

**SPECMONB Series  
Real-Time Spectrum Analyzers  
Specifications and Performance Verification  
Technical Reference**



077-0906-00



# **SPECMONB Series Real-Time Spectrum Analyzers Specifications and Performance Verification Technical Reference**

This document applies to instruments running software version 3.2.x or later.

## **Warning**

The servicing instructions are for use by qualified personnel only. To avoid personal injury, do not perform any servicing unless you are qualified to do so. Refer to all safety summaries prior to performing service.

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## General safety summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it.

To avoid potential hazards, use this product only as specified.

*Only qualified personnel should perform service procedures.*

While using this product, you may need to access other parts of a larger system. Read the safety sections of the other component manuals for warnings and cautions related to operating the system.

### To avoid fire or personal injury

**Use proper power cord.** Use only the power cord specified for this product and certified for the country of use.

**Ground the product.** This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

**Observe all terminal ratings.** To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

The inputs are not rated for connection to mains or Category II, III, or IV circuits.

**Power disconnect.** The power cord disconnects the product from the power source. Do not block the power cord; it must remain accessible to the user at all times.

**Do not operate without covers.** Do not operate this product with covers or panels removed.

**Do not operate with suspected failures.** If you suspect that there is damage to this product, have it inspected by qualified service personnel.

**Avoid exposed circuitry.** Do not touch exposed connections and components when power is present.

**Replace batteries properly.** Replace batteries only with the specified type and rating.

**Use proper fuse.** Use only the fuse type and rating specified for this product.

**Wear eye protection.** Wear eye protection if exposure to high-intensity rays or laser radiation exists.

**Do not operate in wet/damp conditions.**

**Do not operate in an explosive atmosphere.**

**Keep product surfaces clean and dry.**

**Provide proper ventilation.** Refer to the manual's installation instructions for details on installing the product so it has proper ventilation.

**Terms in this manual** These terms may appear in this manual:



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**WARNING.** *Warning statements identify conditions or practices that could result in injury or loss of life.*

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**CAUTION.** *Caution statements identify conditions or practices that could result in damage to this product or other property.*

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**Symbols and terms on the product**

These terms may appear on the product:

- DANGER indicates an injury hazard immediately accessible as you read the marking.
- WARNING indicates an injury hazard not immediately accessible as you read the marking.
- CAUTION indicates a hazard to property including the product.

The following symbol(s) may appear on the product:



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# Preface

This document contains the Specifications and the Performance Verification for the SPECMON3B, SPECMON6B, and SPECMON26B Real Time Spectrum Analyzers. It contains procedures suitable for determining that the analyzer functions, is adjusted properly, and meets the performance characteristics as warranted.

## Related Manuals

The following documents relate to the operation or service of the analyzer:

- The *SPECMONB Series Real-Time Spectrum Analyzers Quick Start User Manual* describes how to use your analyzer.
- The *SPECMONB Series Real-Time Spectrum Analyzers Application Examples Manual*, provides tutorial examples of how to take measurements in different application areas.
- The *SPECMONB Series Real-Time Spectrum Analyzers Programmers Manual* describes how to use a computer to control the analyzer through the GPIB interface.
- The *SPECMONB Series Real-Time Spectrum Analyzers Service Manual* provides information for maintaining and servicing your analyzer to the module level.



# Specifications

This section contains specifications for the SPECMONB Series Real Time Spectrum Analyzers. All specifications are warranted unless noted as a typical specification.

**Table 1: Specification categories**

<b>Category</b>	<b>Description</b>
Specified Characteristics	These are the warranted characteristics of the device, and are tested either on each unit in manufacturing or by type-testing. Specified characteristics include measurement tolerance and temperature limits.
Typical	This is performance that will be met by 80% of instruments with 80% confidence, for ambient temperatures in the range of 18 °C to 28 °C, immediately after performing an alignment. Values include the effects of the uncertainties of external calibration references and aging over the course of the published calibration interval. These values are determined from qualification testing and are not warranted or tested in the performance verification.
Typical-95	This is performance that will be met by 95% of instruments with 95% confidence, for ambient temperatures in the range of 18 to 28°C, immediately after performing an alignment. Values include the effects of the uncertainties of external calibration references and aging over the course of the recommended calibration interval. These values are determined from qualification testing and are not warranted or tested in the performance verification.
Typical-mean	This represents the mean of performance measured on a sample of units. Sample data is collected at laboratory temperature, immediately after performing an alignment. Values do not include the effects of uncertainties of external calibration references and aging over the course of the recommended calibration interval. These values are determined from qualification testing and are not warranted or tested in the performance verification.

Specifications that are marked with the ✓ symbol are checked in the Performance Verification section.

## Performance Conditions

The performance limits in these specifications are valid with these conditions:

- The spectrum analyzer must have been calibrated and adjusted at an ambient temperature between +18 °C and +28 °C.
- The spectrum analyzer must be in an environment with temperature, altitude, humidity, and vibration within the operating limits described in these specifications.
- The spectrum analyzer must have had a warm-up period of at least 20 minutes after starting the analyzer application.

## Electrical Specifications

Table 2: Frequency

Characteristic	Description	
Measurement frequency		
Frequency range, nominal	(LF Band)	1 Hz to 32 MHz
	SPECMON3B (RF band)	9 kHz to 3 GHz
	SPECMON6B (RF band)	9 kHz to 6.2 GHz
	SPECMON26B (RF Band)	1 MHz to 26.5 GHz
Frequency Marker	Readout Accuracy	$\pm(\text{RE} \times \text{MF} + 0.001 \times \text{Span} + 2)$ Hz RE: Reference Frequency Error MF: Marker Frequency [Hz]
	Readout Resolution	Reference level dependent As small as 0.0001 $\mu\text{V}$
Residual FM, typical	<2 Hz <sub>p-p</sub> in 1 second at 200 MHz CF, 100 Hz span, Freq vs Time mode, Autoscale (95% confidence)	
Span Accuracy	$\pm 0.3\%$ of span (Auto mode)	



Table 2: Frequency (cont.)

Characteristic	Description
Reference Frequency	
Stability, nominal	$2 \times 10^{-8}$
Adjustment Range	$\pm 5 \times 10^{-6}$ $\pm 5.5 \times 10^{-7}$ (Opt. PFR)
✓ Initial Accuracy at Cal	Within $1 \times 10^{-7}$ (after a 10 min warmup)
Aging	
Per day	$1 \times 10^{-8}$ (after 30 days of operation) $1 \times 10^{-9}$ (after 30 days of operation) (Opt. PFR)
First year	$1 \times 10^{-6}$ (1 year) $7.5 \times 10^{-8}$ (1 year) (Opt. PFR)
Long term	$3 \times 10^{-7}$ (10 years) (Opt. PFR)
Cumulative Error, typical (Temperature + Aging)	$3 \times 10^{-6}$ (1 year) $4 \times 10^{-7}$ (10 years) (Opt. PFR)
Temperature drift	$2 \times 10^{-6}$ (5 °C to 40 °C) $1 \times 10^{-7}$ (5 °C to 40 °C) (Opt. PFR)
Reference Output Level	✓ Internal or External Internal or External, typical
	>0 dBm +4 dBm
External Reference Input, nominal	BNC Connector, 50 $\Omega$
External Reference Input Frequency, nominal	Every 1 MHz from 1 to 100 MHz plus 1.2288 MHz, 4.8 MHz, and 19.6608 MHz Spurious level on input signal must be <-80 dBc within 100 kHz offset to avoid on-screen spurious
External Reference Input Range	$\pm 1 \times 10^{-6}$ $\pm 3 \times 10^{-7}$ (Opt. PFR)
✓ External Reference Input Level	-10 dBm to +6 dBm

Table 3: Phase noise

Characteristic	Description
✓ Specified	Noise sideband
	Offset
Frequency = 1000 MHz	-103 dBc/Hz
	1 kHz
	-109 dBc/Hz
	10 kHz
	-112 dBc/Hz
	100 kHz
	-130 dBc/Hz
	1 MHz
	-137 dBc/Hz
	6 MHz
	-137 dBc/Hz
	10 MHz

**Table 3: Phase noise (cont.)**

Characteristic	Description		
Typical			
	Frequency = 1000 MHz	-107 dBc/Hz	1 kHz
		-113 dBc/Hz	10 kHz
		-117 dBc/Hz	100 kHz
		-139 dBc/Hz	1 MHz
		-146 dBc/Hz	6 MHz
		-146 dBc/Hz	10 MHz
	Frequency = 2000 MHz	-107 dBc/Hz	1 kHz
		-112 dBc/Hz	10 kHz
		-115 dBc/Hz	100 kHz
		-137 dBc/Hz	1 MHz
		-142 dBc/Hz	6 MHz
		-142 dBc/Hz	10 MHz
SPECMON6B, SPECMON26B	Frequency = 6000 MHz	-104 dBc/Hz	1 kHz
		-108 dBc/Hz	10 kHz
		-114 dBc/Hz	100 kHz
		-135 dBc/Hz	1 MHz
		-147 dBc/Hz	6 MHz
		-147 dBc/Hz	10 MHz
SPECMON26B	Frequency = 10 GHz	-99 dBc/Hz	1 kHz
		-108 dBc/Hz	10 kHz
		-108 dBc/Hz	100 kHz
		-128 dBc/Hz	1 MHz
		-145 dBc/Hz	6 MHz
		-147 dBc/Hz	10 MHz
SPECMON26B	Frequency = 20 GHz	-95 dBc/Hz	1 kHz
		-106 dBc/Hz	10 kHz
		-106 dBc/Hz	100 kHz
		-125 dBc/Hz	1 MHz
		-140 dBc/Hz	6 MHz
		-144 dBc/Hz	10 MHz

**Table 3: Phase noise (cont.)**

Characteristic	Description
SPECMON26B Frequency = 10 MHz (LF band)	-128 dBc/Hz 1 kHz
	-134 dBc/Hz 10 kHz
	-134 dBc/Hz 100 kHz
	-135 dBc/Hz 1 MHz
	-140 dBc/Hz 6 MHz
Integrated Phase (RMS), typical	1.01x10 <sup>-3</sup> radians @ 1 GHz
	1.23x10 <sup>-3</sup> radians @ 2 GHz
	1.51x10 <sup>-3</sup> radians @ 6 GHz
	2.51x10 <sup>-3</sup> radians @ 10 GHz
	3.27x10 <sup>-3</sup> radians @ 20 GHz

**Table 4: RF input**

Characteristic	Description
RF Input Connector, nominal	N type (SPECMON6B) Planar Crown (SPECMON26B)
RF Input Impedance, nominal	50 Ω
RF VSWR, typical 95% confidence	Center Frequency set to within 200 MHz of any VSWR test frequency at time of test. RF ATT = 10 dB
Preamp OFF (SPECMON3B, SPECMON6B)	
>10 MHz to 2 GHz	<1.1
>2 GHz to 5 GHz	<1.25
>5 GHz to 6.2 GHz	<1.3
Preamp OFF (SPECMON26B)	
>10 MHz to 3 GHz	<1.3
>3 MHz to 6.2 GHz	<1.3
>6.2 GHz to 15 GHz	<1.5
>15 GHz to 22 GHz	<1.5
>22 GHz to 26.5 GHz	<1.7
Preamp ON (SPECMON3B, SPECMON6B)	
>10 MHz to 2 GHz	<1.2
>2 GHz to 6.2 GHz	<1.4
Preamp ON (SPECMON26B)	
>10 MHz to 3 GHz	<1.4
>3 GHz to 6.2 GHz	<1.5
>6.2 GHz to 15 GHz	<1.8
>15 GHz to 22 GHz	<1.8
>22 GHz to 26.5 GHz	<2.0

**Table 5: Maximum input level**

<b>Characteristic</b>	<b>Description</b>
Maximum DC voltage	±5 V (RF Input)
Maximum safe input power	+30 dBm (RF Input, RF ATT ≥10 dB, Preamp Off) +20 dBm (RF Input, RF ATT ≥10 dB, Preamp On) +50 Watts peak (RF Input, RF ATT ≥30 dB (<10 μs Pulse Width, 1% Duty Cycle repetitive Pulses))
Maximum Measurable input power	+30 dBm (RF Input, RF ATT Auto) +10 Watts peak (RF Input, RF ATT Auto), (<10 μs Pulse Width, 1% Duty Cycle repetitive pulses)

**Table 6: Input attenuator**

<b>Characteristic</b>	<b>Description</b>
RF Attenuator	0 dB to 55 dB (5 dB step), nominal

Table 7: Analog sweep

Characteristic	RBW	Instrument	Description
Sweep Time, typical RF & IF Optimization set to Minimize Sweep Time	Auto	SPECMON3B	2000 MHz/second tuning rate (standard)
		SPECMON6B	3300 MHz/second tuning rate (Option B40) 8000 MHz/second tuning rate (Option B85) 11000 MHz/second tuning rate (Option B16x)
		SPECMON26B	2000 MHz/second tuning rate (standard) 3300 MHz/second tuning rate (Option B40) 6000 MHz/second tuning rate (Option B85) 8000 MHz/second tuning rate (Option B16x)
		SPECMON3B	1500 MHz/second tuning rate (standard)
	100 kHz	SPECMON6B	2500 MHz/second tuning rate (Option B40) 5300 MHz/second tuning rate (Option B85) 7500 MHz/second tuning rate (Option B16x)
		SPECMON26B	1500 MHz/second tuning rate (standard) 2500 MHz/second tuning rate (Option B40) 4000 MHz/second tuning rate (Option B85) 5500 MHz/second tuning rate (Option B16x)
		SPECMON3B	300 MHz/second tuning rate (standard)
		SPECMON6B	500 MHz/second tuning rate (Option B40) 1000 MHz/second tuning rate (Option B85) 1750 MHz/second tuning rate (Option B16x)
	10 kHz	SPECMON26B	300 MHz/second tuning rate (standard) 500 MHz/second tuning rate (Option B40) 800 MHz/second tuning rate (Option B85) 1500 MHz/second tuning rate (Option B16x)
		SPECMON3B	200 MHz/second tuning rate (standard)
		SPECMON6B	300 MHz/second tuning rate (Option B40) 500 MHz/second tuning rate (Option B85) 850 MHz/second tuning rate (Option B16x)
		SPECMON26B	200 MHz/second tuning rate (standard) 300 MHz/second tuning rate (Option B40) 350 MHz/second tuning rate (Option B85) 700 MHz/second tuning rate (Option B16x)

**Table 8: Amplitude and RF flatness (excluding mismatch error) <sup>1</sup>**

Characteristic	Description	
Reference level setting range, nominal	-170 dBm to +40 dBm, 0.1 dB step, (Standard RF input)	
Frequency response (18 °C to 28 °C)		
✓ 10 dB RF attenuator setting, Preamp OFF	10 MHz to 32 MHz, LF Band	±0.2 dB
	10 MHz to 3 GHz	±0.35 dB
	3 GHz to 6.2 GHz (SPECMON6B, SPECMON26B only)	±0.5 dB
	6.2 GHz to 15 GHz (SPECMON26B only)	±1 dB
	15 GHz to 26.5 GHz (SPECMON26B only)	±1.2 dB
✓ 10 dB RF attenuator setting, Preamp ON (Option 50)	10 MHz to 32 MHz, LF Band	±0.5 dB
	10 MHz to 3 GHz	±0.5 dB
	3 GHz to 6.2 GHz (SPECMON6 only)	±0.7 dB
	6.2 GHz to 15 GHz (SPECMON26B only)	±1.0 dB
	15 GHz to 26.5 GHz (SPECMON26B only)	±1.2 dB
All RF attenuator settings, Preamp OFF, typical	1 Hz to 10 MHz (LF Band)	±0.7 dB
Frequency response (5 °C to 40 °C), typical		
All RF attenuator settings, Preamp OFF	100 Hz to 32 MHz (LF Band)	±0.8 dB
	9 kHz to 3 GHz	±0.5 dB
	1 MHz to 3 GHz	±0.5 dB
	3 GHz to 6.2 GHz (SPECMON6B, SPECMON26B only)	±1.0 dB
	6.2 GHz to 15 GHz (SPECMON26B only)	±1.0 dB
	15 GHz to 26.5 GHz (SPECMON26B only)	±1.5 dB
Attenuator = 10 dB, Preamp ON (Option 50)	1 MHz to 32 MHz (LF Band)	±0.8 dB
	1 MHz to 3 GHz	±0.8 dB
	3 GHz to 6.2 GHz (SPECMON6B, SPECMON26B only)	±1.3 dB
	6.2 GHz to 15 GHz (SPECMON26B only)	±1.5 dB
	15 GHz to 26.5 GHz (SPECMON26B only)	±2.0 dB
Input attenuator switching uncertainty	(SPECMON3B, SPECMON6B only)	±0.3 dB
	(SPECMON26B only)	±0.15 dB
✓ Absolute amplitude accuracy at calibration point (RF)		±0.31 dB (Preamp off)
		±0.5 dB (Preamp on)
Absolute amplitude accuracy at all center frequencies (18 °C to 28 °C) <sup>2</sup> , 95% confidence		

Characteristic	Description
	10 MHz to 3 GHz
	±0.3 dB
	3 GHz to 6.2 GHz (SPECMON6B, SPECMON26B only)
	±0.5 dB
	6.2 GHz to 15 GHz (SPECMON26B only)
	±0.75 dB
	15 GHz to 26.5 GHz (SPECMON26B only)
	±0.9 dB
Level Linearity	±0.1 dB (0 dB to -70 dB Below Reference Level)

<sup>1</sup> All amplitude and frequency response measurements made with Preamp OFF, except where noted, and Flattop window filter used to maximize CW amplitude measurement accuracy.

<sup>2</sup> Reference Level ≤ -15 dBm, -15 dBm to -50 dBm. 10 Hz ≤ RBW ≤ 1 MHz, after alignment performed.

**Table 9: Noise and distortion <sup>1</sup>**

Characteristic	Description
1 dB Compression Input <sup>2, 3</sup> RF Attenuation = 0 dB	2 GHz +6 dBm (SPECMON3B, SPECMON6B) +5 dBm (SPECMON26B)
1 dB Compression Input, typical <sup>2, 3</sup> RF Attenuation = 0 dB	300 MHz to 6.2 GHz +6 dBm (SPECMON3B, SPECMON6B) +5 dBm (SPECMON26B)
	6.2 GHz to 13 GHz +3 dBm (SPECMON26B)
	13 GHz to 15 GHz -2 dBm (SPECMON26B)
	15 GHz to 26.5 GHz +4 dBm (SPECMON26B)
1 dB Compression Input, Preamp ON, typical <sup>2, 3</sup> RF Attenuation = 0 dB	300 MHz to 6.2 GHz -18 dBm (SPECMON3B, SPECMON6B) -17 dBm (SPECMON26B)
	13 GHz to 15 GHz -20 dBm (SPECMON26B)
	15 GHz to 26.5 GHz -17 dBm (SPECMON26B)
3rd Order IM Intercept (TOI)	At 2.130 GHz +17 dBm (SPECMON3B, SPECMON6B) +15 dBm (SPECMON26B)
3rd Order IM Intercept (TOI), typical, (SPECMON3B, SPECMON6B)	At 2.130 GHz +18 dBm
	10 kHz to 32 MHz, LF Band +12.5 dBm
	9 kHz to 120 MHz +10 dBm
	120 MHz to 300 MHz +13 dBm
	300 MHz to 3 GHz +17 dBm
	3 GHz to 6.2 GHz +17 dBm (SPECMON6B)
3rd Order IM Intercept (TOI), typical, (SPECMON26B)	At 2.130 GHz +16 dBm
	10 kHz to 32 MHz, LF Band +12.5 dBm
	1 MHz to 120 MHz +10 dBm
	120 MHz to 300 MHz +13 dBm
	300 MHz to 6.2 GHz +16 dBm
	6.2 GHz to 15 GHz +11 dBm
	15 GHz to 26.5 GHz +11 dBm

**Table 9: Noise and distortion <sup>1</sup> (cont.)**

<b>Characteristic</b>	<b>Description</b>	
3rd Order IM Intercept (TOI), Preamp ON, typical (SPECMON3B, SPECMON6B)	At 2.130 GHz	-5 dBm
	10 kHz to 32 MHz, LF Band	-10 dBm
	9 kHz to 120 MHz	-15 dBm
	120 MHz to 300 MHz	-12.5 dBm
	300 MHz to 3 GHz	-10 dBm
	3 GHz to 6.2 GHz (SPECMON6B only)	-5 dBm
3rd Order IM Intercept (TOI), Preamp ON, typical, (SPECMON26B)	At 2.130 GHz	-5 dBm
	1 MHz to 120 MHz	-10 dBm
	120 MHz to 300 MHz	-10 dBm
	300 MHz to 6.2 GHz	-5 dBm
	6.2 GHz to 15 GHz	-10 dBm
	15 GHz to 26.5 GHz	-10 dBm



Table 9: Noise and distortion <sup>1</sup> (cont.)

Characteristic	Description		
<b>3rd Order Intermodulation Distortion <sup>4</sup></b>			
✓ Specified	At 2.130 GHz	-82 dBc	(SPECMON3B, SPECMON6B)
		-80 dBc	(SPECMON26B)
	Each signal level -25 dBm at the RF input. 1 MHz tone separation. Attenuator = 0, Ref Level = -20 dBm.		
(SPECMON3B, SPECMON6B), typical	10 kHz to 32 MHz (LF Band)	< -75 dBc	
	9 kHz to 120 MHz	< -70 dBc	
	120 MHz to 300 MHz	< -76 dBc	
	300 MHz to 3 GHz	< -84 dBc	
	3 GHz to 6.2 GHz (SPECMON6B only)	< -84 dBc	
(SPECMON26B), typical	10 kHz to 32 MHz, LF Band	< -75 dBc	
	1 MHz to 120 MHz	< -70 dBc	
	120 MHz to 300 MHz	< -76 dBc	
	300 MHz to 3 GHz	< -82 dBc	
	3 GHz to 6.2 GHz	< -82 dBc	
	6.2 GHz to 15 GHz	< -72 dBc	
	15 GHz to 26.5 GHz	< -72 dBc	
	Each signal level -25 dBm at the RF input. 1 MHz tone separation. Attenuator = 0, Ref Level = -20 dBm.		
<b>3rd Order Intermodulation Distortion, Preamp On, typical <sup>5</sup></b>			
(SPECMON3B, SPECMON6B)	1 MHz to 120 MHz	< -70 dBc	
	120 MHz to 300 MHz	< -75 dBc	
	300 MHz to 3 GHz	< -80 dBc	
	3 GHz to 6.2 GHz (SPECMON6 only)	< -90 dBc	

**Table 9: Noise and distortion <sup>1</sup> (cont.)**

<b>Characteristic</b>		<b>Description</b>
(SPECMON26B)	1 MHz to 120 MHz	< -80 dBc
	120 MHz to 300 MHz	< -80 dBc
	300 MHz to 6.2 GHz	< -90 dBc
	6.2 GHz to 15 GHz	< -80 dBc
	6.2 GHz to 15 GHz	< -80 dBc
2 <sup>nd</sup> Harmonic Distortion, typical. Preamp OFF		
(SPECMON3B, SPECMON6B)	10 MHz to 500 MHz	< -80 dBc
	500 MHz to 1 GHz	< -80 dBc
	1 GHz to 3.1 GHz	< -83 dBc
(SPECMON26B)	10 MHz to 500 MHz	< -80 dBc
	500 MHz to 1 GHz	< -74 dBc
	1 GHz to 3.1 GHz	< -74 dBc
	3.1 GHz to 7.5 GHz	< -85 dBc
	7.5 GHz to 13.25 GHz	< -85 dBc
2 <sup>nd</sup> Harmonic Distortion Preamp ON, typical		
	10 MHz to 13.5 GHz	< -50 dBc
2 <sup>nd</sup> Harmonic Distortion Intercept (SHI), typical		
	10 MHz to 500 MHz	+45 dBm
	500 MHz to 1 GHz	+34 dBm
	1 GHz to 3.1 GHz	+34 dBm
	3.1 GHz to 7.5 GHz	+45 dBm
	7.5 GHz to 13.25 GHz	+45 dBm
2 <sup>nd</sup> Harmonic Distortion Intercept (SHI) Preamp ON, typical		
	10 MHz to 13.25 GHz	+10 dBm

Table 9: Noise and distortion <sup>1</sup> (cont.)

Characteristic	Description	
Displayed Average Noise Level (DANL) Normalized to 1 Hz RBW with log-average detector		
Preamp OFF (Minimum noise mode)	✓ Specification	Typical
1 Hz to 100 Hz, LF Band	--	-129 dBm/Hz
100 Hz to 2 kHz, LF Band	-124 dBm/Hz	-143 dBm/Hz
2 kHz to 10 kHz, LF Band	-141 dBm/Hz	-152 dBm/Hz
10 kHz to 32 MHz, LF Band	-150 dBm/Hz	-153 dBm/Hz
9 kHz to 1 MHz	-108 dBm/Hz SPECMON3B, SPECMON6B	-111 dBm/Hz
1 MHz to 10 MHz	-136 dBm/Hz	-139 dBm/Hz
10 MHz to 2 GHz	-154 dBm/Hz SPECMON3B, SPECMON6B	-155 dBm/Hz
	-152 dBm/Hz SPECMON26B	-155 dBm/Hz
2 GHz to 3 GHz	-152 dBm /Hz	-155 dBm /Hz
3 GHz to 4 GHz	-151 dBm /Hz SPECMON6B, SPECMON26B	-155 dBm /Hz
4 GHz to 6.2 GHz	-149 dBm /Hz SPECMON6B, SPECMON26B	-149 dBm /Hz
6.2 GHz to 13 GHz	-146 dBm /Hz SPECMON26B	-149 dBm /Hz
13 GHz to 23 GHz	-144 dBm /Hz SPECMON26B	-147 dBm /Hz
23 GHz to 26.5 GHz	-140 dBm /Hz SPECMON26B	-143 dBm /Hz

**Table 9: Noise and distortion <sup>1</sup> (cont.)**

Characteristic	Description		
	Preamp ON (option 50/51 only)	✓ Specification	Typical
Displayed Average Noise Level (DANL) Normalized to 1 Hz RBW with log-average detector			
	1 MHz to 32 MHz, LF Band	-158 dBm/Hz	-160 dBm/Hz
	1 MHz to 10 MHz	-158 dBm/Hz	-160 dBm/Hz
	10 MHz to 2 GHz	-164 dBm/Hz	-167 dBm/Hz
	2 GHz to 3 GHz	-163 dBm/Hz	-165 dBm/Hz
	3 GHz to 6.2 GHz SPECMON6B	-162 dBm/Hz	-164 dBm/Hz
	3 GHz to 4 GHz SPECMON26B	-160 dBm/Hz	-163 dBm /Hz
	4 GHz to 6.2 GHz SPECMON26B	-159 dBm /Hz	-162 dBm /Hz
	6.2 GHz to 13 GHz SPECMON26B	-159 dBm /Hz	-162 dBm /Hz
	13 GHz to 23 GHz SPECMON26B	-157 dBm /Hz	-160 dBm /Hz
	23 GHz to 26.5 GHz SPECMON26B	-153 dBm /Hz	-156 dBm /Hz

<sup>1</sup> All noise and distortion measurements are made with Preamp OFF except where noted.

<sup>2</sup> Maximize Dynamic Range, "RF & IF Optimization" Mode, Span: 5 MHz.

<sup>3</sup> The 1 dB compression point for the RF conversion system can not be measured from outside the instrument, nor can signals get near it in operation. This is because the A/D converter will clip before the 1 dB compression is reached

<sup>4</sup> Each signal level -25 dBm at the RF input. 1 MHz tone separation. Attenuator = 0, Ref Level = -20 dBm.

<sup>5</sup> Each signal level -45 dBm at the RF input. 1 MHz tone separation. Attenuator = 0, Ref Level = -40 dBm.

**Table 10: Channel Response – Amplitude & Phase deviations**

Center frequency	Span	Amplitude flatness		Phase linearity
		✓ Specification <sup>1</sup>	Typical, RMS	Typical, RMS
0.01 GHz to 6.2 GHz	≤300 kHz <sup>2</sup>	±0.10 dB	0.05 dB	0.1°
0.03 GHz to 6.2 GHz	≤25 MHz	±0.30 dB	0.20 dB	0.5°
0.03 GHz to 6.2 GHz	≤40 MHz <sup>3</sup>	±0.30 dB	0.20 dB	0.5°
0.07 GHz to 3.0 GHz	≤85 MHz <sup>4</sup>	±0.50 dB	0.30 dB	1.5°
>3 GHz to 6.2 GHz	≤85 MHz <sup>4</sup>	±0.50 dB	0.40 dB	1.5°

**Table 10: Channel Response – Amplitude & Phase deviations (cont.)**

Center frequency	Span	Amplitude flatness		Phase linearity
>0.1 GHz to 6.2 GHz	≤165 MHz <sup>5</sup>	±0.50 dB	0.40 dB	1.5°
0.001 GHz to 0.032 GHz (LF Band)	≤20 MHz	±0.40 dB	0.30 dB	0.5°

<sup>1</sup> Checked by the IF test at 65 MHz (or 8GHz) combined with the RF flatness. Vector calibration ensures instruments meet these specifications across the range of measurement center frequencies

<sup>2</sup> Hi Dyn Range mode

<sup>3</sup> Option B40 / Option B85 / Option B16x

<sup>4</sup> Option B85 only

<sup>5</sup> Option B16x only

**Table 11: Channel response <sup>1</sup>**

Characteristic	Span	Description
✓ Amplitude Flatness	BW ≤ 300 kHz <sup>2</sup>	±0.1 dB
	300 kHz < BW ≤ 10 MHz <sup>2</sup>	±0.2 dB
	10 MHz < BW ≤ 25/40 MHz <sup>2</sup>	±0.4 dB
	40 MHz < BW ≤ 85 MHz <sup>2</sup>	±0.5 dB
	85 MHz < BW ≤ 110 MHz <sup>2</sup>	±0.5 dB
	110 MHz < BW ≤ 160 MHz <sup>2</sup>	±0.5 dB
Phase Linearity, typical	BW ≤300 kHz <sup>2</sup>	±0.1°
	300 kHz < BW ≤ 10 MHz <sup>2</sup>	±0.5°
	10 MHz < BW ≤ 25/40 MHz <sup>2</sup>	±0.75°
	40 MHz < BW ≤ 110 MHz <sup>2</sup>	±2.0°
	85 MHz < BW ≤ 110 MHz <sup>2</sup>	±2.0°
	110 MHz < BW ≤ 160 MHz <sup>2</sup>	±2.0°

<sup>1</sup> The BW value used in this table is the bandwidth of the channel. RF Attenuator = 10 dB. Use Flattop Window for maximum CW amplitude verification accuracy.

