SPECMON3 Real-Time Spectrum Analyzers
SPECMON6 Real-Time Spectrum Analyzers
Specifications and Performance Verification

Technical Reference

077-0742-00

Tektronix

SPECMON3 Real-Time Spectrum Analyzers
SPECMON6 Real-Time Spectrum Analyzers
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Technical Reference

This document applies to instruments running software version 2.7.1065 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.

www.tektronix.com

077-0742-00

Tektronix

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For product information, sales, service, and technical support:

- In North America, call 1-800-833-9200.
- Worldwide, visit www.tektronix.com to find contacts in your area.

Warranty

Tektronix warrants that this product will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If any such product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product. Parts, modules and replacement products used by Tektronix for warranty work may be new or reconditioned to like new performance. All replaced parts, modules and products become the property of Tektronix.

In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, with shipping charges prepaid. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which the Tektronix service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Tektronix shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than Tektronix representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; c) to repair any damage or malfunction caused by the use of non-Tektronix supplies; or d) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

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[W2 – 15AUG04]

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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:

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

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

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:

Preface

This document contains the Specifications and the Performance Verification for the SPECMON3 and SPECMON6 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 *SPECMON3 Real-Time Spectrum Analyzes and SPECMON6 Real-Time Spectrum Analyzer Quick Start User Manual* describes how to use your analyzer.
- The *SPECMON3 Real-Time Spectrum Analyzers and SPECMON6 Real-Time Spectrum Analyzers Application Examples Manual*, provides tutorial examples of how to take measurements in different application areas.
- The *SPECMON3 Real-Time Spectrum Analyzers and SPECMON6 Real-Time Spectrum Analyzers Programmers Manual* describes how to use a computer to control the analyzer through the GPIB interface.
- The *SPECMON3 and SPECMON6 Service Manual* provides information for maintaining and servicing your analyzer to the module level.

Specifications

This section lists the SPECMON3 and SPECMON6 Real-Time Spectrum Analyzer specifications. Items listed in the Performance Requirement column are generally quantitative, and are either tested by the *Performance Verification* procedure or are guaranteed by design. Items listed in the Reference Information column are useful operating parameters that have typical values; information in this column is not guaranteed.

***NOTE.** In these tables, characteristics which are warranted are indicated by a ✓ symbol in the Characteristics column.*

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 1: Frequency

Characteristic			Description
Measurement frequency			
	Frequency range, nominal	SPECMON3 (RF band)	9 kHz to 3 GHz
		SPECMON6 (RF band)	9 kHz to 6.2 GHz
	Frequency Marker	Readout Accuracy	±(RE × MF + 0.001 × Span + 2) Hz RE: Reference Frequency Error MF: Marker Frequency [Hz]
		Readout Resolution	Reference level dependent As small as 0.0001 µV
	Residual FM, typical		<2 Hz_{p-p} in 1 second at 200 MHz CF, 100 Hz span, Freq vs Time mode, Autoscale (95% confidence)
	Span Accuracy		±0.3% of span (Auto mode)

Table 1: Frequency (cont.)

Characteristic			Description
Reference Frequency			
	Stability, nominal		2 x 10^{-8}
	Adjustment Range		±5.5 x 10^{-7}
	✓ Initial Accuracy at Cal		Within 1 x 10^{-7} (after a 10 min warmup)
	Aging	Per day	±1 x 10^{-9} (after 30 days of operation)
		Long term	±3 x 10^{-7} (10 years)
		Cumulative Error, typical (Temperature + Aging)	4 x 10^{-7} (10 years)
	Temperature drift		1 x 10^{-7} (10 °C to 40 °C)
	Reference Output Level	✓ Internal or External	>0 dBm
		Internal or External, typical	+4 dBm
	External Reference Input, nominal		BNC Connector, 50 Ω
	External Reference Input Frequency, nominal		10 MHz ±30 Hz (3 ppm) Spurious level on input signal must be <–80 dBc within 100 kHz offset to avoid on-screen spurious
	External Reference Input Range		±3 x 10^{-7}
	✓ External Reference Input Level		–10 dBm to +6 dBm

Table 2: 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
Typical			
	Frequency = 1000 MHz	–107 dBc/Hz	1 kHz
		–113 dBc/Hz	10 kHz
		–116 dBc/Hz	100 kHz
		–139 dBc/Hz	1 MHz
		–144 dBc/Hz	6 MHz
		–144 dBc/Hz	10 MHz

Table 2: Phase noise (cont.)

Characteristic		Description	
	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
	Frequency = 6000 MHz	–104 dBc/Hz	1 kHz
		–109 dBc/Hz	10 kHz
		–114 dBc/Hz	100 kHz
		–132 dBc/Hz	1 MHz
		–141 dBc/Hz	6 MHz
		–141 dBc/Hz	10 MHz
	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

Table 3: Integrated jitter

Characteristic	Description
Integrated Phase (100 Hz to 100 MHz), typical	2.51e-3 radians at 100 MHz
	3.14e-3 radians at 1 GHz
	3.77e-3 radians at 2 GHz
	6.28e-3 radians at 5 GHz

Table 4: RF input

Characteristic			Description
RF Input Connector, nominal			N type
RF Input Impedance, nominal			50 Ω
RF VSWR, typical			<1.6 (10 kHz to 30 MHz, RF ATT = 10 dB, Preamp OFF) Center Frequency set to < 200 MHz at time of test.
✓ RF VSWR			Center Frequency must be set within 200 MHz of any VSWR test frequency at time of test.
	Preamp OFF, RF ATT = 10 dB	10 MHz to 3 GHz	<1.4
		>3 GHz to 6.2 GHz	<1.6
	Option 50 Preamp ON	10 MHz to 6.2 GHz	<1.6

Table 5: Maximum input level

Characteristic	Description
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 Measureable 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

Characteristic	Description
RF Attenuator (DC to 6.2 GHz)	0 dB to 55 dB (5 dB step), nominal

Table 7: Analog sweep

Characteristic	Description	Reference info
Sweep Time, typical	1500 MHz/second tuning rate (standard) 2500 MHz/second tuning rate (Option 40) 6000 MHz/second tuning rate (Option 110)	RBW set to Auto; RF & IF Optimization set to Minimize Sweep Time

Table 8: Amplitude and RF flatness (excluding mismatch error) [1]

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 (SPECMON6 only)	±0.5 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
	All RF attenuator settings, Preamp OFF, typical	9 kHz to 10 MHz	±0.7 dB
		1 Hz to 10 MHz (LF Band)	±0.7 dB

Table 8: Amplitude and RF flatness (excluding mismatch error) [1] (cont.)

Characteristic			Description
Frequency response (5 °C to 40 °C), typical			
	All RF attenuator settings, Preamp OFF	1 Hz to 32 MHz (LF Band)	±0.8 dB
		9 kHz to 3 GHz	±0.5 dB
		3 GHz to 6.2 GHz (SPECMON6 only)	±1.0 dB
	Attenuator = 10 dB, Preamp ON (Option 50)	32 MHz (LF Band)	±0.8 dB
		9 kHz to 3 GHz	±0.8 dB
		3 GHz to 6.2 GHz (SPECMON6 only)	±1.3 dB
Input attenuator switching uncertainty			±0.3 dB

Table 8: Amplitude and RF flatness (excluding mismatch error) [1] (cont.)

Characteristic		Description
✓ Absolute amplitude accuracy at calibration point (RF)		±0.31 dB
Absolute amplitude accuracy at all center frequencies (18 °C to 28 °C) [2], 95% confidence		
	10 MHz to 3 GHz	±0.5 dB
	3 GHz to 6.2 GHz (SPECMON6 only)	±0.8 dB
Level Linearity		±0.1 dB (0 dB to –70 dB Below Reference Level)

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

[2] Reference Level ≤ –15 dBm, –15 dBm to –50 dBm. 10 Hz ≤ RBW ≤ 1 MHz, after alignment performed.

Table 9: Noise and distortion

Characteristic			Description
1 dB Compression Input [1]	RF Attenuation = 0 dB, 2 GHz		+7 dBm
3rd Order IM Intercept	At 2.130 GHz		+17 dBm
3rd Order IM Intercept, typical	At 2.130 GHz		+17 dBm
	80 MHz to 300 MHz		+13 dBm
	300MHz to 3 GHz		+17 dBm
	3 GHz to 6.2 GHz (SPECMON6 only)		+17 dBm
3rd Order Intermodulation Distortion			
	✓ Specified	2.130 GHz	–84 dBc
		Each signal level -25 dBm at the RF input. 1 MHz tone separation. Attenuator = 0, Ref Level = –20 dBm.	
	Typical	10 kHz to 32 MHz (LF Band)	<–75 dBc
		9 kHz to 80 MHz	<–72 dBc
		80 MHz to 300 MHz	<–76 dBc
		300MHz to 3 GHz	<–84 dBc
		3 GHz to 6.2 GHz (SPECMON6 only)	–84 dBc
	Each signal level –25 dBm at the RF input. 1 MHz tone separation. Attenuator = 0, Ref Level = –20 dBm.		
2nd Harmonic Distortion, typical. Preamp OFF			
	10 MHz to 3.1 GHz (–40 dBm at RF Input, Atten = 0), typical		<–80 dBc (10 MHz to 500 MHz)
			<–80 dBc (500 MHz to 1 GHz)
			<–83 dBc (1 GHz to 3.1 GHz)

Table 9: Noise and distortion (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 4 kHz, LF Band	–124 dBm/Hz	–130 dBm/Hz
		4 kHz to 10 kHz, LF Band	–141 dBm/Hz	–143 dBm/Hz
		10 kHz to 32 MHz, LF Band	–150 dBm/Hz	–153 dBm/Hz
		9 kHz to 1 MHz	–108 dBm/Hz	–111 dBm/Hz
		1 MHz to 10 MHz	–136 dBm/Hz	–139 dBm/Hz
		10 MHz to 2 GHz	–154 dBm/Hz	–157 dBm/Hz
		2 GHz to 3 GHz	–153 dBm /Hz	–156 dBm /Hz
		3 GHz to 4 GHz (SPECMON6 only)	–151 dBm /Hz	–154 dBm /Hz
		4 GHz to 6.2 GHz (SPECMON6 only)	–149 dBm /Hz	–152 dBm /Hz
	Preamp ON (option 50 only)		✓ *Specification*	*Typical*
		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 (SPECMON6 only)	–161 dBm/Hz	–164 dBm/Hz

1 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

Table 10: Channel Response – Amplitude & Phase Flatness (Standard/Option 40)

Frequency range	Span	Amplitude flatness		Phase flatness
		✓ *Specification*	*Typical, RMS*	*Typical, RMS*
0.01 GHz to 6.2 GHz	≤300 kHz	±0.10 dB	±0.05 dB	±0.1°
0.03 GHz to 6.2 GHz	≤25/40 MHz	±0.30 dB	±0.20 dB	±0.5°
0.001 GHz to 0.032 GHz (LF path only)	≤20 MHz	±0.50 dB	±0.40 dB	±1.0°

Table 11: Channel Response – Amplitude & Phase Flatness (Option 110)

Frequency range	Span	Amplitude flatness		Phase flatness
		✓ *Specification*	*Typical, RMS*	*Typical, RMS*
0.07 GHz to 6.2 GHz	≤110 MHz	±0.50 dB	±0.40 dB	±1.5°

Table 12: Channel response [1]

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

1 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.

