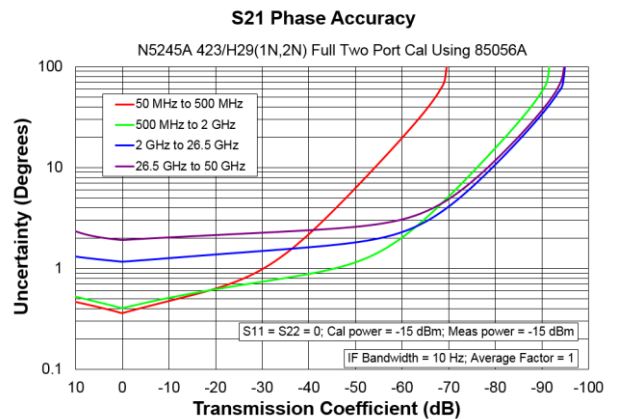
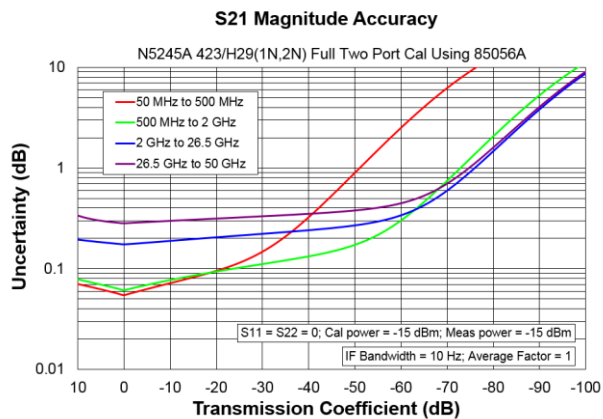
### Transmission Uncertainty (S21)

The following charts were generated for Opt 423 / H29.

N5244B Opt 423 / H29 with 85056A (S21)



N5245B Opt 423 / H29 with 85056A (S21)

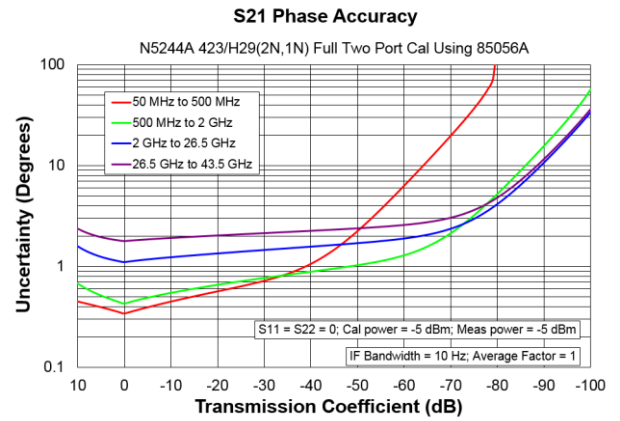
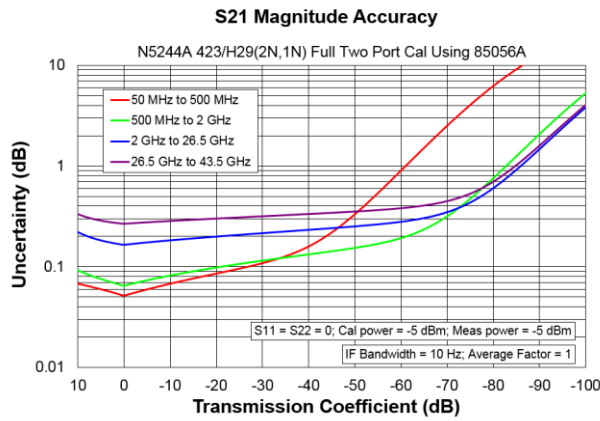


## Specifications: N5244B and N5245B Option H29 (continued)

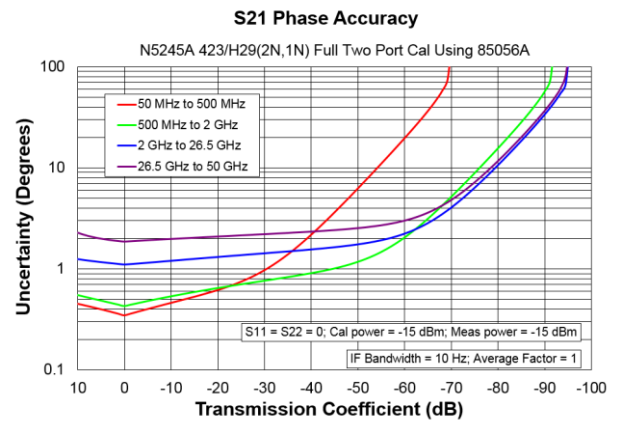
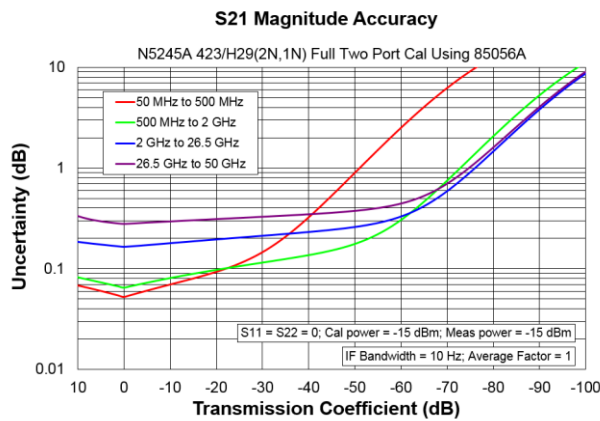
### Transmission Uncertainty (S12)

The following charts were generated for Opt 423 / H29.