<sup>2</sup> After calibration and normalization, CF=200 MHz.

**Table 12: Pulse measurements, typical**

Characteristic	Description	
	85/160 MHz BW	25/40 MHz BW
Minimum Pulse Width for detection, typical	50 ns	150 ns
Average ON Power (18 °C to 28 °C), typical	±0.3 dB + absolute Amplitude Accuracy	
	For pulse widths ≥100 ns, duty cycles of 0.5 to 0.001, and S/N ratio = 30 dB	For pulse widths ≥300 ns, and signal levels >70 dB below Ref Level
Duty Factor, typical	±0.2% of reading	
	For pulse widths ≥150 ns, duty cycles of 0.5 to 0.001, and S/N ratio ≥30 dB	For pulse widths ≥450 ns, duty cycles of 0.5 to 0.001, and S/N ratio ≥30 dB

**Table 12: Pulse measurements, typical (cont.)**

<b>Characteristic</b>	<b>Description</b>	
Average Transmitted Power, typical	$\pm 0.4$ dB + absolute Amplitude Accuracy	
	For pulse widths $\geq 100$ ns, duty cycles of 0.5 to 0.001, and S/N ratio $\geq 30$ dB	For pulse widths $\geq 300$ ns, duty cycles of 0.5 to 0.001, and S/N ratio $\geq 30$ dB
Peak Pulse Power, typical	$\pm 0.4$ dB + absolute Amplitude Accuracy	
	For pulse widths $\geq 100$ ns, duty cycles of 0.5 to 0.001, and S/N ratio $\geq 30$ dB	For pulse widths $\geq 300$ ns, duty cycles of 0.5 to 0.001, and S/N ratio $\geq 30$ dB
Pulse Width, typical	$\pm 0.25\%$ of reading	
	For pulse widths $\geq 150$ ns, duty cycles of 0.5 to 0.001, and signal levels $> 50$ dB below Ref Level	For pulse widths $\geq 450$ ns, duty cycles of 0.5 to 0.001, and S/N ratio $\geq 30$ dB
System Rise time, typical	$< 12$ ns (85 MHz BW)	$< 40$ ns (25 MHz BW)
	$< 7$ ns (160 MHz BW)	$< 25$ ns (40 MHz BW)
Pulse-to-Pulse carrier phase, NON-Chirped Pulse, typical <sup>1 2</sup>		
	<b>60 MHz BW</b>	<b>25 MHz BW</b>
2 GHz	$\pm 0.3^\circ$	$\pm 0.2^\circ$
10 GHz	$\pm 0.5^\circ$	$\pm 0.5^\circ$
20 GHz	$\pm 0.8^\circ$	$\pm 0.8^\circ$
	<b>85 MHz BW</b>	<b>40 MHz BW</b>
2 GHz	$\pm 0.3^\circ$	$\pm 0.2^\circ$
10 GHz	$\pm 0.5^\circ$	$\pm 0.5^\circ$
20 GHz	$\pm 0.8^\circ$	$\pm 0.8^\circ$
	<b>160 MHz BW</b>	
2 GHz	$\pm 0.3^\circ$	
10 GHz	$\pm 0.5^\circ$	
20 GHz	$\pm 0.8^\circ$	

Table 12: Pulse measurements, typical (cont.)

Characteristic	Description			
Pulse-to-Pulse carrier phase, Linear-Chirped Pulse, typical <sup>3 4</sup>		<b>60 MHz BW</b>	<b>25 MHz BW</b>	
	2 GHz	±0.3°	±0.25°	
	10 GHz	±0.5°	±0.5°	
	20 GHz	±0.8°	±0.8°	
		<b>85 MHz BW</b>	<b>40 MHz BW</b>	
	2 GHz	±0.3°	±0.25°	
	10 GHz	±0.5°	±0.5°	
	20 GHz	±0.8°	±0.8°	
		<b>160 MHz BW</b>		
	2 GHz	±0.3°		
	10 GHz	±0.5°		
	20 GHz	±0.8°		
	Pulse-to-Pulse carrier frequency, NON-Chirped pulse, typical <sup>5 6</sup>		<b>60 MHz BW</b>	<b>25 MHz BW</b>
		2 GHz	±50 kHz	±15 kHz
		10 GHz	±75 kHz	±20 kHz
20 GHz		±100 kHz	±25 kHz	
		<b>85 MHz BW</b>	<b>40 MHz BW</b>	
2 GHz		±100 kHz	±20 kHz	
10 GHz		±125 kHz	±30 kHz	
20 GHz		±175 kHz	±40 kHz	
		<b>160 MHz BW</b>		
2 GHz		±100 kHz		
10 GHz		±125 kHz		
20 GHz		±175 kHz		

**Table 12: Pulse measurements, typical (cont.)**

<b>Characteristic</b>	<b>Description</b>		
Pulse-to-Pulse carrier frequency, Linear-Chirped pulse, typical <sup>7 8</sup>			
		<b>60 MHz BW</b>	<b>25 MHz BW</b>
	2 GHz	±125 kHz	±15 kHz
	10 GHz	±150 kHz	±20 kHz
	20 GHz	±150 kHz	±25 kHz
		<b>85 MHz BW</b>	<b>40 MHz BW</b>
	2 GHz	±125 kHz	±20 kHz
	10 GHz	±150 kHz	±30 kHz
	20 GHz	±175 kHz	±50 kHz
		<b>160 MHz BW</b>	
	2 GHz	±125 kHz	
	10 GHz	±150 kHz	
	20 GHz	±200 kHz	
	Pulse-to-Pulse delta frequency, NON-Chirped pulse, typical <sup>9 10</sup>		
			<b>60 MHz BW</b>
2 GHz		±1.5 kHz	±500 Hz
10 GHz		±3 kHz	±1.5 kHz
20 GHz		±4 kHz	±2 kHz
		<b>85 MHz BW</b>	<b>40 MHz BW</b>
2 GHz		±2 kHz	±1 kHz
10 GHz		±3 kHz	±2 kHz
20 GHz		±4 kHz	±3 kHz
		<b>160 MHz BW</b>	
2 GHz		±4.5 kHz	
10 GHz		±6 kHz	
20 GHz		±8 kHz	



Table 12: Pulse measurements, typical (cont.)

Characteristic	Description			
Pulse frequency linearity (Absolute frequency error RMS), typical <sup>11 12</sup>	<b>60 MHz BW</b>			
	2 GHz	±8 kHz	<b>25 MHz BW</b>	
	10 GHz	±15 kHz	±2.5 kHz	
	20 GHz	±20 kHz	±2.5 kHz	
		<b>85 MHz BW</b>	<b>40 MHz BW</b>	
	2 GHz	±15 kHz	±3.5 kHz	
	10 GHz	±20 kHz	±5 kHz	
	20 GHz	±25 kHz	±7.5 kHz	
		<b>160 MHz BW</b>		
	2 GHz	±20 kHz		
	10 GHz	±25 kHz		
	20 GHz	±40 kHz		
	Chirp frequency linearity (Absolute frequency error RMS), typical <sup>13 14</sup>	<b>60 MHz BW</b>		
		2 GHz	±25 kHz	<b>20 MHz BW</b>
		10 GHz	±30 kHz	±3 kHz
20 GHz		±30 kHz	±3 kHz	
		<b>85 MHz BW</b>	<b>25/40 MHz BW</b>	
2 GHz		±25 kHz	±5 kHz	
10 GHz		±25 kHz	±8 kHz	
20 GHz		±30 kHz	±10 kHz	
		<b>160 MHz BW</b>		
2 GHz		±35 kHz		
10 GHz		±40 kHz		
20 GHz		±40 kHz		

<sup>1</sup> For 60 MHz / 85 MHz / 160 MHz bandwidths, and conditions of:

Pulse ON power ≥ -20 dBm

Frequency Estimation = Manual

CW (non-chirped) pulses

Signal peak at Ref Lvl.

Atten = Auto

Pulse width ≥ 200 ns.

PRI ≤ 300 us.

Duty cycle ≥ 0.0007

$t_{\text{meas}} - t_{\text{reference}} \leq 10 \text{ ms}$

Phase measurement includes 100 pulses minimum.

Measured pulses to be adjacent.

- Measurement time position excludes the beginning and ending of the pulse extending for a time =  $(10/\text{measurement Bandwidth})$  as measured from the 50% point of the Tr or Tf.
- 2 For 25 MHz / 40 MHz bandwidths, and conditions of:
- Pulse ON power  $\geq -20$  dBm
  - Frequency Estimation = Manual
  - CW (non-chirped) pulses
  - Signal peak at Ref Lvl.
  - Atten = Auto
  - Pulse width  $\geq 300$  ns.
  - PRI  $\leq 300$  us.
  - Duty cycle  $\geq 0.001$
  - $t_{\text{meas}} - t_{\text{reference}} \leq 10$  ms
  - Phase measurement includes 100 pulses minimum.
  - Measured pulses to be adjacent.
  - Measurement time position excludes the beginning and ending of the pulse extending for a time =  $(10/\text{measurement Bandwidth})$  as measured from the 50% point of the Tr or Tf.
- 3 For 60 MHz / 85 MHz / 160 MHz bandwidths, and conditions of:
- Linear Chirped pulses
  - For signal type: Linear chirp, Peak to peak chirp deviation:  $\leq (0.8 \times \text{Measurement bandwidth})$
  - Frequency Estimation = Manual
  - Pulse ON power  $\geq -20$  dBm
  - Signal peak at Ref Lvl.
  - Atten = 0 dB
  - Pulse width  $\geq 100$  ns.
  - PRI  $\leq 300$  us.
  - Duty cycle  $\geq 0.0003$
  - $t_{\text{meas}} - t_{\text{reference}} \leq 10$  ms
  - Measurement time position excludes the beginning and ending of the pulse extending for a time =  $(10/\text{measurement Bandwidth})$  as measured from the 50% point of the Tr or Tf.
- 4 For 25 MHz / 40 MHz bandwidths, and conditions of:
- Linear Chirped pulses
  - For signal type: Linear chirp, Peak to peak chirp deviation:  $\leq (0.8 \times \text{Measurement bandwidth})$
  - Frequency Estimation = Manual
  - Pulse ON power  $\geq -20$  dBm
  - Signal peak at Ref Lvl.
  - Atten = 0 dB
  - Pulse width  $\geq 300$  ns.
  - PRI  $\leq 1000$  us.
  - Duty cycle  $\geq 0.0003$
  - $t_{\text{meas}} - t_{\text{reference}} \leq 10$  ms
  - Measurement time position excludes the beginning and ending of the pulse extending for a time =  $(10/\text{measurement Bandwidth})$  as measured from the 50% point of the Tr or Tf.
- 5 For 60 MHz / 85 MHz / 160 MHz bandwidths, and conditions of:
- CW (non-chirped) pulses
  - Frequency Estimation = Manual
  - Pulse ON power  $\geq -20$  dBm
  - Signal peak at Ref Lvl.
  - Atten = 0 dB
  - Pulse width  $\geq 200$  ns.
  - PRI  $\leq 300$  us.
  - Duty cycle  $\geq 0.0007$
  - $t_{\text{meas}} - t_{\text{reference}} \leq 10$  ms
  - Measurement time position excludes the beginning and ending of the pulse extending for a time =  $(10/\text{Measurement Bandwidth})$  as measured from the 50% point of the Tr or Tf.

- 6 For 25 MHz / 40 MHz bandwidths, and conditions of:  
CW (non-chirped) pulses  
Frequency Estimation = Manual  
Pulse ON power  $\geq -20$  dBm  
Signal peak at Ref Lvl.  
Atten = 0 dB  
Pulse width  $\geq 300$  ns.  
PRI  $\leq 300$   $\mu$ s.  
Duty cycle  $\geq 0.001$   
 $t_{\text{meas}} - t_{\text{reference}} \leq 10$  ms  
Measurement time position excludes the beginning and ending of the pulse extending for a time =  $(10/\text{Measurement Bandwidth})$  as measured from the 50% point of the Tr or Tf.
- 7 For 60 MHz / 85 MHz / 160 MHz bandwidths, and conditions of:  
Linear chirped pulses  
For signal type: Linear chirp, Peak to peak chirp deviation:  $\leq (0.8 \times \text{Measurement bandwidth})$   
Frequency Estimation = Manual  
Pulse ON power  $\geq -20$  dBm  
Signal peak at Ref Lvl.  
Atten = 0 dB  
Pulse width  $\geq 100$  ns.  
PRI  $\leq 300$   $\mu$ s.  
Duty cycle  $\geq 0.0003$   
 $t_{\text{meas}} - t_{\text{reference}} \leq 10$  ms  
Measurement time position excludes the beginning and ending of the pulse extending for a time =  $(10/\text{Measurement Bandwidth})$  as measured from the 50% point of the Tr or Tf.
- 8 For 25 MHz / 40 MHz bandwidths, and conditions of:  
Linear chirped pulses  
For signal type: Linear chirp, Peak to peak chirp deviation:  $\leq (0.8 \times \text{Measurement bandwidth})$   
Frequency Estimation = Manual  
Pulse ON power  $\geq -20$  dBm  
Signal peak at Ref Lvl.  
Atten = 0 dB  
Pulse width  $\geq 300$  ns.  
PRI  $\leq 1000$   $\mu$ s.  
Duty cycle  $\geq 0.0003$   
 $t_{\text{meas}} - t_{\text{reference}} \leq 10$  ms  
Measurement time position excludes the beginning and ending of the pulse extending for a time =  $(10/\text{Measurement Bandwidth})$  as measured from the 50% point of the Tr or Tf.
- 9 For 60 MHz / 85 MHz / 160 MHz bandwidths, and conditions of:  
CW (non-chirped) pulses  
Frequency Estimation = Manual  
Pulse ON power  $\geq -20$  dBm  
Signal peak at Ref Lvl.  
Atten = 0 dB  
Pulse width  $\geq 1.0$   $\mu$ s.  
PRI  $\leq 300$   $\mu$ s.  
Duty cycle  $\geq 0.0007$   
 $t_{\text{meas}} - t_{\text{reference}} \leq 10$  ms  
Measurement time position excludes the beginning and ending of the pulse extending for a time =  $(10/\text{Measurement Bandwidth})$  as measured from the 50% point of the Tr or Tf.
- 10 For 25 MHz / 40 MHz bandwidths, and conditions of:  
CW (non-chirped) pulses  
Frequency Estimation = Manual  
Pulse ON power  $\geq -20$  dBm

Signal peak at Ref Lvl.

Atten = 0 dB

Pulse width  $\geq 2.0$  us.

PRI  $\leq 300$  us.

Duty cycle  $\geq 0.001$

$t_{\text{meas}} - t_{\text{reference}} \leq 10$  ms

Measurement time position excludes the beginning and ending of the pulse extending for a time =  $(10/\text{Measurement Bandwidth})$  as measured from the 50% point of the Tr or Tf.

- 11 For 60 MHz / 85 MHz / 160 MHz bandwidths, and conditions of:

Linear chirped pulses

For signal type: Linear chirp, Peak to peak chirp deviation:  $\leq (0.8 \times \text{Measurement bandwidth})$

Frequency Estimation = Manual

Pulse ON power  $\geq -20$  dBm

Signal peak at Ref Lvl.

Atten = 0 dB

Pulse width  $\geq 100$  ns.

PRI  $\leq 300$  us.

Duty cycle  $\geq 0.0003$

$t_{\text{meas}} - t_{\text{reference}} \leq 10$  ms

Absolute Frequency Error determined over center 50% of pulse.

- 12 For 25 MHz / 40 MHz bandwidths, and conditions of:

Linear chirped pulses

For signal type: Linear chirp, Peak to peak chirp deviation:  $\leq (0.8 \times \text{Measurement bandwidth})$

Frequency Estimation = Manual

Pulse ON power  $\geq -20$  dBm

Signal peak at Ref Lvl.

Atten = 0 dB

Pulse width  $\geq 300$  ns.

PRI  $\leq 1000$  us.

Duty cycle  $\geq 0.0003$

$t_{\text{meas}} - t_{\text{reference}} \leq 10$  ms

Absolute Frequency Error determined over center 50% of pulse.

- 13 For 25 MHz / 40 MHz bandwidths, and conditions of:

CW (non-chirped) pulses

Frequency Estimation = Manual

Pulse ON power  $\geq -20$  dBm

Signal peak at Ref Lvl.

Atten = 0 dB

Pulse width  $\geq 100$  ns.

PRI  $\leq 300$  us.

Duty cycle  $\geq 0.0003$

$t_{\text{meas}} - t_{\text{reference}} \leq 10$  ms

Absolute Frequency Error determined over center 50% of pulse.

- 14 For 25 MHz / 40 MHz bandwidths, and conditions of:

Linear chirped pulses

For signal type: Linear chirp, Peak to peak chirp deviation:  $\leq (0.8 \times \text{Measurement bandwidth})$

Frequency Estimation = Manual

Pulse ON power  $\geq -20$  dBm

Signal peak at Ref Lvl.

Atten = 0 dB

Pulse width  $\geq 300$  ns.

PRI  $\leq 1000$  us.

Duty cycle  $\geq 0.0003$

$$t_{\text{meas}} - t_{\text{reference}} \leq 10 \text{ ms}$$

Absolute Frequency Error determined over center 50% of pulse.

**Table 13: Impulse response**

Characteristic	Description
Impulse Response Measurement Range (nominal)	15 to 40 dB Across the width of the chirp
Impulse Response Measurement Accuracy (nominal)	$\pm 2 \text{ dB}^1$ For a signal 40 dB in amplitude and delayed 1% to 40% of the chirp width
Impulse Response Weighting	Taylor Window

<sup>1</sup> Chirp width 100 MHz, pulse width 10  $\mu\text{s}$ , minimum signal delay 1% of pulse width or 10/(chirp bandwidth), whichever is greater, and minimum 2000 sample points during pulse on-time.

**Table 14: Test Parameters for Pulse to Pulse Carrier Phase/Frequency**

	Acquisition BW (MHz)	Gaussian Filter BW (MHz)	IQ Sampling Rate (MHz)	Min Pulse Length (ns)	Min Measurement Timing from Rising Edge (ns)
Std/Option B40	20	10	25	3000	1000
Std/Option B40	25	12.5	50	3000	1000
Option B85	60	30	75	1500	500
Option B85	85	42.5	150	750	250
Option B16x	160	80	200	600	200

**Table 15: Spurious response**

Characteristic	Description	
Residual Response (Atten = 0 dB, Ref = -30 dBm, RBW = 1 kHz)	✓ 200 MHz to 3 GHz	<-95 dBm
	✓ 3 GHz to 6.2 GHz (SPECMON6B only)	<-95 dBm
	✓ 15 GHz to 26.5 GHz (SPECMON26B only)	<-95 dBm
	500 kHz to 32 MHz, LF band	<-100 dBm, typical
	500 kHz to 80 MHz, RF band, SPECMON3B, 6B	<-75 dBm, typical
	1 MHz to 80 MHz, RF band, SPECMON26B	<-75 dBm, typical
	80 MHz to 200 MHz, RF band, SPECMON26B	<-95 dBm, typical
Residual DC Offset after Normalization (LF Path), typical	<-40 dBm (Ref level $\leq 0$ dBm)	
	<-40 dBm from Ref level (Ref level $> 0$ dBm)	

**Table 15: Spurious response (cont.)**

Characteristic	Description
✓ Spurious Response with Signal (Image Suppression)	<p>&lt;-75 dBc (10 kHz to &lt;30 MHz, Ref= -30 dBm, Atten = 10 dB, RF Input Level = -30 dBm, RBW = 10 Hz)</p> <p>&lt;-75 dBc (30 MHz to 3 GHz, Ref= -30 dBm, Atten = 10 dB, RF Input Level = -30 dBm, RBW = 10 Hz)</p> <p>&lt;-70 dBc (3 GHz to 6.2 GHz, Ref= -30 dBm, Atten = 10 dB, RF Input Level = -30 dBm, RBW = 10 Hz)</p> <p>&lt;-76 dBc (6.2 GHz to 15 GHz, Ref= -30 dBm, Atten = 10 dB, RF input Level = -30 dBm, RBW = 10 Hz)</p> <p>&lt;-72 dBc (15 GHz to 26.5 GHz, Ref= -30 dBm, Atten = 10 dB, RF input Level = -30 dBm, RBW = 10 Hz)</p> <p>Equal or better performance is expected when Preamp is turned on and the power level at the output of RF attenuator is lower or equal than -55 dBm.</p>
Spurious Response with Signal at Center Frequency	✓ CF = 1 MHz to 6.2 GHz, offset ≥ 400 kHz (See Table 16.)
	✓ CF = 1 MHz to 6.2 GHz, offset ≤ 400 kHz (See Table 17.)
Spurious Response with Signal at Frequency other than Center Frequency	300 MHz to 6.2 GHz (See Table 18.)
✓ Spurious Response with Signal at 3.5125 GHz - Half-IF (SPECMON3B, SPECMON6B, SPECMON26B)	<p>&lt;-80 dBc (CF 30 MHz to 3 GHz, Ref = -30 dBm, Atten = 10 dB, RBW = 1 kHz)</p> <p>Signal frequency range = 3.53275 GHz, RF input level = -30 dBm</p> <p>This is an input signal at half the IF frequency.</p>
✓ Spurious Response with Signal at 3.5125 GHz - Half IF (SPECMON6B, SPECMON26B)	<p>&lt;-80 dBc (CF 30 MHz to 6.2 GHz, Ref = -30 dBm, Atten = 10 dB, RBW = 1 kHz)</p> <p>Signal frequency range = 3.53275 GHz, RF input level = -30 dBm</p> <p>This is an input signal at half the IF frequency.</p>
✓ Spurious Response with Signal at 3.5125 GHz - Half IF (SPECMON26B)	<p>&lt;-80 dBc (CF 6.2 GHz to 26.5 GHz, Ref = -30 dBm, Atten = 10 dB, RBW = 1 kHz)</p> <p>Signal frequency range = 3.53275 GHz, RF input level = -30 dBm</p> <p>This is an input signal at half the IF frequency.</p>
✓ Spurious Response with Signal at Half Block Converter Output Frequency (SPECMON26B)	<p>&lt;-80 dBc. CF 6.2 GHz to 26.5 GHz, Ref= -30 dBm, Atten = 10 dB, RBW=1 kHz)</p> <p>Set the Signal Frequency following the 'Half IF Table', RF input Level = -30 dBm (See Table 72.)</p>

Table 15: Spurious response (cont.)

Characteristic	Description
<p>✓ Spurious Response with Signal at Block Converter output frequency (SPECMON26B)</p> <p>Equal or better performance is expected when Preamp is turned on and the power level at the output of RF attenuator is lower or equal than -55dBm. Not guaranteed and not part of PV.</p>	<p>&lt;-70 dBc. (CF 6.2 GHz to 26.5 GHz, Ref= -30 dBm, Atten = 10 dB, RBW=1 kHz)</p> <p>Set the Signal Frequency following the 'IF Feed-Through Table', RF input Level = -30 dBm (See Table 73.)</p>
Local Oscillator Feed-through to Input Connector (Spurious Leakage), typical (Attenuator = 10 dB)	<p>&lt;-60 dBm (SPECMON3B, SPECMON6B)</p> <p>&lt;-90 dBm (SPECMON26B)</p>

Table 16: Spurious response with signal at center frequency (offset  $\geq 400$  kHz)

Frequency	Span $\leq 25$ MHz, Swept Spans $> 25$ MHz		For Option B40 <sup>1</sup> Span $\leq 40$ MHz Swept Spans $> 40$ MHz		For Option B85/B16x <sup>1</sup> 40 MHz $<$ Span $\leq 160$ MHz	
	Specification	Typical	Specification	Typical		
1 MHz to 32 MHz (LF band)	-80 dBc	-85 dBc	--	--		
30 MHz to 3 GHz	-73 dBc	-80 dBc	-73 dBc	-80 dBc	-73 dBc	-75 dBc
3 GHz to 6.2 GHz (SPECMON6B only)	-73 dBc	-80 dBc	-73 dBc	-80 dBc	-73 dBc	-75 dBc
15 GHz to 26.5 GHz (SPECMON26B only)	-66 dBc	-76 dBc	-66 dBc	-76 dBc	-66 dBc	-73 dBc

<sup>1</sup> Center frequency  $\geq 150$  MHz for Options B40/B85/B16x.

Table 17: Spurious response with signal at center frequency ( $10$  kHz  $\leq$  offset  $\leq 400$  kHz)

Frequency	Typical, Span = 1 MHz
1 MHz to 32 MHz (LF band)	-75 dBc
30 MHz to 3 GHz	-75 dBc
3 GHz to 6.2 GHz (SPECMON6B only)	-75 dBc
15 GHz to 26.5 GHz (SPECMON26B only)	-68 dBc

Table 18: Spurious response with signal at other than CF

Frequency	Span $\leq 25$ MHz, Swept Spans $> 25$ MHz	For Option B40 <sup>1</sup> Span $\leq 40$ MHz, Swept Spans $> 40$ MHz	For Option B85 <sup>1</sup> 40 MHz $<$ Span $\leq$ 85 MHz	For Option B16x <sup>1,2</sup> 85 MHz $<$ Span $\leq$ 160 MHz
1 MHz to 32 MHz (LF band)	-80 dBc	--	--	--
30 MHz to 3 GHz	-80 dBc	-80 dBc	-76 dBc	-73 dBc

**Table 18: Spurious response with signal at other than CF (cont.)**

<b>Frequency</b>	<b>Span ≤25 MHz, Swept Spans &gt;25 MHz</b>	<b>For Option B40<sup>1</sup> Span ≤40 MHz, Swept Spans &gt;40 MHz</b>	<b>For Option B85<sup>1</sup> 40 MHz &lt; Span ≤ 85 MHz</b>	<b>For Option B16x<sup>1 2</sup> 85 MHz &lt; Span ≤ 160 MHz</b>
3 GHz to 6.2 GHz (SPECMON6B only)	-80 dBc	-73 dBc	-76 dBc	-73 dBc
15 GHz to 26.5 GHz (SPECMON26B only)	-76 dBc	-76 dBc	-73 dBc	-73 dBc

<sup>1</sup> Center frequency ≥150 MHz for Options B40/B85/B16x.

<sup>2</sup> -70 dBc for input signals 20 MHz above or below instrument center frequency

**Table 19: Acquisition**

<b>Characteristic</b>	<b>Description</b>
Real-time Capture Bandwidth, nominal	25 MHz (RF, Standard Version) 40 MHz (RF, Option B40 Version) 85 MHz (RF, Option B85 Version) 165 MHz (RF, Option B16x Version)
Demodulation Bandwidth	25 MHz (RF, Standard Version) 40 MHz (RF, Option B40 Version) 85 MHz (RF, Option B85 Version) 165 MHz (RF, Option B16x Version)
A/D Converter, nominal	16 bits, 200 Ms/s (Standard Version & Option B40) 16 bits, 200 Ms/s & 14 bits, 400 Ms/s (Option B85/B16x)



Table 19: Acquisition (cont.)