2 After calibration and normalization, CF=200 MHz.

Table 13: Pulse measurements, typical

Characteristic	Description	
	110 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	±3% 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
Average Transmitted Power, typical	±0.4 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, duty cycles of 0.5 to 0.001, and S/N ratio ≥ 30 dB
Peak Pulse Power, typical	±0.4 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, duty cycles of 0.5 to 0.001, and S/N ratio ≥ 30 dB

Table 13: Pulse measurements, typical (cont.)

Characteristic		Description	
Pulse Width, typical		±3% of reading	
		For pulse widths ≥150 ns, duty cycles of 0.5 to 0.001, and signal levels >50 dB below Ref Level	For pulse widths ≥450 ns, duty cycles of 0.5 to 0.001, and S/N ratio ≥ 30 dB
System Rise time, typical		<12 ns	<40 ns
Pulse-to-Pulse carrier phase, typical [1] [2]		**110 MHz BW**	**25 MHz BW**
	2 GHz	±0.72°	±0.35°
		60 MHz BW	**20 MHz BW**
	2 GHz	±0.7°	±0.3°
Pulse-to-Pulse carrier phase, typical [3] [4]		**110 MHz BW**	**25 MHz BW**
	2 GHz	±0.5°	±0.3°
		60 MHz BW	**20 MHz BW**
	2 GHz	±0.5°	±0.3°
Pulse-to-Pulse carrier frequency, typical [5] [6]		**110 MHz BW**	**20 MHz BW**
	2 GHz	±225 kHz	±13kHz
		60 MHz BW	
	2 GHz	±80 kHz	
Pulse-to-Pulse carrier frequency, typical [7] [8]		**110 MHz BW**	**20 MHz BW**
	2 GHz	±200 kHz	±12 kHz
		60 MHz BW	
	2 GHz	±130 kHz	
Pulse frequency linearity (Absolute frequency error RMS), typical [9] [10]		**110 MHz BW**	**20 MHz BW**
	2 GHz	±65 kHz	±7 kHz
		60 MHz BW	**25 MHz**
	2 GHz	±26 kHz	±10 kHz
Chirp frequency linearity (Absolute frequency error RMS), typical [11] [12]		**110 MHz BW**	**25 MHz BW**
	2 GHz	±50 kHz	±6 kHz
		60 MHz BW	**20 MHz BW**
	2 GHz	±30 kHz	±5 kHz

1 For 60 MHz / 110 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
$t_{meas} - t_{reference} \lneqq 10$ 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/measurement Bandwidth) as measured from the 50% point of the Tr or Tf.

2 For 20 MHz / 25 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 ≥ 300 ns.
PRI ≤300 us.
Duty cycle ≥ 0.001
$t_{meas} - t_{reference} \leq 10$ 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/measurement Bandwidth) as measured from the 50% point of the Tr or Tf.

3 For 110 MHz / 60 MHz bandwidths, and conditions of:
Linear Chirped pulses
For signal type: Linear chirp, Peak to peak chirp deviation: ≤ (0.8 x Measurement bandwidth)
Frequency Estimation = Manual
Pulse ON power ≥–20 dBm
Signal peak at Ref Lvl.
Atten = 0 dB
Pulse width ≥ 100 ns.
PRI ≤300 us.
Duty cycle ≥ 0.0003
$t_{meas} - t_{reference} \leq 10$ ms
Measurement time position excludes the beginning and ending of the pulse extending for a time = (10/measurement Bandwidth) as measured from the 50% point of the Tr or Tf.

4 For 25 MHz / 20 MHz bandwidths, and conditions of:
Linear Chirped pulses
For signal type: Linear chirp, Peak to peak chirp deviation: ≤ (0.8 x Measurement bandwidth)
Frequency Estimation = Manual
Pulse ON power ≥–20 dBm
Signal peak at Ref Lvl.
Atten = 0 dB
Pulse width ≥ 300 ns.
PRI ≤1000 us.
Duty cycle ≥ 0.0003
$t_{meas} - t_{reference} \leq 10$ ms
Measurement time position excludes the beginning and ending of the pulse extending for a time = (10/measurement Bandwidth) as measured from the 50% point of the Tr or Tf.

5 For 110 MHz / 60 MHz bandwidths, and conditions of:
CW (non-chirped) pulses
Frequency Estimation = Manual
Pulse ON power ≥–20 dBm
Signal peak at Ref Lvl.

Atten = 0 dB
Pulse width ≥ 200 ns.
PRI ≤300 us.
Duty cycle ≥ 0.0007
$t_{meas} - t_{reference} \leq 10$ ms
Measurement time position excludes the beginning and ending of the pulse extending for a time = (10/Measurement Bandwidth) as measured from the 50% point of the Tr or Tf.

6 For 20 MHz bandwidth, and conditions of:
CW (non-chirped) pulses
Frequency Estimation = Manual
Pulse ON power ≥–20 dBm
Signal peak at Ref Lvl.
Atten = 0 dB
Pulse width ≥ 300 ns.
PRI ≤300 us.
Duty cycle ≥ 0.001
$t_{meas} - t_{reference} \leq 10$ ms
Measurement time position excludes the beginning and ending of the pulse extending for a time = (10/Measurement Bandwidth) as measured from the 50% point of the Tr or Tf.

7 For 20 MHz bandwidth, and conditions of:
Linear chirped pulses
For signal type: Linear chirp, Peak to peak chirp deviation: ≤ (0.8 x Measurement bandwidth)
Frequency Estimation = Manual
Pulse ON power ≥–20 dBm
Signal peak at Ref Lvl.
Atten = 0 dB
Pulse width ≥ 100 ns.
PRI ≤300 us.
Duty cycle ≥ 0.0003
$t_{meas} - t_{reference} \leq 10$ ms
Measurement time position excludes the beginning and ending of the pulse extending for a time = (10/Measurement Bandwidth) as measured from the 50% point of the Tr or Tf.

8 For 20 MHz bandwidth, and conditions of:
Linear chirped pulses
For signal type: Linear chirp, Peak to peak chirp deviation: ≤ (0.8 x Measurement bandwidth)
Frequency Estimation = Manual
Pulse ON power ≥–20 dBm
Signal peak at Ref Lvl.
Atten = 0 dB
Pulse width ≥ 300 ns.
PRI ≤1000 us.
Duty cycle ≥ 0.0003
$t_{meas} - t_{reference} \leq 10$ ms
Measurement time position excludes the beginning and ending of the pulse extending for a time = (10/Measurement Bandwidth) as measured from the 50% point of the Tr or Tf.

9 For 60 MHz / 110 MHz bandwidth, and conditions of:
CW (non-chirped) pulses
Frequency Estimation = Manual
Pulse ON power ≥–20 dBm
Signal peak at Ref Lvl.
Atten = 0 dB
Pulse width ≥ 200 ns.
PRI ≤300 us.
Duty cycle ≥ 0.0007

Absolute frequency error determined over center 50% of pulse.

10 For 20/25 MHz bandwidth, and conditions of:

CW (non-chirped) pulses

Frequency Estimation = Manual

Pulse ON power ≥–20 dBm

Signal peak at Ref Lvl.

Atten = 0 dB

Pulse width ≥ 300 ns.

PRI ≤ 300 us.

Duty cycle ≥ 0.001

Absolute frequency error determined over center 50% of pulse

11 For 60 MHz / 110 MHz bandwidth, and conditions of:

Linear chirped pulses

For signal type: Linear chirp, Peak to peak chirp deviation: ≤ (0.8 x Measurement bandwidth)

Frequency Estimation = Manual

Pulse ON power ≥–20 dBm

Signal peak at Ref Lvl.

Atten = 0 dB

Pulse width ≥ 100 ns.

PRI ≤300 us.

Duty cycle ≥ 0.0003

$t_{meas} – t_{reference}$ ≤ 10 ms

Absolute Frequency Error determined over center 50% of pulse.

12 For 20/25 MHz bandwidth, and conditions of:

Linear chirped pulses

For signal type: Linear chirp, Peak to peak chirp deviation: ≤ (0.8 x Measurement bandwidth)

Frequency Estimation = Manual

Pulse ON power ≥–20 dBm

Signal peak at Ref Lvl.

Atten = 0 dB

Pulse width ≥ 300 ns.

PRI ≤1000 us.

Duty cycle ≥ 0.0003

$t_{meas} – t_{reference}$ ≤ 10 ms

Absolute Frequency Error determined over center 50% of pulse.

Table 14: Impulse response

Characteristic	Description
Impulse Response Measurement Range (nominal)	15 to 40 dB
	Across the width of the chirp

Table 14: Impulse response (cont.)

Characteristic	Description
Impulse Response Measurement Accuracy (typical)	±2 dB [1]
	For a signal 40 dB in amplitude and delayed 1% to 40% of the chirp width
Impulse Response Weighting	Taylor Window

1 Chirp width 100 MHz, pulse width 10 μs, minimum signal delay 1% of pulse width or 10/(chirp bandwidth), whichever is greater, and minimum 2000 sample points during pulse on-time.

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 (SPECMON6 only)	<–95 dBm
	500 kHz to 32 MHz, LF Band	<–100 dBm, typical
	500 kHz to 80 MHz, RF band	–75 dBm, typical
	80 MHz to 200 MHz, RF band	–95 dBm, typical
Residual DC Offset after Normalization (LF Path), typical		<-40 dBm (Ref level ≤ 0 dBm) <-40 dBm from Ref level (Ref level > 0 dBm)
✓ Spurious Response with Signal (Image Suppression)		<–75 dBc (100 Hz to < 30 MHz, Ref= –30 dBm, Atten = 10 dB, RF Input Level = –30 dBm, RBW = 10 Hz) <–83 dBc (30 MHz to 3 GHz, Ref= –30 dBm, Atten = 10 dB, RF Input Level = –30 dBm, RBW = 10 Hz) <–70 dBc (3 GHz to 6.2 GHz, Ref= –30 dBm, Atten = 10 dB, RF Input Level = –30 dBm, RBW = 10 Hz) (SPECMON6 only)
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 (SPECMON6)		<–80 dBc (CF 30 MHz to 3 GHz, Ref = –30 dBm, Atten = 10 dB, RBW = 1 kHz) Signal frequency range = 3.5125 GHz, RF input level = –30 dBm This is an input signal at half the IF frequency.

Table 15: Spurious response (cont.)

Characteristic	Description
✓ Spurious Response with Signal at 3.5125 GHz - Half IF (SPECMON6)	<–80 dBc (CF 30 MHz to 6.2 GHz, Ref = –30 dBm, Atten = 10 dB, RBW = 1 kHz) Signal frequency range = 3.5125 GHz, RF input level = –30 dBm This is an input signal at half the IF frequency.
Local Oscillator Feed-through to Input Connector (Spurious Leakage), typical	<–60 dBm (Attenuator = 10 dB)

Table 16: Spurious response with signal at center frequency (offset ≥ 400 kHz)

	Span ≤ 25 MHz, Swept Spans > 25 MHz		For Option 40/110 [1] 25 MHz < Span ≤ 110 MHz	
Frequency	**Specification**	**Typical**	**Specification**	**Typical**
1 MHz to 32 MHz (LF band)	–71 dBc	–75 dBc	– –	– –
30 MHz to 3 GHz	–73 dBc	–78 dBc	–73 dBc	–75 dBc
3 GHz to 6.2 GHz (SPECMON6 only)	–73 dBc	–78 dBc	–73 dBc	–75 dBc

1 Center frequency ≥ 90 MHz for Options 40/110.

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

	Span ≤ 25 MHz, Swept Spans > 25 MHz		For Option 40/110 [1] 25 MHz < Span ≤ 110 MHz	
Frequency	**Specification**	**Typical**	**Specification**	**Typical**
1 MHz to 32 MHz (LF band)	– –	–71 dBc	– –	– –
30 MHz to 3 GHz	– –	–73 dBc	– –	–73 dBc
3 GHz to 6.2 GHz (SPECMON6 only)	– –	–73 dBc	– –	–73 dBc

1 1 Center frequency ≥ 90 MHz for Options 40/110.