N5244B Opt 423 / H29 with 85056A (S12)



N5245B Opt 423 / H29 with 85056A (S12)

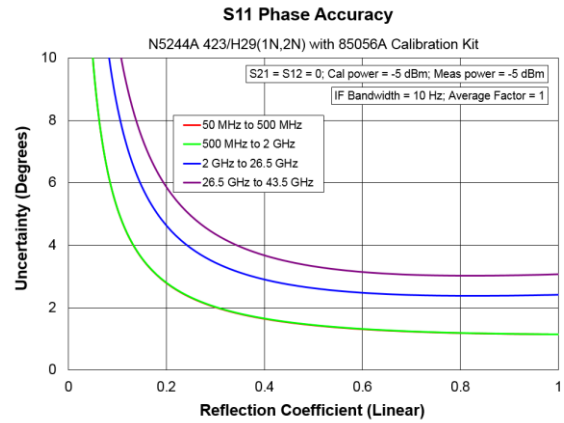
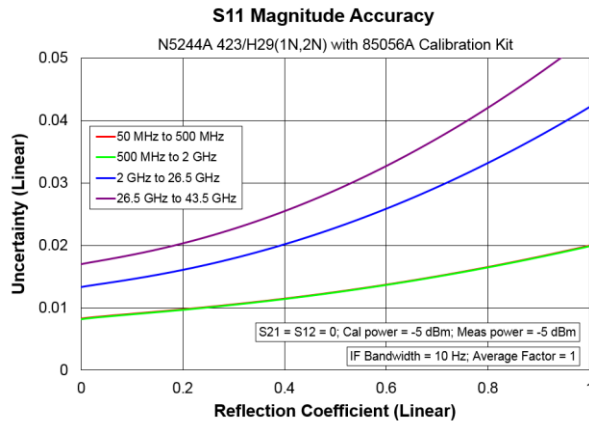


## Specifications: N5244B and N5245B Option H29 (continued)

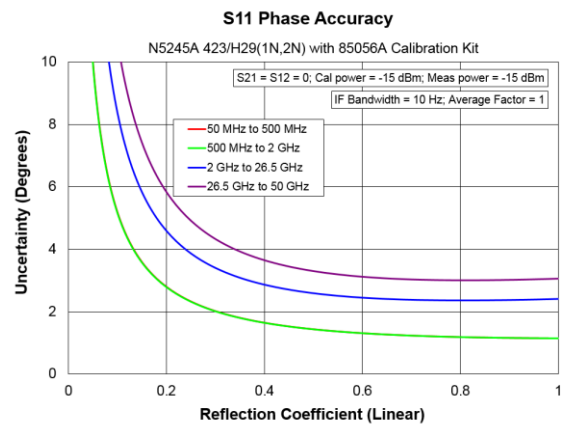
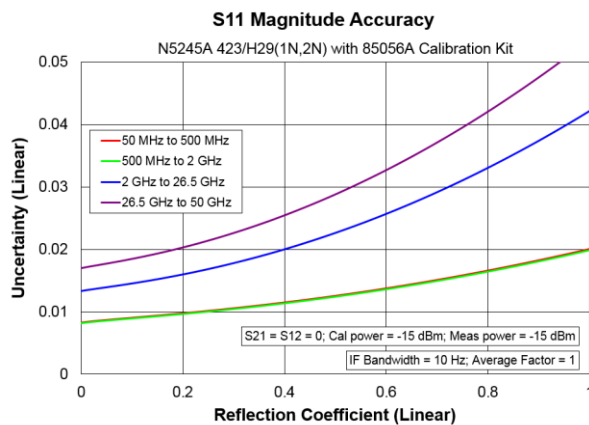
### Reflection Uncertainty

The following charts were generated for Opt 423 / H29.

N5244B Opt 423 / H29 with 85056A



N5245B Opt 423 / H29 with 85056A



Specifications: N5244B and N5245B Option H29 (continued)

Table 2. N4693A 2-Port Electronic Calibration Module

N5244B and N5245B Option H29

Applies to the N5244B and N5245B analyzer with Option H29, an N4693A (2.4 mm) electronic calibration module, an 85133F flexible test port cable set, and a full 2-port calibration. S-parameter measurements were made with the analyzer in the noise figure configuration. Environmental temperature  $23^{\circ} \pm 3^{\circ} \text{C}$ , with  $< 1^{\circ} \text{C}$  deviation from calibration temperature.

| Description                                        | Specification (dB)  |                    |                    |                       |                       |                     |
|----------------------------------------------------|---------------------|--------------------|--------------------|-----------------------|-----------------------|---------------------|
|                                                    | 10 MHz to<br>45 MHz | 45 MHz to<br>2 GHz | 2 GHz to<br>20 GHz | 20 GHz to<br>26.5 GHz | 26.5 GHz to<br>40 GHz | 40 GHz to<br>50 GHz |
| Directivity                                        | 32                  | 42                 | 45                 | 41                    | 41                    | 36                  |
| Source Match                                       | 25                  | 44                 | 37                 | 35                    | 35                    | 32                  |
| Load Match                                         | 25                  | 42                 | 35                 | 33                    | 33                    | 30                  |
| Reflection Tracking <sup>1</sup>                   |                     |                    |                    |                       |                       |                     |
| Mag                                                | $\pm 0.050$         | $\pm 0.030$        | $\pm 0.050$        | $\pm 0.060$           | $\pm 0.060$           | $\pm 0.080$         |
| Phase ( $^{\circ}$ )                               | $\pm 0.330$         | $\pm 0.198$        | $\pm 0.330$        | $\pm 0.396$           | $\pm 0.396$           | $\pm 0.528$         |
| S <sub>21</sub> Transmission Tracking <sup>1</sup> |                     |                    |                    |                       |                       |                     |
| Mag                                                | $\pm 0.146$         | $\pm 0.061$        | $\pm 0.076$        | $\pm 0.101$           | $\pm 0.108$           | $\pm 0.166$         |
| Phase ( $^{\circ}$ )                               | $\pm 0.966$         | $\pm 0.400$        | $\pm 0.500$        | $\pm 0.665$           | $\pm 0.715$           | $\pm 1.093$         |
| S <sub>12</sub> Transmission Tracking <sup>1</sup> |                     |                    |                    |                       |                       |                     |
| Mag                                                | $\pm 0.118$         | $\pm 0.052$        | $\pm 0.065$        | $\pm 0.091$           | $\pm 0.103$           | $\pm 0.156$         |
| Phase ( $^{\circ}$ )                               | $\pm 0.781$         | $\pm 0.341$        | $\pm 0.431$        | $\pm 0.598$           | $\pm 0.681$           | $\pm 1.032$         |