Characteristic	Description				
	Span	Sample Rate	Acquisition BW	Record Length (Standard)	Record Length (option 53)
Sampling Rate and Available Memory time in RTSA/Time/Demod Mode, nominal	165 MHz	200.0E+6	165E+6	1.34	5.37
	85 MHz	200.0E+6	165E+6	1.34	5.37
	80 MHz	100.0E+6	80E+6	2.68	10.74
	40 MHz	50.0E+6	40E+6	4.77	19.09
	25 MHz	50.0E+6	40E+6	4.77	19.09
	20 MHz	25.0E+6	20E+6	9.54	38.18
	10 MHz	12.5E+6	10E+6	19.09	76.35
	5 MHz	6.250E+6	5E+6	38.18	152.71
	2 MHz	3.125E+6	2.5E+6	42.9	171.8
	1 MHz	1.562500E+6	1.250E+6	85.9	343.6
	500 kHz	781.250000E+3	625E+3	171.8	687.2
	200 kHz	390.625000E+3	312.5E+3	343.6	1374.4
	100 kHz	195.312500E+3	156.25E+3	687.2	2748.8
	50 kHz	97.656250E+3	78.125E+3	1374.4	5497.6
	20 kHz	48.828125E+3	39.0625E+3	2748.8	10995.1
	10 kHz	24.4140625E+3	19.531250E+3	5497.6	21990.2
	5 kHz	12.20703125E+3	9.765625E+3	10995.1	43980.5
	2 kHz	3.0517578125E+3	2.44140625E+3	43980.4	175921.8
	1 kHz	1.52587890625E+3	1.220703125E+3	87960.8	351843.6
	500 Hz	762.939453125	610.3515625	175921.7	703687.3
200 Hz	381.4697265625	305.17578125	351843.4	1407374.5	
100 Hz	190.73486328125	152.587890625	703686.8	2814749.1	
The record lengths given here use $M = 10^6$ instead of $1M = 2^{20}$ . This is done to allow sufficient samples to be discarded to compensate for filter delays.					
Minimum Acquisition Length in RTSA/Time/Demod Mode, nominal	64 samples				

**Table 19: Acquisition (cont.)**

Characteristic	Description
Maximum Acquisition Length in RTSA/Time/Demod Mode (Acquisition BW Dependent), nominal	256 M samples (Std) 1 G samples (Opt 53)
Acquisition Length Setting resolution in RTSA/Time/Demod Mode, nominal	1 sample
Acquisition Memory Size	Acq BW >2.5 MHz (1 GB) (Std) 256 MSamples
	Acq BW ≤2.5 MHz (1 GB) (Std) 128 MSamples
	Acq BW >2.5 MHz (4 Gbyte) (Option 53) 1 GSamples
	Acq BW ≤2.5 MHz (4 Gbyte) (Option 53) 512 MSamples

**Table 20: Amplitude vs. time**

Characteristic	Description
Time Scale (Zero Span), nominal	400 ns min to 2000 s max (Option B16x) 1 μs min to 2000 s max (Standard)
Time Accuracy	±0.5% of total time
Time Resolution	0.1% of total time
Time Linearity	±0.5% of total time (measured at 11 equally-spaced points across the display, including the ends)

Table 21: Trigger

Characteristic	Description
Trigger Mode, Type, & Source, nominal	<p>Modes:</p> <ul style="list-style-type: none"> <li>Free Run (Triggered by the end of the preceding acquisition)</li> <li>Triggered (Triggered by Event)</li> <li>Fast Frame (Triggered by Event, sequential storage of acquisitions)</li> </ul> <p>Types:</p> <ul style="list-style-type: none"> <li>Single (one acquisition from one trigger)</li> <li>Continuous (repeated acquisitions from repeating triggers)</li> </ul> <p>Sources:</p> <ul style="list-style-type: none"> <li>RF Input</li> <li>Trigger 1 (Front)</li> <li>Trigger 2/ Gate (Rear)</li> <li>Gated (Logical AND of the selected edge [rising or falling] of TRIG 1 and the selected level [LOW or HIGH] of TRIG 2)</li> <li>Line</li> </ul>
Trigger Event Types	<ul style="list-style-type: none"> <li>Power Level (IF Span BW after RBW and VBW filters)</li> <li>Frequency Mask</li> <li>DPX Statistics Trigger</li> <li>Runt Trigger (applies to Power Level Trigger)</li> <li>Time-Qualified Trigger</li> <li>Holdoff Trigger</li> </ul>
Trigger Event Delay Range, nominal	20 ns to 60 s
Trigger Event Delay Resolution, nominal	20 ns
Trigger Event Delay Uncertainty, nominal	±20 ns
Pre/Post Trigger Setting, nominal	Trigger Position is settable within 1% to 99% of Total Data Length
Power Trigger Level Range, nominal	0 dB to -100 dB from Reference Level
Power Trigger Level Resolution, nominal	0.1 dB
Power Trigger Level Accuracy	This applies when the Trigger Level is between 10% and 90% of the signal amplitude
Typical	±0.5 dB (level ≥ -50 dB from Reference Level) for trigger levels >30 dB above the noise floor
Nominal	±1.5 dB (from -50 dB to -70 dB from Reference Level) for trigger levels >30 dB above the noise floor
Power Trigger Position Timing Uncertainty, typical	<ul style="list-style-type: none"> <li>±12 ns for 25/40 MHz Acq BW using no trigger RBW</li> <li>±15 ns for 25/40 MHz Acq BW using 20 MHz trigger RBW</li> <li>±4 ns for 85/165 MHz Acq BW using no trigger RBW</li> <li>±5 ns for 85/165 MHz Acq BW using 60 MHz trigger RBW</li> </ul>
Power Trigger Bandwidth setting, nominal	Not an independent setting. This is set by the "Time Domain Bandwidth" control.

**Table 21: Trigger (cont.)**

<b>Characteristic</b>	<b>Description</b>
Power Trigger Minimum Event Duration, nominal	6.2 ns (Acq BW = 85/165 MHz, no TDBW, Option B85/B16x) 25 ns (Acq BW = 25/40 MHz, no TDBW, Standard & Option B40)
Frequency Edge Trigger Range, nominal	$\pm(1/2 \times (\text{ACQ BW or TDBW if TDBW is active}))$
Frequency Edge Trigger Timing Uncertainty, nominal	Same as power trigger position timing uncertainty.
Frequency Mask Trigger Mask Point Horizontal Resolution, nominal	<0.12% of span
Frequency Mask Trigger Level Range, nominal	0 to -80 dB from reference level for spans $\leq 25$ MHz (Standard) for spans $\leq 40$ MHz (Option B40) for spans $\leq 85$ MHz (Option B85) for spans $\leq 165$ MHz (Option B16x)
Frequency Mask Trigger Level Resolution, nominal	0.1 dB
Frequency Mask Trigger Level Accuracy (with respect to Reference Level)	Instrument Center Frequency $\geq 100$ MHz
Typical	$\pm(\text{Channel Response Flatness} + 1 \text{ dB})$ (for mask levels $\geq -50$ dB) for masks >30 dB above the noise floor
Nominal	$\pm(\text{Channel Response Flatness} + 2.5 \text{ dB})$ (for mask levels of -50 dB to -70 dB) for masks >30 dB above the noise floor
Frequency Mask Trigger Max Real-time Event Detection Bandwidth, nominal	25 MHz (1024 point FFT, 50% overlapping, Option B25) 40 MHz (1024 point FFT, 50% overlapping, Option B40) 85 MHz (1024 point FFT, 50% overlapping, Option B85) 165 MHz (1024 point FFT, 50% overlapping, Option B16x)

Table 21: Trigger (cont.)

Characteristic	Description							
	Span, MHz	RBW, kHz	FFT length, points	Spect- rums/s	Amplitude			
					Standard		Option 09	
Frequency Mask Trigger Real-time Event Minimum Duration for 100% probability of trigger, nominal				Full	-3 dB	Full	-3 dB	
165	20000	1024	390625	15.5	15.4	2.7	2.6	
	10000	1024	390625	15.6	15.4	2.8	2.6	
	1000	1024	390625	17.8	15.7	5.0	2.9	
	300	2048	195313	23.4	16.3	13.1	6.1	
	100	8192	48828	44.5	23.4	44.5	23.4	
	30	32768	12207	161.9	91.7	161.9	91.7	
	25	32768	12207	178.0	93.6	178.0	93.6	
85	10000	1024	390625	15.6	15.4	2.8	2.6	
	1000	1024	390625	17.8	15.7	5.0	2.9	
	500	1024	390625	20.2	15.9	7.4	3.1	
	300	1024	390625	23.4	16.3	10.6	3.5	
	100	4096	97656	44.5	23.4	34.2	13.2	
	30	16384	24414	121.0	50.7	121.0	50.7	
	20	16384	24414	161.0	55.6	161.0	55.6	
40	5000	1024	390625	15.8	15.4	3.0	2.6	
	1000	1024	390625	17.8	15.7	5.0	2.9	
	300	1024	390625	23.3	16.3	10.5	3.5	
	100	2048	195313	39.4	18.3	29.1	8.1	
	30	4096	97656	90.4	21.8	90.4	21.8	
	20	8192	48828	140.7	36.3	140.7	36.3	
	10	16384	24414	281.3	72.6	281.3	72.6	
25	3800	1024	390625	16.0	15.4	3.2	2.6	
	1000	1024	390625	17.7	15.7	4.9	2.9	
	300	1024	390625	23.4	16.3	10.6	3.5	
	200	1024	390625	27.4	16.8	14.6	4.1	

Table 21: Trigger (cont.)

Characteristic	Description
Frequency Mask Trigger Timing Uncertainty	Standard: $\pm 13 \mu\text{s}$ at 25 MHz span for base unit (Standard) RBW $\geq 300$ kHz $\pm 13 \mu\text{s}$ at 40 MHz span (Option B40), RBW $\geq 300$ kHz $\pm 10 \mu\text{s}$ at 85 MHz span (Option B85), RBW $\geq 1$ MHz $\pm 9 \mu\text{s}$ at 165 MHz span (Option B16x), RBW $\geq 1$ MHz Option 09: $\pm 7 \mu\text{s}$ at 25 MHz span for base unit (Standard) RBW $\geq 300$ kHz $\pm 6 \mu\text{s}$ at 40 MHz span (Option B40), RBW $\geq 300$ kHz $\pm 3 \mu\text{s}$ at 85/110 MHz span (Option B85), RBW $\geq 1$ MHz $\pm 3 \mu\text{s}$ at 165 MHz span (Option B16x), RBW $\geq 1$ MHz Instrument Center Frequency $\geq 100$ MHz
Runt Trigger Level Range, nominal	Same as Power Trigger Level Range
Runt Trigger Level Resolution, nominal	Same as Power Trigger Level Resolution
Runt Trigger Polarity, nominal	Too short Not fully off
Runt Trigger Level Accuracy	Same as Power Trigger Level Accuracy This applies when the Runt Trigger Level is between 10% and 90% of the signal amplitude.
Runt Trigger Position Timing Uncertainty	Same as Power Trigger Position Timing Uncertainty
DPX Density Trigger Minimum Detectable Trigger Event Duration, typical	Same as DPX Min Signal Duration for 100% probability of intercept
DPX Density Trigger Threshold Setting Range, nominal	0% – 100%
DPX Density Trigger Area of Interest Range, nominal	2 to 801 pixels (horizontal) x 2 to 201 pixels (vertical)
DPX Density Trigger Area of Interest Resolution, nominal	1 pixel, horizontal or vertical
DPX Density Trigger Area of Interest Accuracy, nominal	Horizontal: $\pm 0.25\%$ of Span Vertical: $\pm (2 \times \text{DPX amplitude accuracy})$

**Table 21: Trigger (cont.)**

Characteristic	Description																		
DPX Density Trigger Timing Uncertainty, nominal	<p>For a signal events less than 40 ms, where DPX RBW = AUTO and Density = Higher:                      Uncertainty = -(Signal Event Duration + DPX Minimum Event Duration) to +(DPX Minimum Event Duration)</p> <p>DPX Minimum Event Duration value taken from table below:</p> <table border="1"> <thead> <tr> <th colspan="3">DPX Minimum Event Duration</th> </tr> <tr> <th>Real Time Span</th> <th>Standard</th> <th>Option 09</th> </tr> </thead> <tbody> <tr> <td>165 MHz</td> <td>17.8 <math>\mu</math>s</td> <td>5.0 <math>\mu</math>s</td> </tr> <tr> <td>85 MHz</td> <td>20.2 <math>\mu</math>s</td> <td>7.4 <math>\mu</math>s</td> </tr> <tr> <td>40 MHz</td> <td>23.2 <math>\mu</math>s</td> <td>10.5 <math>\mu</math>s</td> </tr> <tr> <td>25 MHz</td> <td>27.4 <math>\mu</math>s</td> <td>14.6 <math>\mu</math>s</td> </tr> </tbody> </table> <p>For signal events 40 ms or longer, the timing uncertainty is not specified.                      For Density = Lower, the timing uncertainty is not specified.                      Instrument Center Frequency <math>\geq</math>50 MHz</p>	DPX Minimum Event Duration			Real Time Span	Standard	Option 09	165 MHz	17.8 $\mu$ s	5.0 $\mu$ s	85 MHz	20.2 $\mu$ s	7.4 $\mu$ s	40 MHz	23.2 $\mu$ s	10.5 $\mu$ s	25 MHz	27.4 $\mu$ s	14.6 $\mu$ s
DPX Minimum Event Duration																			
Real Time Span	Standard	Option 09																	
165 MHz	17.8 $\mu$ s	5.0 $\mu$ s																	
85 MHz	20.2 $\mu$ s	7.4 $\mu$ s																	
40 MHz	23.2 $\mu$ s	10.5 $\mu$ s																	
25 MHz	27.4 $\mu$ s	14.6 $\mu$ s																	
Time Qualified Trigger Source	Power Trigger or Frequency Mask Trigger or DPX Statistics Trigger or Runt Trigger or External Trigger or Gated																		
Time Qualified Trigger Type, nominal	Shorter or Longer or Inside or Outside Reference information: INSIDE means the measured time of the source event is greater than or equal to the minimum time AND less than or equal to the maximum time. OUTSIDE means the measured time of the source event is less than the minimum time OR greater than the maximum time																		
Time Qualified Trigger (minimum or maximum) Time Range, nominal	0 ns to 10 s																		
Time Qualified Trigger (Minimum or Maximum) Time Resolution	Trigger Source is not EXTERNAL: 5 ns Trigger Source is EXTERNAL: SPAN $\leq$ 40 MHz: 20 ns 40 MHz < SPAN $\leq$ 165 MHz: 5 ns																		

**Table 21: Trigger (cont.)**

Characteristic	Description
Time Qualified Trigger (minimum or maximum) Time Accuracy, nominal	<p>For Power Trigger:  <math>\pm[(2 \times \text{Power Trigger Position Timing Uncertainty}) + 5 \text{ ns}]</math>;                      All conditions for Power Trigger Position timing uncertainty must be met</p> <p>For FMT:  <math>\pm[(2 \times \text{Frequency Mask Timing Uncertainty}) + 5 \text{ ns}]</math>;                      All conditions for Frequency Mask Trigger timing uncertainty must be met</p> <p>For DPX Density Trigger:  <math>\pm 50 \text{ ms}</math>;</p> <p>For External Trigger SPAN <math>\leq 40 \text{ MHz}</math>:  <math>\pm[(2 \times \text{External Trigger Timing Uncertainty}) + 20 \text{ ns}]</math>;                      All conditions for External Trigger Timing uncertainty must be met</p> <p>For External Trigger <math>40 \text{ MHz} &lt; \text{SPAN} \leq 165 \text{ MHz}</math>:  <math>\pm[(2 \times \text{External Trigger Timing Uncertainty}) + 5 \text{ ns}]</math>;                      All conditions for External Trigger Timing uncertainty must be met</p> <hr/> Instrument Center Frequency $\geq 100 \text{ MHz}$
Holdoff Trigger	<p>ON or OFF</p> <p>Reference Information: Holdoff Trigger means triggers will be held off until a period of time equal to or greater than the Holdoff Trigger Time occurs with no trigger events; once the Holdoff timer has expired, a trigger will be generated on the next trigger event</p>
Holdoff Trigger Source	Applied to any allowed combination of trigger source and time qualification
Holdoff Trigger Time Range, nominal	20 ns to 10 s
Holdoff Trigger Time Resolution, nominal	<p>Trigger Source is not EXTERNAL: 5 ns</p> <p>Trigger Source is EXTERNAL:</p> <p>SPAN <math>\leq 40 \text{ MHz}</math>: 20 ns</p> <p>40 MHz &lt; SPAN <math>\leq 165 \text{ MHz}</math>: 5 ns</p>



Table 21: Trigger (cont.)

Characteristic	Description
Holdoff Trigger Time Accuracy, nominal	<p>For Power Trigger:  <math>\pm(\text{Power Trigger Position Timing Uncertainty} + 5 \text{ ns})</math>;            All conditions for Power Trigger Position Timing Uncertainty must be met</p> <p>For FMT:  <math>\pm(\text{Frequency Mask Trigger Timing Uncertainty} + 5 \text{ ns})</math>;            All conditions for Frequency Mask Trigger Timing Uncertainty must be met</p> <p>For DPX Density Trigger:  <math>\pm 50 \text{ ms}</math>;</p> <p>For External Trigger SPAN <math>\leq 40 \text{ MHz}</math>:  <math>\pm(\text{External Trigger Timing Uncertainty} + 20 \text{ ns})</math>;            All conditions for External Trigger Timing uncertainty must be met</p> <p>For External Trigger <math>25 \text{ MHz} &lt; \text{SPAN} \leq 110 \text{ MHz}</math>:  <math>\pm(\text{External Trigger Timing Uncertainty} + 5 \text{ ns})</math>;            All conditions for External Trigger Timing Uncertainty must be met</p> <p>If Time Qualified Trigger is used, the Accuracy value increases to 2X the number given above for the specified trigger source.</p>
External Trigger 1 Threshold Voltage, nominal	Variable: $-2.5 \text{ V}$ to $+2.5 \text{ V}$ settable
External Trigger 2 Threshold Voltage, nominal	Fixed: TTL
External Trigger 1 Threshold Voltage Setting Resolution, nominal	$0.01 \text{ V}$
External Trigger 1 Input Impedance, nominal	Selectable: $50 \Omega$ or $5 \text{ k}\Omega$
External Trigger 2 Input Impedance, nominal	Fixed: $10 \text{ k}\Omega$
External Trigger 1 Minimum Pulse Width (applies to $50 \Omega$ Impedance only), nominal	$>5 \text{ ns}$
External Trigger 2 to External Trigger 1 Minimum Delay, nominal	$>20 \text{ ns}$ This is the time from the rising edge of the external gate signal to the rising edge of the external trigger signal needed to guarantee a trigger will be accepted. This specification also applies from the falling edge of the external trigger signal to the falling edge of the external gate signal.
External Trigger 1 Timing Uncertainty ( $50 \Omega$ impedance only)	

**Table 21: Trigger (cont.)**

Characteristic	Description
>80 MHz to 165 MHz acquisition BW	±11 ns
>40 MHz to 80 MHz acquisition BW	±13.5 ns
>20 MHz to 40 MHz acquisition BW	±20 ns
Instrument Center Frequency ≥50 MHz	
Trigger Output Voltage, nominal (Output Current <1 mA)	HIGH: >2.0 V LOW: <0.4 V
Trigger Output Impedance, nominal	50 Ω
Power Trigger Output Position Timing Uncertainty	±2 sample points (Decimated clock periods, refer to the following table) This trigger has no specified timing relation to the signal at the RF input. For a given instrument setup, the delay from the RF input to this trigger output will be the same within the uncertainty given in this specification. The time delay can be measured for a specific instrument setup and it will be stable as long as the setup is not changed. If the setup changes, the delay should be measured again.
Trigger Re-arm Time, minimum	10 MHz Acquisition BW: ≤25 μs 40 MHz Acquisition BW (Opt. B40): ≤10 μs 85 MHz Acquisition BW (Opt. B85): ≤5 μs 165 MHz Acquisition BW (Opt. B16x): ≤5 μs
Trigger Holdoff Time, nominal	Acq BW >40 MHz: 5 ns min. to 1000 ms Acq BW ≤40 MHz: 20 ns min. to 1000 ms

**Table 22: Resolution bandwidth filter (SA mode)**

Characteristic	Description
Filter Shape, nominal	Gaussian-like (Actual filter shape is Kaiser with $\beta = 16.72$ )
Bandwidth Accuracy	0.5% (Auto-coupled)
Range, nominal	See the following table
Resolution, nominal	1, 2, 3, 5 (for sequence selection) 1% (for user-entry mode)
Minimum Settable RBW, nominal	See the following table
Shape Factor, typical	4.1:1 (60 dB:3 dB) (±3%)

Table 23: Range and settable RBW (SA mode)

Acquisition BW	Frequency Domain Resolution Bandwidth Range	
	Maximum RBW	Minimum RBW
165 MHz (Option B16x)	20 MHz	100 Hz
85 MHz (Option B85)	10 MHz	100 Hz
40 MHz (Option B40)	8 MHz	100 Hz
25 MHz	5 MHz	100 Hz
20 MHz	4 MHz	100 Hz
10 MHz	2 MHz	10 Hz
5 MHz	1 MHz	10 Hz
2.5 MHz	500 kHz	10 Hz
1.25 MHz	250 kHz	1 Hz
625 kHz	125 kHz	1 Hz
312.5 kHz	62.5 kHz	1 Hz
156.25 kHz	31.2 kHz	0.1 Hz
78.125 kHz	15.6 kHz	0.1 Hz
39.0625 kHz	7.81 kHz	0.1 Hz
19.53125 kHz	3.91 kHz	0.1 Hz
9.765625 kHz	1.95 kHz	0.1 Hz
4.8828125 kHz	977 Hz	0.1 Hz
2.44140625 kHz	488 Hz	0.1 Hz
1.220703125 kHz	244 Hz	0.1 Hz
610.3515625 Hz	122 Hz	0.1 Hz
305.17578125 Hz	61 Hz	0.1 Hz
152.587890625 Hz	30.5 Hz	0.1 Hz

Table 24: Resolution bandwidth filter (time-domain mode)

Characteristic	Description
Filter Shape, nominal	Gaussian-like (Actual filter shape is Kaiser with $b = 16.72$ )
Shape Factor, typical	4.1:1 (60 dB:3 dB) ( $\pm 10\%$ ) for filters up to 10 MHz < approximately 2.5:1 (60 dB:3 dB) for filters >10 MHz to 80 MHz
Range, nominal	See the following table
Bandwidth Accuracy	1 Hz to 10 MHz = 0.5% (Auto-coupled) 20 MHz, 60 MHz & 80 MHz = 1%
Resolution, nominal	1, 2, 3, 5 (plus 60 MHz for Option B85) (for sequence selection) 1% (for user-entry mode)
Minimum Settable RBW, nominal	See the following table

**Table 25: Range and settable RBW (time-domain mode)**

Acquisition BW	Time Domain Trigger And Amplitude vs. Time	
	Maximum TDBW	Minimum TDBW
165 MHz (Opt B16x)	80 MHz	16 kHz
85 MHz (Opt B85)	80 MHz	16 kHz
60 MHz (Opt B85)	10 MHz	4 kHz
25 MHz	5 MHz	2 kHz
20 MHz	2.5 MHz	1 kHz
10 MHz	1.25 MHz	500 Hz
5 MHz	625 kHz	250 Hz
2.5 MHz	312.5 kHz	125 Hz
1.25 MHz	156.25 kHz	62.5 Hz
625 kHz	78.125 kHz	31.25 Hz
312.5 kHz	39.0625 kHz	15.625 Hz
156.25 kHz	19.53125 kHz	7.8125 Hz
78.125 kHz	9.765625 kHz	3.90625 Hz
39.0625 kHz	4.8828125 kHz	1.953125 Hz
19.53125 kHz	2.44140625 kHz	1 Hz
9.765625 kHz	1.220703125 Hz	1 Hz
4.8828125 kHz	610.3515625 Hz	1 Hz
2.44140625 kHz	305.17578125 Hz	1 Hz
1.220703125 kHz	152.587890625 Hz	1 Hz
610.3515625 Hz	76.2939453125 Hz	1 Hz
305.17578125 Hz	38.14697265625 Hz	1 Hz
152.587890625 Hz	19.073486328125 Hz	1 Hz

<sup>1</sup> Time Domain Trigger bandwidth can always be set to "Wide Open", equal to the acquisition BW

**Table 26: Preamp (Option 50/51)**

Characteristic	Description
Noise Figure	<7 dB at 2 GHz (Opt. 50) <10 dB at 15 GHz (Opt. 51) <13 dB at 26.5 GHz (Opt. 51)
Bandwidth	1 MHz to 6.2 GHz (Opt. 50) 1 MHz to 26.5 GHz (Opt. 51)
Gain, nominal	20 dB at 2 GHz (Opt. 50) 20 dB at 10 GHz (Opt. 51)

**Table 27: Digital IQ output**

Characteristic	Min	Max
Differential Output voltage magnitude ( $R_{LOAD} = 100 \Omega$ )	247 mV	454 mV
Steady state common mode output voltage	1.125 V	1.375 V

<sup>1</sup> LVDS signaling - ANSI EIA/TIA-644 standard

**Table 28: I & Q Outputs (Opt. 65)**

Characteristic	Description
Output Level, nominal	Two LVDS Logic outputs
Output Data Rate, nominal	200 MS/s on both I and Q outputs
Control Output, nominal	Clock: LVDS, Max 50 MHz (200 MHz, Opt. B85 and B16x)
Control Input, nominal	IQ Data Output Enabled and connecting GND enables output
Clock Rising Edge to Data Transition Time (Hold Time), typical	8.4 ns (Std and Opt. B40) 1.23 ns (Opt. B85 and B16x)
Data Transition to Clock Rising Edge (Setup Time), typical	8.2 ns (Std and Opt. B40) 1.20 ns (Opt. B85 and B16x)

**Table 29: 28 Volt noise source drive output**

Characteristic	Description
Output Level, nominal	28 VDC @ 140 mA
Output voltage turn ON/OFF time	Turn ON: 100 $\mu$ s Turn OFF: 500 $\mu$ s

**Table 30: Zero Span Analog Output (Opt. 66)**

Item	Description
Output Voltage, typical	1.0 V @ 0 dBm input 0 dBm reference level, 10 dB/div vertical scale, measured into a 50 $\Omega$ load. Full-scale voltage is relative to reference level.
Output Voltage Slope, nominal	10 mV/dB 10 dB/div vertical scale, measured into a 50 $\Omega$ load. Slope will vary with vertical scale setting.
Maximum Output Voltage, nominal	1.25 V
Output Voltage Accuracy, typical	$\pm 5\%$ of full-scale voltage
Output Range Log Fidelity, typical	>60 dB @ 1 GHz CF
Output Log Accuracy, typical	$\pm 0.75$ dB within range
Output Bandwidth, nominal	Up to maximum RBW

**Table 30: Zero Span Analog Output (Opt. 66) (cont.)**

Item	Description
Continuous Output, nominal	Continuous output for spans up to the maximum real-time acquisition bandwidth of the instrument. Output is disabled for swept spans.
Output Impedance, nominal	ON: 50 OFF: 5 k $\Omega$
Output Reverse Power Protection, typical	$\pm 20$ V
Connector, nominal	BNC female
Output Delay Accuracy, typical	$\pm(1 \mu\text{s} + 10\%)$ This is the signal delay measured from RF input to ZSO output. This display is intended as an indication only.

## Electrical Functional Specifications

**Table 31: Measurement function**

Characteristic	Description
Power and Frequency Domain Measurement Functions, nominal	Channel Power Adjacent Channel Power Multi-carrier Adjacent Channel Power/Leakage Ratio dBm/Hz Marker dBc/Hz Marker
Time Domain and Statistical Measurement Functions, nominal	RF I/Q vs. Time Power vs. Time Frequency vs. Time Phase vs. Time CCDF Peak-to-Average Ratio
Analog Modulation Analysis, nominal	%Amplitude Modulation (+, -, rms, modulation depth) Frequency Modulation ( $\pm$ peak, +peak to -peak, rms, peak-peak/2, frequency error) Phase Modulation ( $\pm$ peak, rms, +peak to -peak)
Audio Analysis (Option 10)	

Table 31: Measurement function (cont.)