Table 18: Spurious response with signal at other than CF

	Span ≤ 25 MHz, Swept Spans > 25 MHz		For Option 40/110 [1] 25 MHz < Span ≤ 110 MHz	
Frequency	Specification	Typical	Specification	Typical
1 MHz to 32 MHz (LF band)	– –	–71 dBc	– –	– –
30 MHz to 3 GHz	– –	–73 dBc	– –	–73 dBc
3 GHz to 6.2 GHz (SPECMON6 only)	– –	–73 dBc	– –	–73 dBc

1 1 Center frequency ≥ 90 MHz for Options 40/110.

Table 19: Acquisition

Characteristic	Description
Real-time Capture Bandwidth, nominal	25 MHz (RF, Standard Version) 40 MHz (RF, Option 40 Version) 110 MHz (RF, Option 110 Version)
Demodulation Bandwidth	25 MHz (RF, Standard Version) 40 MHz (RF, Option 40 Version) 110 MHz (RF, Option 110 Version)
A/D Converter, nominal	14 bits, 100 Ms/s (Standard Version) 14 bits, 100 Ms/s & 14 bits, 300 Ms/s (Option 40 and Option 110)

Table 19: Acquisition (cont.)

Characteristic		Description			
Sampling Rate and Available Memory time in RTSA/Time/Demod Mode, nominal		**Acquisition BW**	**Sample Rate (for I and Q)**	**Record Length**	**Record Length (option 53)**
		110 MHz (Option 110)	150 MS/s	1.79 s	7.15 s
		60 MHz (Option 110)	75 MS/s	3.58 s	14.31 s
		40 MHz (Option 40/110)	75 MS/s	3.58 s	14.31 s
		30 MHz (Option 40/110)	37.5 MS/s	7.16 s	28.63 s
		25 MHz	50 MS/s	4.77 s	19.08 s
		20 MHz	25 MS/s	9.54 s	38.17 s
		10 MHz	12.5 MS/s	19.08 s	76.35 s
		5 MHz	6.25 MS/s	38.17 s	152.7 s
		2 MHz	3.125 MS/s	42.9 s	171.8 s
		1 MHz	1.56 MS/s	85.8 s	343.5 s
		500 kHz	781 kS/s	171.7 s	687.1 s
		200 kHz	390 kS/s	343.5 s	1374 s
		100 kHz	195 kS/s	687.1 s	2748 s
		50 kHz	97.6 kS/s	1374 s	5497 s
		20 kHz	48.8 kS/s	2748 s	10955 s
		10 kHz	24.4 kS/s	5497 s	21990 s
		5 kHz	12.2 kS/s	10955 s	43980 s
		2 kHz	3.05 kS/s	43980 s	175921 s
		1 kHz	1.52 kS/s	87960 s	351843 s
		500 Hz	762 S/s	175921 s	703687 s
		200 Hz	381 S/s	351843 s	1407374 s
		100 Hz	190 S/s	703686 s	2814749 s
Minimum Acquisition Length in RTSA/Time/Demod Mode, nominal		64 samples			
Maximum Acquisition Length in RTSA/Time/Demod Mode (Acquisition BW Dependent), nominal		256,000,000 samples (Std.) 1,000,000,000 samples (Option 53)			
Acquisition Length Setting resolution in RTSA/Time/Demod Mode, nominal		1 sample			
Fast Frame Acquisition Mode		Up to 65,535 records can be stored in a single acquisition (for Pulse Measurements and Spectrogram Analysis)			
Acquisition Memory Size	Acq BW > 2.5 MHz (1 GB) (Std)	256 MSamples			

Table 19: Acquisition (cont.)

Characteristic		Description
	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 110) 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	Modes: Free Run (Triggered by the end of the preceding acquisition) Triggered (Triggered by Event) Fast Frame (Triggered by Event, sequential storage of acquisitions) Types: Single (one acquisition from one trigger) Continuous (repeated acquisitions from repeating triggers) Sources: RF Input Trigger 1 (Front) Trigger 2/ Gate (Rear) Gated (Logical AND of the selected edge [rising or falling] of TRIG 1 and the selected level [LOW or HIGH] of TRIG 2) Line
Trigger Event Delay Range, nominal	20 ns to 60 s
Trigger Event Delay Resolution, nominal	20 ns
Trigger Event Delay Uncertainty, nominal	±20 ns

Table 21: Trigger (cont.)

Characteristic	Description
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	±0.5 dB (level ≥ –50 dB from Reference Level) for trigger levels >30 dB above the noise floor ±1.5 dB (from –50 dB to –70 dB from Reference Level) for trigger levels >30 dB above the noise floor This applies when the Trigger Level is between 10% and 90% of the signal amplitude
Power Trigger Position Timing Uncertainty, typical	±12 ns for 25 MHz Acq BW using no trigger RBW ±15 ns for 25 MHz Acq BW using 20 MHz trigger RBW ±4 ns for 110 MHz Acq BW using no trigger RBW ±5 ns for 110 MHz Acq BW using 60 MHz trigger RBW
Power Trigger Bandwidth setting, nominal	Not an independent setting. This is set by the "Time Domain Bandwidth" control
Frequency Mask Trigger Mask Point Horizontal Resolution (Option 52), nominal	<0.2% of span
Frequency Mask Trigger Level Range (Option 02), nominal	0 to –80 dB from reference level for spans ≤25 MHz (Standard) for spans ≤110 MHz (Option 110)
Frequency Mask Trigger Level Resolution (Option 52), nominal	0.1 dB
Frequency Mask Trigger Level Accuracy (Option 52) (with respect to Reference Level)	±(Channel Response Flatness + 1 dB) (for mask levels ≥ –50 dB) for masks >30 dB above the noise floor ±(Channel Response Flatness + 2.5 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 (Option 52), nominal	25 MHz (1024 point FFT, 50% overlapping, Standard) 40 MHz (1024 point FFT, 50% overlapping, Option 40) 110 MHz (1024 point FFT, 50% overlapping, Option 110)
Frequency Mask Trigger Real-time Event Minimum Duration for 100% probability of trigger (Option 52), nominal	30.7 μs at 25 MHz span (Standard) 10.3 μs at 110 MHz span (Option 110)
Frequency Mask Trigger Timing Uncertainty	±12.8 μs at 25 MHz span (Standard) ±5.12 μs at 110 MHz span (Option 110)
External Trigger 1 Threshold Voltage, nominal	Variable: –2.5 V to +2.5 V settable
External Trigger 2 Threshold Voltage, nominal	Fixed: TTL
External Trigger 1 Threshold Voltage Setting Resolution, nominal	0.01 V
External Trigger 1 Input Impedance, nominal	Selectable: 50 Ω or 5 kΩ
External Trigger 2 Input Impedance, nominal	Fixed: 5 kΩ
External Trigger 1 Minimum Pulse Width (applies to 50 Ω Impedance only), nominal	> 5 ns

Table 21: Trigger (cont.)

Characteristic		Description
External Trigger 2 to External Trigger 1 Minimum Delay, nominal		> 20 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 Ω impedance only)		
	>85 MHz to 110 MHz acquisition BW	±10 ns
	>75 MHz to 85 MHz acquisition BW	±12 ns
	>25 MHz to 75 MHz acquisition BW	±15 ns
	>20 MHz to 25 MHz acquisition BW	±20 ns
Trigger Output Voltage, nominal (Output Current < 1mA)		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: ≤ 10 µs 110 MHz Acquisition BW: ≤ 4 µs

Table 22: Trigger (without Option 200)

Characteristic	Description	Reference information
Trigger Event Types	Power Level (IF Span BW after RBW and VBW filters); Frequency Mask (Option 52)	
Frequency Mask Trigger Real-time Event Minimum Duration for 100% probability of trigger (Option 52), nominal	30.7 µs at 25 MHz span (Standard) 10.3 µs at 110 MHz span (Option 110)	
Frequency Mask Trigger Timing Uncertainty	±12.8 µs at 25 MHz span (Standard) ±5.12 µs at 110 MHz span (Option 110)	Measured with mask level set at 6 dB below signal peak, RBW = AUTO

Table 23: Trigger (with Option 200)

Characteristic	Description			
Trigger Event Types	Power Level (IF Span BW after RBW and VBW filters) Frequency Mask (Option 52) DPX Statistics Trigger Runt Trigger (applies to Power Level Trigger) Time-Qualified Trigger Holdoff Trigger			
Power Trigger Minimum Event Duration, nominal	12 ns (Acq BW = 110 MHz, no TDBW, Option 110 25 ns (Acq BW = 40 MHz, no TDBW, Option 40 40 ns (Acq BW = 25 MHz, no TDBW, Standard			
Frequency Edge Trigger Range, nominal	±(1/2 x (ACQ BW or TDBW if TDBW is active))			
Frequency Edge Trigger Timing Uncertainty, nominal	Same as power trigger position timing uncertainty.			
Frequency Mask Trigger Maximum Real-time Event Detection Bandwidth (Opt. 52)	25 MHz (1024 point FFT, 50% overlapping, Standard) 110 MHz (1024 point FFT, 50% overlapping, Option 110)			
Frequency Mask Trigger Real-time Event Minimum Duration for 100% probability of trigger (Option 52), nominal	Option 110, span = 110 MHz		Standard Unit, span = 25 MHz	
	FMT RBW	Minimum event duration (µs)	FMT RBW	Minimum event duration (µs)
	10 MHz	3.7	5 MHz	4
	1 MHz	5.8	1 MHz	5.8
	100 kHz	37.6	100 kHz	27.5
			10 kHz	267.8
	Option 40, span = 40 MHz			
	FMT RBW	Minimum event duration (µs)		
	5 MHz	3.9		
	1 MHz	5.8		
	300 kHz	11.4		
	100 kHz	30.8		
	10 kHz	294.5		
Frequency Mask Trigger Timing Uncertainty	±7 µs at 25 MHz span (RBW ≧ 300 kHz, Standard Unit) ±4 µs at 110 MHz span (RBW ≧ 1 MHz, Option 110) Measured with Mask Level set at 6 dB below signal peak. Uncertainty will vary with Mask Level setting relative to peak signal level.			
Runt Trigger Level Range, nominal	Same as Power Trigger Level Range			
Runt Trigger Level Resolution, nominal	Same as Power Trigger Level Resolution			

Table 23: Trigger (with Option 200) (cont.)

Characteristic	Description
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 Statistics Trigger Minimum Detectable Trigger Event Duration, typical	Same as DPX Min Signal Duration for 100% probability of intercept
DPX Statistics Trigger Threshold Setting Range, nominal	0%– 100%
DPX Statistics Trigger Area of Interest Range, nominal	2 to 801 pixels (horizontal) x 2 to 201 pixels (vertical)
DPX Statistics Trigger Area of Interest Resolution, nominal	2 pixels, horizontal or vertical
DPX Statistics Trigger Area of Interest Accuracy, nominal	Horizontal: ±0.25% of Span Vertical: ±(2 X DPX amplitude accuracy)
DPX Statistics Trigger Timing Uncertainty, nominal	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) For Span = 110 MHz: Uncertainty = –(Signal Event Duration + 10.3 μs) to +10.3 us For Span = 25 MHz: Uncertainty = –(Signal Event Duration + 23.9 μs) to +23.9 μs For signal events 40 ms or longer, the timing uncertainty is not specified. For Density = Lower, the timing uncertainty is not specified.
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

Table 23: Trigger (with Option 200) (cont.)