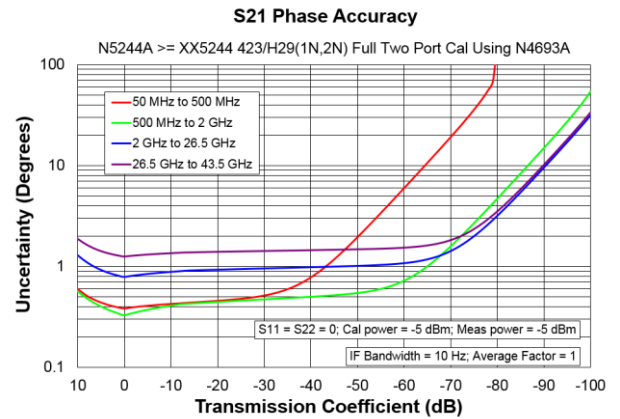
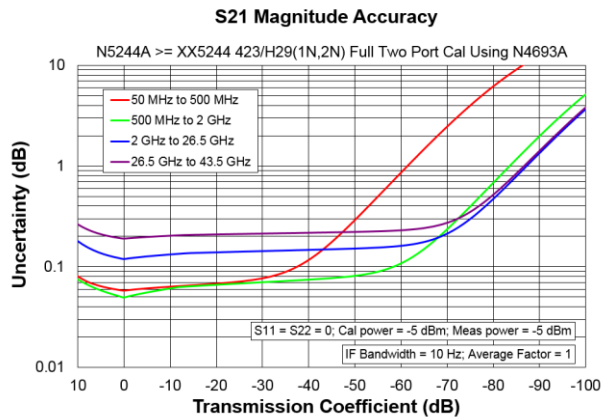
<sup>1</sup>Temperature deviation is a characteristic value.

## Specifications: N5244B and N5245B Option H29 (continued)

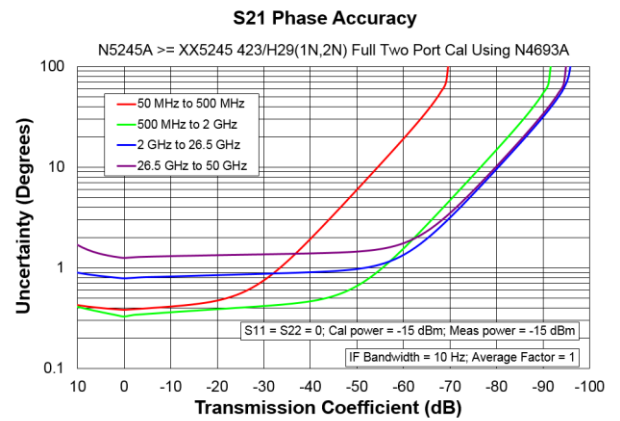
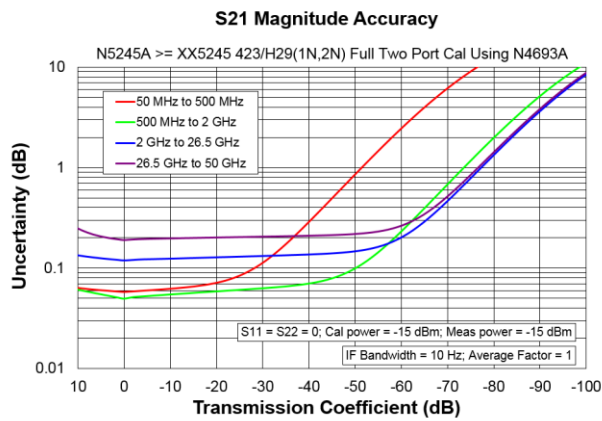
### Transmission Uncertainty (S21)

The following charts were generated for Opt 423 / H29.

N5244B Opt 423 / H29 with N4693A (S21)



N5245B Opt 423 / H29 with N4693A (S21)

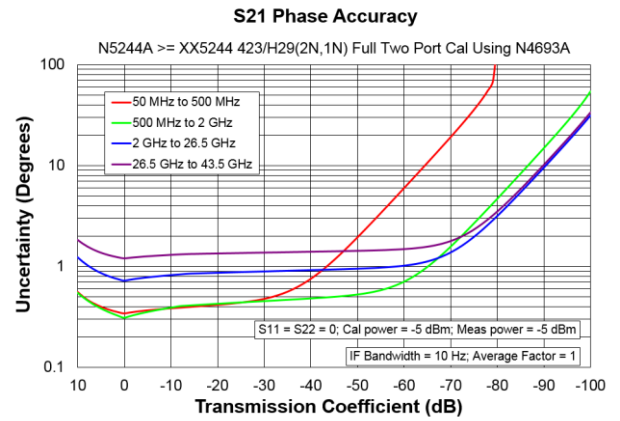
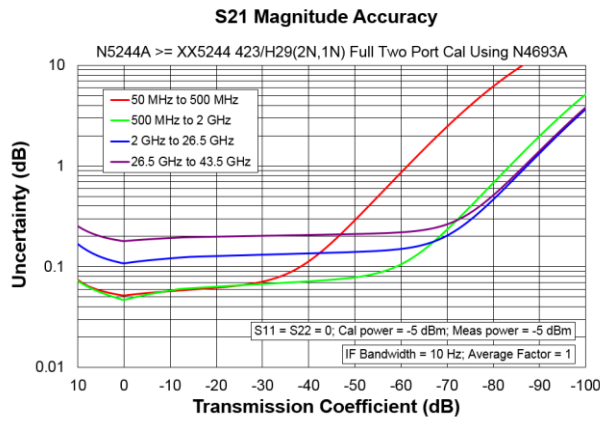


## Specifications: N5244B and N5245B Option H29 (continued)

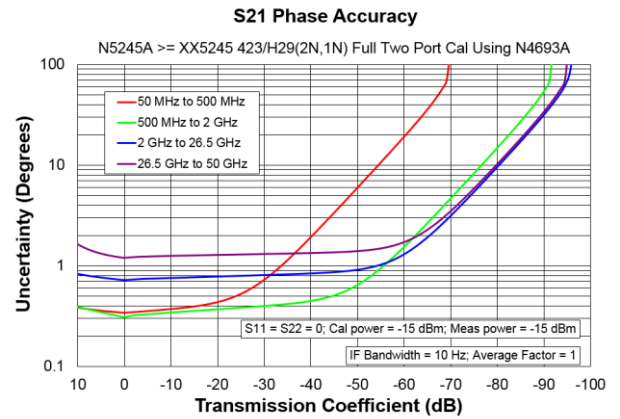
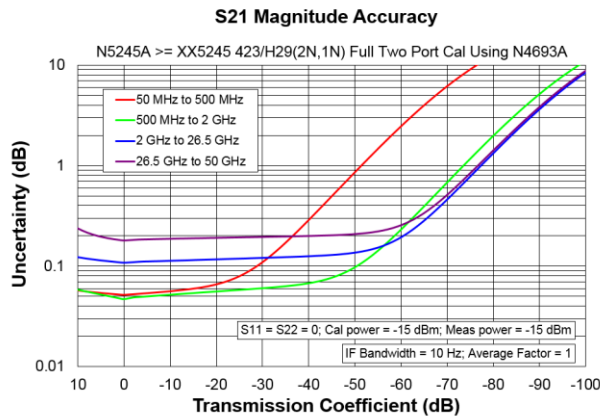
### Transmission Uncertainty (S12)

The following charts were generated for Opt 423 / H29.