Characteristic	Description
AM	Carrier Power Audio Frequency, Modulation Depth (+peak, -peak, pk-pk/2, RMS) SINAD Modulation Distortion S/N Total Harmonic Distortion Total Non-Harmonic Distortion Hum and Noise
FM	Carrier Power Frequency Error Audio Frequency Deviation (+peak, -peak, pk-pk/2, RMS) SINAD Modulation Distortion, S/N Total Harmonic Distortion Total Non-Harmonic Distortion Hum and Noise
PM	Carrier Power Carrier Frequency Error Audio Frequency Deviation (+peak, -peak, pk-pk/2, RMS) SINAD Modulation Distortion S/N Total Harmonic Distortion Total Non-Harmonic Distortion Hum and Noise
Direct	Signal Power Audio Frequency (+peak, -peak, pk-pk/2, RMS) SINAD, Modulation Distortion S/N Total Harmonic Distortion Total Non-Harmonic Distortion Hum and Noise

**Table 31: Measurement function (cont.)**

<b>Characteristic</b>	<b>Description</b>
Phase Noise and Jitter Measurements (Option 11)	Phase Noise vs. Frequency Offset Carrier Power Frequency Error RMS Phase Noise Integrated Jitter Residual FM
Frequency and Phase Settling Measurements (Option 12)	Frequency Settling Time Phase Settling Time
Advanced Measurements Suite (Option 20), nominal	Rise Time Fall Time Pulse Width Pulse Peak Power Pulse Average Power Pulse Ripple Pulse Repetition Interval Duty Cycle Pulse-to-Pulse Phase Frequency Error Droop Trend FFT of Trend
General Purpose Digital Modulation Analysis (Option 21), nominal	EVM (RMS/Peak, EVM vs. Time) Magnitude Error (RMS/Peak, Magnitude Error vs. Time) Phase Error (RMS/Peak, Phase Error vs. Time) Waveform Quality ( $\rho$ ) Frequency Error Origin Offset Gain Imbalance Quadrature Error Constellation Symbol Table Modulation Error Rate (MER) RMS



**Table 32: Views by domain**

Characteristic	Description
Frequency, nominal	Spectrum (Amplitude vs. Frequency) DPX™ Spectrum Display (Color-graded Frequency-of-Occurrence) Spectrogram (Spectrums over Time vs. Frequency)
Time and Statistics, nominal	Frequency vs. Time Amplitude vs. Time Phase vs. Time RF I&Q vs. Time Time Overview CCDF Peak-Average-Ratio
Advanced Measurements Suite (Option 20), nominal	Pulse Results Table Pulse Trace (Selectable by pulse number) Pulse Statistics (Trend of Pulse Results and FFT of Trend)
General Purpose Digital Modulation Analysis (Option 21), nominal	Constellation Diagram I/Q vs. Time EVM vs. Time Symbol Table (Binary or Hexadecimal)

**Table 33: Analog demodulation accuracy**

Characteristic	Description
Amplitude vs. Time Accuracy, typical	$\pm 1\%$ (-10 dBfs Input at center, 5% to 95% Modulation Depth)
Phase vs. Time Accuracy, typical	$\pm 0.1^\circ$ for modulations $< 180^\circ$ , and rates $< 500$ kHz (-10 dBfs Input at center)
Frequency vs. Time Accuracy, typical	$\pm 0.1\%$ of Span for deviations $< 2$ MHz, and modulation frequencies $< 500$ kHz (-10 dBfs Input at center)

**Table 34: General purpose analog modulation accuracy**

Characteristic	Description
AM Demodulation Accuracy, typical	$\pm 2\%$ (0 dBm Input at center, Carrier Frequency 1 GHz, 10 to 60 % Modulation Depth; 1 kHz/5 kHz Input/Modulated frequency; 0 dBm Input Power Level, Reference Level 10 dBm, Atten = Auto)
PM Demodulation Accuracy, typical	$\pm 3^\circ$ (0 dBm Input at center; Carrier Frequency 1 GHz, 400 Hz/1 kHz Input/Modulated Frequency; 0 dBm Input Power Level, Reference Level 10 dBm, Atten = Auto)
FM Demodulation Accuracy, typical	$\pm 1\%$ of Span (0 dBm Input at center; Carrier Frequency 1 GHz, 1 kHz/5 kHz Input/Modulated Frequency, 0 dBm Input Power Level, Reference Level 10 dBm, Atten = Auto )

**Table 35: General purpose digital modulation analysis (Option 21)**

Characteristic	Description
Carrier Type, nominal	Continuous, Burst (5 $\mu$ s minimum on-time)
Analysis Period, nominal	Up to 80,000 samples
Modulation Format Presets, nominal	$\pi/2$ DBPSK, BPSK, SBPSK, QPSK, DQPSK, $\pi/4$ DQPSK, D8PSK, 8PSK, OQPSK, SOQPSK, CPM, 16QAM, 32QAM, 64QAM, 256QAM, MSK, GFSK, 2FSK, 4FSK, 8FSK, 16FSK, C4FM
Measurement Filter, nominal	Root Raised Cosine, Raised Cosine, Gaussian, Rectangular, IS-95 Base EQ, None
Reference Filter, nominal	Gaussian, Raised Cosine, Rectangular, IS-95 baseband, None
Filter Roll-off Factor, nominal	$\alpha$ : 0.001 to 1, 0.001 step
Maximum Symbol Rate, nominal	100 MS/s (Option 21)
Standard Setup Presets, nominal	None
Measurement Functions, nominal	Constellation, EVM, Symbol Table
Vector Diagram Display Format, nominal	Symbol/Locus Display Frequency Error Measurement Origin Offset Measurement
Constellation Diagram Display Format, nominal	Symbol Display Frequency Error Measurement Origin Offset Measurement
Eye Diagram Display Format, nominal	None
Error Vector Diagram Display Format, nominal	EVM, Magnitude Error, Phase Error Waveform Quality ( $\rho$ ) Measurement Frequency Error Measurement Origin Offset Measurement
Symbol Table Display Format, nominal	Binary, Hexadecimal

**Table 36: Digital demodulation accuracy (Option 21)**

Characteristic	Description	
QPSK Residual	CF	2 GHz
EVM, typical	Symbol Rate	100 kHz
		1 MHz
		10 MHz
		30 MHz
		60 MHz
		120 MHz

Table 36: Digital demodulation accuracy (Option 21) (cont.)

Characteristic		Description	
256 QAM Residual EVM, typical	CF		2 GHz
	Symbol Rate	10 MHz	0.4%
		30 MHz	0.6% (Option B40/B85/B16x only)
		60 MHz	0.6% (Option B85/B16x only)
		120 MHz	1.0% (Option B16x only)
OQPSK Residual EVM, typical	CF		2 GHz
	Symbol Rate	100 kHz	0.5%, 200 kHz measurement BW
		1 MHz	0.5%, 2 MHz measurement BW
		10 MHz	1.1%, 20 MHz measurement BW
	Reference Filter: Raised Cosine, Measurement Filter: Root Raised Cosine, Filter Parameter: Alpha = 0.3		
S-OQPSK (MIL) Residual EVM, typical	CF		250 MHz
	Symbol Rate	4 kHz	0.3%, 64 kHz measurement bandwidth
	Reference Filter: MIL STD, Measurement Filter: None		
S-OQPSK (MIL) Residual EVM, typical	CF		2 GHz
	Symbol Rate	20 kHz	0.5%, 320 kHz measurement bandwidth
		100 kHz	0.5%, 1.6 MHz measurement bandwidth
		1 MHz	0.5%, 16 MHz measurement bandwidth
	Reference Filter: MIL STD, Measurement Filter: None		
S-OQPSK (ARTM) Residual EVM, typical	CF		250 MHz
	Symbol Rate	4 kHz	0.3%, 64 kHz measurement bandwidth
	Reference Filter: ARTM STD, Measurement Filter: None		
0S-OQPSK (ARTM) Residual EVM, typical	CF		2 GHz
	Symbol Rate	20 kHz	0.4%, 320 kHz measurement bandwidth
		100 kHz	0.4%, 1.6 MHz measurement bandwidth
		1 MHz	0.4%, 16 MHz measurement bandwidth
	Reference Filter: ARTM STD, Measurement Filter: None		
S-BPSK (MIL) Residual EVM, typical	CF		250 MHz
	Symbol Rate	4 kHz	0.25%, 64 kHz measurement bandwidth
	Reference Filter: MIL STD, Measurement Filter: None		
S-BPSK (MIL) Residual EVM, typical	CF		2 GHz
	Symbol Rate	20 kHz	0.5%, 320 kHz measurement bandwidth
		100 kHz	0.5%, 1.6 MHz measurement bandwidth
		1 MHz	0.5%, 16 MHz measurement bandwidth
	Reference Filter: MIL STD, Measurement Filter: None		

**Table 36: Digital demodulation accuracy (Option 21) (cont.)**

Characteristic		Description
CPM (MIL)	CF	250 MHz
Residual EVM, typical	Symbol Rate	4 kHz
	Reference Filter: MIL STD, Measurement Filter: None	
CPM (MIL)	CF	2 GHz
Residual EVM, typical	Symbol Rate	20 kHz
		100 kHz
		1 MHz
Reference Filter: MIL STD, Measurement Filter: None		
2/4/8/16 FSK	CF	2 GHz
Residual RMS FSK Error, typical	Symbol Rate	10 kHz
	0.3 % (2FSK, 10 kHz frequency deviation)	
		0.4 % (4/8/16FSK, 10 kHz frequency deviation)

**Table 37: OFDM measurement (Option 22)**

Item	Description
OFDM Maximum Residual EVM(RMS) (802.11a/g/j OFDM and 802.16-2004)	-49 dB @ 2.4 GHz
	-49 dB @ 5.8 GHz

**Table 38: WLAN 802.11a/b/g/j/p Tx measurement (Option 23)**

Characteristic	Description
OFDM Maximum Residual EVM (RMS) (802.11a/g/j/p OFDM), typical	-49 dB at 2.4 GHz
	-48 dB at 5.8 GHz
OFDM Maximum Residual EVM (RMS) (802.11a/g/j/p OFDM), typical-mean	-50 dB at 2.4 GHz
	-50 dB at 5.8 GHz
OFDM Maximum Residual EVM (RMS) (802.11b OFDM), typical	1.0%
OFDM Maximum Residual EVM (RMS) (802.11b OFDM), typical-mean	0.9%

**Table 39: WLAN 802.11n Tx measurement (Option 24)**

Characteristic	Description
OFDM Maximum Residual EVM (RMS) (802.11n OFDM) 40 MHz BW, typical	-47 dB at 2.4 GHz
	-48 dB at 5.8 GHz
OFDM Maximum Residual EVM (RMS) (802.11n OFDM) 40 MHz BW, typical-mean	-48 dB at 2.4 GHz
	-48.5 dB at 5.8 GHz

**Table 40: WLAN 802.11ac Tx measurement (Option 25)**

Characteristic	Description
OFDM Maximum Residual EVM (RMS) (802.11ac OFDM), typical	-48 dB at 40 MHz BW
	-48 dB at 80 MHz BW
	-45 dB at 160 MHz BW
OFDM Maximum Residual EVM (RMS) (802.11ac OFDM), typical-mean	-49 dB at 40 MHz BW
	-48.5 dB at 80 MHz BW
	-45.5 dB at 160 MHz BW

**Table 41: ACLR measurement**

Characteristic	Description
ACLR (3GPP Down Link, 1 DPCH) (2130 MHz), typical	-69 dBc (Adjacent Channel)
	-80 dBc w/Noise Correction ACPR (Adjacent Channel)
	-70 dBc (First Alternate Channel)
	-82 dBc w/Noise Correction (First Alternate Channel)

**Table 42: Digital phosphor spectrum processing (DPx)**

Characteristic	Description
Spectrum Processing Rate, nominal	390,625 per second (Span Independent)
DPX Bitmap Image Resolution, nominal	201 pixels vertical x 801 pixels horizontal
DPX Bitmap Color Dynamic Range, nominal	2 <sup>33</sup> levels
Min Signal Duration for 100% Probability of Intercept, typical Standard instrument	Same as Frequency Mask Trigger Minimum Signal Duration
Span Range, nominal	100 Hz to 25 MHz (Standard)
	100 Hz to 40 MHz (Option B40)
	100 Hz to 85 MHz (Option B85)
	100 Hz to 165 MHz (Option B16x)
Swept Span Range, nominal	Up to instrument frequency range
Dwell Time per Step (Swept Spans), nominal	5 ms to 100 s

**Table 42: Digital phosphor spectrum processing (DPx) (cont.)**

Characteristic	Description		
RBW Settings, nominal	Acquisition Bandwidth		
	RBW (Min)		
	RBW (Max)		
	165 MHz (Option B16x)	25 kHz	20 MHz
	85 MHz (Option B85)	12.9 kHz	10 MHz
	60 MHz (Option B40)	9.1 kHz	9.12 MHz
	40 MHz (Option B40/B85)	6.1 kHz	6.08 MHz
	25 MHz	3.79 kHz	3.8 MHz
	20 MHz	3.03 kHz	3.04 MHz
	10 MHz	1.52 kHz	1.52 MHz
	5 MHz	758 Hz	760 kHz
	2 MHz	303 Hz	304 kHz
	1 MHz	152 Hz	152 kHz
	500 kHz	75.8 Hz	76.0 kHz
	200 kHz	30.3 Hz	30.4 kHz
	100 kHz	15.2 Hz	15.2 kHz
	50 kHz	7.58 Hz	7.6 kHz
	20 kHz	3.03 Hz	3.04 kHz
	10 kHz	1.52 Hz	1.52 kHz
	5 kHz	0.758 Hz	760 Hz
2 kHz	0.303 Hz	304 Hz	
1 kHz	0.152 Hz	152 Hz	
500 Hz	0.100 Hz	76 Hz	
200 Hz	0.100 Hz	30.4 Hz	
100 Hz	0.100 Hz	15.2 Hz	
RBW Accuracy	±0.5% (Auto-coupled)		
Zerospan, Frequency, or Phase Measurement BW Range, nominal	Decimation of $2^N$ from Sample Rate (after DIFP decimation). Minimum BW = 100 Hz $0 \leq N \leq 20$		
Zerospan, Frequency, or Phase Time Domain BW (TDBW) Range, nominal	Maximum – (See Table 25.) Minimum $\leq 15$ Hz for Sample Rate $\leq 200$ MS/s Minimum $\leq 5$ Hz for Sample Rate $\leq 50$ MS/s Minimum = 1 Hz for Sample Rate $\leq 6.25$ MS/s		
Zerospan, Frequency, or Phase Time Domain BW (TDBW) Accuracy, nominal	±1%		

**Table 42: Digital phosphor spectrum processing (DPx) (cont.)**

<b>Characteristic</b>	<b>Description</b>
Zerospan, Frequency, or Phase Sweep Time Range, nominal	100 ns minimum 2000 s maximum, Measurement BW >80 MHz
Zerospan, Frequency, or Phase Sweep Time Accuracy, nominal	$\pm(0.5\% + \text{Reference Frequency Accuracy})$
Zerospan Amplitude Range, nominal	+130 dBm to -270 dBm
Zerospan Waveform Rate, nominal	50,000 triggered waveforms per second (sweep time $\leq 20 \mu\text{s}$ )
Zerospan Trigger Timing Uncertainty, nominal	$\pm(2 \times \text{Zerospan Sweep Time}/800)$ Reference Information: Only valid if using Power Trigger and only valid at trigger point. For example: $\pm 200 \text{ ns}/800$ or $\pm 250 \text{ ps}$ for a 100 ns sweep time $\pm 200 \mu\text{s}/800$ or $\pm 250 \text{ ns}$ for a 100 $\mu\text{s}$ sweep time
DPX Frequency Range	$\pm 100 \text{ MHz}$
DPX Frequency Timing Uncertainty, nominal	$\pm(\text{Frequency Sweep Time}/800)$ Reference Information: Only valid if using Frequency Edge Trigger and only valid at the trigger point. For example: $\pm 100 \text{ ns}/800$ or $\pm 125 \text{ ps}$ for a 100 ns sweep time $\pm 100 \mu\text{s}/800$ or $\pm 125 \text{ ps}$ for a 100 $\mu\text{s}$ sweep time
Phase Range	$\pm 200$ degrees
<b>DPX Spectrogram Performance (DPXogram)</b>	
Span range	100 Hz to Maximum acquisition bandwidth
DPXogram trace detection	+Peak, -Peak, Avg (Vrms)
DPXogram trace length	801 to 10401 points
DPXogram memory depth	Trace Length = 801: 60,000 traces Trace Length = 2401: 20,000 traces Trace Length = 4001: 12,000 traces Trace Length = 10401: 4,600 traces

**Table 42: Digital phosphor spectrum processing (DPx) (cont.)**

Characteristic	Description
Time resolution per line	25.6 $\mu$ s to 6400 s, user-settable, Std. 5.12 $\mu$ s to 6400 s, user-settable, Opt. 09
Maximum recording time vs. line resolution	1.54 seconds (801 points/trace, 25.6 $\mu$ s/line to 4444 days (801 points/trace, 6400 s/line), Std 0.31 seconds (801 points/trace, 5.12 $\mu$ s/line) to 4444 days (801 points/trace, 6400 s/line), Opt. 09

<sup>1</sup> Instrument Center Frequency  $\geq$ 50 MHz

**Table 43: xdB Bandwidth Measurement**

Characteristic	Description
xdB Bandwidth, typical	$\pm$ 3%

**Table 44: Frequency Settling Time Measurement (Option 12) <sup>1</sup>**

Measurement frequency, averages	Frequency Uncertainty at stated measurement bandwidth				
	165 MHz BW	85 MHz BW	10 MHz BW	1 MHz BW	100 kHz BW
<b>1 GHz</b>					
Single measurement	2 kHz	2 kHz	100 Hz	10 Hz	1 Hz
100 Averages	200 Hz	200 Hz	10 Hz	1 Hz	0.1 Hz
1000 Averages	50 Hz	50 Hz	2 Hz	1 Hz	0.05 Hz
<b>10 GHz</b>					
Single measurement	5 kHz	5 kHz	100 Hz	10 Hz	5 Hz
100 Averages	300 Hz	300 Hz	10 Hz	1 Hz	0.5 Hz
1000 Averages	100 Hz	100 Hz	5 Hz	0.5 Hz	0.1 Hz
<b>20 GHz</b>					
Single measurement	2 kHz	2 kHz	100 Hz	10 Hz	5 Hz
100 Averages	200 Hz	200 Hz	10 Hz	1 Hz	0.5 Hz



**Table 44: Frequency Settling Time Measurement (Option 12)<sup>1</sup> (cont.)**

Measurement frequency, averages	Frequency Uncertainty at stated measurement bandwidth					
	1 GHz	165 MHz BW	85 MHz BW	10 MHz BW	1 MHz BW	100 kHz BW
1000 Averages	100 Hz	100 Hz	5 Hz	0.5 Hz	0.2 Hz	

Reference information: Measured input signal > -20 dBm, Attenuator: Auto

<sup>1</sup> Settled Frequency Uncertainty, 95% confidence.

**Table 45: Phase Settling Time Measurement (Option 12)<sup>1</sup>**

Measurement frequency, averages	Phase uncertainty (degrees) at stated measurement bandwidth				
	1 GHz	165 MHz BW	85 MHz BW	10 MHz BW	1 MHz BW
Single measurement	1.00	1.00	0.50	0.50	
100 Averages	0.10	0.10	0.05	0.05	
1000 Averages	0.05	0.05	0.01	0.01	
<b>10 GHz</b>					
Single measurement	1.50	1.50	1.00	0.50	
100 Averages	0.20	0.20	0.10	0.05	
1000 Averages	0.10	0.10	0.05	0.02	
<b>20 GHz</b>					
Single measurement	1.00	1.00	0.50	0.50	
100 Averages	0.10	0.10	0.05	0.05	
1000 Averages	0.05	0.05	0.02	0.02	

Reference information: Measured input signal > -20 dBm, Attenuator: Auto

<sup>1</sup> Settled Frequency Uncertainty, 95% confidence.

**Table 46: AM/FM/PM and Direct audio measurements (Option 10)<sup>1</sup>**

Characteristic	Description	Reference information
<b>Analog demodulation</b>		
Carrier frequency range (for modulation and audio measurements), typical	9 kHz or $\frac{1}{2} \times$ (Audio Analysis Bandwidth) to maximum input frequency	
Maximum audio frequency span, typical	10 MHz	

**Table 46: AM/FM/PM and Direct audio measurements (Option 10) <sup>1</sup> (cont.)**

Characteristic	Description	Reference information
Global Conditions for Audio Measurements, nominal	Input Frequency: <2 GHz RBW: Auto Averaging: Off Filters: Off FM Performance: Modulation Index >0.1	
<b>Audio filters</b>		
Low Pass (kHz)	0.3, 3, 15, 30, 80, 300, and user-entered up to 0.9 × audio bandwidth	
High Pass (Hz)	20, 50, 300, 400, and user-entered up to 0.9 × audio bandwidth	
Standard	CCITT, C-Message	
De-emphasis (μs)	25, 50, 75, 750, and user-entered	
File	User-supplied .txt or .csv file of amplitude/frequency pairs. Up to 1000 amplitude/frequency pairs supported.	
<b>FM modulation analysis</b>		
FM Measurements	Carrier Power, Frequency Error, Audio Frequency, Deviation (+peak, -peak, pk-pk/2, RMS), SINAD, Modulation Distortion, S/N, Total Harmonic Distortion, Total Non-Harmonic Distortion, Hum and Noise	
FM carrier power accuracy, typical	±0.85 dB	Carrier frequency: 10 MHz to 2 GHz Input power: -20 to 0 dBm
FM carrier frequency accuracy, typical	±0.5 Hz + (transmitter frequency × reference frequency error)	Deviation: 1 to 10 kHz
FM deviation accuracy, typical	±(1% of (rate + deviation) + 50 Hz)	Rate: 1 kHz to 1 MHz
FM rate accuracy, typical	±0.2 Hz	Deviation: 1 to 100 kHz
FM residual THD, typical	0.10%	Rate: 1 to 10 kHz Deviation: 5 kHz
FM residual distortion, typical	0.7%	Rate: 1 to 10 kHz Deviation: 5 kHz
FM residual SINAD, typical	43 dB	Rate: 1 to 10 kHz Deviation: 5 kHz
<b>AM modulation analysis</b>		
AM Measurements	Carrier Power, Audio Frequency, Modulation Depth (+peak, -peak, pk-pk/2, RMS), SINAD, Modulation Distortion, S/N, Total Harmonic Distortion, Total Non-Harmonic Distortion, Hum and Noise	
AM carrier power accuracy, typical	±0.85 dB	Carrier frequency: 10 MHz to 2 GHz Input power: -20 to 0 dBm
AM depth accuracy, typical	±0.2% + (0.01 × measured value)	Rate: 1 kHz to 100 kHz Depth: 10% to 90%

**Table 46: AM/FM/PM and Direct audio measurements (Option 10)<sup>1</sup> (cont.)**

<b>Characteristic</b>	<b>Description</b>	<b>Reference information</b>
AM rate accuracy, typical	±0.2 Hz	Rate: 1 kHz to 1 MHz Depth: 50%
AM residual THD, typical	0.16%	Rate: 1 to 10 kHz Depth: 50%
AM residual distortion, typical	0.13%	Rate: 1 to 10 kHz Depth: 50%
AM residual SINAD, typical	58 dB	Rate: 1 to 10 kHz Depth: 50%
<b>PM modulation analysis</b>		
PM Measurements	Carrier Power, Carrier Frequency Error, Audio Frequency, Deviation (+peak, -peak, pk-pk/2, RMS), SINAD, Modulation Distortion, S/N, Total Harmonic Distortion, Total Non-Harmonic Distortion, Hum and Noise	
PM carrier power accuracy, typical	±0.85 dB	Carrier frequency: 10 MHz to 2 GHz Input power: -20 to 0 dBm
PM carrier frequency accuracy, typical	±0.2 Hz + (transmitter frequency × reference frequency error)	Deviation: 0.628 radians
PM deviation accuracy, typical	±100% × (0.01 + (measured rate / 1 MHz))	Rate: 10 kHz to 20 kHz Deviation: 0.628 to 6 radians
PM rate accuracy, typical	±0.2 Hz	Rate: 1 kHz to 10 kHz Deviation: 0.628 radians
PM residual THD, typical	0.1%	Rate: 1 kHz to 10 kHz Deviation: 0.628 radians
PM residual distortion, typical	1%	Rate: 1 kHz to 10 kHz Deviation: 0.628 radians
PM residual SINAD, typical	40 dB	Rate: 1 kHz to 10 kHz Deviation: 0.628 radians
<b>Direct audio input</b>		
Audio Measurements	Signal Power, Audio Frequency (+peak, -peak, pk-pk/2, RMS), SINAD, Modulation Distortion, S/N, Total Harmonic Distortion, Total Non-Harmonic Distortion, Hum, and Noise	
Direct input frequency range (for audio measurements only)	9 kHz to 10 MHz	
Audio frequency span	10 MHz, maximum	
Audio frequency accuracy, typical	±0.2 Hz	
Signal power accuracy, typical	±1.5 dB	
Direct audio input residual THD, typical	0.1%	Frequency: 1 to 10 kHz Input level: 0.316 V

**Table 46: AM/FM/PM and Direct audio measurements (Option 10) <sup>1</sup> (cont.)**

Characteristic	Description	Reference information
Direct audio input residual distortion	0.8%	Frequency: 1 to 10 kHz Input level: 1.0 Vp
Direct audio input residual SINAD	42 dB	Frequency: 1 to 10 kHz Input level: 1.0 Vp

<sup>1</sup> Signal and instrument settings for characteristics listed in this table:  
 Input frequency: <2 GHz  
 RBW: Auto  
 Averaging: Off  
 Filters: Off  
 FM Performance: Modulation Index > 0.1

**Table 47: Adaptive equalizer**

Characteristic	Description
Type	Linear, decision-directed, feed-forward (FIR) equalizer with coefficient adaptation and adjustable convergence rate
Modulation types supported	BPSK, QPSK, OQPSK, $\pi/2$ -DBPSK, $\pi/4$ -DQPSK, 8-PSK, 8-DSPK, 16-DPSK, 16/32/64/128/256-QAM
Reference filters for all modulation types except for OQPSK	Raised Cosine, Rectangular, None
Reference filters for OQPSK	Raised Cosine, Half Sine
Filter length	1 - 128 taps
Taps/symbol: Raised Cosine, Half Sine, or No Filter	1, 2, 4, or 8
Taps/symbol: Rectangular Filter	1
Equalizer controls	Off, Train, Hold, Reset

**Table 48: OBW measurement**

Characteristic	Description
OBW Accuracy	
2 GHz OFDM Carrier, 20 MHz 99% OBW (Measurement in a 40 MHz measurement BW)	$\pm 0.35\%$

**Table 49: File Saving Speeds**

Characteristic	Description
Save to Hard Disk Drive Speed (Standard), typical	4 s (20 Msamples)
	20 s (100 Msamples)
	250 s (954 Msamples)

**Table 49: File Saving Speeds (cont.)**

<b>Characteristic</b>	<b>Description</b>
Save to Hard Disk Drive Speed	4 s (20 Msamples)
(Option 56, Removable Hard Disk Drive), typical	20 s (100 Msamples)
	200 s (1 Gsamples)

**Table 50: Data Transfer/Measurement Speeds**

<b>Characteristic</b>	<b>Description</b>
Spectrum Traces Transfer Speed via Ethernet, typical	25 ms/trace
Marker Readout Transfer Speed via Ethernet, typical	5 ms
Center Frequency Tuning Speed via Ethernet, typical	100 ms (Tune 1 GHz to 1.01 GHz)
	125 ms (Tune 1 GHz to 10 GHz, SPECMON26B only)

## Physical Characteristics

Table 51: Physical characteristics

Characteristic	Description	
<b>Dimensions</b>	<b>mm</b>	<b>in.</b>
Width (handles folded in)	473	18.6
Height (with feet, without accessory pouch)	282	11.1
Length	531	20.9
<b>Weight (without accessories)</b>	<b>kg</b>	<b>lb.</b>
Net	24.7	54.5 (SPECMON3B, 6B)
	29.3	64.7 (SPECMON26B)

Table 52: Display/computer

Characteristic	Description
LCD Panel Size	264 mm (10.4 in)
Display Resolution	
Internal LCD	1024 x 768 pixels (Nominally configured for 800 x 600 operation)
External VGA display	Up to 2048 x 1536
Colors	32-bit
CPU	Intel Core i3-3120ME, 2.0 GHz
DRAM	4 Gbyte DDR3 PC3-10600 CL=9 204 SODIMM
OS	Microsoft Windows 7 Ultimate 64-bit
System Bus	PCIe
Hard Disk Drive	
Standard	3.5 in. SATA II, 7200 rpm, 160 GByte (minimum size)
Removeable (Option 56)	2.5 in. SATA II, solid state, 3 Gb/s, 160 GByte (minimum size)
I/O Ports	
USB	USB 2.0 x 4 (2 front panel, 2 rear panel)
GPIB	IEEE 488.2 (rear panel)
LAN	10/100/1000 Base-T
VGA	D-SUB 15 pin, rear panel - up to 2048 x1536 )
PS2	Keyboard only (rear panel)
Audio	Realtek HD Audio, Internal speaker, Rear panel Headphone out, Mic IN

## Safety

For detailed information on Safety, see the *SPECMONB Series Real-Time Spectrum Analyzers Quick Start User Manual*, Tektronix part number 071-3229-XX.

## Certifications and Compliances

For detailed information on Certifications and Compliances, see the *SPECMONB Series Real-Time Spectrum Analyzers Quick Start User Manual*.

## Environmental Characteristics

Table 53: Environmental characteristics

Characteristic	Description	
Temperature range <sup>1</sup>	Operating	+5 °C to +40 °C
	Nonoperating	-20 °C to +60 °C
Relative Humidity	Operating:	+40 °C at 95% relative humidity, meets intent of EN 60068-2-30 Frequency amplitude response may vary up to ±3 dB at +40 °C and greater than 45% relative humidity.
Altitude	Operating	Up to 3000 m (approximately 10000 ft)
	Nonoperating	Up to 12190 m (40000 ft)
Vibration	Operating	0.22 Grms. Profile = 0.00010 g <sup>2</sup> /Hz at 5 Hz to 350 Hz, -3dB/Octave slope from 350 Hz to 500 Hz, 0.00007 g <sup>2</sup> /Hz at 500 Hz, 3 Axes at 10 min/axis (Except when accessing DVD/CD), Class 8. Electrical Specifications defined in sections above are not warranted under the operating vibration conditions.
	Nonoperating	2.28 Grms. Profile = 0.0175 g <sup>2</sup> /Hz at 5 Hz to 100 Hz, -3 dB/Octave slope from 100 Hz to 200 Hz, 0.00875 g <sup>2</sup> /Hz at 200 Hz to 350 Hz, -3dB/Octave slope from 350 Hz to 500 Hz, 0.00613 g <sup>2</sup> /Hz at 500 Hz, 3 Axes at 10 min/axis. Class 5
Shock	Operating	(15 G), half-sine, 11 ms duration. Three shocks per axis in each direction (18 shocks total)
	Nonoperating	296 m/s <sup>2</sup> (30 G), half-sine, 11 ms duration. Three shocks per axis in each direction (18 shocks total)

**Table 53: Environmental characteristics (cont.)**

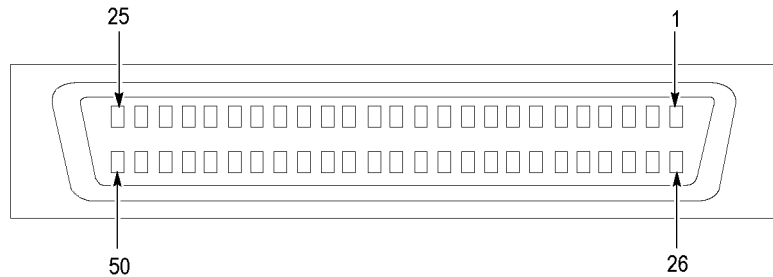
Characteristic	Description
Cooling Clearance	
Both sides	50 mm (1.97 in)

<sup>1</sup> Measured one inch (2.5 cm) away from the ventilation air intake (located at the left side of the instrument when viewed from the front).