Characteristic	Description
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: 6.7 ns Trigger Source is EXTERNAL: SPAN ≤25 MHz: 20 ns 25 MHz < SPAN ≤ 110 MHz: 6.7 ns
Time Qualified Trigger (minimum or maximum) Time Accuracy, nominal	For Power Trigger: ±[(2 X Power Trigger Position Timing Uncertainty) + 6.7 ns]; All conditions for Power Trigger Position timing uncertainty must be met For FMT: ±[(2 X Frequency Mask Timing Uncertainty) + 6.7 ns]; All conditions for Frequency Mask Trigger timing uncertainty must be met For DPX Statistics Trigger: ±42 ms; For External Trigger SPAN ≤ 25 MHz: ±[(2 X External Trigger Timing Uncertainty) + 20 ns]; All conditions for External Trigger Timing uncertainty must be met For External Trigger 25 MHz < SPAN ≤ 110 MHz: ±[(2 X External Trigger Timing Uncertainty) + 6.7 ns]; All conditions for External Trigger Timing uncertainty must be met
Holdoff Trigger	ON or OFF 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
Holdoff Trigger Source	Applied to any allowed combination of trigger source and time qualification
Holdoff Trigger Time Range, nominal	20 ns to 10 s

Table 23: Trigger (with Option 200) (cont.)

Characteristic	Description
Holdoff Trigger Time Resolution, nominal	Trigger Source is not EXTERNAL: 6.7 ns Trigger Source is EXTERNAL: SPAN ≤40 MHz: 20 ns 40 MHz < SPAN ≤ 110 MHz: 6.7 ns
Holdoff Trigger Time Accuracy, nominal	For Power Trigger: ±(Power Trigger Position Timing Uncertainty + 6.7 ns); All conditions for Power Trigger Position Timing Uncertainty must be met For FMT: ±(Frequency Mask Trigger Timing Uncertainty + 6.7 ns); All conditions for Frequency Mask Trigger Timing Uncertainty must be met For DPX Statistics Trigger: ±42 ms; For External Trigger SPAN ≤ 25 MHz: ±(External Trigger Timing Uncertainty + 20 ns); All conditions for External Trigger Timing uncertainty must be met For External Trigger 25 MHz < SPAN ≤ 110 MHz: ±(External Trigger Timing Uncertainty + 6.7 ns); All conditions for External Trigger Timing Uncertainty must be met If Time Qualified Trigger is used, the Accuracy value increases to 2X the number given above for the specified trigger source.

Table 24: Resolution bandwidth filter (SA mode)

Characteristic	Description
Filter Shape, nominal	Gaussian-like (Actual filter shape is Kaiser with $\beta = 16.72$)
Bandwidth Accuracy	1.0% (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) (±10%)

Table 25: Range and settable RBW (SA mode)

	Frequency Domain Resolution Bandwidth Range	
Acquisition BW	Maximum RBW	Minimum RBW
110 MHz (Option 110)	10 MHz	100 Hz
25 MHz	5 MHz	100 Hz
20 MHz	5 MHz	100 Hz
10 MHz	2 MHz	10 Hz

Table 25: Range and settable RBW (SA mode) (cont.)

	Frequency Domain Resolution Bandwidth Range	
Acquisition BW	**Maximum RBW**	**Minimum RBW**
5 MHz	1 MHz	10 Hz
2.5 MHz	625 kHz	10 Hz
1.25 MHz	312 kHz	1 Hz
625 kHz	156 kHz	1 Hz
312.5 kHz	78 kHz	1 Hz
156.25 kHz	39 kHz	0.1 Hz
78.125 kHz	20 kHz	0.1 Hz
39.0625 kHz	10 kHz	0.1 Hz
19.53125 kHz	5 kHz	0.1 Hz
9.765625 kHz	2 kHz	0.1 Hz
4.8828125 kHz	1 kHz	0.1 Hz
2.44140625 kHz	610 Hz	0.1 Hz
1.220703125 kHz	305 Hz	0.1 Hz
610.3515625 Hz	152 Hz	0.1 Hz
305.17578125 Hz	76 Hz	0.1 Hz
152.587890625 Hz	38 Hz	0.1 Hz

Table 26: 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) (±10%) for filters up to 10 MHz < approximately 2.5:1 (60 dB:3 dB) for filters >10 MHz to 60 MHz
Range, nominal	See the following table
Bandwidth Accuracy	1 Hz to 10 MHz = 1% (Auto-coupled) 20 MHz & 60 MHz = 10%
Resolution, nominal	1, 2, 3, 5 (plus 60 MHz for Option 110) (for sequence selection) 1% (for user-entry mode)
Minimum Settable RBW, nominal	See the following table

Table 27: Range and settable RBW (time-domain mode)

	Time Domain Trigger And Amplitude vs. Time	
Acquisition BW	**Maximum TDBW**	**Minimum TDBW**
110 MHz (Opt 110)	60 MHz	11 kHz
60 MHz (Opt 110)	7.5 MHz	6 kHz
25 MHz	20 MHz	4 kHz
20 MHz	2.5 MHz	2 kHz
10 MHz	1.25 MHz	1 kHz

Table 27: Range and settable RBW (time-domain mode) (cont.)

	Time Domain Trigger And Amplitude vs. Time	
Acquisition BW	Maximum TDBW	Minimum TDBW
5 MHz	625 kHz	500 Hz
2.5 MHz	312.5 kHz	250 Hz
1.25 MHz	156.25 kHz	125 Hz
625 kHz	78.125 kHz	62.5 Hz
312.5 kHz	39.0625 kHz	31.25 Hz
156.25 kHz	19.53125 kHz	15.625 Hz
78.125 kHz	9.765625 kHz	7.8125 Hz
39.0625 kHz	4.8828125 kHz	3.90625 Hz
19.53125 kHz	2.44140625 kHz	1.953125 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

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

Table 28: Preamp (Option 50)

Characteristic	Description
Noise Figure	<7 dB at 2 GHz
Bandwidth	1 MHz to 6.2 GHz
Gain, nominal	18 dB at 2 GHz

Table 29: Digital IQ output

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

1 LVDS signaling - ANSI EIA/TIA-644 standard

Table 30: 28 Volt noise source drive output

Characteristic	Description
Output Level, nominal	28 VDC @ 140 mA

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, Occupied Bandwidth xdB Down 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 (±peak, +peak to –peak, rms, peak-peak/2, frequency error) Phase Modulation (±peak,, rms, +peak to –peak)
Audio Analysis (Option 10)	
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

Table 31: Measurement function (cont.)

Characteristic	Description
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
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

Table 31: Measurement function (cont.)

Characteristic	Description
Advanced Measurements Suite (Option 20), nominal	Average On Power Peak Power Average Transmitted Power Pulse Width, Rise Time, Fall Time, Repetition Interval (seconds) Repetition Interval (Hz) Duty Factor (%) Duty Factor (ratio) Ripple (dB) Ripple (%) Droop (dB) Droop (%) Overshoot (dB) Overshoot (%) Pulse-to-Pulse Frequency Difference, Pulse-to-Pulse Phase Difference RMS Frequency Error, Max Frequency Error RMS Phase Error Max Phase Error Frequency Deviation Phase Deviation Impulse Response (dB) Impulse Response (time) Time Stamp

General Purpose Digital Modulation Analysis (Option 21), nominal	Constellation
	Error Vector Magnitude (EVM) vs. Time (RMS Peak)
	Magnitude Error vs. Time (RMS/Peak)
	Phase Error vs. Time (RMS/Peak)
	Signal Quality (EVM RMS/Peak)
	    EVM (RMS/Peak), Location
	    Magnitude Error (RMS/Peak), Location
	    Phase Error (RMS/Peak), Location
	    Waveform Quality (RHO)
	    Modulation Error Rate (MER) RMS
	    Frequency Offset
	    IQ Origin Offset
	    Gain Imbalance
	    Quadrature Error
	Symbol Table

Table 32: Views by domain

Characteristic	Description
Frequency, nominal	Spectrum (Amplitude vs. Frequency) DPX™ Spectrum Display (Live RF color-graded spectrum) Spectrogram (Amplitude vs. Frequency over Time) Channel Power and ACPR MCPR Occupied Bandwidth Spurious
Time and Statistics, nominal	Frequency vs. Time Amplitude vs. Time Phase vs. Time RF I&Q vs. Time Time Overview CCDF Peak-Average-Ratio
Phase Noise and Jitter Measurements (Option 11)	Phase Noise
Frequency and Phase Settling Measurements (Option 12)	Frequency Settling Phase Settling
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) Demodulated IQ vs. Time Eye Diagram Trellis Diagram Frequency Deviation vs. Time

Table 33: Analog demodulation accuracy

Characteristic	Description
Amplitude vs. Time Accuracy, typical	±1% (–10 dBfs Input at center, 5% to 95% Modulation Depth)
Phase vs. Time Accuracy, typical	±0.1° for modulations <180°, and rates <500 kHz. (–10 dBfs Input at center)
Frequency vs. Time Accuracy, typical	±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	±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	±3° (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	±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 μs minimum on-time)
Analysis Period, nominal	Up to 80,000 samples
Modulation Format Presets, nominal	BPSK, QPSK, DQPSK, OQPSK, pi/2DBPSK, pi/4DQPSK, D8PSK, 8PSK, 16QAM, 64QAM, 256QAM, GMSK, GFSK, MSK, 2FSK, 4FSK, 8FSK, 16FSK, CPM, SOQPSK, SBPSK, C4FM
Measurement Filter, nominal	Root Raised Cosine, Raised Cosine, Gaussian, Rectangular, IS-95, IS-95 Base EQ, C4FM-P25, half sine, None, User defined
Reference Filter, nominal	Gaussian, Raised Cosine, Rectangular, IS-95 baseband, SBPSK-MIL, SOQPSK-MIL, SOQPSK-ARTM, None, User defined
Filter Rolloff Factor, nominal	a: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 (r) 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 EVM, typical	CF		2 GHz
	Symbol Rate	100 kHz	0.35%
		1 MHz	0.35%
		10 MHz	0.5%
		30 MHz	1.5% (Option 110 only)
		60 MHz	2.0% (Option 110 only)

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	1% (Option 110 only)
		60 MHz	1.5% (Option 110 only)
		80 MHz	1.5% (Option 110 only)
OQPSK Residual EVM, typical	CF		2 GHz
	Symbol Rate	100 kHz	0.4%
		1 MHz	0.4%
		10 MHz	1.3%
	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%
	Reference Filter: MIL STD, Measurement Filter: None		
S-OQPSK (MIL) Residual EVM, typical	CF		2 GHz
		20 kHz	0.5%
		100 kHz	0.5%
		1 MHz	0.5%
	Reference Filter: MIL STD, Measurement Filter: None		
S-OQPSK (ARTM) Residual EVM, typical	CF		250 MHz
	Symbol Rate	4 kHz	0.3%
	Reference Filter: ARTM STD, Measurement Filter: None		
0S-OQPSK (ARTM) Residual EVM, typical	CF		2 GHz
	Symbol Rate	20 kHz	0.5%
		100 kHz	0.5%
		1 MHz	0.5%
	Reference Filter: ARTM STD, Measurement Filter: None		
S-BPSK (MIL) Residual EVM, typical	CF		250 MHz
	Symbol Rate	4 kHz	0.2%
	Reference Filter: MIL STD, Measurement Filter: None		
S-BPSK (MIL) Residual EVM, typical	CF		2 GHz
	Symbol Rate	20 kHz	0.5%
		100 kHz	0.5%
		1 MHz	0.5%
	Reference Filter: MIL STD, Measurement Filter: None		

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

Characteristic			Description
CPM (MIL) Residual EVM, typical	CF		250 MHz
	Symbol Rate	4 kHz	0.3%
	Reference Filter: MIL STD, Measurement Filter: None		
CPM (MIL) Residual EVM, typical	CF		2 GHz
	Symbol Rate	20 kHz	0.5%
		100 kHz	0.5%
		1 MHz	0.5%
	Reference Filter: MIL STD, Measurement Filter: None		
2/4/8/16 FSK Residual RMS FSK Error, typical	CF		2 GHz
	Symbol Rate	10 kHz	0.5%

Table 37: ACLR measurement

Characteristic	Description
ACLR (3GPP Down Link, 1 DPCH) (2130 MHz), typical	–70 dBc (Adjacent Channel) –79 dBc w/Noise Correction ACPR (Adjacent Channel) –70 dBc (First Alternate Channel) –79 dBc w/Noise Correction (First Alternate Channel)

Table 38: Digital phosphor spectrum processing (DPx)

Characteristic	Description
Spectrum Processing Rate, nominal	48,833 per second (Span Independent) 292,000 per second (Span Independent) (Option 200)
Min Signal Duration for 100% Probability of Intercept, typical Standard instrument	30.7 µs (Standard, Option 40) 24 µs (Option 110, instrument center frequency ≥ 50 MHz)

Table 38: Digital phosphor spectrum processing (DPx) (cont.)