N5244B Opt 423 / H29 with N4693A (S12)



N5245B Opt 423 / H29 with N4693A (S12)

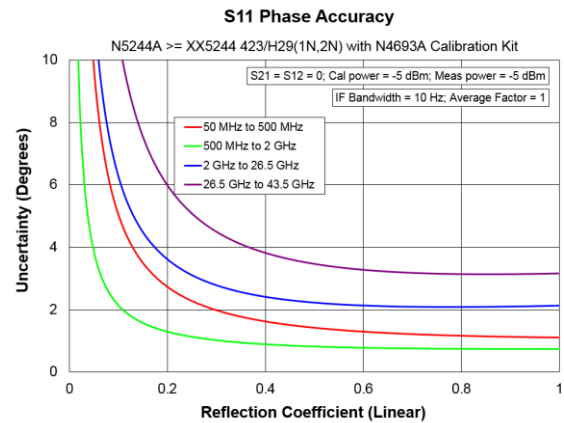
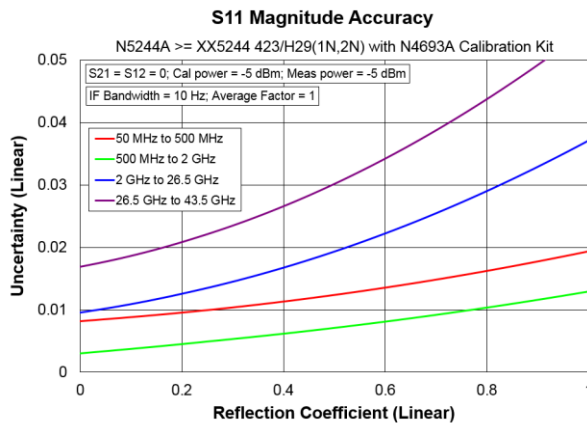


## Specifications: N5244B and N5245B Option H29 (continued)

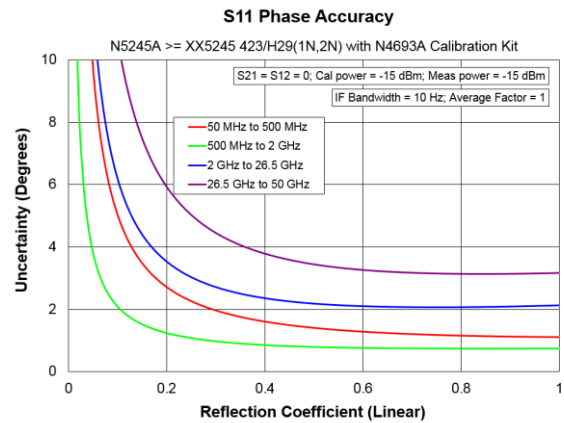
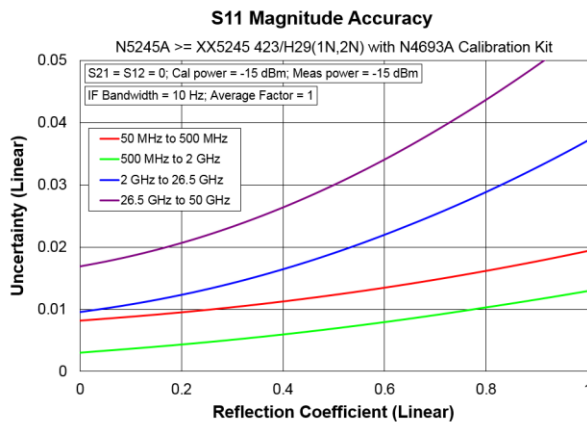
### Reflection Uncertainty

The following charts were generated for Opt 423 / H29.

#### N5244B Opt 423 / H29 with N4693A



#### N5245B Opt 423 / H29 with N4693A



This document does not present specifications for the 85056D Calibration Kit. Please download our free Uncertainty Calculator from [http://www.keysight.com/find/na\\_calculator](http://www.keysight.com/find/na_calculator) to generate the data and curves for the 85056D Calibration Kit.

## Uncorrected System Performance, N5244B and N5245B Option H29

Noise Error Terms: N5244B and N5245B Option H29

Table 3. Noise State Directivity, Port 1 and Port 2<sup>1</sup> (dB)

| Frequency          | Specification | Typical |
|--------------------|---------------|---------|
| 10 MHz to 50 MHz   | 17            | 20      |
| 50MHz to 200MHz    | 22            | 27      |
| 200 MHz to 500 MHz | 23            | 27      |
| 500 MHz to 3.2 GHz | 23            | 30      |
| 3.2 GHz to 10 GHz  | 22            | 25      |
| 10 GHz to 13.5 GHz | 18            | 23      |
| 13.5 GHz to 16 GHz | 18            | 21      |
| 16 GHz to 20 GHz   | 17            | 19      |
| 20 GHz to 24 GHz   | 15            | 19      |
| 24 GHz to 26.5 GHz | 15            | 21      |
| 26.5GHz to 43.5GHz | 15            | 20      |
| 43.5GHz to 46GHz   | 14            | 20      |
| 46GHz to 50GHz     | 14            | 18      |

<sup>1</sup>Analyzer test set switches are set in accordance with the Figure 1 block diagram on page 30, but with a jumper replacing the ECal module.

Table 4. Noise State Load Match, Port 1<sup>1</sup> (dB)

| Frequency          | Specification | Typical |
|--------------------|---------------|---------|
| 10 MHz to 50 MHz   | 10            | 15      |
| 50 MHz to 500 MHz  | 16            | 22      |
| 500 MHz to 3.2 GHz | 12            | 16      |
| 3.2 GHz to 10 GHz  | 10            | 18      |
| 10 GHz to 13.5 GHz | 10            | 17      |
| 13.5 GHz to 16 GHz | 10            | 15      |
| 16 GHz to 20 GHz   | 10            | 17      |
| 20 GHz to 24 GHz   | 9             | 15      |
| 24 GHz to 26.5 GHz | 8             | 14      |
| 26.5GHz to 43.5GHz | 5             | 10      |
| 43.5GHz to 46GHz   | 5             | 10      |
| 46GHz to 50GHz     | 5             | 9       |

<sup>1</sup>Analyzer test set switches are set in accordance with the Figure 1 block diagram on page 30, but with a jumper replacing the ECal module.