**Table 54: Power requirements**

Characteristic	Description
Voltage range	
50 Hz/60 Hz	100 V - 120 V 200 V - 240 V
400 Hz	90 V - 132 V
Maximum Power dissipation (fully loaded)	Maximum power 400 W
Maximum line current	5.5 Amps at 50 Hz, 90 V line
Surge Current	Max 35 A peak (25 °C) for ≤5 line cycles, after product has been turned off for at least 30 s.

## Digital IQ Output Connector Pin Assignment (Option 65 Only)



**Figure 1: Digital IQ output connector pin assignment**

**Table 55: I OUTPUT connector pin assignment**

Pin number	Signal name	Description
1	IQ_ENABLE*	IQ output enable signal input Open: IQ output disable GND: IQ output enable
26	GND	Ground
2	EXT_IQ_MSW-	Reserved for future use
27	EXT_IQ_MSW+	



**Table 55: I OUTPUT connector pin assignment (cont.)**

Pin number	Signal name	Description
3	EXT_I0-	I output data (bit 0), LVDS
28	EXT_I0+	
4	EXT_I1-	I output data (bit 1), LVDS
29	EXT_I1+	
5	EXT_I2-	I output data (bit 2), LVDS
30	EXT_I2+	
6	EXT_I3-	I output data (bit 3), LVDS
31	EXT_I3+	
7	GND	Ground
32	GND	
8	EXT_I4-	I output data (bit 4), LVDS
33	EXT_I4+	
9	EXT_I5-	I output data (bit 5), LVDS
34	EXT_I5+	
10	EXT_I6-	I output data (bit 6), LVDS
35	EXT_I6+	
11	EXT_I7-	I output data (bit 7), LVDS
36	EXT_I7+	
12	GND	Ground
37	GND	
13	EXT_I8-	I output data (bit 8), LVDS
38	EXT_I8+	
14	EXT_I9-	I output data (bit 9), LVDS
39	EXT_I9+	
15	EXT_I10-	I output data (bit 10), LVDS
40	EXT_I10+	
16	EXT_I11-	I output data (bit 11), LVDS
41	EXT_I11+	
17	GND	Ground
42	GND	
18	EXT_I12-	I output data (bit 12), LVDS
43	EXT_I12+	
19	EXT_I13-	I output data (bit 13), LVDS
44	EXT_I13+	
20	EXT_I14-	I output data (bit 14), LVDS
45	EXT_I14+	

**Table 55: I OUTPUT connector pin assignment (cont.)**

Pin number	Signal name	Description
21	EXT_I15-	I output data (bit 15), LVDS
46	EXT_I15+	
22	GND	Ground
47	GND	
23	GND	
48	GND	
24	EXT_IQ_DAV-	IQ Data Valid indicator, LVDS
49	EXT_IQ_DAV+	
25	EXT_IQ_CLK-	IQ output clock, LVDS
50	EXT_IQ_CLK+	

**Table 56: Q OUTPUT connector pin assignment**

Pin number	Signal name	Description
1	IQ_ENABLE*	IQ output enable signal input Open: IQ output disable GND: IQ output enable
26	GND	Ground
2	GND	
27	GND	
3	EXT_Q0-	Q output data (bit 0), LVDS
28	EXT_Q0+	
4	EXT_Q1-	Q output data (bit 1), LVDS
29	EXT_Q1+	
5	EXT_Q2-	Q output data (bit 2), LVDS
30	EXT_Q2+	
6	EXT_Q3-	Q output data (bit 3), LVDS
31	EXT_Q3+	
7	GND	Ground
32	GND	
8	EXT_Q4-	Q output data (bit 4), LVDS
33	EXT_Q4+	
9	EXT_Q5-	Q output data (bit 5), LVDS
34	EXT_Q5+	
10	EXT_Q6-	Q output data (bit 6), LVDS
35	EXT_Q6+	
11	EXT_Q7-	Q output data (bit 7), LVDS
36	EXT_Q7+	

**Table 56: Q OUTPUT connector pin assignment (cont.)**

Pin number	Signal name	Description
12	GND	Ground
37	GND	
13	EXT_Q8-	Q output data (bit 8), LVDS
38	EXT_Q8+	
14	EXT_Q9-	Q output data (bit 9), LVDS
39	EXT_Q9+	
15	EXT_Q10-	Q output data (bit 10), LVDS
40	EXT_Q10+	
16	EXT_Q11-	Q output data (bit 11), LVDS
41	EXT_Q11+	
17	GND	Ground
42	GND	
18	EXT_Q12-	Q output data (bit 12), LVDS
43	EXT_Q12+	
19	EXT_Q13-	Q output data (bit 13), LVDS
44	EXT_Q13+	
20	EXT_Q14-	Q output data (bit 14), LVDS
45	EXT_Q14+	
21	EXT_Q15-	Q output data (bit 15), LVDS
46	EXT_Q15+	
22	GND	Ground
47	GND	
23	GND	
48	GND	
24	GND	
49	GND	
25	GND	
50	GND	

**Table 57: Mating connections**

Recommendation	Description
Mating cable	Tektronix part number 174-5194-00
Mating connector	3M N10250-52E2PC

## Digital IQ Output Timing

All I/Q output signals are synchronous to clock EXT\_IQ\_CLK. The clock operates at either 50 MHz or 200 MHz, depending on the selected real-time span of the analyzer. (See Table 59 on page 63.)

Data is valid when the EXT\_IQ\_DAV signal is asserted high; data is invalid when EXT\_IQ\_DAV is low. The EXT\_IQ\_DAV duty cycle varies with the real-time SPAN, as shown in the following table. At spans where the duty cycle is less than 100%, the EXT\_IQ\_DAV signal is high for one clock cycle, then low for one or more clock cycles.

**Table 58: EXT\_IQ\_DAV Duty cycle versus Span**

Span	EXT_IQ_CLK frequency (MHz)	EXT_IQ_DAV duty cycle (%)
60 MHz	200	50.0
40 MHz	50	100.0
20 MHz	50	50.0
10 MHz	50	25.0
5 MHz	50	12.5
2 MHz	50	6.250
1 MHz	50	3.125
500 kHz	50	1.5625
200 kHz	50	0.78125
100 kHz	50	0.39063
50 kHz	50	0.19531
20 kHz	50	0.097656
10 kHz	50	0.048828
5 kHz	50	0.024414
2 kHz	50	0.006104
1 kHz	50	0.003052
500 kHz	50	0.001526
200 kHz	50	0.000763
100 kHz	50	0.000381

The rising edge of EXT\_IQ\_CLK is aligned to be in the center of the settled EXT\_I[15:0], EXT\_Q[15:0], and EXT\_IQ\_DAV signals.

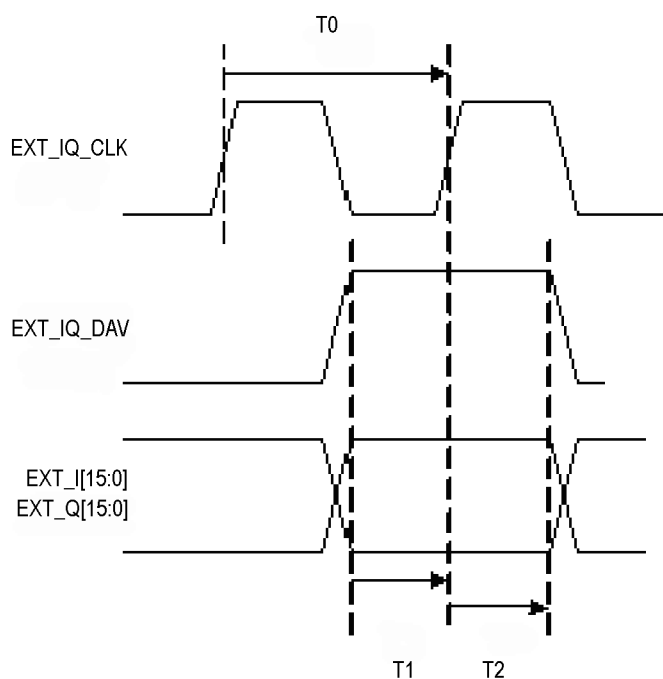


Figure 2: IQ Timing

Table 59: IQ Timing

Real Time Span	T0	T1	T2
>40 MHz ( $\leq 165$ MHz)	5 ns	1.20 ns	1.23 ns
$\leq 40$ MHz	20 ns	8.2 ns	8.4 ns

### Possible Interruption of Data from Digital I/Q Outputs

There are three conditions during which the analyzer will interrupt the flow of data to the digital I/Q outputs. Those conditions are:

- Alignments
- Control Changes
- Stitched Spectrum Mode

When any of these conditions are active, the EXT\_IQ\_DAV signal will be held in its inactive state. The EXT\_IQ\_CLK signal will remain active and operate at the frequency consistent with the SPAN value selected for the analyzer.

The EXT\_IQ\_DAV signal will remain inactive for the duration of any alignment or control change. Once the alignment or control change has been completed, the EXT\_IQ\_DAV signal becomes active again. While the EXT\_IQ\_DAV signal is inactive, the data from the digital I/Q outputs are not valid and should be ignored.

The duty cycle of the EXT\_IQ\_DAV signal varies from 100% at the widest SPAN values to a very small percentage at the narrowest SPAN values. (See Table 58.) At a SPAN of 100 Hz, the duty cycle will be 0.00038%; here, the EXT\_IQ\_DAV signal is active (high) for 20 ns, and then inactive (low) for  $\approx 5.28$  ms.

The length of time that the EXT\_IQ\_DAV signal is inactive can be used to determine if the analyzer is performing an alignment or a control change. If the EXT\_IQ\_DAV signal is inactive for longer than 10 ms, then the SPECMON analyzer digital I/Q output data stream has been interrupted.

External equipment used to detect the occurrence of a data interruption can monitor the state of the EXT\_IQ\_DAV signal. If the EXT\_IQ\_DAV signal is inactive for 10 ms or more, an alignment or control change has occurred. The duration of the data interruption can be determined by measuring the time between successive EXT\_IQ\_DAV pulses.

### Digital IQ Output Scaling

Output power in dBm for a sinusoidal input

Where:

$$P(dBm) = 20 \log \left( \frac{\sqrt{I^2 + Q^2}}{2^{14} \sqrt{2}} \right) + Ref$$

Where:

- I and Q are the digital values at the Digital IQ output port
- Ref = Reference Level

Valid for center frequencies that exceed:

- Center frequency  $\geq 80$  MHz for Spans  $> 40$  MHz
- Center frequency  $\geq 30$  MHz for Spans  $> 312.5$  kHz and  $\leq 40$  MHz
- Center frequency  $\geq 2$  MHz for Spans  $< 312.3$  kHz

# Performance Verification

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**NOTE.** *The performance verification procedure is not a calibration procedure. The performance verification procedure only verifies that your instrument meets key specifications. For your instrument to be calibrated, it must be returned to a Tektronix service facility.*

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## Prerequisites

The tests in this section make up an extensive, valid confirmation of performance and functionality when the following requirements are met:

- The cabinet must be installed on the instrument.
- The instrument must have passed the Power On Self Tests (POST).
- The instrument must have been last adjusted at an ambient temperature between +18 °C (+64 °F) and +28 °C (+82 °F), must have been operating for a warm-up period of at least 20 minutes after starting the spectrum analyzer application, and must be operating at an ambient temperature. (See Table 53.)

## Required Equipment

The procedures, use external, traceable signal sources to directly check warranted characteristics. (See page 69, *Warranted Characteristics Tests.*) The following table lists the equipment required for this procedure.

**Table 60: Equipment required for Performance Verification**

Item number and	Minimum requirements	Example	Purpose
1. Frequency Counter	Frequency Range: 10 MHz; Accuracy: $1 \times 10^{-9}$	Agilent 53132A Option 10	Checking reference output frequency accuracy
2. RF Power Meter		Agilent E4418B	Adjusting signal generator output level, checking reference output power level
3. RF Power Sensor 1	9 kHz to 18 GHz RF Flatness: <3% Calibration factor data uncertainty: <2% (RSS)	Agilent E9304A Option H18	Checking reference output power level
4. RF Power Sensor 2	10 MHz to 26.5 GHz RF Flatness	Agilent E4413A, Option H10	
5. Signal Generator	Frequency Accuracy: $\pm 3 \times 10^{-7}$ Output Frequency: 0 to 40 GHz	Anritsu MG3694B Options 2A, 3A, 4, 15A, 16, 22, SM5821	Checking RF flatness, intermodulation distortion, image suppression, and external reference lock check.

Table 60: Equipment required for Performance Verification (cont.)

Item number and	Minimum requirements	Example	Purpose
6. RF Signal Generator	Output Frequency 10 MHz to 26.5 GHz	Anritsu MG3694B	Checking phase noise and third order intermodulation distortion
	Phase Noise at Center Frequency = 1 GHz	Options 2A, 3A, 4, 15A, 16, 22, SM5821	
	<b>Offset</b>	<b>SSB Phase Noise (F) dBc/Hz</b>	
	10 Hz	-71	
	100 Hz	-93	
	1 kHz	-118	
	10 kHz	-121	
100 kHz	-119		
1 MHz	-138		
7. Precision Attenuator	30 dB		
8. Power Splitter		Agilent 11667B	Adjusting signal generator output level
9. Power Combiner		Anritsu 2089-6208-00	Checking intermodulation distortion
10. Low Pass Filters (2)	<3 dB loss DC –3 GHz >50 dB rejection 4 GHz to 14 GHz		Checking third order intermodulation distortion
11. Voltmeter	Capable of measuring 30 VDC	Standard Equipment	Checking Noise Source Checking Zero-Span Output
12. BNC Cable	50 $\Omega$ , 36 in. male to male BNC connectors		Signal interconnection
13. 3.5 mm -3.5 mm Cable	50 $\Omega$ , 36 in. male to male 3.5 mm connectors		Signal interconnection
14. N-SMA Cable	50 $\Omega$ , 36 in. male N to male SMA connectors		Signal interconnection
15. Termination, Precision 50 $\Omega$	Impedance: 50 $\Omega$ 3.5 mm male		Signal interconnection
16. N-Female to BNC male Adapter		Tektronix part number 103-0058-00	N cable to spectrum analyzer connections
17. 3.5 mm (F) to 3.5 mm (F) coaxial adapter		Tektronix part number 131-8508-00	
18. N-3.5mm cable	50 $\Omega$ , 36 in. male N to male 3.5 mm connectors		
19. N-Male to 3.5 mm male adapter			
20. 3.5 mm attenuator	3 dB (two required)	Midwest Microwave ATT-0550-03-35M-02	Checking third order intermodulation distortion



Table 60: Equipment required for Performance Verification (cont.)

Item number and	Minimum requirements	Example	Purpose
21.	Planar Crown RF Input Connector - 3.5 mm (SPECMON26B only)	Tektronix part number 131-9062-00	
22.	Planar Crown RF Input Connector - Type N (SPECMON3B & 6B only)	Tektronix part number 131-4329-00	

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**NOTE.** *You may need more adaptors than come with the instrument.*

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**NOTE.** *Always use the Planar Crown adaptor that comes with the SPECMON26B instruments to connect to other equipment. Use a proper adaptor when connecting cables with a different connector type.*

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**NOTE.** *Be sure that any adaptor and cable you use is specified to operate at the frequency range of the test you are performing.*

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## Preliminary Checks

These steps should be performed before proceeding to the Warranted Characteristics tests.

**Fan Check** Plug in the spectrum analyzer, power it on, and check that the fans located on the left side of the instrument are operating.




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**CAUTION.** *Turn the spectrum analyzer off immediately if the fans are not operating. Operating the Signal Analyzer without fans will damage the instrument.*

---

**Warm-up** Make sure the spectrum analyzer application is running, and allow the instrument to warm up for at least 20 minutes.

---

**NOTE.** *The fans will slow down and be quieter when the application is started; this is normal. Fan speed may vary while the application is running, depending on the internal temperature detected by the instrument.*

---

**Touch Screen Check**

Check that the touch screen detects touches:

1. Verify that the touch screen is enabled (**Touch Screen Off** button is not lighted).
2. Use your finger or a stylus to touch several of the on-screen touchable readouts, such as RBW or Span, and verify they become active when touched.

**Diagnostics**

Run a complete Diagnostics test session:

1. Select **Tools > Diagnostics** from the menubar.
2. Select the **All Modules, All Tests** checkbox at the top of the list.
3. Touch the **RUN** button. The diagnostics tests will take some time to complete, and some of them are interactive:
  - a. Noise Source Drive 28VDC Out diagnostic will ask you to test the noise source output on the spectrum analyzer rear panel.
    - Check with a voltmeter that the voltage is 28 V  $\pm$ 2 V.
  - b. The LED Check diagnostic will ask you to verify that all the highlighted LEDs are turned on:
    - Compare the LEDs highlighted in the diagnostic display with the buttons on the front panel.
    - Press each of the keys and rotate the knob on the front panel. You should see the corresponding key in the diagnostic display turn green. Verify that each key is recognized.
    - Click the PASS or FAIL button when done.
  - c. The Display Pixel Test will ask you to look for video problems on the test patterns:
    - Check the Green screen for any stuck or missing pixels. Any keypress, click, or touch will move to the next screen.
    - Repeat with the Red screen, the Blue Screen, and the Gray scale screen. Select Yes or No when the LCD Test dialog asks “Did you see any video problems”.
4. When all diagnostics tests have completed, check that there is a check mark beside each diagnostic name. An X instead of a check mark indicates that the diagnostic had a failure.
5. Click the **Diagnostics Failure** Info tab and verify there is no failure information listed.
6. Click the **Exit Diagnostics** button to exit diagnostics.

**Alignment** You should align the instrument before proceeding with the Warranted Characteristics tests.

1. Select **Alignments** in the **Tools** menu. The Alignments dialog box will open.
2. Select **Align Now**. The alignment process will take a few minutes.
3. Verify that no alignment failures are reported in the status bar.

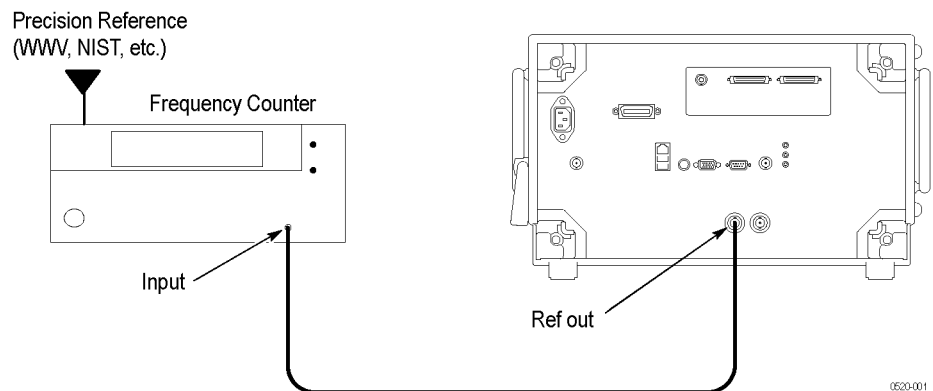
## Warranted Characteristics Tests

The following procedures verify the SPECMONB Series Signal Analyzer performance is within the warranted specifications.

### Frequency Accuracy

#### Check Reference Output Frequency Accuracy

1. Connect **Ref Out** on the spectrum analyzer rear panel through a 50  $\Omega$  precision coaxial cable to the frequency counter input. See the following figure.
2. Connect a precision frequency reference to the frequency counter.



**Figure 3: Connections for Reference Frequency Output Accuracy check**

3. Set the Frequency counter:

Function	Frequency
Gate time	2 s

4. Check that the frequency counter reads 10 MHz  $\pm$ 4 Hz. Enter the frequency in the test record.

## Check Reference Output Power Level

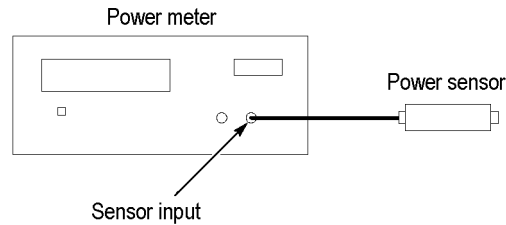
1. Set up the power meter and sensor.

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**NOTE.** Store the power sensor correction factors in the power meter, if you have not yet done so.

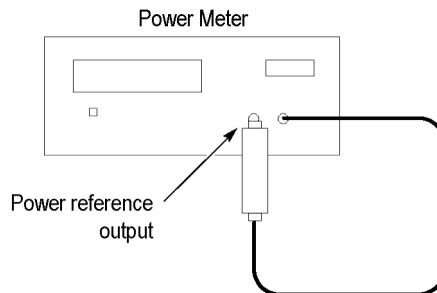
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- a. Connect the power sensor to the Sensor input on the power meter, as shown in the following figure.



**Figure 4: Power meter setup**

- b. Press **Zero/Cal**, and then press **ZERO** on the power meter.
- c. Connect the RF input of the power sensor to the power meter power reference output, as shown in the following figure.



**Figure 5: Power meter calibration**

- d. Press **CAL** to execute the calibration.
  - e. Disconnect the RF input of the power sensor from the power meter reference output.
2. Connect the power sensor RF input to the Ref Out connector on the SPECMONB rear panel, using the N-female to BNC male adapter (see the following figure).
  3. Press **Frequency/Cal Factor**, and then set **Freq** to 10 MHz.
  4. Check that the Ref Out signal is >0 dBm. Enter this level in the test record.

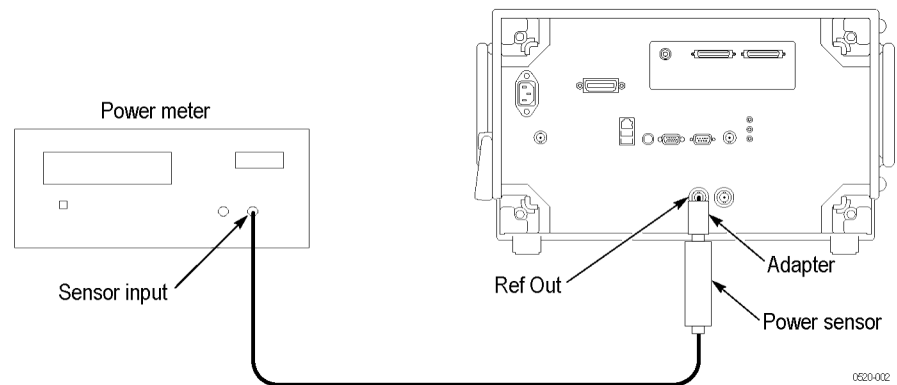


Figure 6: Equipment connections for Ref Out power level check

### External Reference Input Level

1. Connect the signal generator output to the **Ref In** connector on the spectrum analyzer rear panel, using a 50  $\Omega$  N-N coaxial cable and N-female to BNC male adapter (see the following figure).

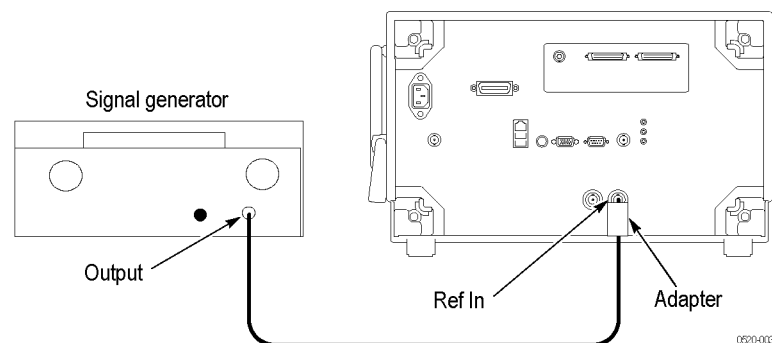


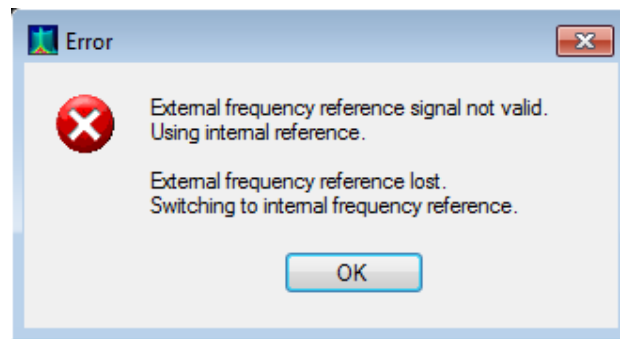
Figure 7: Equipment connections for Ref In power level check

2. Set the Signal generator controls:

Frequency	10 MHz
Level	0 dBm
RF	On

3. Set the SPECMONB to use the external reference:
  - a. Select **Setup > Configure In/Out > Frequency Reference**.
  - b. Select the **External** radio button.
4. Check the Input Reference limits:
  - a. Check that the Status Bar shows **Ref: Ext**.
  - b. Set the **Source** to **Internal (10 MHz)**.
  - c. Set the signal generator output level to **-10 dBm**.

- d. Set the **Source** to **External**.
- e. Check that the Status Bar shows **Ref: Ext**.
- f. Set the **Source** to **Internal (10 MHz)**.
- g. Set the signal generator output level to +6 dBm.
- h. Set the **Source** to **External**.
- i. Check that the Status Bar shows **Ref: Ext**.
- j. Disconnect the signal generator from the **Ref In** connector. An error message should pop up to indicate loss of lock (see the following figure).



- k. Click OK on the error message, and check that the Status Bar shows **Ref: Int**.
- l. Enter Pass or Fail in the test record.
- m. Repeat the test at 100 MHz, beginning with step 2.

## Phase Noise (Instruments with Option 11)

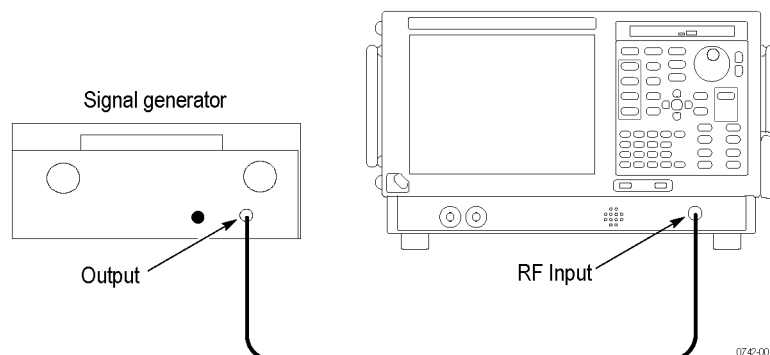
If Option 11 is installed in your instrument, use the following procedure to check the phase noise. If Option 11 is not installed in your instrument, use the procedure that follows. (See page 74, *Phase Noise (Instruments without Option 11)*.)

---

**NOTE.** *The intent of the Phase Noise test is to measure the phase noise level of the instrument. The phase noise specification does not cover residual spurs. If the specific measurement frequency results in measuring a residual spur that is visible above the noise level, the phase noise specification applies not to the spur but to the noise level on either side of the spur. Please refer to the Spurious Response specifications. (See Table 15.) Also, refer to the Spurious Response section of this procedure to determine whether or not a residual spur is within the specification. (See page 118, Spurious Response.)*

---

1. Connect the generator output to the RTSA RF Input, using a 50  $\Omega$  coaxial cable (see the following figure).



**Figure 8: Equipment connections for phase noise checks**

2. Reset the spectrum analyzer to factory defaults: select **Setup > Preset (Main)** from the **Setup** menu.
3. Select **Tools > Alignments** and then select **Align Now**.
4. Modify the default settings:

Center Frequency	1.00 GHz
Setup > Settings > Freq & Span > Center	
Span	1 MHz
Setup > Settings > Freq & Span > Span	
Ref Level	+5 dBm
Setup > Amplitude > Internal Settings > Ref Level	
RF & IF Optimization	Maximize Dynamic Range
Setup > Amplitude > Internal Settings > RF & IF Optimization	

5. Set the generator as follows:

Center Frequency	1.00 GHz
Output level	+5 dBm
RF	On

6. Select Run > Run Single to stop acquisitions.
7. Display the Phase Noise measurement:
  - Select **Setup > Displays**.
  - Select the **RF Measurements** folder.
  - Select the **Phase Noise** display and select **Add**.

- Select the **Spectrum** display and select **Remove**.
  - Select **OK**.
8. Select **Setup > Settings** to display the Phase Noise settings control panel.
  9. On the Frequency tab, set the Start Offset to 1 kHz for both the Measurement BW and the Integration BW.
  10. Set the Stop Offset to 10 MHz for both the Measurement BW and the Integration BW.
  11. Select the Parameters tab.
  12. Set the Average value to 20 and click the check box to enable averaging.
  13. Select the Traces tab.
  14. Select **Trace 2** in the Trace drop-down list. Deselect the **Show** checkbox so that Trace 2 is not be displayed.
  15. Select Trace 1 from the trace drop-down list above the graph display. Select the Marker readout on the left side of the graph. Set the Marker value to 6 MHz.
  16. Press the Single key and wait for 20 averages to complete.
  17. Read the value for the 6 MHz offset from the Offset readout.
  18. Document the test results in the test record at each frequency.

## Phase Noise (Instruments without Option 11)

### Check Phase Noise

If Option 11 is not installed in your instrument, use the following procedure to check the phase noise. If Option 11 is installed in your instrument, use the preceding procedure. (See page 72, *Phase Noise (Instruments with Option 11)*.)