Characteristic	Description			
Min Signal Duration for 100% Probability of Intercept, typical Option 200	**Standard, Span = 25 MHz**		**Option 40, Span = 40 MHz**	
	DPX RBW	**Minimum event duration (µs)**	**DPX RBW**	**Minimum event duration (µs)**
	5 MHz	4.0	5 MHz	3.9
	1 MHz	5.8	1 MHz	5.8
	100 kHz	27.5	300 kHz	11.4
	10 kHz	267.8	100 kHz	30.8
			10 kHz	294.5
	Option 110, Span = 110 MHz [1]			
	DPX RBW	**Minimum event duration (µs)**		
	10 MHz	3.7		
	1 MHz	5.8		
	100 kHz	37.6		
Span Range, nominal	100 Hz to 25 MHz (Standard) 100 Hz to 40 MHz (Option 40) 100 Hz to 110 MHz (Option 110)			

Table 38: Digital phosphor spectrum processing (DPx) (cont.)

Characteristic	Description			
RBW Settings, nominal	**Acquisition Bandwidth**	**RBW (Min)**	RBW (Min) Option 200	RBW (Max) Option 200
	110 MHz (Option 110)	640 kHz	16.7 kHz	10 MHz
	85 MHz (Option 110)	640 kHz	20 kHz	10 MHz
	55 MHz (Option 110)	320 kHz	10 kHz	5 MHz
	40 MHz (Option 40/110)	320 kHz	10 kHz	5 MHz
	25 MHz	214 kHz	10 kHz	3 MHz
	20 MHz	107 kHz	5 kHz	2 MHz
	10 MHz	53.3 kHz	2 kHz	1 MHz
	5 MHz	26.7 kHz	1 kHz	500 kHz
	2 MHz	13.4 kHz	500 Hz	200 kHz
	1 MHz	6.66 kHz	200 Hz	100 kHz
	500 kHz	3.33 kHz	100 Hz	50 kHz
	200 kHz	1.67 kHz	50 Hz	20 kHz
	100 kHz	833 Hz	20 Hz	10 kHz
	50 kHz	417 Hz	10 Hz	5 kHz
	20 kHz	209 Hz	5 Hz	2 kHz
	10 kHz	105 Hz	2 Hz	1 kHz
	5 kHz	52 Hz	1 Hz	500 Hz
	2 kHz	13.1 Hz	1 Hz	200 Hz
	1 kHz	6.51 Hz	1 Hz	100 Hz
	500 Hz	3.26 Hz	1 Hz	50 Hz
	200 Hz	1.63 Hz	1 Hz	20 Hz
	100 Hz	0.819 Hz	1 Hz	10 Hz
RBW Accuracy	±1%			
Span Accuracy (Option 200)	±1%			
Amplitude Accuracy (Option 200)	±0.5 dB Reference Information: This specification is in addition to the overall amplitude accuracy uncertainty for spectrum analysis mode, and includes any channel flatness degradation caused by the real-time flatness correction in DPX mode. Measured using the DPX average trace.			
Zerospan, Frequency, or Phase Measurement BW Range, nominal	Decimation of 2^N from Sample Rate (after DIFP decimation). Minimum BW = 100 Hz $0 \le N \le 20$			

Table 38: Digital phosphor spectrum processing (DPx) (cont.)

Characteristic	Description
Zerospan, Frequency, or Phase Time Domain BW (TDBW) Range, nominal	Maximum – (See Table 27.) Minimum ≤ 15 Hz for Sample Rate ≤ 150 MS/s Minimum ≤ 5 Hz for Sample Rate ≤ 50 MS/s Minimum = 1 Hz for Sample Rate ≤ 6.25 MS/s
Zerospan, Frequency, or Phase Time Domain BW (TDBW) Accuracy, nominal	±1%
Zerospan, Frequency, or Phase Sweep Time Range, nominal	100ns minimum 1 s maximum, Measurement BW > 60 MHz 2000 s maximum, Measurement BW ≤ 60 MHz
Zerospan, Frequency, or Phase Sweep Time Accuracy, nominal	±(0.5% + Reference Frequency Accuracy)
Zerospan Amplitude Range, nominal	+130 dBm to -270 dBm
Zerospan Trigger Timing Uncertainty, nominal	± (Zerospan Sweep Time/800) Reference Information: Only valid if using Power Trigger and only valid at trigger point. For example: ±100 ns/800 or ±125 ps for a 100 ns sweep time ±100 µs/800 or ±125 ps for a 100 µs sweep time
DPX Frequency Range	±100 MHz
DPX Frequency Timing Uncertainty, nominal	± (Frequency Sweep Time/800) Reference Information: Only valid if using Frequency Edge Trigger and only valid at the trigger point. For example: ±100 ns/800 or ±125 ps for a 100 ns sweep time ±100 ns/800 or ±125 ps for a 100 µs sweep time
Phase Range	±200 degrees
DPX Spectrogram Performance (DPXogram)	
Span range	100 Hz to Maximum acquisition bandwidth
DPXogram trace detection	+Peak, -Peak, Avg(Vrms)
DPXogram trace length	801 to 4001 points
DPXogram memory depth	Trace Length = 801: 60,000 traces Trace Length = 2401: 20,000 traces Trace Length = 4001: 12,000 traces

Table 38: Digital phosphor spectrum processing (DPx) (cont.)

Characteristic	Description
Time resolution per line	110 μs to 6400 μs, user settable
Maximum recording time vs. line resolution	6.6 seconds (801 points/trace, 110 μs/line) to 4444 days (801 points/trace, 6400 s/line)

1 Instrument Center Frequency ≥ 50 MHz

Table 39: Frequency Settling Time Measurement (Option 12) [1]

Measurement frequency, averages	Frequency Uncertainty at stated measurement bandwidth			
1 GHz	110 MHz BW	10 MHz BW	1 MHz BW	100 kHz BW
Single measurement	2 kHz	100 Hz	10 Hz	1 Hz
100 Averages	200 Hz	10 Hz	1 Hz	0.1 Hz
1000 Averages	50 Hz	2 Hz	1 Hz	0.05 Hz
Reference information: Measured input signal > –20 dBm, Attenuator: Auto				

1 Settled Frequency Uncertainty, 95% confidence.

Table 40: AM/FM/PM and Direct audio measurements (Option 10) [1]

Characteristic	Description	Reference information
Analog demodulation		
Carrier frequency range (for modulation and audio measurements)	½ × (Audio Analysis Bandwidth) to maximum input frequency	
Maximum audio frequency span	10 MHz	
Audio filters		
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.	
FM modulation analysis		
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

Table 40: AM/FM/PM and Direct audio measurements (Option 10) [1] (cont.)

Characteristic	Description	Reference information
FM residual THD, typical	0.10%	Rate: 1 to 10 kHz Deviation: 5 kHz
FM residual distortion, typical	0.13%	Rate: 1 to 10 kHz Deviation: 5 kHz
FM residual SINAD, typical	58 dB	Rate: 1 to 10 kHz Deviation: 5 kHz
AM modulation analysis		
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%
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	0.17%	Rate: 1 to 10 kHz Depth: 50%
AM residual SINAD, typical	56 dB	Rate: 1 to 10 kHz Depth: 50%
PM modulation analysis		
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
Direct audio input		
Direct input frequency range (for audio measurements only)	1 Hz to 156 kHz	
Audio frequency span	156 kHz, maximum	

Table 40: AM/FM/PM and Direct audio measurements (Option 10) [1] (cont.)

Characteristic	Description	Reference information
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
Direct audio input residual distortion	0.1%	Frequency: 1 to 10 kHz Input level: 0.316 V
Direct audio input residual SINAD	60 dB	Frequency: 1 to 10 kHz Input level: 0.316 V

1 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 41: 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, π/2-DBPSK,π /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 42: OBW measurement

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

Table 43: xdB Bandwidth Measurement

Characteristic	Description
xdB Bandwidth, typical	±3%

Table 44: Settled Phase Uncertainty (Option 12) [1]

Measurement frequency, averages	Phase uncertainty (degrees) at stated measurement bandwidth		
1 GHz	**110 MHz BW**	**10 MHz BW**	**1 MHz BW**
Single measurement	1.00	0.50	0.50
100 Averages	0.10	0.05	0.05
1000 Averages	0.05	0.01	0.01
Reference information: Measured input signal > –20 dBm, Attenuator: Auto			

1 Settled Phase Uncertainty, 95% confidence.

Table 45: File Saving Speeds

Characteristic	Description
Save to Hard Disk Drive Speed (Standard), typical	7 s (20 Msamples)
	32 s (100 Msamples)
	405 s (1 Gsamples)
Save to Hard Disk Drive Speed (Option 56,Removable Hard Disk Drive), typical	8 s (20 Msamples)
	40 s (100 Msamples)
	450 s (1 Gsamples)

Table 46: Data Transfer/Measurement Speeds

Characteristic	Description
Spectrum Traces Transfer Speed via Ethernet, typical	85 ms/trace
Marker Readout Transfer Speed via Ethernet, typical	5 ms
Center Frequency Tuning Speed via Ethernet, typical	150 ms (Tune 1 GHz to 1.01 GHz)

Physical Characteristics

Table 47: Physical characteristics

Characteristic		Description	
Dimensions		**mm**	**in.**
	Width (handles folded in)	473	18.6
	Height (with feet, without accessory pouch)	282	11.1
	Length	531	20.9
Weight (without accessories)		**kg**	**lb.**
	Net	24.7	54.5

Table 48: 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 Celeron M 550 2.0 GHz (1M L2 Cache, 533 MHz FSB) Intel GME965 GMCH/ICH8-Mz
DRAM		4 Gbyte DDR2 667 DIMM (2 x (256M x 64) PC2-5300 200 pin SODIMM (Standard)
OS		Microsoft Windows 7 Ultimate 64-bit
System Bus		PCIe
Hard Disk Drive		
	Standard	3.5 in. SATA II, 7200rpm, 160GByte (minimum size)
	Removeable (Option 56)	2.5 in. SATA II, 5400rpm, 8M buffer, 160GByte (minimum size)
	CD/DVD (Option 57)	SATA I, class 1 laser Read formats: CD-R, CD-RW, CD-ROM, DVD-R, DVD-ROM, DVD-RW, DVD+R, DVD+RW, DVD-RAM Recordable disc: CD-R, CD-RW
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 (Intel 82566MM)
	VGA	D-SUB 15 pin, rear panel - up to 2048 x1536)

Table 48: Display/computer (cont.)