Table 5. Noise State Load Match, Port 2<sup>1</sup> (dB)

| Frequency          | Specification | Typical |
|--------------------|---------------|---------|
| 10 MHz to 50 MHz   | 7             | 12      |
| 50 MHz to 500 MHz  | 12            | 18      |
| 500 MHz to 3.2 GHz | 9             | 11      |
| 3.2 GHz to 10 GHz  | 5.5           | 9.5     |
| 10 GHz to 13.5 GHz | 5.5           | 9.5     |
| 13.5 GHz to 16 GHz | 5.5           | 10      |
| 16 GHz to 20 GHz   | 5.5           | 10      |
| 20 GHz to 24 GHz   | 5.5           | 11.5    |
| 24 GHz to 26.5 GHz | 5.5           | 11.5    |
| 26.5GHz to 43.5GHz | 4             | 9       |
| 43.5GHz to 46GHz   | 4             | 9       |
| 46GHz to 50GHz     | 4             | 8       |

<sup>1</sup>Analyzer test set switches are set in accordance with the Figure 1 block diagram on page 30, but with a jumper replacing the ECal module.

Table 6. Noise State Reflection Tracking ( $S_{11}$  and  $S_{22}$ ), Min/Max (dB)

| Frequency           | Specification | Typical( $S_{11}$ ) | Typical( $S_{22}$ ) |
|---------------------|---------------|---------------------|---------------------|
| 10 MHz to 50MHz     | --            | +1.5/-1.5           | +1.5/-1.5           |
| 50 MHz to 500MHz    | --            | +1.5/-1.5           | +1.5/-1.5           |
| 500 MHz to 3.2GHz   | --            | +1.5/-1.5           | +1.5/-1.5           |
| 3.2 GHz to 10GHz    | --            | +1.5/-1.5           | +1.5/-1.5           |
| 10 GHz to 13.5GHz   | --            | +1.5/-1.5           | +1.5/-1.5           |
| 13.5 GHz to 16GHz   | --            | +1.5/-1.5           | +1.5/-1.5           |
| 16 GHz to 20GHz     | --            | +1.5/-1.5           | +1.5/-1.5           |
| 20 GHz to 24 GHz    | --            | +1.5/-1.5           | +1.5/-1.5           |
| 24 GHz to 26.5GHz   | --            | +1.5/-2.0           | +1.5/-1.5           |
| 26.5 GHz to 43.5GHz | --            | +1.5/-2.5           | +1.5/-7             |
| 43.5 GHz to 46GHz   | --            | +1.5/-3.0           | +1.5/-9             |
| 46 GHz to 50GHz     | --            | +1.5/-3.5           | +1.5/-20            |

Table 7. Noise State Transmission Tracking, Min/Max (dB)

| Frequency           | Specification | Typical(Port1) | Typical(Port2) |
|---------------------|---------------|----------------|----------------|
| 10 MHz to 50 MHz    | --            | +1.5/-1.5      | +1.5/-1.5      |
| 50 MHz to 500 MHz   | --            | +1.5/-1.5      | +1.5/-1.5      |
| 500 MHz to 3.2 GHz  | --            | +1.5/-1.5      | +1.5/-1.5      |
| 3.2 GHz to 10 GHz   | --            | +1.5/-1.5      | +1.5/-1.5      |
| 10 GHz to 13.5 GHz  | --            | +1.5/-1.5      | +1.5/-1.5      |
| 13.5 GHz to 16 GHz  | --            | +1.5/-1.5      | +1.5/-1.5      |
| 16 GHz to 20 GHz    | --            | +1.5/-1.5      | +1.5/-1.5      |
| 20 GHz to 24 GHz    | --            | +1.5/-1.5      | +1.5/-1.5      |
| 24 GHz to 26.5 GHz  | --            | +1.5/-1.5      | +1.5/-1.5      |
| 26.5 GHz to 43.5GHz | --            | +1.5/-5.0      | +1.5/-1.5      |
| 43.5 GHz to 46GHz   | --            | +1.5/-5.0      | +1.5/-1.5      |
| 46 GHz to 50GHz     | --            | +1.5/-25.0     | +1.5/-1.5      |

Table 8. Noise State Source Match, Port 1<sup>1</sup> (dB)

| Frequency            | Specification | Typical |
|----------------------|---------------|---------|
| 10 MHz to 50 MHz     | 8             | 12      |
| 50 MHz to 500 MHz    | 16            | 25      |
| 500 MHz to 3.2 GHz   | 16            | 21      |
| 3.2 GHz to 10 GHz    | 12            | 18      |
| 10 GHz to 13.5 GHz   | 12            | 17      |
| 13.5 GHz to 16 GHz   | 12            | 17      |
| 16 GHz to 20 GHz     | 12            | 18      |
| 20 GHz to 24 GHz     | 9             | 15      |
| 24 GHz to 26.5 GHz   | 9             | 15      |
| 26.5 GHz to 43.5 GHz | 5             | 10      |
| 43.5 GHz to 46 GHz   | 5             | 11      |
| 46 GHz to 50GHz      | 4             | 9       |

<sup>1</sup>Analyzer test set switches are set in accordance with the Figure 1 block diagram on page 30, but with a jumper replacing the ECal module.

Table 9. Noise State Source Match, Port 2<sup>1</sup> (dB)

| Frequency            | Specification | Typical |
|----------------------|---------------|---------|
| 10 MHz to 50 MHz     | 8             | 12      |
| 50 MHz to 500 MHz    | 10            | 17      |
| 500 MHz to 3.2 GHz   | 10            | 13      |
| 3.2 GHz to 10 GHz    | 6             | 8       |
| 10 GHz to 13.5 GHz   | 6             | 9       |
| 13.5 GHz to 16 GHz   | 6             | 9       |
| 16 GHz to 20 GHz     | 6             | 10      |
| 20 GHz to 24 GHz     | 6             | 10      |
| 24 GHz to 26.5 GHz   | 6             | 10      |
| 26.5 GHz to 43.5 GHz | 4             | 9       |
| 43.5 GHz to 46 GHz   | 4             | 10      |
| 46 GHz to 50GHz      | 3             | 8       |

<sup>1</sup>Analyzer test set switches are set in accordance with the Figure 1 block diagram on page 30, but with a jumper replacing the ECal module.