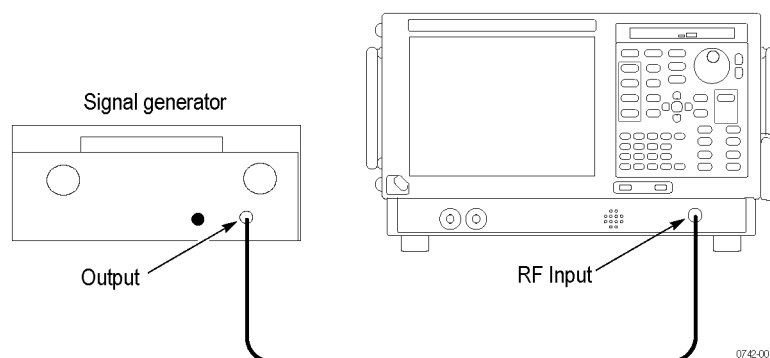
---

**NOTE.** *The intent of the Phase Noise test is to measure the phase noise level of the instrument. The phase noise specification does not cover residual spurs. If the specific measurement frequency results in measuring a residual spur that is visible above the noise level, the phase noise specification applies not to the spur but to the noise level on either side of the spur. Please refer to the Spurious Response specifications. (See Table 15.) Also, refer to the Spurious Response section of this procedure to determine whether or not a residual spur is within the specification. (See page 118, Spurious Response.)*

---



1. Connect the generator output to the RTSA RF Input, using a 50  $\Omega$  coaxial cable (see the following figure).



**Figure 9: Equipment connections for phase noise checks**

2. Reset the spectrum analyzer to factory defaults: Select Setup > **Preset (Main)** from the **Setup** menu.
3. Press Tools > Alignments and then select Align Now.
4. Modify the settings:

Center Frequency	1.00 GHz
Setup > Settings > Freq & Span > Center	
Span	1 MHz
Setup > Settings > Freq & Span > Span	
VBW	10 Hz (box checked)
Setup > Settings > BW > VBW	
Detection	Avg (VRMS)
Setup > Settings > Traces > Detection	
Function	Avg (VRMS)
Setup > Settings > Traces > Function	
Count	100 (box checked)
Setup > Settings > Traces > Count	
Trace Points	2401
Setup > Settings > Prefs > Trace Points	
Marker Noise Mode	Check Marker Noise mode box
Setup > Settings > Prefs > Marker Noise Mode	
RF & IF Optimization	Maximize Dynamic Range
Setup > Amplitude > Internal Settings > RF & IF Optimization	
Reference level	+5 dBm
Setup > Amplitude > Internal Settings > Ref Level	

5. Set the generator as follows:

Frequency	1.00 GHz
Output level	+5 dBm
RF	On

6. Turn on the Reference Marker (MR) and Marker 1 (M1), and set them for Delta operation and Noise Mode.
  - a. Select **Markers > Define Markers**.
  - b. Select the **Add** soft key to add the MR marker.
  - c. Select the **Add** soft key again to add the M1 marker.
  - d. Select **Delta** from the **Readouts** dropdown menu.
7. For each span shown in the following table, perform steps a through e:

**Table 61: Phase noise offsets (Low range; without Option 11)**

Span	M1 Offset
4 kHz	CF + 1 kHz
40 kHz	CF + 10 kHz
300 kHz	CF + 100 kHz

- a. Press the **Span** key and enter a Span value from the table.
  - b. Select **Run > Run Single**.
  - c. Select the Reference Marker with the Marker Select key and press the Peak key.
  - d. Select Marker 1 (M1) with the marker select key.
  - e. Set the Marker 1 (M1) frequency by entering the offset value from the table above in the Frequency box at the bottom center of the display.
  - f. Read the marker noise level in dBc/Hz, in the Delta Marker readout (upper right corner of the screen), and enter the value in the test record. (Limits are shown in the test record.)
8. Record the generator signal amplitude in the Test Record:
    - a. Select Marker (MR) with the Marker Select key.
    - b. Select the Markers Peak key to center the MR marker on the peak of the 1000 MHz signal.
    - c. Record the MR Marker amplitude (upper-left corner of the screen.) This value is called **Carrier Power** and is used below.

9. Obtain the phase noise at 1 MHz offset. Start by setting the spectrum analyzer to the settings listed below:
  - a. Center Frequency (Freq key): 1001 MHz
  - b. Span (Span key): 10 kHz
  - c. Reference Level Offset: -30 dBm (This is the amplitude control in the upper left of the display.)
  - d. Set input attenuation for manual control.
    - Select **Setup > Amplitude > Internal Settings**.
    - Deselect the Internal Attenuator **Auto** check box.
    - Set **Internal Attenuator** to 0 dB.
  - a. Select **Run > Run Single**.
  - b. Center the M1 marker in the middle of the screen:
    - Select **Markers > Define Markers**
    - Select **Readouts > Absolute**.
    - Press the **Select** key to select the **M1** marker.
    - Select **Marker Frequency**. Set to 1001 MHz.

The marker is now located at the center frequency position.
  - a. Read the noise amplitude on Marker **M1**, in dBm/Hz.
  - b. Subtract the value of **MR** obtained in step 8 to obtain the phase noise amplitude at 1 MHz.

For example, if  $MR = 4.7$  dBm and  $M1 = -129.6$  dBm/Hz, then  $M1 - MR = -134.3$  dBc/Hz.
  - c. Enter the value obtained at 1 MHz in the test record for phase noise at 1 MHz.
10. Obtain the phase noise at 6 MHz offset. Start by setting the spectrum analyzer to the settings listed below:
  - a. Center Frequency (Freq key): 1006 MHz.
  - b. Span (Span key): 10 kHz.
  - c. Select **Run > Run Single**.
  - d. Set the Marker M1 Frequency to 1006 MHz.
  - e. Read the noise level on Marker **M1** in dBm/Hz.
  - f. Subtract the value of Carrier Power obtained in step 8 in order to obtain the phase noise amplitude at +6 MHz.

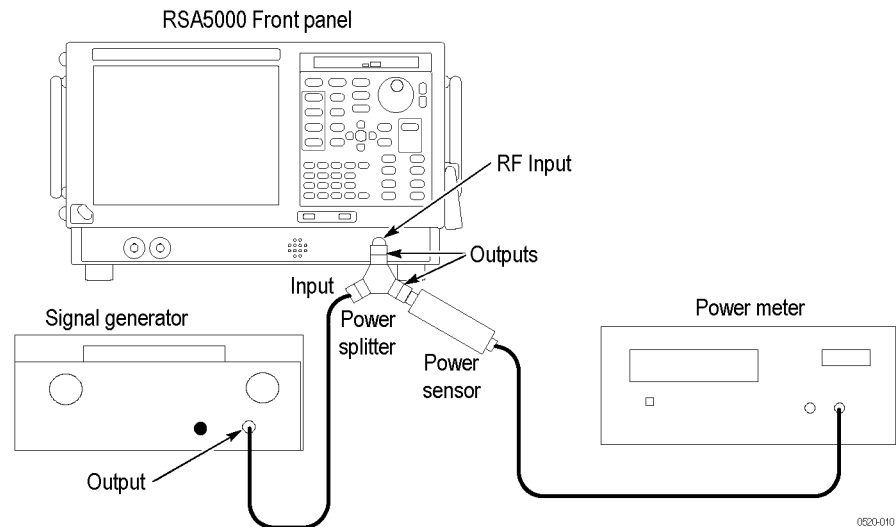


## Amplitude

### RF Flatness (Frequency Response) 10 MHz to 26.5 GHz

1. Connect the RF generator, power splitter, power meter, and spectrum analyzer, as shown in the following figure.

The power splitter outputs should connect directly to the SPECMONB RF Input and to the Power Sensor, without using cables.



**Figure 10: Equipment connections for RF flatness check**

2. To record the test readings, you can make a printout of the following table. (See Table 64.)
3. Reset the spectrum analyzer to factory defaults: Setup > Preset (Main).
4. Select **Tools > Alignments** and then select **Align Now**.
5. Set the SPECMONB as follows:

Ref Level	-15 dBm
Setup > Amplitude > Internal Settings > Ref Level	
Internal Attenuator	10 dB (Auto unchecked)
Setup > Amplitude > Internal Settings > Internal Attenuator	
Span	1 MHz
Setup > Settings > Freq & Span > Span	
LF Path	Use Low Freq... box unchecked
Setup > Acquire > Input Params	

6. Set the RF signal generator for a -14 dBm output amplitude and turn RF On.

7. Set both the RF signal generator output frequency and the spectrum analyzer Center Frequency to the first frequency in the RF Flatness table that follows. This is the reference frequency. (See Table 62.)
8. Select the Markers Peak key to set the Reference Marker (MR) to the carrier peak.
9. Adjust the RF signal generator output level for a marker reading of  $-20 \pm 0.5$  dBm.
10. Record the Power Meter reading and the SPECMONB marker reading in the following table.
11. Set both the RF Generator output frequency and the SPECMONB center frequency to the next frequency in the table.
12. Press the **Markers Peak** key to set the Reference Marker (MR) to the carrier peak.
13. Calculate the  $\Delta$ Power Meter number: subtract the Power meter reading at 100 MHz from the Power Meter reading at this frequency.
14. Calculate the  $\Delta$ RTSA number: subtract the RTSA reading at 100 MHz from the RTSA reading at this frequency.
15. Calculate the RF Flatness Error:  

$$RF\ Flatness\ Error = \Delta RTSA\ at\ this\ freq - \Delta Power\ Meter\ at\ this\ freq$$
 Readings are in dBm, error is in dB.
16. Repeat items 11 through 15 for each of the center frequencies shown in the RF Flatness table up to the maximum bandwidth of the device-under-test. (See Table 62.)

**Table 62: RF Flatness (Preamp OFF)**

Attenuator = 10 dB

Frequency	Power meter reading	$\Delta$ Power meter (vs. 100 MHz)	RTSA reading	$\Delta$ RTSA reading (vs. 100 MHz)	RF flatness error <sup>1</sup>
100 MHz		0		0	0
10 MHz					
20 MHz					
30 MHz					
40 MHz					
50 MHz					
60 MHz					
70 MHz					
80 MHz					
90 MHz					

Table 62: RF Flatness (Preamp OFF) (cont.)

Attenuator = 10 dB

Frequency	Power meter reading	$\Delta$ Power meter (vs. 100 MHz)	RTSA reading	$\Delta$ RTSA reading (vs. 100 MHz)	RF flatness error <sup>1</sup>
200 MHz					
300 MHz					
400 MHz					
500 MHz					
600 MHz					
700 MHz					
800 MHz					
900 MHz					
1.0 GHz					
1.1 GHz					
1.2 GHz					
1.3 GHz					
1.4 GHz					
1.5 GHz					
1.6 GHz					
1.7 GHz					
1.8 GHz					
1.9 GHz					
2.0 GHz					
2.1 GHz					
2.2 GHz					
2.3 GHz					
2.4 GHz					
2.5 GHz					
2.6 GHz					
2.7 GHz					
2.8 GHz					
2.9 GHz					
3.0 GHz					
<b>SPECMON6B/26B only</b>					
3.1 GHz					
3.2 GHz					
3.3 GHz					
3.4 GHz					
3.5 GHz					

**Table 62: RF Flatness (Preamp OFF) (cont.)**

**Attenuator = 10 dB**

Frequency	Power meter reading	$\Delta$ Power meter (vs. 100 MHz)	RTSA reading	$\Delta$ RTSA reading (vs. 100 MHz)	RF flatness error <sup>1</sup>
3.6 GHz					
3.7 GHz					
3.8 GHz					
3.9 GHz					
4.0 GHz					
4.1 GHz					
4.2 GHz					
4.3 GHz					
4.4 GHz					
4.5 GHz					
4.6 GHz					
4.7 GHz					
4.8 GHz					
4.9 GHz					
5.0 GHz					
5.1 GHz					
5.2 GHz					
5.3 GHz					
5.4 GHz					
5.5 GHz					
5.6 GHz					
5.7 GHz					
5.8 GHz					
5.9 GHz					
6.0 GHz					
6.1 GHz					
6.2 GHz					
<b>SPECMON26B only</b>					
6.3 GHz					
6.4 GHz					
6.5 GHz					
6.6 GHz					
6.7 GHz					
6.8 GHz					
6.9 GHz					



Table 62: RF Flatness (Preamp OFF) (cont.)

Attenuator = 10 dB

Frequency	Power meter reading	$\Delta$ Power meter (vs. 100 MHz)	RTSA reading	$\Delta$ RTSA reading (vs. 100 MHz)	RF flatness error <sup>1</sup>
7.0 GHz					
7.1 GHz					
7.2 GHz					
7.3 GHz					
7.4 GHz					
7.5 GHz					
7.6 GHz					
7.7 GHz					
7.8 GHz					
7.9 GHz					
8.0 GHz					
8.1 GHz					
8.2 GHz					
8.3 GHz					
8.4 GHz					
8.5 GHz					
8.6 GHz					
8.7 GHz					
8.8 GHz					
8.9 GHz					
9.0 GHz					
9.1 GHz					
9.2 GHz					
9.3 GHz					
9.4 GHz					
9.5 GHz					
9.6 GHz					
9.7 GHz					
9.8 GHz					
9.9 GHz					
10.0 GHz					
10.1 GHz					
10.2 GHz					
10.3 GHz					
10.4 GHz					

**Table 62: RF Flatness (Preamp OFF) (cont.)**

**Attenuator = 10 dB**

Frequency	Power meter reading	$\Delta$ Power meter (vs. 100 MHz)	RTSA reading	$\Delta$ RTSA reading (vs. 100 MHz)	RF flatness error <sup>1</sup>
10.5 GHz					
10.6 GHz					
10.7 GHz					
10.8 GHz					
10.9 GHz					
11.0 GHz					
11.1 GHz					
11.2 GHz					
11.3 GHz					
11.4 GHz					
11.5 GHz					
11.6 GHz					
11.7 GHz					
11.8 GHz					
11.9 GHz					
12.0 GHz					
12.1 GHz					
12.2 GHz					
12.3 GHz					
12.4 GHz					
12.5 GHz					
12.6 GHz					
12.7 GHz					
12.8 GHz					
12.9 GHz					
12.0 GHz					
12.1 GHz					
12.2 GHz					
12.3 GHz					
12.4 GHz					
12.5 GHz					
12.6 GHz					
12.7 GHz					
12.8 GHz					
12.9 GHz					

Table 62: RF Flatness (Preamp OFF) (cont.)

Attenuator = 10 dB

Frequency	Power meter reading	$\Delta$ Power meter (vs. 100 MHz)	RTSA reading	$\Delta$ RTSA reading (vs. 100 MHz)	RF flatness error <sup>1</sup>
13.0 GHz					
13.1 GHz					
13.2 GHz					
13.3 GHz					
13.4 GHz					
13.5 GHz					
13.6 GHz					
13.7 GHz					
13.8 GHz					
13.9 GHz					
14.0 GHz					
14.1 GHz					
14.2 GHz					
14.3 GHz					
14.0 GHz					
14.1 GHz					
14.2 GHz					
14.3 GHz					
14.4 GHz					
14.5 GHz					
14.6 GHz					
14.7 GHz					
14.8 GHz					
14.9 GHz					
15.0 GHz					
15.1 GHz					
15.2 GHz					
15.3 GHz					
15.4 GHz					
15.5 GHz					
15.6 GHz					
15.7 GHz					
15.8 GHz					
15.9 GHz					
16.0 GHz					

**Table 62: RF Flatness (Preamp OFF) (cont.)**

**Attenuator = 10 dB**

Frequency	Power meter reading	$\Delta$ Power meter (vs. 100 MHz)	RTSA reading	$\Delta$ RTSA reading (vs. 100 MHz)	RF flatness error <sup>1</sup>
16.1 GHz					
16.2 GHz					
16.3 GHz					
16.4 GHz					
16.5 GHz					
16.6 GHz					
16.7 GHz					
16.8 GHz					
16.9 GHz					
17.0 GHz					
17.1 GHz					
17.2 GHz					
17.3 GHz					
17.4 GHz					
17.5 GHz					
17.6 GHz					
17.7 GHz					
17.8 GHz					
17.9 GHz					
18.0 GHz					
18.1 GHz					
18.2 GHz					
18.3 GHz					
18.4 GHz					
18.5 GHz					
18.6 GHz					
18.7 GHz					
18.8 GHz					
18.9 GHz					
19.0 GHz					
19.1 GHz					
19.2 GHz					
19.3 GHz					
19.4 GHz					
19.5 GHz					

Table 62: RF Flatness (Preamp OFF) (cont.)

Attenuator = 10 dB

Frequency	Power meter reading	$\Delta$ Power meter (vs. 100 MHz)	RTSA reading	$\Delta$ RTSA reading (vs. 100 MHz)	RF flatness error <sup>1</sup>
19.6 GHz					
19.7 GHz					
19.8 GHz					
19.9 GHz					
20.0 GHz					
20.1 GHz					
20.2 GHz					
20.3 GHz					
20.4 GHz					
20.5 GHz					
20.6 GHz					
20.7 GHz					
20.8 GHz					
20.9 GHz					
21.0 GHz					
21.1 GHz					
21.2 GHz					
21.3 GHz					
21.4 GHz					
21.5 GHz					
21.6 GHz					
21.7 GHz					
21.8 GHz					
21.9 GHz					
22.0 GHz					
22.1 GHz					
22.2 GHz					
22.3 GHz					
22.4 GHz					
22.5 GHz					
22.6 GHz					
22.7 GHz					
22.8 GHz					
22.9 GHz					
23.0 GHz					

**Table 62: RF Flatness (Preamp OFF) (cont.)**

**Attenuator = 10 dB**

Frequency	Power meter reading	$\Delta$ Power meter (vs. 100 MHz)	RTSA reading	$\Delta$ RTSA reading (vs. 100 MHz)	RF flatness error <sup>1</sup>
23.1 GHz					
23.2 GHz					
23.3 GHz					
23.4 GHz					
23.5 GHz					
23.6 GHz					
23.7 GHz					
23.8 GHz					
23.9 GHz					
24.0 GHz					
24.1 GHz					
24.2 GHz					
24.3 GHz					
24.4 GHz					
24.5 GHz					
24.6 GHz					
24.7 GHz					
24.8 GHz					
24.9 GHz					
25.0 GHz					
25.1 GHz					
25.2 GHz					
25.3 GHz					
25.4 GHz					
25.5 GHz					
25.6 GHz					
25.7 GHz					
25.8 GHz					
25.9 GHz					
26.0 GHz					
26.1 GHz					
26.2 GHz					
26.3 GHz					

Table 62: RF Flatness (Preamp OFF) (cont.)

Attenuator = 10 dB

Frequency	Power meter reading	$\Delta$ Power meter (vs. 100 MHz)	RTSA reading	$\Delta$ RTSA reading (vs. 100 MHz)	RF flatness error <sup>1</sup>
26.4 GHz					
26.5 GHz					

<sup>1</sup> Use the formula in Step 15

- Enter the largest variation in each of the following frequency ranges into the test record:

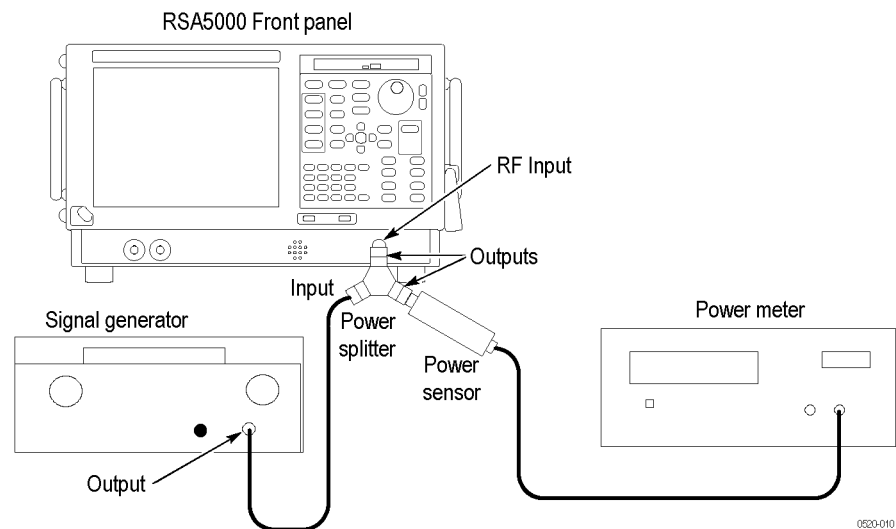
10 MHz - 3 GHz (Preamp Off)

3.1 GHz - 6.2 GHz (Preamp Off, SPECMON6B/26B only)

6.3 GHz - 26.5 GHz (Preamp Off, SPECMON26B only)

### Low Frequency (LF) Input Path Accuracy

- Connect the RF generator, power splitter, power meter, and spectrum analyzer, as shown in the following figure.



**Figure 11: Equipment connections for Low Frequency (LF) input path accuracy check**

- The power splitter outputs should connect directly to the SPECMONB RF Input and to the Power Sensor, without using cables.
- Reset the spectrum analyzer to factory defaults; select **Setup > Preset (Main)**.
- Select **Tools > Alignments** and then select **Align Now**.
- Set the SPECMONB as follows:

Ref Level	-15 dBm
Setup > Amplitude > Internal Settings > Ref Level	
Internal Attenuator	10 dB (Auto unchecked)
Setup > Amplitude > Internal Settings	
Span	1 MHz
Setup > Settings > Freq & Span > Span	
LF Path	Use Low Freq box checked
Setup > Acquire > Input Params	

6. Set the RF generator for a -14 dBm output amplitude and turn RF On.
7. Set both the RF signal generator output frequency and the SPECMONB Center Frequency to the first frequency shown in the table *Low Frequency Input Path Flatness (Preamp Off, if installed)*. (See Table 63.) This is the reference frequency.
8. Select the **Markers Peak** key to set the Reference Marker (MR) to the carrier peak.
9. Adjust the RF signal generator output level for a marker reading of  $-20 \pm 0.5$  dBm.
10. Record the Power Meter reading and the SPECMONB marker reading in the following table.
11. Set both the RF generator output frequency and the SPECMONB Center Frequency to the next frequency in the table.
12. Select the **Markers Peak** key to set the Reference Marker (MR) to the carrier peak.
13. Record the Power Meter reading and the SPECMONB marker reading in the following table.
14. Calculate the  $\Delta$  Power Meter number: subtract the Power Meter reading at 10 MHz from the Power Meter reading at this frequency.
15. Calculate the  $\Delta$  RTSA number: subtract the RTSA reading at 10 MHz from the RTSA reading at this frequency.
16. Calculate the RF Flatness Error:  
$$RF \text{ Flatness Error} = \Delta \text{ RTSA at this freq} - \Delta \text{ Power Meter at this freq}$$
Readings are in dBm, error is in dB.
17. Repeat parts 11 through 16 for each of the center frequencies shown in the following table.



Table 63: Low Frequency input path flatness

Attenuator = 10 dB

Frequency	Power meter reading	$\Delta$ Power meter (vs. 10 MHz)	RTSA reading	$\Delta$ RTSA reading (vs. 10 MHz)	RF flatness error <sup>1</sup>
10 MHz		0		0	0
11 MHz					
12 MHz					
13 MHz					
14 MHz					
15 MHz					
16 MHz					
17 MHz					
18 MHz					
19 MHz					
20 MHz					
21 MHz					
22 MHz					
23 MHz					
24 MHz					
25 MHz					
26 MHz					
27 MHz					
28 MHz					
29 MHz					
30 MHz					
31 MHz					
31.49 MHz					

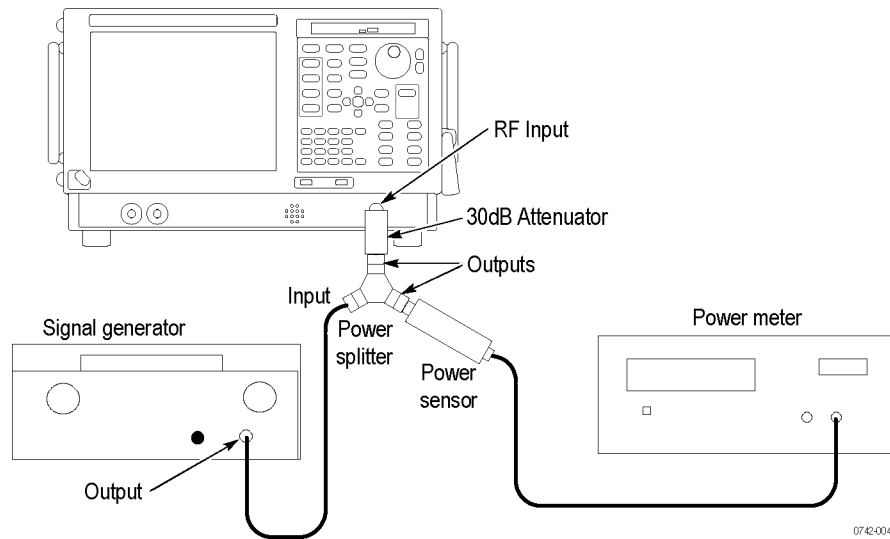
<sup>1</sup> Use the formula in Step 16

18. Enter the largest variation in each of the following frequency range into the test record:

10 MHz - 32 MHz

**RF Flatness (Frequency Response) 10 MHz to 26.5 GHz, Preamp On (Option 50/51 Installed)**

1. Connect the RF generator, power splitter, power meter, and spectrum analyzer, as shown in the following figure. The 30 dB attenuator is connected between the power splitter and the SPECMONB RF input connector.



**Figure 12: Equipment connections for RF Flatness (Frequency Response) 10 MHz to 26.5 GHz check**

2. Reset the spectrum analyzer to factory defaults: select **Setup > Preset (Main)**.
3. Select **Tools > Alignments** and then select **Align Now**.
4. Set the SPECMONB as follows:

Ref Level	-45 dBm
Setup > Amplitude > Internal Settings > Ref Level	
Internal Attenuator	10 dB (Auto unchecked)
Setup > Amplitude > Internal Attenuator	
Internal Preamp	Internal Preamp box checked
Setup > Amplitude > Internal Settings	
Span	1 MHz
Setup > Settings > Freq & Span > Span	
LF Path	Use Low Freq Signal path box unchecked
Setup > Acquire > Input Params	

5. Set the RF generator for a -14 dBm output amplitude and turn RF On.
6. Set both the RF signal generator output frequency and the SPECMONB Center Frequency to the first frequency shown in the table *RF Flatness (Option 50 Preamp ON)*. (See Table 64.) This is the reference frequency.

7. Select the **Markers Peak** key to set the Reference Marker (MR) to the carrier peak.
8. Record the Power Meter reading and the SPECMONB marker reading in the following table.
9. Set both the RF generator output frequency and the SPECMONB Center Frequency to the next frequency in the table.
10. Select the **Markers Peak** key to set the Reference Marker (MR) to the carrier peak.
11. Calculate the  $\Delta$ Power Meter number: subtract the Power Meter reading at 100 MHz from the Power Meter reading at this frequency.
12. Calculate the  $\Delta$ RTSA number: subtract the RTSA reading at 100 MHz from the RTSA reading at this frequency.
13. Calculate the RF Flatness Error:
 
$$RF\ Flatness\ Error = \Delta RTSA\ at\ this\ freq - \Delta Power\ Meter\ at\ this\ freq + \text{delta } 30\ dB\ attenuator\ at\ this\ frequency$$

Readings are in dBm and error is in dB.
14. Repeat steps 9 through 13 for each of the center frequencies shown in the following table.

Table 64: RF flatness (Option 50/51 Preamp ON)

Attenuator = 10 dB

Frequency	Power meter reading	$\Delta$ Power meter (vs. 100 MHz)	RTSA reading (vs. 100 MHz)	30 dB attenuator	$\Delta$ 30 dB attenuator	RF flatness error <sup>1</sup>
100 MHz		0		0	0	
10 MHz						
20 MHz						
30 MHz						
40 MHz						
50 MHz						
60 MHz						
70 MHz						
80 MHz						
90 MHz						
200 MHz						
300 MHz						
400 MHz						
500 MHz						
600 MHz						

**Table 64: RF flatness (Option 50/51 Preamp ON) (cont.)**

**Attenuator = 10 dB**

Frequency	Power meter reading	$\Delta$ Power meter (vs. 100 MHz)	RTSA reading (vs. 100 MHz)	30 dB attenuator	$\Delta$ 30 dB attenuator	RF flatness error <sup>1</sup>
700 MHz						
800 MHz						
900 MHz						
1.0 GHz						
1.1 GHz						
1.2 GHz						
1.3 GHz						
1.4 GHz						
1.5 GHz						
1.6 GHz						
1.7 GHz						
1.8 GHz						
1.9 GHz						
2.0 GHz						
2.1 GHz						
2.2 GHz						
2.3 GHz						
2.4 GHz						
2.5 GHz						
2.6 GHz						
2.7 GHz						
2.8 GHz						
2.9 GHz						
3.0 GHz						
<b>SPECMON6B/26B only</b>						
3.1 GHz						
3.2 GHz						
3.3 GHz						
3.4 GHz						
3.5 GHz						
3.6 GHz						
3.7 GHz						
3.8 GHz						
3.9 GHz						

Table 64: RF flatness (Option 50/51 Preamp ON) (cont.)