Characteristic	Description
PS2	Keyboard only (rear panel)
Audio	Realtek HD Audio (ALC888), Internal speaker, Rear panel Headphone out, Mic IN

Safety

For detailed information on Safety, see the *SPECMON3 Real-Time Spectrum Analyzer and SPECMON6 Real-Time Spectrum Analyzer Quick Start User Manual*, Tektronix part number 071-3064-XX.

Certifications and Compliances

For detailed information on Certifications and Compliances, see the *SPECMON3 Real-Time Spectrum Analyzer and SPECMON6 Real-Time Spectrum Analyzer Quick Start User Manual*.

Environmental Characteristics

Table 49: Environmental characteristics

Characteristic			Description
Temperature range [1]			
	Operating		+5 °C to +40 °C
		When accessing DVD	+5 °C to +40 °C
	Non-operating		–20 °C to +60 °C
Relative Humidity			90% RH at 30 °C (No condensation) (80% RH max when accessing CD) Maximum wet-bulb temperature 29 °C
Altitude			
	Operating		Up to 3000 m (approximately 10000 ft)
	Non-operating		Up to 12190 m (40000 ft)
Vibration			

Table 49: Environmental characteristics (cont.)

Characteristic		Description
	Operating	0.22 Grms. Profile = 0.00010 g^2/Hz at 5 Hz to 350 Hz, –3dB/Octave slope from 350 Hz to 500 Hz, 0.00007 g^2/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.
	Non-operating	2.28 Grms. Profile = 0.0175 g^2/Hz at 5 Hz to 100 Hz, –3 dB/Octave slope from 100 Hz to 200 Hz, 0.00875 g^2/Hz at 200 Hz to 350 Hz, –3dB/Octave slope from 350 Hz to 500 Hz, 0.00613 g^2/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) (1 G max when accessing DVD) (DVD tray ejection may occur)
	Non-operating	296 m/s^2 (30 G), half-sine, 11 ms duration. Three shocks per axis in each direction (18 shocks total) (DVD tray ejection may occur)
Cooling Clearance		
	Both Sides	50 mm (1.97 in)

1 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 50: 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 55 Only)

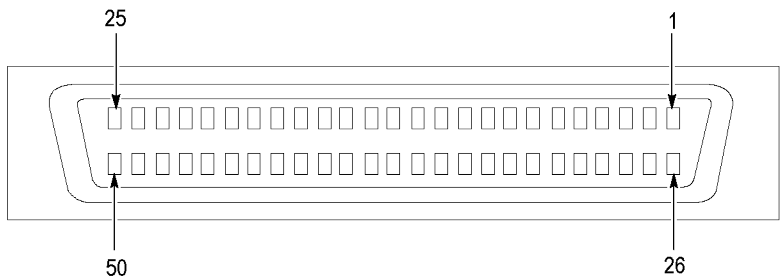

Figure 1: Digital IQ output connector pin assignment

Table 51: 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+	
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	

Table 51: I OUTPUT connector pin assignment (cont.)

Pin number	Signal name	Description
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+	
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 52: 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+	

Table 52: Q OUTPUT connector pin assignment (cont.)

Pin number	Signal name	Description
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+	
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+	

Table 52: Q OUTPUT connector pin assignment (cont.)

Pin number	Signal name	Description
22	GND	Ground
47	GND	
23	GND	
48	GND	
24	GND	
49	GND	
25	GND	
50	GND	

Table 53: 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 150 MHz, depending on the selected real-time span of the analyzer. (See Table 55.)

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 54: EXT_IQ_DAV Duty cycle versus Span

Span	EXT_IQ_CLK frequency (MHz)	EXT_IQ_DAV duty cycle (%)
60 MHz	150	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

Table 54: EXT_IQ_DAV Duty cycle versus Span (cont.)

Span	EXT_IQ_CLK frequency (MHz)	EXT_IQ_DAV duty cycle (%)
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.

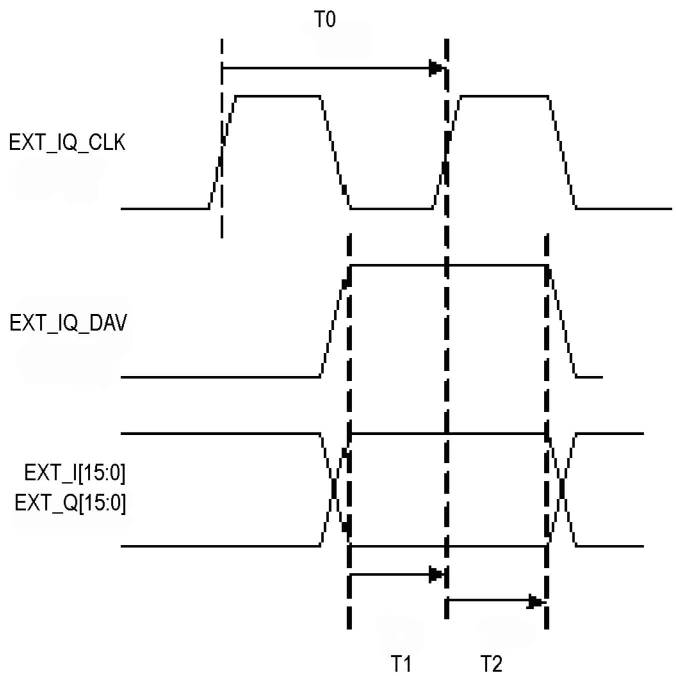

Figure 2: IQ Timing

Table 55: IQ Timing

Real Time Span	T0	T1	T2
>40 MHz	6.6 ns	1.54 ns	1.58 ns
≤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 54.) 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 ≈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:

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

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 ≥ 80 MHz for Spans > 40 MHz
- Center frequency ≥ 30 MHz for Spans > 312.5 kHz and ≤ 40 MHz
- Center frequency ≥ 2 MHz for Spans < 312.3 kHz

Performance Verification

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.*

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 analyzer application, and must be operating at an ambient temperature. (See Table 49.)

Required Equipment

The procedures, use external, traceable signal sources to directly check warranted characteristics. (See page 55, *Warranted Characteristics Tests*.) The following table lists the equipment required for this procedure.

Table 56: Equipment required for Performance Verification

Item number and	Minimum requirements	Example	Purpose
1. Frequency Counter	Frequency Range: 10 MHz; Accuracy: 1 x 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	9 kHz to 18 GHz RF Flatness: <3% Calibration factor data uncertainty: <2% (RSS)	Agilent E9304A Option H18	
4. Signal Generator	Frequency Accuracy: ±3 x 10^{-7} Output Frequency: 0 to 20 GHz	Anritsu MG3692B Options 2A, 3A, 4, 15A, 16, 22, SM5821	Checking RF flatness, intermodulation distortion, image suppression, and external reference lock check.

Table 56: Equipment required for Performance Verification (cont.)

Item number and	Minimum requirements		Example	Purpose
5. RF Signal Generator	Output Frequency 0 to 18 GHz		Anritsu MG3692B Options 2A, 3A, 4, 15A, 16, 22, SM5821	Checking phase noise and third order intermodulation distortion
	Phase Noise at Center Frequency = 1 GHz			
	Offset	**SSB Phase Noise (F) dBc/Hz**		
	10 Hz	–71		
	100 Hz	–93		
	1 kHz	–118		
	10 kHz	–121		
	100 kHz	–119		
	1 MHz	–138		
6. Precision Attenuator	30 dB			
7. Network Analyzer	10 MHz to 3 GHz 10 MHz to 14 GHz		Agilent 8757D with directional bridge [1]	Checking VSWR
8. Power Splitter			Agilent 11667A	Adjusting signal generator output level
9. Power Combiner	Range: 0 to 14 GHz Isolation: >18 dB Insertion loss: 6 dB 3 dB = 2200 MHz		Agilent 11667A with attenuators [2]	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
12. BNC Cable	50 Ω, 36 in. male to male BNC connectors		Tektronix part number 011-0049-01	Signal interconnection
13. N-N Cable	50 Ω, 36 in. male to male N connectors			Signal interconnection
14. N-SMA Cable	50 Ω, 36 in. male N to male SMA connectors			Signal interconnection
15. Termination, Precision 50 Ω	Impedance: 50 Ω Type N male			Signal interconnection
16. N-Female to BNC male Adapter			Tektronix part number 103-0058-00	N cable to analyzer connections
18. 3.5 mm (F) to 3.5 mm (F) coaxial adapter			Tektronix part number 131-8508-00	
19. N-3.5mm cable	50 Ω, 36 in. male N to male SMA connectors			

Table 56: Equipment required for Performance Verification (cont.)

Item number and	Minimum requirements	Example	Purpose
20. N-Male to 3.5 mm male adapter			
21. 3.5 mm attenuator	3 dB (two required)	Midwest Microwave ATT-0550-03-35M-02	Checking third order intermodulation distortion

1 The Agilent 85027A Directional Bridge can be used.

2 The Agilent 11667A Power Splitter can be used.

Preliminary Checks

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

Fan Check

Plug in the analyzer, power it on, and check that the fans located on the left side of the analyzer are operating.

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

Warm-up

Make sure the 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.*

CD Drive Check

Press the button on the DVD-R/W drive (Option 57 only) and verify that the tray door opens. Press the button again to close it.

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 analyzer rear-panel.
      - Check with a voltmeter that the voltage is 28 V ±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 SPECMON3 and SPECMON6 Spectrum Analyzer performance is within the warranted specifications.

Frequency Accuracy

Check Reference Output Frequency Accuracy

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

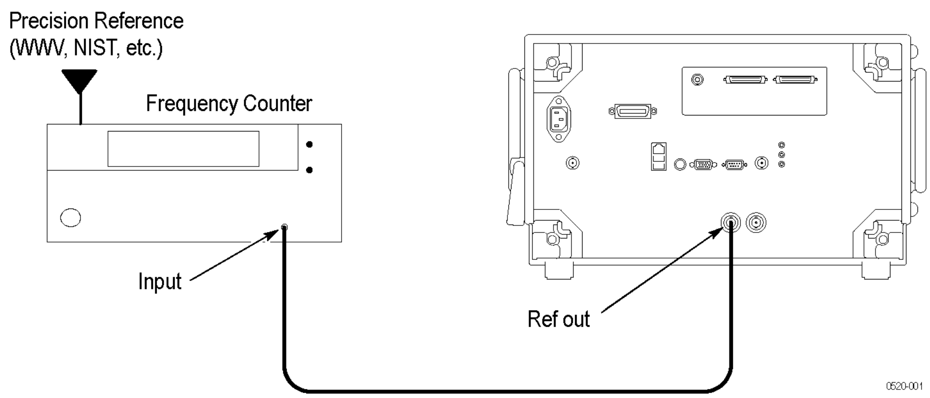

Figure 3: Connections for Reference Frequency Output Accuracy check

3. Set the Frequency counter:

Function	Frequency
Gate time	2 s

4. Check that the frequency counter reads 10 MHz ±4 Hz. Enter the frequency in the test record.

Check Reference Output Power Level

1. Set up the power meter and sensor.

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

---

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

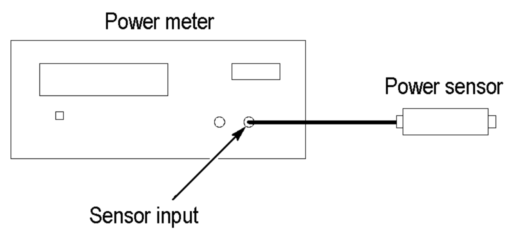

Figure 4: Power meter setup

   b. Press **Zero/Cal**, 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.