## Test Port Input: Option H29

Table 10. Receiver Noise Figure, Port 2 (dB)

| Frequency                                                    | Specification | Typical |
|--------------------------------------------------------------|---------------|---------|
| <b>800 kHz High Gain Setting<sup>1</sup></b>                 |               |         |
| 10 MHz to 60 MHz <sup>2</sup>                                | 22.0          | --      |
| 60 MHz to 200 MHz                                            | 9.0           | --      |
| 200 MHz to 2 GHz                                             | 12.0          | --      |
| 2 GHz to 13.5 GHz                                            | 14.5          | --      |
| 13.5 GHz to 20 GHz                                           | 14.5          | --      |
| 20 GHz to 26.5 GHz                                           | 17.0          | --      |
| <b>2 MHz, 4 MHz, 8 MHz BW, High Gain Setting<sup>1</sup></b> |               |         |
| 10 MHz to 60 MHz <sup>2</sup>                                | 22.0          | --      |
| 60 MHz to 200 MHz                                            | 9.0           | --      |
| 200 MHz to 2 GHz                                             | 12.0          | --      |
| 2 GHz to 13.5 GHz                                            | 14.5          | --      |
| 13.5 GHz to 20 GHz                                           | 14.5          | --      |
| 20 GHz to 26.5 GHz                                           | 17.0          | --      |
| <b>24 MHz BW, High Gain Setting<sup>1</sup></b>              |               |         |
| 10 MHz to 60 MHz <sup>2</sup>                                | 36.5          | --      |
| 60 MHz to 200 MHz                                            | 9.0           | --      |
| 200 MHz to 2 GHz                                             | 12.0          | --      |
| 2 GHz to 13.5 GHz                                            | 14.5          | --      |
| 13.5 GHz to 16 GHz                                           | 14.5          | --      |
| 16 GHz to 26.5 GHz                                           | 18.5          | --      |

<sup>1</sup>Using Option H29 noise receivers.

<sup>2</sup>Noise figure below 60 MHz is degraded due to noise from a local supply regulator in the N5244B/45B.

Table 11. Noise Jitter<sup>1,2</sup> (dB)

| Frequency                            | Specification | Typical |
|--------------------------------------|---------------|---------|
| <b>4 MHz BW, Low Gain Setting</b>    |               |         |
| 10 MHz to 15 MHz                     | 0.30          | 0.15    |
| 15 MHz to 3 GHz                      | 0.10          | 0.07    |
| 3 GHz to 13.5 GHz                    | 0.11          | 0.07    |
| 13.5 GHz to 26.5 GHz                 | 0.11          | 0.07    |
| <b>4 MHz BW, Medium Gain Setting</b> |               |         |
| 10 MHz to 15 MHz                     | 0.30          | 0.15    |
| 15 MHz to 3 GHz                      | 0.10          | 0.07    |
| 3 GHz to 13.5 GHz                    | 0.10          | 0.07    |
| 13.5 GHz to 26.5 GHz                 | 0.10          | 0.07    |
| <b>4 MHz BW, High Gain Setting</b>   |               |         |
| 10 MHz to 15 MHz                     | 0.10          | 0.07    |
| 15 MHz to 3 GHz                      | 0.10          | 0.07    |
| 3 GHz to 13.5 GHz                    | 0.10          | 0.07    |
| 13.5 GHz to 26.5 GHz                 | 0.10          | 0.07    |

<sup>1</sup> 201 points, 1 noise average

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

Table 12. Noise Receiver Linearity (dB)

| Power Range                          | Specification | Typical |
|--------------------------------------|---------------|---------|
| <b>4 MHz BW, Low Gain Setting</b>    |               |         |
| -36 dBm to -64 dBm                   | +/-0.05 dB    | --      |
| -64 dBm to -70 dBm                   | +/-0.10 dB    | --      |
| <b>4 MHz BW, Medium Gain Setting</b> |               |         |
| -48 dBm to -76 dBm                   | +/-0.05 dB    | --      |
| -76 dBm to -86 dBm                   | +/-0.10 dB    | --      |
| <b>4 MHz BW, High Gain Setting</b>   |               |         |
| -58 dBm to -84 dBm                   | +/-0.05 dB    | --      |
| -84 dBm to -92 dBm                   | +/-0.10 dB    | --      |

Table 13. Noise Receiver Input Range

| Power Range                                                | Specification      |                     |                    |
|------------------------------------------------------------|--------------------|---------------------|--------------------|
|                                                            | High Gain Setting  | Medium Gain Setting | Low Gain Setting   |
| <b>500 MHz to 3 GHz</b>                                    |                    |                     |                    |
| Max DUT NF + Gain (dB)                                     | 32 dB              | 44 dB               | 55 dB              |
| Max Input Power (dBm) for <0.1 dB Compression <sup>1</sup> | <=-57 dBm          | <=-45 dBm           | <=-36 dBm          |
| Max Operating Input Power (dBm)                            | -37 dBm<br>Typical | -33 dBm<br>Typical  | -26 dBm<br>Typical |
| Limit BW for full NF + Gain                                | 400 MHz            | 400 MHz             | 400 MHz            |
| <b>3 GHz to 13.5 GHz</b>                                   |                    |                     |                    |
| Max DUT NF + Gain (dB)                                     | 46 dB              | 57 dB               | 68 dB              |
| Max Input Power (dBm) for <0.1 dB Compression <sup>1</sup> | <=-43 dBm          | <=-32 dBm           | <=-21 dBm          |
| Max Operating Input Power (dBm) <b>Typical</b>             | -23 dBm            | -20 dBm             | -13 dBm            |
| Limit BW for full NF + Gain                                | 400 MHz            | 400 MHz             | 400 MHz            |
| <b>13.5 GHz to 26.5 GHz</b>                                |                    |                     |                    |
| Max DUT NF + Gain (dB)                                     | 46 dB              | 57 dB               | 68 dB              |
| Max Input Power (dBm) for <0.1 dB Compression <sup>1</sup> | <=-43 dBm          | <=-32 dBm           | <=-21 dBm          |
| Max Operating Input Power (dBm) <b>Typical</b>             | -23 dBm            | -20 dBm             | -13 dBm            |
| Limit BW for full NF + Gain                                | 400 MHz            | 400 MHz             | 400 MHz            |

<sup>1</sup> Derived from 0.25 dB CW compression specification and -5 dB offset, derived from exponential model for device compression. Referenced to test port 2.