Attenuator = 10 dB

Frequency	Power meter reading	$\Delta$ Power meter (vs. 100 MHz)	RTSA reading (vs. 100 MHz)	30 dB attenuator	$\Delta$ 30 dB attenuator	RF flatness error <sup>1</sup>
4.0 GHz						
4.1 GHz						
4.2 GHz						
4.3 GHz						
4.4 GHz						
4.5 GHz						
4.6 GHz						
4.7 GHz						
4.8 GHz						
4.9 GHz						
5.0 GHz						
5.1 GHz						
5.2 GHz						
5.3 GHz						
5.4 GHz						
5.5 GHz						
5.6 GHz						
5.7 GHz						
5.8 GHz						
5.9 GHz						
6.0 GHz						
6.1 GHz						
6.2 GHz						
<b>SPECMON26B only</b>						
6.3 GHz						
6.4 GHz						
6.5 GHz						
6.6 GHz						
6.7 GHz						
6.8 GHz						
6.9 GHz						
7.0 GHz						
7.1 GHz						
7.2 GHz						

**Table 64: RF flatness (Option 50/51 Preamp ON) (cont.)**

**Attenuator = 10 dB**

<b>Frequency</b>	<b>Power meter reading</b>	<b><math>\Delta</math> Power meter (vs. 100 MHz)</b>	<b>RTSA reading (vs. 100 MHz)</b>	<b>30 dB attenuator</b>	<b><math>\Delta</math>30 dB attenuator</b>	<b>RF flatness error <sup>1</sup></b>
7.3 GHz						
7.4 GHz						
7.5 GHz						
7.6 GHz						
7.7 GHz						
7.8 GHz						
7.9 GHz						
8.0 GHz						
8.1 GHz						
8.2 GHz						
8.3 GHz						
8.4 GHz						
8.5 GHz						
8.6 GHz						
8.7 GHz						
8.8 GHz						
8.9 GHz						
9.0 GHz						
9.1 GHz						
9.2 GHz						
9.3 GHz						
9.4 GHz						
9.5 GHz						
9.6 GHz						
9.7 GHz						
9.8 GHz						
9.9 GHz						
10.0 GHz						
10.1 GHz						
10.2 GHz						
10.3 GHz						
10.4 GHz						
10.5 GHz						
10.6 GHz						

Table 64: RF flatness (Option 50/51 Preamp ON) (cont.)

Attenuator = 10 dB

Frequency	Power meter reading	$\Delta$ Power meter (vs. 100 MHz)	RTSA reading (vs. 100 MHz)	30 dB attenuator	$\Delta$ 30 dB attenuator	RF flatness error <sup>1</sup>
10.7 GHz						
10.8 GHz						
10.9 GHz						
11.0 GHz						
11.1 GHz						
11.2 GHz						
11.3 GHz						
11.4 GHz						
11.5 GHz						
11.6 GHz						
11.7 GHz						
11.8 GHz						
11.9 GHz						
12.0 GHz						
12.1 GHz						
12.2 GHz						
12.3 GHz						
12.4 GHz						
12.5 GHz						
12.6 GHz						
12.7 GHz						
12.8 GHz						
12.9 GHz						
12.0 GHz						
12.1 GHz						
12.2 GHz						
12.3 GHz						
12.4 GHz						
12.5 GHz						
12.6 GHz						
12.7 GHz						
12.8 GHz						
12.9 GHz						
13.0 GHz						

**Table 64: RF flatness (Option 50/51 Preamp ON) (cont.)**

**Attenuator = 10 dB**

<b>Frequency</b>	<b>Power meter reading</b>	<b><math>\Delta</math> Power meter (vs. 100 MHz)</b>	<b>RTSA reading (vs. 100 MHz)</b>	<b>30 dB attenuator</b>	<b><math>\Delta</math>30 dB attenuator</b>	<b>RF flatness error <sup>1</sup></b>
13.1 GHz						
13.2 GHz						
13.3 GHz						
13.4 GHz						
13.5 GHz						
13.6 GHz						
13.7 GHz						
13.8 GHz						
13.9 GHz						
14.0 GHz						
14.1 GHz						
14.2 GHz						
14.3 GHz						
14.0 GHz						
14.1 GHz						
14.2 GHz						
14.3 GHz						
14.4 GHz						
14.5 GHz						
14.6 GHz						
14.7 GHz						
14.8 GHz						
14.9 GHz						
15.0 GHz						
15.1 GHz						
15.2 GHz						
15.3 GHz						
15.4 GHz						
15.5 GHz						
15.6 GHz						
15.7 GHz						
15.8 GHz						
15.9 GHz						
16.0 GHz						



Table 64: RF flatness (Option 50/51 Preamp ON) (cont.)

Attenuator = 10 dB

Frequency	Power meter reading	$\Delta$ Power meter (vs. 100 MHz)	RTSA reading (vs. 100 MHz)	30 dB attenuator	$\Delta$ 30 dB attenuator	RF flatness error <sup>1</sup>
16.1 GHz						
16.2 GHz						
16.3 GHz						
16.4 GHz						
16.5 GHz						
16.6 GHz						
16.7 GHz						
16.8 GHz						
16.9 GHz						
17.0 GHz						
17.1 GHz						
17.2 GHz						
17.3 GHz						
17.4 GHz						
17.5 GHz						
17.6 GHz						
17.7 GHz						
17.8 GHz						
17.9 GHz						
18.0 GHz						
18.1 GHz						
18.2 GHz						
18.3 GHz						
18.4 GHz						
18.5 GHz						
18.6 GHz						
18.7 GHz						
18.8 GHz						
18.9 GHz						
19.0 GHz						
19.1 GHz						
19.2 GHz						
19.3 GHz						
19.4 GHz						

**Table 64: RF flatness (Option 50/51 Preamp ON) (cont.)**

**Attenuator = 10 dB**

<b>Frequency</b>	<b>Power meter reading</b>	<b><math>\Delta</math> Power meter (vs. 100 MHz)</b>	<b>RTSA reading (vs. 100 MHz)</b>	<b>30 dB attenuator</b>	<b><math>\Delta</math>30 dB attenuator</b>	<b>RF flatness error <sup>1</sup></b>
19.5 GHz						
19.6 GHz						
19.7 GHz						
19.8 GHz						
19.9 GHz						
20.0 GHz						
20.1 GHz						
20.2 GHz						
20.3 GHz						
20.4 GHz						
20.5 GHz						
20.6 GHz						
20.7 GHz						
20.8 GHz						
20.9 GHz						
21.0 GHz						
21.1 GHz						
21.2 GHz						
21.3 GHz						
21.4 GHz						
21.5 GHz						
21.6 GHz						
21.7 GHz						
21.8 GHz						
21.9 GHz						
22.0 GHz						
22.1 GHz						
22.2 GHz						
22.3 GHz						
22.4 GHz						
22.5 GHz						
22.6 GHz						
22.7 GHz						
22.8 GHz						

Table 64: RF flatness (Option 50/51 Preamp ON) (cont.)

Attenuator = 10 dB

Frequency	Power meter reading	$\Delta$ Power meter (vs. 100 MHz)	RTSA reading (vs. 100 MHz)	30 dB attenuator	$\Delta$ 30 dB attenuator	RF flatness error <sup>1</sup>
22.9 GHz						
23.0 GHz						
23.1 GHz						
23.2 GHz						
23.3 GHz						
23.4 GHz						
23.5 GHz						
23.6 GHz						
23.7 GHz						
23.8 GHz						
23.9 GHz						
24.0 GHz						
24.1 GHz						
24.2 GHz						
24.3 GHz						
24.4 GHz						
24.5 GHz						
24.6 GHz						
24.7 GHz						
24.8 GHz						
24.9 GHz						
25.0 GHz						
25.1 GHz						
25.2 GHz						
25.3 GHz						
25.4 GHz						
25.5 GHz						
25.6 GHz						
25.7 GHz						
25.8 GHz						
25.9 GHz						
26.0 GHz						
26.1 GHz						
26.2 GHz						

**Table 64: RF flatness (Option 50/51 Preamp ON) (cont.)**

**Attenuator = 10 dB**

Frequency	Power meter reading	$\Delta$ Power meter (vs. 100 MHz)	RTSA reading (vs. 100 MHz)	30 dB attenuator	$\Delta$ 30 dB attenuator	RF flatness error <sup>1</sup>
26.3 GHz						
26.4 GHz						
26.5 GHz						

<sup>1</sup> Use the formula in Step 13

**15.** Enter the largest variation in each of the following frequency range into the test record:

10 MHz - 3 GHz (Preamp On, Option 50 only)

3.1 GHz - 6.2 GHz (Preamp On, SPECMON6B, Option 50 only)

6.3 GHz - 26.5 GHz (Preamp On, SPECMON26B, Option 51 only)

**Absolute Accuracy at Calibration Point, RF Path**

1. Connect the RF generator, power splitter, power meter, and spectrum analyzer. (See Figure 10 on page 79.)
2. Reset the spectrum analyzer to factory defaults: select **Setup > Preset (Main)**.
3. Select **Tools > Alignments** and select **Align Now**.
4. Set the SPECMONB:

Reference Level	-20 dBm
Setup > Amplitude > Internal Settings > Ref Level	
Center Frequency	100 MHz
Setup > Settings > Center	

**5.** Set the RF Generator:

Output Frequency	100 MHz
Output Level	-14 dBm
RF	On

6. Set the frequency span (Span key) to 300 kHz.
7. Press the **Markers > Peak** key to set the Reference Marker (MR) to the carrier peak.
8. Record the reading on the Power Meter and on the SPECMONB marker amplitude.
9. Calculate the Absolute Amplitude Accuracy:

$$\Delta = \text{SPECMONB reading} - \text{Power Meter reading}$$

Readings are in dBm, error is in dB.

10. Record the Absolute Amplitude Error in the test record. (Limits are shown in the test record.)
11. Repeat steps 6 through 10 for frequency spans of 1 MHz and 41 MHz (Option B40, B85, and B16x).

### Absolute Accuracy at Calibration Point, LF path

1. Connect the RF generator, power splitter, power meter, and spectrum analyzer. (See Figure 12 on page 92.)
2. Reset the spectrum analyzer to factory defaults: select **Setup > Preset (Main)**.
3. Select **Tools > Alignments** and select **Align Now**.
4. Set the SPECMONB:

Reference Level	-20 dBm
Setup > Amplitude > Internal Settings > Ref Level	
Center Frequency	10 MHz
Setup > Settings > Center	
Span	1 MHz
Setup > Settings > Freq & Span > Span	
LF Path	<i>Use Low Freq signal path checked</i>
Setup > Acquire > Input Params	

5. Set the RF Generator:

Output Frequency	10 MHz
Output Level	-14 dBm
RF	On

6. Press the **Markers Peak** key to set the Reference Marker (MR) to the carrier peak.
7. Record the reading on the Power Meter and on the SPECMONB marker amplitude.
8. Calculate the Absolute Amplitude Accuracy:

$$\Delta = \text{SPECMONB reading} - \text{Power Meter reading}$$

Readings are in dBm, error is in dB.

9. Record the Absolute Amplitude Error in the test record. (Limits are shown in the test record.)

**Absolute Accuracy at Calibration Point, RF Path, Preamp ON**

1. Connect the RF generator, power splitter, power meter, and spectrum analyzer. (See Figure 11 on page 89.)
2. Reset the spectrum analyzer to factory defaults: select **Setup > Preset (Main)**.
3. Select **Tools > Alignments** and select **Align Now**.
4. Set the SPECMONB:
  - Reference Level - 30 dBm  
Setup > Amplitude > Internal Settings > Ref Level
  - Center Frequency 100 MHz  
Setup > Settings > Center
  - Internal Attenuator 10 dB (Auto unchecked)  
Setup > Amplitude > Internal Attenuator
  - Internal Preamp Internal Preamp box checked  
Setup > Amplitude > Internal Attenuator
5. Set the RF Generator:
  - Output Frequency 100 MHz
  - Output Level -24 dBm
  - RF On
6. Set the frequency span (Span key) to 300 kHz.
7. Press the **Markers > Peak** key to set the Reference Marker (MR) to the carrier peak.
8. Record the reading on the Power Meter and on the SPECMONB marker amplitude.
9. Calculate the Absolute Amplitude Accuracy:
  - $\Delta = \text{SPECMONB reading} - \text{Power Meter reading}$
  - Readings are in dBm, error is in dB.
10. Record the Absolute Amplitude Error in the test record. (Limits are shown in the test record.)
11. Repeat steps 6 through 10 for frequency spans of 1 MHz and 41 MHz (Option B85 and B16x).

**Absolute Accuracy at Calibration Point, LF path, Preamp ON (only for SPECMON3B and SPECMON6B)**

1. Connect the RF generator, power splitter, power meter, and SPECMONB. (See Figure 11 on page 89.)
2. Reset the spectrum analyzer to factory defaults: select **Setup > Preset (Main)**.
3. Select **Tools > Alignments** and select **Align Now**.
4. Set the SPECMONB:
  - Reference Level - 10 dBm  
Setup > Amplitude > Internal Settings > Ref Level
  - Center Frequency 100 MHz  
Setup > Settings > Center
  - Internal Attenuator 10 dB (Auto unchecked)  
Setup > Amplitude > Internal Attenuator
  - Internal Preamp Internal Preamp box checked  
Setup > Amplitude > Internal Attenuator
  - LF Path  
Setup > Acquire > Input Params  
*Use Low Freq signal path* checked.
5. Set the RF Generator:
  - Output Frequency 10 MHz
  - Output Level -4 dBm
  - RF On
6. Set the frequency span (Span key) to 300 kHz.
7. Press the **Markers Peak** key to set the Reference Marker (MR) to the carrier peak.
8. Record the reading on the Power Meter and on the SPECMONB marker amplitude.
9. Calculate the Absolute Amplitude Accuracy:
  - $\Delta = \text{SPECMONB reading} - \text{Power Meter reading}$
  - Readings are in dBm, error is in dB.
10. Record the Absolute Amplitude Error in the test record. (Limits are shown in

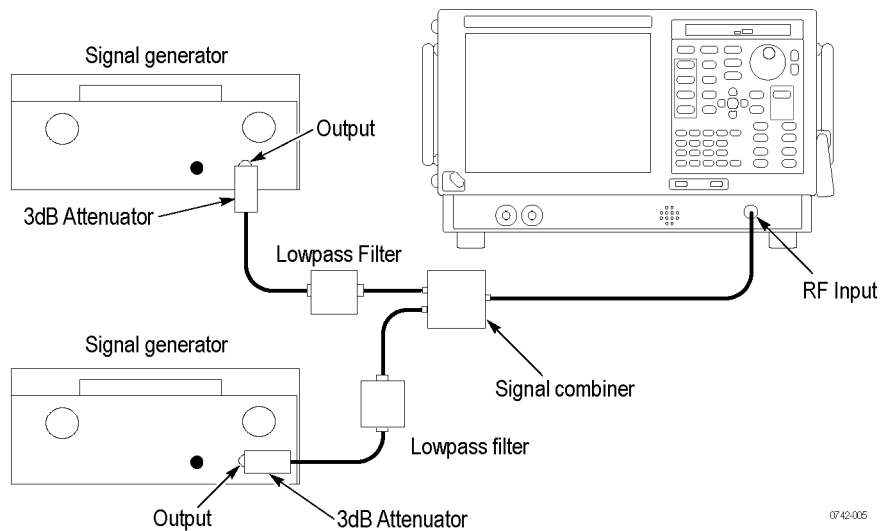
the test record.)

- Repeat steps 6 through 10 for frequency span of 1 MHz and 41 MHz (Option B40, B85, and B16x)..

## Noise and Distortion

### Third Order Intermodulation Distortion

- Set up the RF CW generators, Lowpass filters, Signal Combiner, and spectrum analyzer as shown in the following figure.



**Figure 13: Equipment connections for Third Order Intermodulation Distortion check**

- Reset the SPECMONB to factory defaults: select **Setup > Preset (Main)**.
- Select **Tools > Alignments** and select **Align Now**.
- Set the SPECMONB:

Ref Level	-20 dBm
Setup > Amplitude > Internal Settings > Ref Level	
Internal Attenuator	0 dB (Auto unchecked)
Setup > Amplitude > Internal Settings > Internal Attenuator	
RF & IF Optimization	Maximize Dynamic Range
Setup > Amplitude > Internal Settings > RF & IF Optimization	
Span	10 kHz
Setup > Settings > Freq & Span > Span	
RBW	Auto checked
Setup > Settings > BW > RBW	



Function	Avg (VRMS)
Setup > Settings > Traces > Function	
Averaging	25 (Count checked)
(Settings > Traces > Avg (VRMS))	

5. Set each of the rf signal generators to provide a power level of  $-22$  dBm and turn RF On.
  - a. Set the first generator output frequency to 2.1295 GHz, and the second generator output frequency to 2.1305 GHz.
  - b. Set the SPECMONB Function to Normal (Setup > Settings > Traces > Function > Normal).
  - c. Set the SPECMONB Center frequency to 2.1295 GHz. Press the **Markers Peak** key. Adjust the first generator output level for a marker reading of  $-25.0$  dBm. Record this as carrier #1.
  - d. Set the SPECMONB Center frequency to 2.1305 GHz. Press the **Markers Peak** key. Adjust the second generator output level for a marker reading of  $-25.0$ . This is carrier amplitude #2.
6. Set the SPECMONB Function to Averaging (Setup > Settings > Traces > Function > Avg (VRMS)).
7. Set the RTSA center frequency to 2.1285 GHz. After averaging has completed, press the **Markers Peak** key and read the amplitude level of the signal displayed at the center of the screen. Record this as TOI #1.
8. Set the RTSA center frequency to 2.1315 GHz. After averaging has completed, press the **Markers > Peak** key and read the amplitude level of the signal displayed at the center of the screen. Record this as TOI #2.
9. Calculate the Third Order Intermodulation Distortion (TOI) using the following procedure. Record the results in the test record.
  - a. Record the maximum reading from step 7 or step 8.
  - b. Record the minimum reading from step 5 c or step 5 d.
  - c. Calculate the TOI using this equation:
 
$$\text{TOI} = \text{step a} - \text{step b}$$

#### DANL - Preamp OFF, LF Path

1. Terminate the SPECMONB RF Input with a  $50 \Omega$  terminator.
2. Reset the SPECMONB to factory defaults: select **Setup > Preset (Main)**.
3. Select **Tools > Alignments** and select **Align Now**.
4. Set the SPECMONB:

Reference Level	-50 dBm
Setup > Amplitude > Ref Level	
Internal Attenuator	0 dB (Auto unchecked)
Setup > Amplitude > Internal Attenuator	
RF & IF Optimization	Minimize Noise
Setup > Amplitude > RF & IF Optimization	
Center Frequency	9 kHz
Setup > Settings > Freq & Span > Center	
Span	1 kHz
Setup > Settings > Freq & span > Span	
RBW	Auto (box checked)
Setup > Settings > BW > RBW	
Detection	Avg (of logs)
Setup > Settings > Traces > Detection	
Function	Avg (of logs)
Setup > Settings > Traces > Function	
Count	100 (Count box checked)
Setup > Settings > Traces > Function	
LF Path	Use Low Freq... box checked
Setup > Acquire > Input Params	

5. Set the markers for Noise Mode operation:

- a. Select **Markers > Define Markers**.
- b. Select the **Add** soft key to add the Reference marker (MR).
- c. Select **Add** again to add the M1 marker.
- d. Select **Absolute** from the **Readouts** drop-down list.
- e. Select **Setup > Settings**, click the **Prefs** tab, and then select the **Marker Noise Mode** checkbox so it is checked.

6. Set the SPECMONB to each of the Center Frequencies listed in the following table by pressing the Freq key and entering the value listed. After averaging is

completed, press the **Markers > Peak**. As noted below, if the peak is on a spur, not the noise floor, place the marker on the highest point of the noise floor.

---

**NOTE.** *The intent of the DANL test is to measure the average internal noise level of the instrument. The DANL specification does not cover residual spurs. If the specific measurement frequency results in measuring a residual spur that is visible above the noise level, the DANL specification applies not to the spur but to the noise level on either side of the spur. Please refer to the Spurious Response specifications. (See Table 15 on page 23.) Also, refer to the Spurious Response section of this procedure to determine whether or not a residual spur is within the specification. (See page 118, Spurious Response.)*

---

**Table 65: Frequencies of interest for DANL (LF path)**

Center frequency	Marker noise level	Frequency range
4.1 kHz		4 kHz -10 kHz
9.9 kHz		
10.1 kHz		10 kHz - 32 MHz
31 MHz		

### DANL – Preamp OFF, RF Path

1. Reset the SPECMONB to factory defaults: select **Setup > Preset (Main)**.
2. Select **Tools > Alignments** and select **Align Now**.
3. Set the SPECMONB:

Reference Level	-50 dBm
Setup > Amplitude > Internal Settings > Ref Level	
Internal Attenuator	0 dB (Auto unchecked)
Setup > Amplitude > Internal Settings > Internal Attenuator	
RF & IF Optimization	Minimize Noise
Setup > Amplitude > RF & IF Optimization	
Center Frequency	10 MHz
Setup > Settings > Freq & Span > Center	
Span	100 kHz
Setup > Settings > Freq & Span > span	
RBW	Auto (box checked)
Setup > Settings > BW > RBW	
Detection	Avg (of logs)
Setup > Settings > Traces > Detection	
Function	Avg (of logs)
Setup > Settings > Traces > Function	

Count 1000 (Count box checked)  
 Setup > Settings > Traces > Function  
 LF Path *Use Low Freq Signal path box*  
 Setup > Acquire > Input Params unchecked

4. Set the markers for Noise Mode operation:
  - a. Select **Markers > Define Markers**.
  - b. Select the **Add** soft key to add the Reference marker (MR).
  - c. Select **Add** again to add the M1 marker.
  - d. Select **Absolute** from the **Readouts** drop-down list.
  - e. Select **Setup > Settings**, click the **Prefs** tab, and then select the **Marker Noise Mode** checkbox so it is checked.
5. Set the SPECMONB to each of the Center Frequencies listed in the following table by pressing the **Freq** key and entering the value listed. After averaging is completed, press the **Markers > Peak** key, for each Center Frequency setting. As noted below, if the peak is on a spur, not the noise floor, place the marker on the highest point of the noise floor.

**Table 66: Frequencies of interest for DANL (RF path)**

Center frequency	Marker noise level	Frequency range
1.1 MHz		1 MHz - 10 MHz (All models)
9.9 MHz		
10 MHz		10 MHz - 2.0 GHz (All models)
1.99 GHz		
2.01 GHz		2.0 GHz - 3.0 GHz (All models)
2.99 GHz		
3.01 GHz		3.0 GHz - 4.0 GHz (SPECMON6B/26B)
3.99 GHz		
4.01 GHz		4 GHz - 6.2 GHz (SPECMON6B/26B)
6.2 GHz		
6.2 GHz		6.2 GHz -15 GHz (SPECMON26B)
15 GHz		
15 GHz		15 GHz -26.5 GHz (SPECMON26B)
26.5 GHz		

6. Enter the highest noise level for each of the frequency ranges shown into the test record. (Limits are shown in the test record.)

## DANL - Preamp ON, LF Path (Option 50/51 Only)

1. Reset the SPECMONB to factory defaults: select **Setup > Preset (Main)**.
2. Select **Tools > Alignments** and select **Align Now**.
3. Set the SPECMONB:

Reference Level	-50 dBm
Setup > Amplitude > Internal Settings > Ref Level	
Internal Attenuator	0 dB (Auto unchecked)
Setup > Amplitude > Internal Settings > Internal Attenuator	
RF & IF Optimization	Minimize Noise
Setup > Amplitude > RF & IF Optimization	
Internal Preamp	ON (Internal Preamp box checked)
Setup > Amplitude > Internal Settings > Internal Preamp	
Center Frequency	1.1 MHz
Setup > Settings > Freq & Span > Center	
Span	100 kHz
Setup > Settings > Freq & Span > span	
RBW	Auto (box checked)
Setup > Settings > BW > RBW	
Detection	Avg (of logs)
Setup > Settings > Traces > Detection	
Function	Avg (of logs)
Setup > Settings > Traces > Function	
Count	100 (Count box checked)
Setup > Settings > Traces > Function	
LF Path	Use Low Freq... (box checked)
Setup > Acquire > Input Params	

4. Set the markers for Noise Mode operation:
  - a. Select **Markers > Define Markers**.
  - b. Select the **Add** button to add the Reference marker (MR).
  - c. Select **Add** again to add the M1 marker.
  - d. Select **Absolute** from the **Readouts** drop-down list.
  - e. Select **Setup > Settings** and select the **Prefs** tab. Select the **Marker Noise Mode** checkbox so it is checked.
5. Set the SPECMONB to each of the Center Frequencies listed in the following table by pressing the Freq key and entering the value listed. After averaging is completed, press the Markers > Peak key. As noted below, if the peak is

on a spur, not the noise floor, place the marker on the highest point of the noise floor.

---

**NOTE.** *The intent of the DANL test is to measure the average internal noise level of the instrument. The DANL specification does not cover residual spurs. If the specific measurement frequency results in measuring a residual spur that is visible above the noise level, the DANL specification applies not to the spur but to the noise level on either side of the spur. Please refer to the Spurious Response specifications. (See Table 15 on page 23.) Also, refer to the Spurious Response section of this procedure to determine whether or not a residual spur is within the specification. (See page 118, Spurious Response.)*

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**Table 67: Frequencies of interest for DANL LF path check (Option 50/51)**

Center frequency	Marker Noise level	Frequency range
1.1 MHz		1 MHz - 32 MHz
31.9 MHz		

**DANL – Preamp ON, RF Path (Option 50/51 Only)**

1. Reset the SPECMONB to factory defaults: select **Setup > Preset (Main)**.
2. Select **Tools > Alignments** and select **Align Now**.
3. Set the SPECMONB:

Reference Level	-50 dBm
Setup > Amplitude > Internal Settings > Ref Level	
Internal Attenuator	0 dB (Auto unchecked)
Setup > Amplitude > Internal Settings > Internal Attenuator	
RF & IF Optimization	Minimize Noise
Setup > Amplitude > RF & IF Optimization	
Internal Preamp	ON (Internal Preamp box checked)
Setup > Amplitude > Internal Settings > Internal Preamp	
Center Frequency	1.1 MHz
Setup > Settings > Freq & Span > Center	
Span	100 kHz
Setup > Settings > Freq & Span > span	
RBW	Auto (box checked)
Setup > Settings > BW > RBW	
Detection	Avg (of logs)
Setup > Settings > Traces > Detection	

Function	Avg (of logs)
Setup > Settings > Traces > Function	
Count	100 (Count box checked)
Setup > Settings > Traces > Function	
LF Path	Use Low Freq Signal path box
Setup > Acquire > Input Params	unchecked

4. Set the markers for Noise Mode operation:
  - a. Select **Markers > Define Markers**.
  - b. Select the **Add** button to add the Reference marker (MR).
  - c. Select **Add** again to add the M1 marker.
  - d. Select **Absolute** from the **Readouts** drop-down list.
  - e. Select **Setup > Settings** and select the **Prefs** tab. Select the **Marker Noise Mode** checkbox so it is checked.
5. Set the SPECMONB to each of the Center Frequencies listed in the following table by pressing the Freq key and entering the value listed. After averaging is completed, press the Markers > Peak key. As noted below, if the peak is on a spur, not the noise floor, place the marker on the highest point of the noise floor.

---

**NOTE.** *The intent of the DANL test is to measure the average internal noise level of the instrument. The DANL specification does not cover residual spurs. If the specific measurement frequency results in measuring a residual spur that is visible above the noise level, the DANL specification applies not to the spur but to the noise level on either side of the spur. Please refer to the Spurious Response specifications. (See Table 1-18.) Also, refer to the Spurious Response section of this procedure to determine whether or not a residual spur is within the specification. (See page 118, Spurious Response.)*

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**Table 68: Frequencies of interest for DANL check (Option 50)**

Center frequency	Marker Noise level	Frequency range
1.1 MHz		1 MHz - 10 MHz (All models)
9.9 MHz		
10.1 MHz		10 MHz - 2 GHz (All models)
1.99 GHz		
2.01 GHz		2 GHz - 3 GHz (All models)
2.99 GHz		
3.01 GHz		3 GHz - 6.2 GHz
6.2 GHz		(SPECMON6B/26B)

**Table 68: Frequencies of interest for DANL check (Option 50) (cont.)**

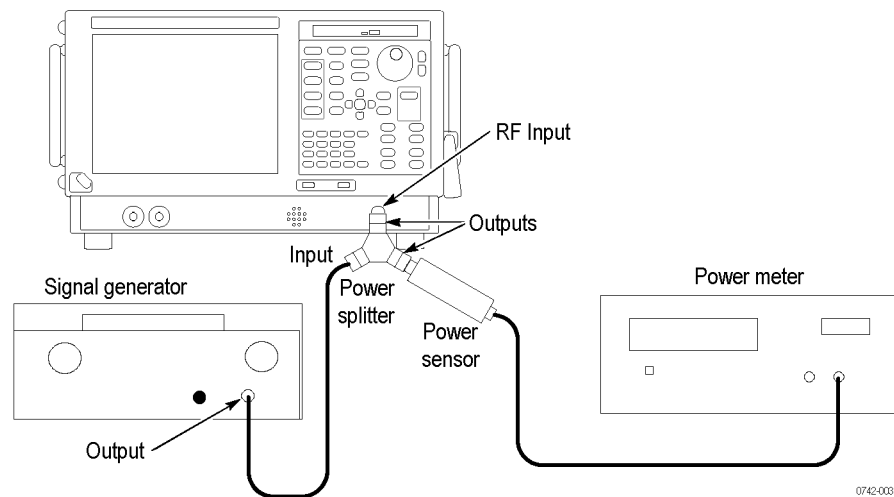
Center frequency	Marker Noise level	Frequency range
6.2 GHz		6.2 GHz - 15 GHz (SPECMON26B)
15 GHz		15 GHz - 26.5 GHz (SPECMON26B)

7. Enter the highest noise level for each of the frequency ranges shown into the test record. (Limits are shown in the test record.)