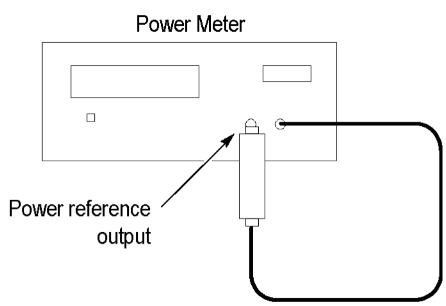

Figure 5: Power meter calibration

   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 SPECMON analyzer rear-panel, using the N-female to BNC male adapter (see the following figure).

3. Press **Frequency/Cal Factor**, then set **Freq** to 10 MHz.

4. Check that the Ref Out signal is >0 dBm. Enter this level in the test record.

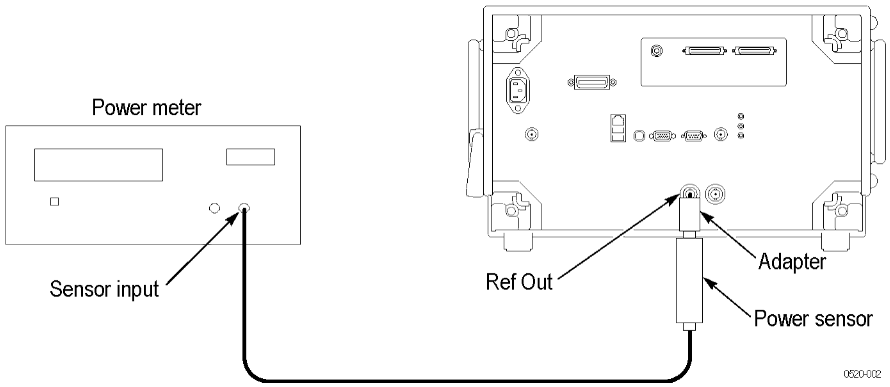

Figure 6: Equipment connections for Ref Out power level check

External Reference Input Level

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

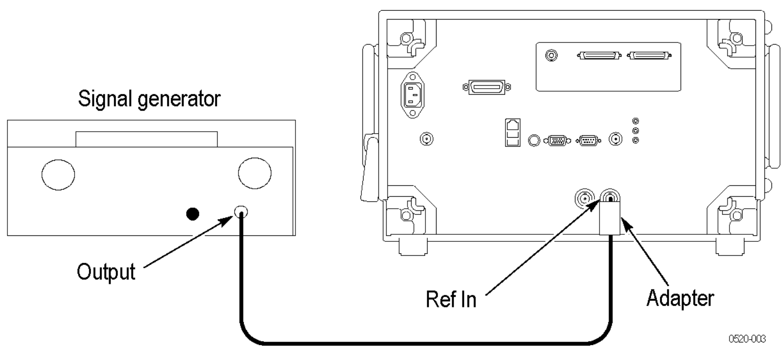

Figure 7: Equipment connections for Ref In power level check

2. Set the Signal generator controls:

Frequency	10 MHz
Level	0 dBm
RF	On

3. Set the analyzer 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).

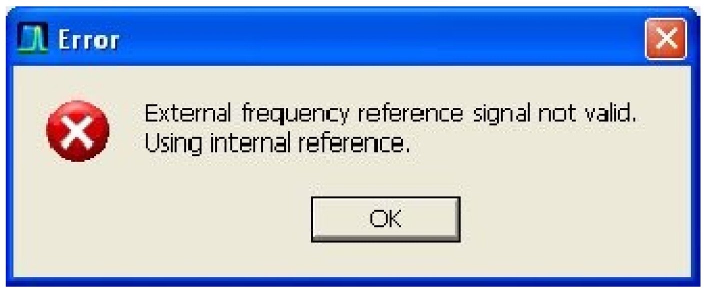

Figure 8: Error message showing loss of lock to External Reference signal

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.

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 (See page 60, *Phase Noise (Instruments without Option 11)*.) that follows.

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 94, Spurious Response.)*

1. Connect the generator output to the RTSA RF Input, using a 50 Ω N-N coaxial cable (see the following figure).

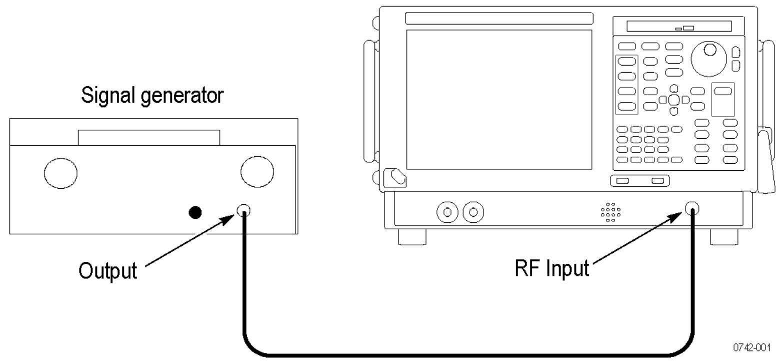

Figure 9: Equipment connections for phase noise checks

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

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 (See page 58, *Phase Noise (Instruments with Option 11)*.) procedure.

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 94, Spurious Response.)*

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1. Connect the generator output to the RTSA RF Input, using a 50 Ω N-N coaxial cable (see the following figure).

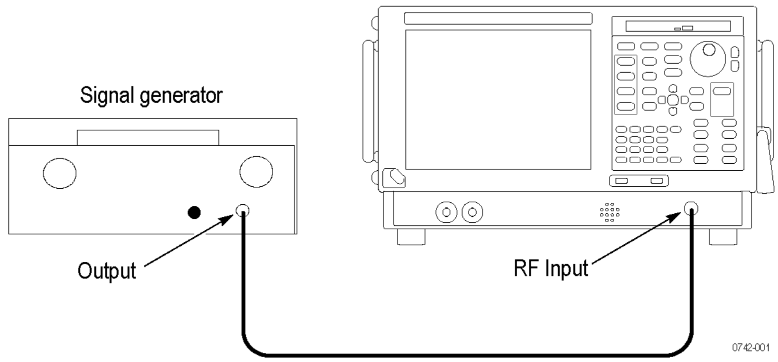

Figure 10: Equipment connections for phase noise checks

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

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 through :

Table 57: 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 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 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.

For example, if Carrier Power = 4.7 dBm and M1 = -145.1 dBm/Hz, then M1-Carrier Power = – 49.8 dBc/Hz.

g. Enter the value obtained at 6 MHz in the test record for phase noise at 6 MHz.

11. Obtain the phase noise at 10 MHz offset. Start by setting the analyzer to the settings below:

a. Center Frequency (Center key): 1010 MHz.

b. Span (Span key): 10 kHz.

c. Select **Run** > **Run Single**.

d. Set the Marker Frequency to 1010 MHz.

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 94, Spurious Response.)*

e. Read the noise amplitude on marker **M1** in dBm/Hz.

f. Subtract the value of the Carrier Power marker obtained in step 8 to obtain the phase noise amplitude at +10 MHz.

For example, if Carrier Power = 4.7 dBm and M1 = –146.1 dBm/Hz,

Then M1-Carrier Power = –150.8 dBc/Hz.

g. Enter the value obtained at 10 MHz in the test record for phase noise at 10 MHz.

RF Input

Input VSWR (Preamp OFF)

1. Connect the SPECMON3 or SPECMON6 and the Network Analyzer as shown in the following figure.

NOTE. *Verify that the network analyzer is properly calibrated, as specified by the manufacturer, before taking measurements on the SPECMON analyzer.*

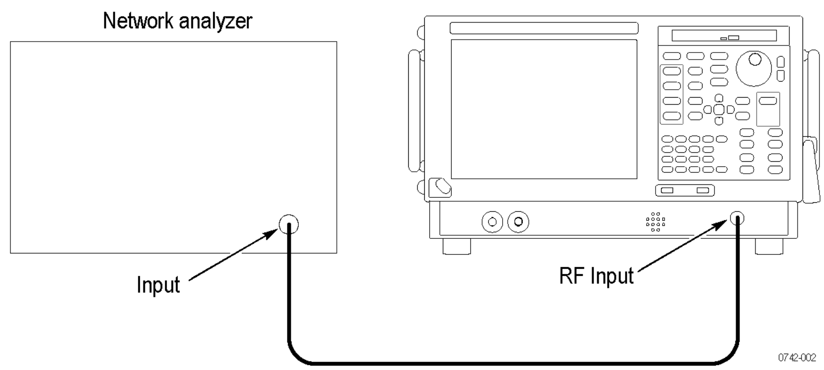

Figure 11: Equipment connections for VSWR check

2. Reset the SPECMON analyzer to factory defaults: select **Setup** > **Preset (Main)**.
3. Select **Setup** > **Amplitude** > **Internal Settings**. Deselect the **Auto** check box and set the **Internal Attenuator** value to 10 dB.
4. Set up the Network Analyzer as follows:
   a. Preset.
   b. Calibration > Cal Set > [select appropriate Cal Set] > OK.
   c. Trace > Format > SWR > OK
   d. Scale > Scale > Per Division > 100 mUnits > OK.
   e. Set Span (F4) to 100 MHz.
5. Set the Center frequency of the SPECMON analyzer to each frequency in the VSWR test frequencies table. Set the Network Analyzer center frequency [Start/Center > Center (F3)] to the same frequency. Press Marker Search > MAX (F1) and record the value in the table.
6. Enter the highest VSWR in the table in the test record.
7. SPECMON6 only: Set the Center frequency of the SPECMON to each frequency in the SPECMON6 VSWR test frequencies table. Set the Network

Analyzer center frequency [Start/Center > Center (F3)] to the same frequency. Press Marker Search > MAX (F1) and record the value in the table.

8. SPECMON6 only: Enter the highest VSWR in the table in the test record.

Table 58: SPECMON3 VSWR Test Frequencies (MHz)

60	560	1060	1560	2060	2560
160	660	1160	1660	2160	2660
260	760	1260	1760	2260	2760
360	860	1360	1860	2360	2860
460	960	1460	1960	2460	2960

Table 59: SPECMON6 VSWR Test Frequencies (GHz)

3.05	3.55	4.05	4.55	5.05	5.55	6.05
3.15	3.65	4.15	4.65	5.15	5.65	6.15
3.25	3.75	4.25	4.75	5.25	5.75	
3.35	3.85	4.35	4.85	5.35	5.85	
3.45	3.95	4.45	4.95	5.45	5.95	

Input VSWR (Preamp ON - Option 50 Only)

1. Reset the SPECMON analyzer to factory defaults: select **Setup** > **Preset (Main)**.
2. Select **Setup** > **Amplitude** > **Internal Settings**. Deselect the **Auto** check box and set the Internal Attenuator to 10 dB.
3. Select **Setup** > **Amplitude** > **Internal Settings**. Select the **Internal Preamp** check box.
4. Set up the Network Analyzer as follows:
   - Preset.
   - Calibration > Cal Set > [select appropriate Cal set] > OK.
   - Trace > Format > SWR > OK.
   - Scale > Scale > Per Division > 100 mUnits > OK.
   - Set Span (F4) to 100 MHz.
5. Set the Center frequency of the SPECMON analyzer to each frequency in the SPECMON VSWR Preamp On Test Frequencies table. Set the Network Analyzer center frequency (Start /Center > Center (F3)) to the same frequency. Press Marker Search > MAX (F1) and record the value in the table.