## Test Port Output: Option H29

Table 14. Max Leveled Power, Port 1 Filtered Mode (dBm)

Option 423/H29

| Frequency          | Specification | Typical |
|--------------------|---------------|---------|
| 10 MHz to 50 MHz   | 3             | 10      |
| 50 MHz to 500 MHz  | 7             | 10      |
| 500 MHz to 3.2 GHz | 7             | 9       |
| 3.2 GHz to 10 GHz  | 12            | 15      |
| 10 GHz to 13.5 GHz | 10            | 12      |
| 13.5 GHz to 16 GHz | 10            | 12      |
| 16 GHz to 20 GHz   | 9             | 12      |
| 20 GHz to 26.5 GHz | 9             | 12      |
| 26.5 GHz to 30 GHz | 8             | 12      |
| 30 GHz to 32GHz    | 6             | 10      |
| 32 GHz to 35 GHz   | 8             | 12      |
| 35 GHz to 40 GHz   | 2             | 6       |
| 40 GHz to 43.5 GHz | 2             | 6       |
| 43.5 GHz to 47 GHz | -4            | 2       |
| 47 GHz to 50 GHz   | -15           | -7      |

Table 15. Max Leveled Power, Port 1 High Power Mode (dBm)

Option 423/H29

| Frequency          | Specification | Typical |
|--------------------|---------------|---------|
| 10 MHz to 50 MHz   | 10            | 17      |
| 50 MHz to 2 GHz    | 12            | 15      |
| 2 GHz to 3.2 GHz   | 9             | 12      |
| 3.2 GHz to 10 GHz  | 12            | 15      |
| 10 GHz to 13.5 GHz | 10            | 12      |
| 13.5 GHz to 16 GHz | 10            | 12      |
| 16 GHz to 20 GHz   | 9             | 12      |
| 20 GHz to 26.5 GHz | 9             | 12      |
| 26.5 GHz to 30 GHz | 8             | 12      |
| 30 GHz to 32 GHz   | 6             | 10      |
| 32 GHz to 35 GHz   | 8             | 12      |
| 35 GHz to 40 GHz   | 2             | 6       |
| 40 GHz to 43.5 GHz | 2             | 6       |
| 43.5 GHz to 47 GHz | -4            | 2       |
| 47 GHz to 50 GHz   | -15           | -7      |

Table 16. Max Leveled Power, Port 1 Source 1, Combine Mode, Filtered Mode (dBm)

Option 423/H29

| Frequency          | Specification | Typical |
|--------------------|---------------|---------|
| 10 MHz to 50 MHz   | --            | 3       |
| 50 MHz to 500 MHz  | --            | 3       |
| 500 MHz to 3.2 GHz | --            | 3       |
| 3.2 GHz to 10 GHz  | --            | 7       |
| 10 GHz to 13.5 GHz | --            | 3       |
| 13.5 GHz to 16 GHz | --            | 3       |
| 16 GHz to 20 GHz   | --            | 1       |
| 20 GHz to 24 GHz   | --            | 1       |
| 24 GHz to 26.5 GHz | --            | 1       |
| 26.5 GHz to 30 GHz | --            | 0       |
| 32 GHz to 35 GHz   | --            | 0       |
| 35 GHz to 40 GHz   | --            | -6      |
| 40 GHz to 43.5 GHz | --            | -6      |
| 43.5 GHz to 47 GHz | --            | -10     |
| 47 GHz to 50 GHz   | --            | -20     |

Table 17. Max Leveled Power, Port 1 Source 1, Combine Mode, High Power Mode (dBm)

Option 423/H29

| Frequency          | Specification | Typical |
|--------------------|---------------|---------|
| 10 MHz to 50 MHz   | --            | 10      |
| 50 MHz to 500 MHz  | --            | 10      |
| 500 MHz to 3.2 GHz | --            | 4       |
| 3.2 GHz to 10 GHz  | --            | 7       |
| 10 GHz to 13.5 GHz | --            | 3       |
| 13.5 GHz to 16 GHz | --            | 3       |
| 16 GHz to 20 GHz   | --            | 1       |
| 20 GHz to 24 GHz   | --            | 1       |
| 24 GHz to 26.5 GHz | --            | 1       |
| 26.5 GHz to 30 GHz | --            | 0       |
| 32 GHz to 35 GHz   | --            | 0       |
| 35 GHz to 40 GHz   | --            | -6      |
| 40 GHz to 43.5 GHz | --            | -6      |
| 43.5 GHz to 47 GHz | --            | -10     |
| 47 GHz to 50 GHz   | --            | -20     |

Table 18. Max Leveled Power, Port 1 Source 2, Combine Mode, Filtered Mode (dBm)

Option 423/H29

| Frequency          | Specification | Typical |
|--------------------|---------------|---------|
| 10 MHz to 50 MHz   | --            | 4       |
| 50 MHz to 500 MHz  | --            | 3       |
| 500 MHz to 3.2 GHz | --            | 3       |
| 3.2 GHz to 10 GHz  | --            | 6       |
| 10 GHz to 13.5 GHz | --            | 3       |
| 13.5 GHz to 16 GHz | --            | 3       |
| 16 GHz to 20 GHz   | --            | 1       |
| 20 GHz to 24 GHz   | --            | 1       |
| 24 GHz to 26.5 GHz | --            | 1       |
| 26.5 GHz to 30 GHz | --            | -1      |
| 32 GHz to 35 GHz   | --            | -1      |
| 35 GHz to 40 GHz   | --            | -7      |
| 40 GHz to 43.5 GHz | --            | -7      |
| 43.5 GHz to 47 GHz | --            | -12     |
| 47 GHz to 50 GHz   | --            | -24     |

Table 19. Max Leveled Power, Port 1 Source 2, Combine Mode, High Power Mode (dBm)

Option 423/H29

| Frequency          | Specification | Typical |
|--------------------|---------------|---------|
| 10 MHz to 50 MHz   | --            | 10      |
| 50 MHz to 500 MHz  | --            | 10      |
| 500 MHz to 3.2 GHz | --            | 4       |
| 3.2 GHz to 10 GHz  | --            | 6       |
| 10 GHz to 13.5 GHz | --            | 3       |
| 13.5 GHz to 16 GHz | --            | 3       |
| 16 GHz to 20 GHz   | --            | 1       |
| 20 GHz to 24 GHz   | --            | 1       |
| 24 GHz to 26.5 GHz | --            | 1       |
| 26.5 GHz to 30 GHz | --            | -1      |
| 32 GHz to 35 GHz   | --            | -1      |
| 35 GHz to 40 GHz   | --            | -7      |
| 40 GHz to 43.5 GHz | --            | -7      |
| 43.5 GHz to 47 GHz | --            | -12     |
| 47 GHz to 50 GHz   | --            | -24     |