## IF Flatness (Channel Response)

1. Connect the RF generator, power splitter, power meter, and spectrum analyzer as shown in the following figure.

The power splitter outputs should connect directly to the SPECMONB RF Input and to the Power Sensor.



**Figure 14: Equipment connections for IF flatness check**

2. Reset the SPECMONB to factory defaults: select **Setup > Preset (Main)**.
3. Select **Tools > Alignments** and select **Align Now**.
4. Set the SPECMONB:

Center	200 MHz
Setup > Settings > Freq & Span > Span	
Span	300 kHz
Setup > Settings > Freq & Span > Span	



5. Set the RF generator output frequency to 200 MHz. This is the reference frequency.
6. Select the **Markers > Peak** key to set the Reference marker to the carrier peak.
7. Adjust the signal generator output level to  $-4$  dBm and turn RF On.
8. Record the Power Meter reading and the spectrum analyzer marker reading in the IF Flatness table. (See Table 69.)
9. Set the RF generator output frequency to the next frequency in the IF Flatness table that follows.
10. Leave the spectrum analyzer center frequency at 200 MHz and press the **Markers Peak** key.
11. Record the Power Meter reading and the spectrum analyzer marker reading in the IF Flatness table.
12. Calculate the  $\Delta$  Power Meter number: subtract the Power Meter reading at 200 MHz from the Power Meter reading at this frequency.
13. Calculate the  $\Delta$  RTSA number: subtract the SPECMONB marker reading at 200 MHz from the SPECMONB marker reading at this frequency.
14. Calculate the IF Flatness Error using the formula:  

$$RF \text{ Flatness Error} = \Delta \text{ RTSA at this freq} - \Delta \text{ Power Meter at this freq}$$
Readings are in dBm, error is in dB.
15. Repeat parts 9 through 14 for each of the remaining generator frequencies shown in the Span = 300 kHz portion of the following table.
16. Record the highest Calculated IF Flatness Error for the Span setting into the test record. (Limits are shown in the test record.)
17. Repeat steps 4 through 16 for Span settings of 20 MHz and 25 MHz, using the appropriate span segment of the following table.
18. (Option B85/B16x only.) Repeat steps 4 through 16 for an 85 or 160 MHz Span setting.

Table 69: IF flatness

Generator Frequency	RTSA reading	$\Delta$ RTSA reading (vs. 200 MHz)	Power meter reading	$\Delta$ power meter reading (vs. 200 MHz)	Calculated IF Flatness Error
<b>Span = 300 kHz</b>					
200 MHz		0		0	0
199.85 MHz					
199.88 MHz					
199.91 MHz					

**Table 69: IF flatness (cont.)**

Generator Frequency	RTSA reading	$\Delta$ RTSA reading (vs. 200 MHz)	Power meter reading	$\Delta$ power meter reading (vs. 200 MHz)	Calculated IF Flatness Error
<b>Span = 300 kHz</b>					
199.94 MHz					
199.97 MHz					
200.03 MHz					
200.06 MHz					
200.09 MHz					
200.12 MHz					
200.15 MHz					
<b>Span = 20 MHz</b>					
200 MHz		0		0	0
190 MHz					
192 MHz					
194 MHz					
196 MHz					
198 MHz					
202 MHz					
204 MHz					
206 MHz					
208 MHz					
210 MHz					
<b>Span = 25 MHz</b>					
200 MHz					
187.5 MHz		0		0	0
190 MHz					
192.5 MHz					
195 MHz					
197.5 MHz					
202.5 MHz					
205 MHz					
207.5 MHz					
210 MHz					
212.5 MHz					
<b>Span = 85 MHz (Option B85 only)</b>					
200 MHz		0		0	0
157.5 MHz					

**Table 69: IF flatness (cont.)**

**Span = 85 MHz (Option B85 only)**

166 MHz
174.5 MHz
183 MHz
191.5 MHz
208.5 MHz
217 MHz
225.5 MHz
234 MHz
242.5 MHz

**160 MHz (Option B16x only)**

200 MHz
120 MHz
130 MHz
140 MHz
150 MHz
160 MHz
170 MHz
180 MHz
190 MHz
210 MHz
220 MHz
230 MHz
240 MHz
250 MHz
260 MHz
270 MHz
280 MHz

## Spurious Response

### Residual Response

1. Terminate the SPECMONB RF Input.
2. Reset the SPECMONB to factory defaults: select **Setup > Preset (Main)**.
3. Select **Tools > Alignments** and select **Align Now**.
4. Set the SPECMONB:

Ref Level	-40 dBm
Setup > Amplitude > Internal Attenuator	0 dB (Auto unchecked)
Setup > amplitude > Internal Settings > Internal Attenuator	
Setup > Amplitude > RF & IF Optimization > Maximum Dynamic Range	
RBW	1 kHz
Setup > Settings > BW > RBW	
Function	Avg (VRMS)
Setup > Settings > Traces > Function	
Count	10 (Count checked)
Setup > Settings > Traces > Function > Avg (of logs)	

5. Set the Frequency (Freq key) to each center frequency in the Residual Response Center Frequencies table. Set the span for each center frequency as shown in the table. (See Table 70.) Wait for the averaging to complete, then press the **Markers > Peak** key and record the marker amplitude in the table.
6. Enter the highest of these signal levels into the test record.

**Table 70: Residual response center frequencies**

Center frequency	Span	Range	Marker amplitude
<b>All models</b>			
600 MHz	800 MHz	200 MHz to 1 GHz	
1.5 GHz	1 GHz	1 GHz to 2 GHz	
2.5 GHz	1 GHz	2 GHz to 3 GHz	
<b>SPECMON6B/26B only</b>			
3.5 GHz	1 GHz	3 GHz to 4 GHz	
4.5 GHz	1 GHz	4 GHz to 5 GHz	
5.6 GHz	1.2 GHz	5 GHz to 6.2 GHz	
<b>SPECMON26B only</b>			
6.6 GHz	800 MHz	6.2 GHz to 7 GHz	

Table 70: Residual response center frequencies (cont.)

Center frequency	Span	Range	Marker amplitude
7.5 GHz	1 GHz	7 GHz to 8 GHz	
8.5 GHz	1 GHz	8 GHz to 9 GHz	
9.5 GHz	1 GHz	9 GHz to 10 GHz	
10.5 GHz	1 GHz	10 GHz to 11 GHz	
11.5 GHz	1 GHz	11 GHz to 12 GHz	
12.5 GHz	1 GHz	12 GHz to 13 GHz	
13.5 GHz	1 GHz	13 GHz to 14 GHz	
14.5 GHz	1 GHz	14 GHz to 15 GHz	
15.5 GHz	1 GHz	15 GHz to 16 GHz	
16.5 GHz	1 GHz	16 GHz to 17 GHz	
17.5 GHz	1 GHz	17 GHz to 18 GHz	
18.5 GHz	1 GHz	18 GHz to 19 GHz	
19.5 GHz	1 GHz	19 GHz to 20 GHz	
20.5 GHz	1 GHz	20 GHz to 21 GHz	
21.5 GHz	1 GHz	21 GHz to 22 GHz	
22.5 GHz	1 GHz	22 GHz to 23 GHz	
23.5 GHz	1 GHz	23 GHz to 24 GHz	
24.5 GHz	1 GHz	24 GHz to 25 GHz	
25.75 GHz	1.5 GHz	25 GHz to 26.5 GHz	

### Image Suppression

1. Connect the RF generator capable of at least 26.5 GHz to the SPECMONB RF Input, as shown in the following figure.

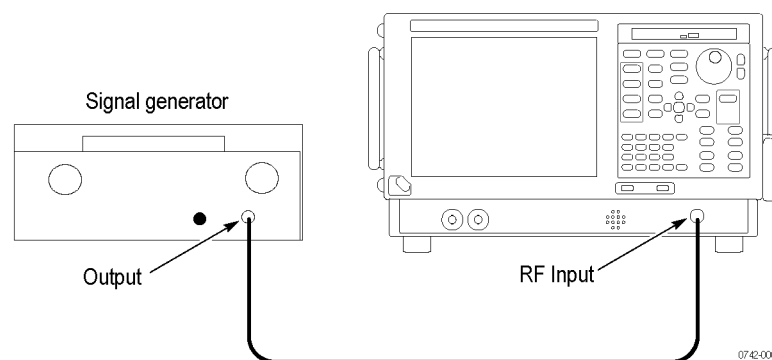


Figure 15: Equipment connections for Image Suppression check

2. Reset the SPECMONB to factory defaults: select **Setup > Preset (Main)**.
3. Select **Tools > Alignments** and select **Align Now**.

4. Set the SPECMONB:

Ref Level	-30 dBm
Setup > Amplitude > Internal Settings > Ref Level	
Internal Attenuator	10 dB (Auto unchecked)
Setup > Amplitude > Internal Settings > Internal Attenuator	
Span	10 kHz
Setup > Settings > Freq & Span > Span	
RBW	10 Hz (Auto unchecked)
Setup > Settings > BW > RBW	
Function	Avg (VRMS)
Setup > Settings > Traces > Function	
Averages	10 (Count checked)
Setup > Settings > Traces > Function	

5. Set the RF generator: Output Level to -30 dBm at the end of the cable and turn RF On. Verify the output level with the power meter, if necessary.
6. For each row of the table below (as appropriate to your instrument model):
- Set the SPECMONB to the Center Frequency shown in the first column.
  - Set the RF signal generator frequency to that shown in the first column.
  - Set **Function** to **Normal** (Setup > Settings > Traces > Function > Normal).
  - Press the **Markers > Peak** key.
  - Adjust the RF signal generator amplitude to produce a signal level within 1 dB of the Reference Level. Record this value as the carrier level.
  - Set the RF generator output frequency to the Image Frequency shown in the second column.
  - Set **Function** to **Avg(VRMS)** (Setup>Settings>Traces>Function).
  - After the averaging has completed, press the **Markers > Peak** key to move the MR marker to the peak signal value.
  - Read the marker amplitude, in dBm, at the upper-left on the screen. Subtract the carrier level (step e) from the signal image amplitude (step h), to convert it to dBc.
  - Enter this value in the test record.
7. Repeat steps 4 through 6 for each frequency in the following table.

Table 71: Image suppression settings

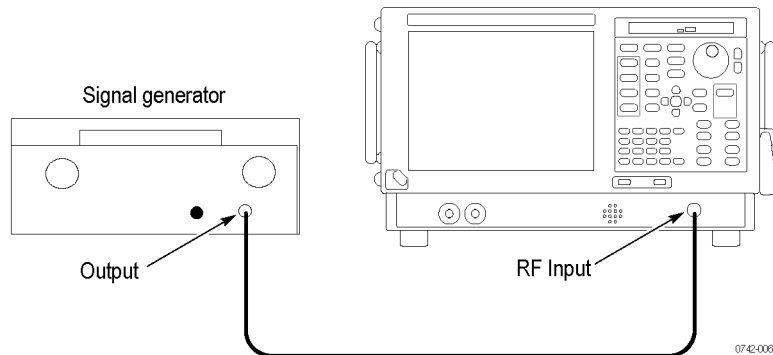
SPECMONB Center Frequency	RF Generator Output Frequency (Image)
<b>All Models</b>	
29 MHz (LF Path)	229 MHz
2.0 GHz	16.03 GHz
3.0 GHz	17.03 GHz
<b>SPECMON6B/26B only</b>	
5.95 GHz	19.98 GHz
<b>SPECMON26B only</b>	
7 GHz	16.68 GHz
10 GHz	17.52 GHz
14.5 GHz	9.5 GHz
18 GHz	23.6 GHz
20 GHz	27.36 GHz
23 GHz	18.6 GHz
25 GHz	16.6 GHz

**NOTE.** The intent of the image spurious test is to measure spurious responses caused by the injection of an external signal that would induce an image product on the display. These images can be the same frequencies as residual spurs. In case of question, slightly change the frequency of the input signal to induce a corresponding change in the displayed frequency of the image spur. Change the input frequency in steps that allow the product to stay within the on-screen frequency span. If the on-screen spur does not move in response to the input signal change, it is not an image and is not covered in the image spurious specification. Some care must be taken in noting the frequency change. The images specified in the specification are 1:1 images and they will move -1:1 with changes in input signal frequency. Never discount the possibility that a spur in question could be coming from the test signal generator. Such spurious responses can also move with changes in signal generator frequency. In case of question, validate the performance of the generator with a different Signal Analyzer and/or filter the signal from the test generator to remove unwanted products.

If the spur seen on screen is a residual, it will still be present with the input to the signal analyzer terminated in 50 ohms. Residual spurs are subject to separate specification limits.

## Spurious Response with Signal

1. Connect the RF generator to the SPECMONB RF Input, as shown in the following figure.



**Figure 16: Equipment connections for Signal Spurious check**

2. Reset the SPECMONB to factory defaults: select **Setup > Preset (Main)**.
3. Select **Tools > Alignments** and select **Align Now**.
4. Set the SPECMONB:

Center Frequency	1 GHz
Setup > Settings > Freq & Span > Center	
Span	25 MHz
Setup > Settings > Freq & Span > Span	
RBW	1 kHz
Setup > Settings > BW > RBW	
Function	Avg (RMS)
Setup > Settings > Traces > Function	
Averages	25 (count box is checked)
Setup > Settings > Traces > Function	
Ref Level	-15 dBm
Setup > Amplitude > Ref Level	
Internal Attenuator	10 dB (Auto unchecked)
Setup > Amplitude > Internal Attenuator	

5. Set the RF generator:

Output Level	-15 dBm
Output Frequency	1 GHz
RF	On



6. Turn on the Marker Reference (MR) and Marker 1 (M1) and set them for Delta Operation.
  - Select **Markers > Define** markers.
  - Select the **Add** key to add the MR marker.
  - Select the **Add** key again to add the M1 marker.
  - Select **Delta** from the **Readouts** dropdown menu.
7. After averaging has completed, press the **Markers > Select** key and select the **MR** marker.
8. Press the **Markers Peak** key.
9. Press the **Markers Select** key and select the M1 marker.
10. Set the M1 marker frequency to -12.5 MHz (Option B85: -42.5 MHz, Option B16x: -55 MHz).
11. Rotate the control knob and verify that all marker amplitudes as shown by the Delta M1 marker readout are less than -73 dBc from -12.5 MHz (Option B85: -42.5 MHz, Option B16x: -55 MHz) to -400 kHz and 400 kHz to 12.5 MHz (Option B85: 42.5 MHz, Option B16x: 55 MHz).
12. (Option B85/B16x only) Set the SPECMONB Span (Setup > Settings > Freq & Span > Span) to 85 MHz or 160 MHz. Repeat steps 7 to 11.
13. Enter Pass or Fail into the test record.

### Spurious Response with Signal (Half-IF)

1. Connect the RF generator to the SPECMONB RF Input.

---

**NOTE.** Use a low-pass filter if the RF generator has a 2<sup>nd</sup> harmonic product greater than -70 dBc.

---

2. Reset the SPECMONB to factory defaults: select **Setup > Preset (Main)**.
3. Select **Tools > Alignments** and select **Align Now**.
4. Set the SPECMONB:

Internal Attenuator	10 dB (Auto unchecked)
Setup > Amplitude > Internal Settings > Ref Level	
Ref Level	-30 dBm
Setup > Amplitude > Internal Settings > Ref Level	
Span	10 kHz
Setup > Settings > Freq & Span > Span	

Function	Avg (VRMS)
Setup > Settings > Traces > Function	
Averages	100 (count checked)
Setup > Settings > Traces > Function	

5. Set the RF generator:

Output Level	-30 dBm (at the end of the cable/filter)
RF	On

6. Measure the Half IF signal level as follows:

- a. Set the RF signal generator to the frequency in the *Center Frequencies for Half-IF* table. (See Table 72.)
- b. Set the SPECMONB Center Frequency to the frequency in the *Center Frequencies for Half-IF* table. (See Table 72.)
- c. Set **Function** to **Normal** (Setup > Settings > Traces > Function > Normal).
- d. Press the **Markers > Peak** key
- e. Adjust the RF signal generator amplitude to produce a signal level within 1 dB of the Reference Level. Record this value as the carrier level.
- f. Set the RF signal generator frequency to the frequencies in the table *Center frequencies and signal generator frequencies for Half-IF*. (See Table 72.)
- g. Set **Function** to **Avg (VRMS)** (Setup > Settings > Traces > Function > Avg (VRMS)).
- h. After the averaging has completed, press the **Markers > Peak** key to move the MR marker to the peak signal value.
- i. Read the marker amplitude (in dBm) at the upper-left on the display. Subtract the carrier level (step e) from the spurious signal amplitude (step h) to convert it to dBc.
- j. Enter this value in the test record.

7. Repeat step for each entry in the table.

**Table 72: Center frequencies and signal generator frequencies for Half-IF**

Center Frequency, MHz	Source Freq, MHz	Freq Span, Hz	Ref Level, dBm	Attenuator, dB	Res BW, Hz
1000	3532.75	10000	-30.00	10.00	100.00
2000	3532.75	10000	-30.00	10.00	100.00
3000	3532.75	10000	-30.00	10.00	100.00
4000	3532.75	10000	-30.00	10.00	100.00

**Table 72: Center frequencies and signal generator frequencies for Half-IF (cont.)**

Center Frequency, MHz	Source Freq, MHz	Freq Span, Hz	Ref Level, dBm	Attenuator, dB	Res BW, Hz
5000	3532.75	10000	-30.00	10.00	100.00
6000	3532.75	10000	-30.00	10.00	100.00
7000	2420	10000	-30.00	10.00	100.00
8000	2000	10000	-30.00	10.00	100.00
10000	1880	10000	-30.00	10.00	100.00
12000	880	10000	-30.00	10.00	100.00
12800	880	10000	-30.00	10.00	100.00
14000	1080	10000	-30.00	10.00	100.00
14500	1330	10000	-30.00	10.00	100.00
17000	2060	10000	-30.00	10.00	100.00
20000	1840	10000	-30.00	10.00	100.00
23000	1100	10000	-30.00	10.00	100.00
25000	2100	10000	-30.00	10.00	100.00

**Table 73: Center frequencies and signal generator frequencies for IF feed-through**

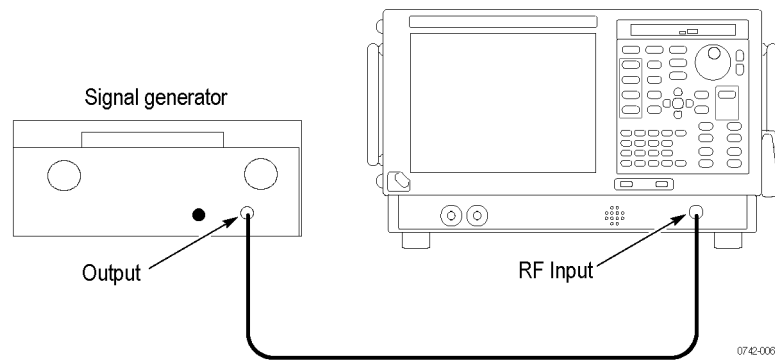
SPECMON26B CF, MHz	Source CF, MHz	SPECMON26B CF, MHz	Source CF, MHz
6550	4490	15250	5550
7707.5	4292.5	15840	4960
8275	3725	17950	2850
8057.5	3782.5	16650	4470
8640	2400	19290	4390
9140	2700	20450	2910
9320	1720	20425	3255
9830	3930	20685	2675
10235	3685	21410	2270
10575	2961	22080	1152
11620	2140	23180	2380
12800	1760	24300	3180
13700	1860	25150	4350
7200	4640	15640	5480
6550	4490	15250	5550

**Table 73: Center frequencies and signal generator frequencies for IF feed-through (cont.)**

SPECMON26B CF, MHz	Source CF, MHz	SPECMON26B CF, MHz	Source CF, MHz
14550	2550	26000	4880
14950	3110	26300	5500

**Option 66 Zero-Span Output (functionality check only)**

1. Connect the RF generator output to the SPECMONB RF Input as shown.



**Figure 17: Equipment connections for Zero-Span Output check**

2. Connect a DMM to the output BNC connector on the back panel labeled **Zero Span Out**.
3. Set the DMM to read DC volts.
4. Set the SPECMONB:

Preset	
Tools > Alignments	Select "Align Now"
	Wait for alignment to complete
Center Frequency	1 GHz
Setup > Settings > Freq & Span > Center	
Ref Level	0 dBm
Setup > Amplitude > Ref Level	
Setup > Configure In/Out	
Zero-Span tab	Zero Span Out: "On"
	RBW: "Auto"
	Output Filter: "Auto"
	Full Scale Voltage: "Auto"

5. Set the RF generator:

Output Level	0 dBm
Output Frequency	1 GHz
Mode	CW

6. Measure the output voltage on the DMM and confirm the voltage reading is 1.0 V,  $\pm 0.25$  V.

## Test Record

Print out the following test record pages and use them to record the performance test results for your signal analyzer.

### SPECMONB Series Test Record

Model:

Serial Number:

Certificate Number:

Calibration Date:

Technician:

Frequency Accuracy	Low limit	Test Result	High limit
Reference output frequency accuracy	9,999,996 Hz		10,000,004 Hz
Reference output power level	0 dBm		
External reference input level	Fail		Pass

Phase Noise (with Option 11)	Test Result	High limit
Offset		
CF + 1 kHz		-103 dBc/Hz
CF + 10 kHz		-109 dBc/Hz
CF + 100 kHz		-112 dBc/Hz
CF + 1 MHz		-130 dBc/Hz
CF + 6 MHz		-137 dBc/Hz
CF + 10 MHz		-137 dBc/Hz

Phase Noise (without Option 11)	Cursor	Carrier power	Phase noise <sup>1</sup>	High limit
Offset				
CF + 1 kHz				-103 dBc/Hz
CF + 10 kHz				-109 dBc/Hz
CF + 100 kHz				-112 dBc/Hz
CF + 1 MHz				-130 dBc/Hz
CF + 6 MHz				-137 dBc/Hz
CF + 10 MHz				-137 dBc/Hz

<sup>1</sup> Phase noise = -(cursor measurement – carrier power)

<b>RF Input Flatness</b>	<b>Low limit</b>	<b>Test Result</b>	<b>High limit</b>
Attenuator = 10 dB			
10 MHz - 3 GHz (Preamp OFF)	-0.35 dB		+0.35 dB
10 MHz - 3 GHz (Preamp ON, SPECMON3B/6B)	-0.5 dB		+0.5 dB
3 GHz - 6.2 GHz (Preamp OFF, SPECMON6B/26B)	-0.5 dB		+0.5 dB
3 GHz - 6.2 GHz (Preamp ON, SPECMON6B/26B)	-0.7 dB		+0.7 dB
6.2 GHz - 15 GHz (Preamp OFF, SPECMON26B)	-1.0 dB		+1.0 dB
6.2 GHz - 15 GHz (Preamp ON, SPECMON26B only)	-1.0 dB		+1.0 dB
15 GHz - 26.5 GHz (Preamp OFF, SPECMON26B only)	-1.2 dB		+1.2 dB
15 GHz - 26.5 GHz (Preamp ON, SPECMON26B only)	-1.2 dB		+1.2 dB

<b>LF Input Path Flatness</b>	<b>Low limit</b>	<b>Test Result</b>	<b>High limit</b>
Attenuator = 10 dB			
10 MHz - 32 MHz, (Preamp OFF)	-0.2 dB		+0.2 dB
10 MHz - 32 MHz, (Preamp ON)	-0.5 dB		+0.5 dB

<b>Absolute accuracy at calibration point</b>	<b>Low limit</b>	<b>Test Result</b>	<b>High limit</b>
Absolute amplitude SP 300 kHz, RF Path	-0.31 dB		+0.31 dB
Absolute amplitude SP 1 MHz, RF Path	-0.31 dB		+0.31 dB
Absolute amplitude SP 25.1 MHz, RF Path	-0.31 dB		+0.31 dB
Absolute amplitude SP 1 MHz, LF Path	-0.31 dB		+0.31 dB

<b>Absolute accuracy at calibration point, Preamp ON</b>	<b>Low limit</b>	<b>Test Result</b>	<b>High limit</b>
Absolute amplitude SP 300 kHz, RF Path	-0.5 dB		+0.5 dB
Absolute amplitude SP 1 MHz, RF Path	-0.5 dB		+0.5 dB
Absolute amplitude SP 41 MHz, RF Path	-0.5 dB		+0.5 dB

**Absolute accuracy at calibration point, Preamp ON**

	Low limit	Test Result	High limit
Absolute amplitude SP 300 kHz, LF Path	-0.5 dB		+0.5 dB
Absolute amplitude SP 1 MHz, LF Path	-0.5 dB		+0.5 dB

**Third Order Intermodulation Distortion**

	Test Result	High limit
2.130 GHz		-82 dBc

**Displayed Average Noise Level (DANL)**

	Test Result	High limit
Normalized to 1 Hz RBW, with log-average detector		
100 Hz – 2 kHz (LF Band)		-124 dBm/Hz
2 kHz – 10 kHz (LF Band)		-141 dBm/Hz
10 kHz – 32 MHz (LF Band)		-150 dBm/Hz
9 kHz – 1 MHz (SPECMON3B/6B)		-108 dBm/Hz
1 MHz – 10 MHz		-136 dBm/Hz
10 MHz – 2 GHz (SPECMON3B/6B)		-154 dBm/Hz
10 MHz – 2 GHz (SPECMON26B)		-152 dBm/Hz
2 GHz – 3 GHz		-152 dBm/Hz
3 GHz – 4 GHz (SPECMON6B/26B)		-151 dBm/Hz
4 GHz – 6.2 GHz (SPECMON6B/26B)		-149 dBm/Hz
6.2 GHz – 13 GHz (SPECMON26B)		-146 dBm/Hz
13 GHz – 23 GHz (SPECMON26B)		-144 dBm/Hz
23 GHz – 26.5 GHz (SPECMON26B)		-140 dBm/Hz



Displayed Average Noise Level (DANL)		Test Result	High limit
Preamp ON			
Normalized to 1 Hz RBW, with log-average detector	1 MHz - 32 MHz (LF Band, SPECMON3B/6B)		-158 dBm/Hz
	1 MHz - 10 MHz		-158 dBm/Hz
	10 MHz - 2 GHz		-164 dBm/Hz
	2 GHz - 3 GHz		-163 dBm/Hz
	3 GHz - 6.2 GHz (SPECMON6B)		-162 dBm/Hz
	3 GHz - 4 GHz (SPECMON26B)		-160 dBm/Hz
	4 GHz - 6.2 GHz (SPECMON26B)		-159 dBm/Hz
	6.2 GHz - 13 GHz (SPECMON26B)		-159 dBm/Hz
	13 GHz - 23 GHz (SPECMON26B)		-157 dBm/Hz
	23 GHz - 26.5 GHz (SPECMON26B)		-153 dBm/Hz

IF Flatness (Channel Response)	Low limit	Test Result	High limit
Span Setting			
300 kHz	-0.1 dB		+0.1 dB
20 MHz	-0.3 dB		+0.3 dB
25 MHz	-0.3 dB		+0.3 dB
85 MHz (Option B85 only)	-0.5 dB		+0.5 dB
160 MHz (Option B16x only)	-0.5 dB		+0.5 dB

Residual Response	Test Result	High limit
200 MHz - 3 GHz (SPECMON3B)		-95 dBm
200 MHz - 6.2 GHz (SPECMON6B)		-95 dBm
200 MHz - 15 GHz (SPECMON26B)		-95 dBm
200 MHz - 26.5 GHz (SPECMON26B)		-95 dBm

<b>Image Suppression</b>	<b>Test Result</b>	<b>High limit</b>
All Models		
10 kHz to <30 MHz (LF Path)		-75 dBc
30 MHz to 3 GHz		-75 dBc
SPECMON6B/26B		
3 GHz to 6.2 GHz		-70 dBc
6.2 GHz to 15 GHz (SPECMON26B)		-76 dBc
15 GHz to 26.5 GHz (SPECMON26B)		-72 dBc

<b>Spurious Response with Signal</b>	<b>Low limit</b>	<b>Test Result</b>	<b>High limit</b>
>400 kHz of Center Frequency	Fail		Pass
>400 kHz of Center Frequency (Option B85 only)	Fail		Pass
>400 kHz of Center Frequency (Option B16x only)	Fail		Pass

<b>Spurious Response with Signal (Half IF)</b>	<b>Test Result</b>	<b>High limit</b>
1 GHz		-78 dBc
2 GHz		-78 dBc
3 GHz		-78 dBc
4 GHz (SPECMON6B/26B)		-78 dBc
5 GHz (SPECMON6B/26B)		-78 dBc
6 GHz (SPECMON6B/26B)		-78 dBc
7 GHz (SPECMON26B)		-80 dBc
8 GHz (SPECMON26B)		-80 dBc
10 GHz (SPECMON26B)		-80 dBc
12 GHz (SPECMON26B)		-80 dBc
12.8 GHz (SPECMON26B)		-80 dBc
14 GHz (SPECMON26B)		-80 dBc
14.5 GHz (SPECMON26B)		-80 dBc
17 GHz (SPECMON26B)		-80 dBc
20 GHz (SPECMON26B)		-80 dBc
23 GHz (SPECMON26B)		-80 dBc
25 GHz (SPECMON26B)		-80 dBc