Table 20. Max Leveled Power, Port 2 (dBm)

Option 423/H29

| Frequency          | Specification | Typical |
|--------------------|---------------|---------|
| 10 MHz to 50 MHz   | 9             | 18      |
| 50 MHz to 500 MHz  | 12            | 18      |
| 500 MHz to 3.2 GHz | 12            | 15      |
| 3.2 GHz to 10 GHz  | 12            | 15      |
| 10 GHz to 13.5 GHz | 10            | 12      |
| 13.5 GHz to 16 GHz | 10            | 12      |
| 16 GHz to 20 GHz   | 8             | 11      |
| 20 GHz to 26.5 GHz | 8             | 11      |
| 26.5 GHz to 30 GHz | 7             | 11      |
| 30 GHz to 32 GHz   | 5             | 9       |
| 32 GHz to 35 GHz   | 7             | 11      |
| 35 GHz to 40 GHz   | 1             | 5       |
| 40 GHz to 43.5 GHz | 1             | 5       |
| 43.5 GHz to 47 GHz | -5            | 2       |
| 47 GHz to 50 GHz   | -15           | -6      |

## Test Set Block Diagrams

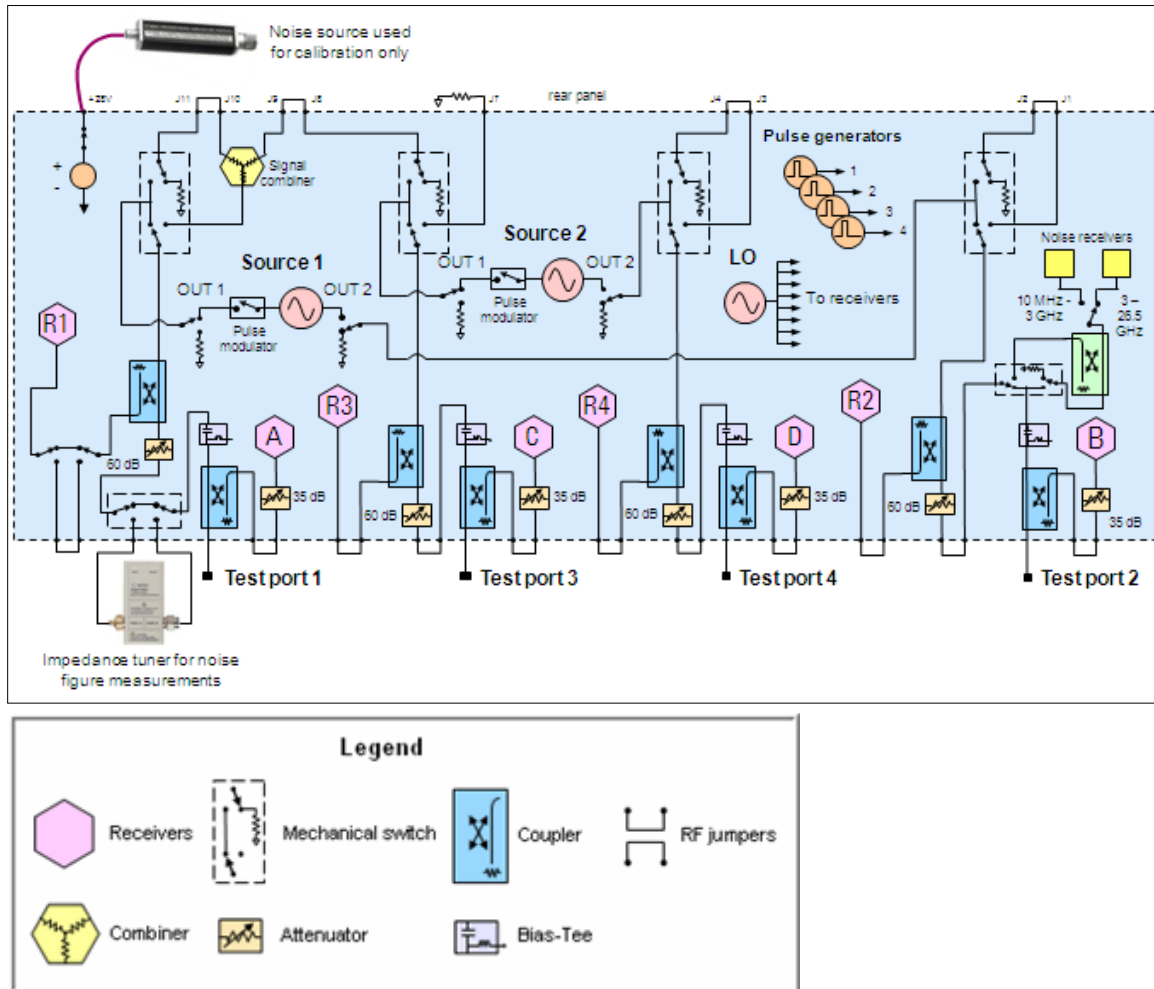
### NOTE

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

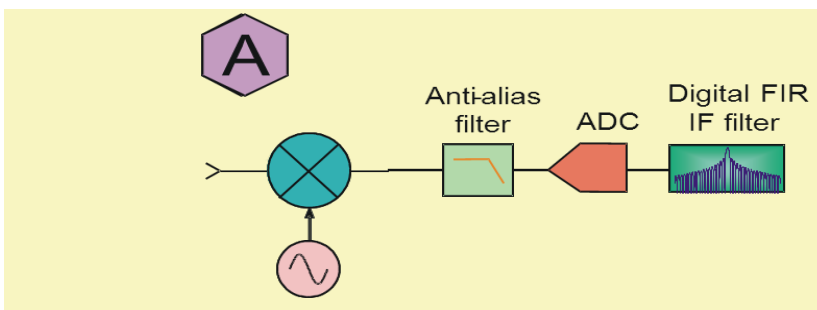
Figure 1. 4-Port N5244B and N5245B Option 423/H29

Adds internal combiner and mechanical switches.

Also shown, Option S93025A adds 4 pulse generators. Option 021 and 022 adds pulse modulators.



Receiver Block Diagram





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