Table 60: SPECMON VSWR Preamp On test frequencies (MHz)

60	560	1060	1560	2060	2560
160	660	1160	1660	2160	2660
260	760	1260	1760	2260	2760
360	860	1360	1860	2360	2860
460	960	1460	1960	2460	2960

6. Enter the highest VSWR in the table in the test record.
7. **SPECMON6 only:** Set the Center frequency of the SPECMON6 to each frequency in the SPECMON6 VSWR Preamp On Test Frequencies table. Set the Network Analyzer center frequency (Start /Center > Center (F3)) to the same frequency. Press Marker Search > MAX (F1) and record the value in the table.

Table 61: SPECMON6 VSWR Preamp On Test Frequencies (GHz)

3.05	3.55	4.05	4.55	5.05	5.55	6.05
3.15	3.65	4.15	4.65	5.15	5.65	6.15
3.25	3.75	4.25	4.75	5.25	5.75	
3.35	3.85	4.35	4.85	5.35	5.85	
3.45	3.95	4.45	4.95	5.45	5.95	

8. **SPECMON6**: Enter the highest VSWR in the table in the test record.

Amplitude

RF Flatness (Frequency Response) 10 MHz to 6.2 GHz

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

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

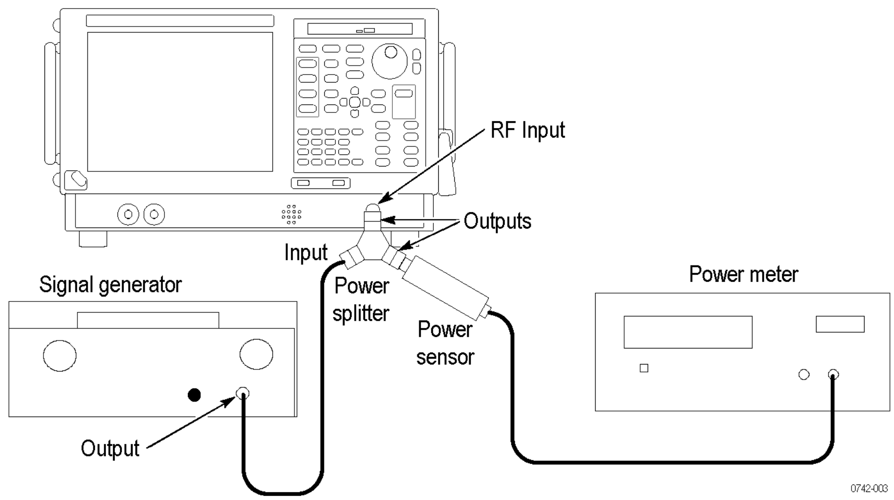

Figure 12: Equipment connections for RF Flatness check

2. To record the test readings, you can make a printout of the following table. (See Table 62.)
3. Reset the SPECMON analyzer to factory defaults: Setup > Preset (Main).
4. Select **Tools** > **Alignments** and then select **Align Now**.
5. Set the SPECMON analyzer as follows:

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

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 SPECMON 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 ± 0.5 dBm.
10. Record the Power Meter reading and the SPECMON analyzer marker reading in the following table.
11. Set both the RF Generator output frequency and the SPECMON analyzer 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 ΔPower Meter number: subtract the Power meter reading at 100 MHz from the Power Meter reading at this frequency.
14. Calculate the ΔRTSA number: subtract the RTSA reading at 100 MHz from the RTSA reading at this frequency.
15. Calculate the RF Flatness Error:

    RF Flatness Error = ΔRTSA at this freq – ΔPower 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. (See Table 62.)

Table 62: RF Flatness (Preamp OFF)

Attenuator = 10 dB

Frequency	Power meter reading	Δ Power meter (vs. 100 MHz)	RTSA reading	Δ RTSA reading (vs. 100 MHz)	RF flatness error [1]
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					

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

Attenuator = 10 dB					
Frequency	Power meter reading	Δ Power meter (vs. 100 MHz)	RTSA reading	Δ RTSA reading (vs. 100 MHz)	RF flatness error [1]
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					
SPECMON6 only					
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 62: RF Flatness (Preamp OFF) (cont.)

Attenuator = 10 dB

Frequency	Power meter reading	Δ Power meter (vs. 100 MHz)	RTSA reading	Δ RTSA reading (vs. 100 MHz)	RF flatness error [1]
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					

1 Use the formula in Step 15

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

10 MHz - 3 GHz (Preamp OFF)

3 GHz - 6.2 GHz (Preamp Off, SPECMON6 only)

Low Frequency (LF) Input Path Accuracy

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

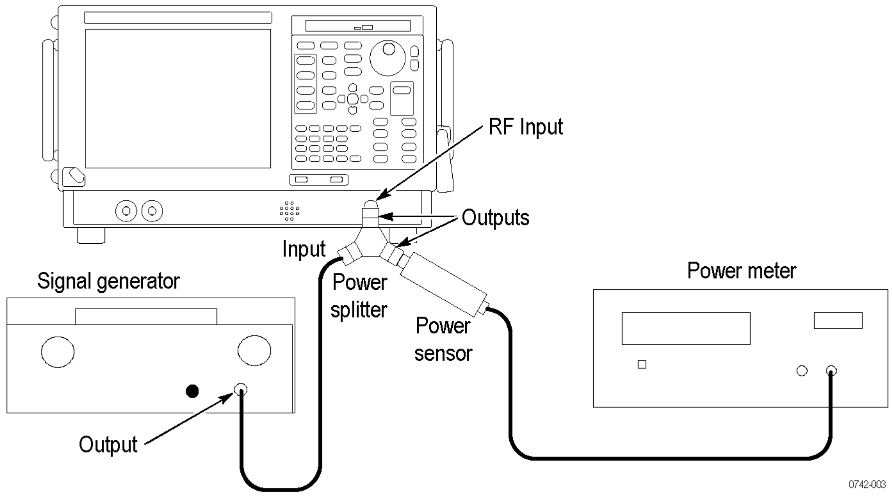

Figure 13: Equipment connections for Low Frequency (LF) input path accuracy check

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

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

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 SPECMON analyzer 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 maker reading of –20 ± 0.5 dBm.
10. Record the Power Meter reading and the SPECMON analyzer marker reading in the following table.
11. Set both the RF generator output frequency and the SPECMON analyzer 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 SPECMON analyzer marker reading in the following table.
14. Calculate the Δ Power Meter number: subtract the Power Meter reading at 10 MHz from the Power Meter reading at this frequency.
15. Calculate the Δ RTSA number: subtract the RTSA reading at 10 MHz from the RTSA reading at this frequency.
16. Calculate the RF Flatness Error:

    RF Flatness Error = Δ RTSA at this freq - Δ 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 (Preamp OFF)

Attenuator = 10 dB

Frequency	Power meter reading	Δ Power meter (vs. 10 MHz)	RTSA reading	Δ RTSA reading (vs. 10 MHz)	RF flatness error [1]
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					

Table 63: Low Frequency Input Path Flatness (Preamp OFF) (cont.)

Attenuator = 10 dB

Frequency	Power meter reading	Δ Power meter (vs. 10 MHz)	RTSA reading	Δ RTSA reading (vs. 10 MHz)	RF flatness error [1]
22 MHz					
23 MHz					
24 MHz					
25 MHz					
26 MHz					
27 MHz					
28 MHz					
29 MHz					
30 MHz					
31 MHz					
31.49 MHz					

[1] 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 (Preamp OFF)

RF Flatness (Frequency Response) 10 MHz to 6.2 GHz , Preamp On (Option 50 Installed)

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

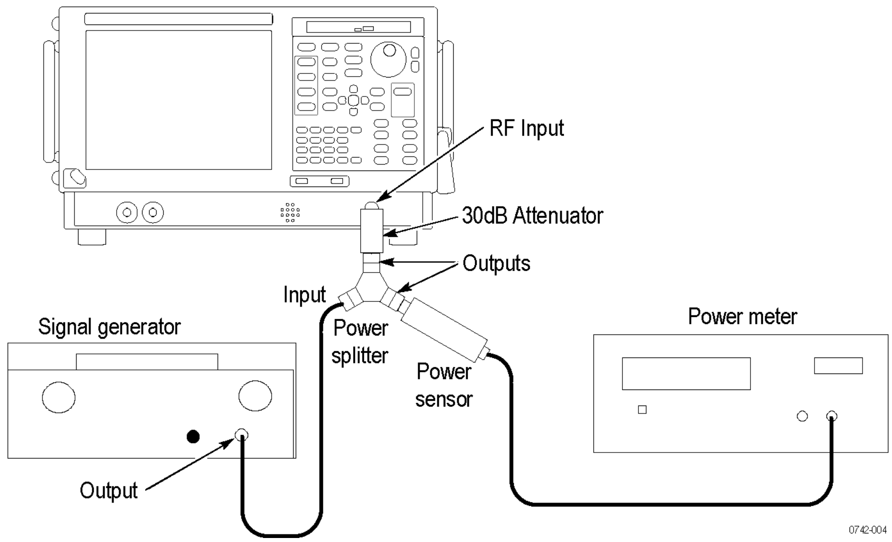

Figure 14: Equipment connections for RF Flatness (Frequency Response) 10 MHz to 6.2 GHz check

2. Reset the SPECMON analyzer to factory defaults: select **Setup** > **Preset (Main)**.
3. Select **Tools** > **Alignments** and then select **Align Now**.
4. Set the SPECMON analyzer 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 SPECMON analyzer 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 SPECMON analyzer marker reading in the following table.
9. Set both the RF generator output frequency and the SPECMON analyzer 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 ΔPower Meter number: subtract the Power Meter reading at 100 MHz from the Power Meter reading at this frequency.
12. Calculate the ΔRTSA number: subtract the RTSA reading at 100 MHz from the RTSA reading at this frequency.
13. Calculate the RF Flatness Error:

    RF Flatness Error = ΔRTSA at this freq - ΔPower Meter at this freq + 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 Preamp ON)

Attenuator = 10 dB

Frequency	Power meter reading	Δ Power meter (vs. 100 MHz)	RTSA reading	Δ RTSA reading (vs. 100 MHz)	30 dB attenuator	Δ30 dB attentuator	RF flatness error [1]
100 MHz		0		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 Preamp ON) (cont.)

Attenuator = 10 dB							
Frequency	Power meter reading	∆ Power meter (vs. 100 MHz)	RTSA reading	∆ RTSA reading (vs. 100 MHz)	30 dB attenuator	Δ30 dB attentuator	RF flatness error [1]
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							
SPECMON6 only							
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 Preamp ON) (cont.)

Attenuator = 10 dB

Frequency	Power meter reading	∆ Power meter (vs. 100 MHz)	RTSA reading	∆ RTSA reading (vs. 100 MHz)	30 dB attenuator	Δ30 dB attentuator	RF flatness error [1]
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							

1 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 MHz - 6.2 GHz (Preamp On, SPECMON6 only)

Low Frequency (LF) Input Path, Preamplifier On Accuracy (Option 50 Only)

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

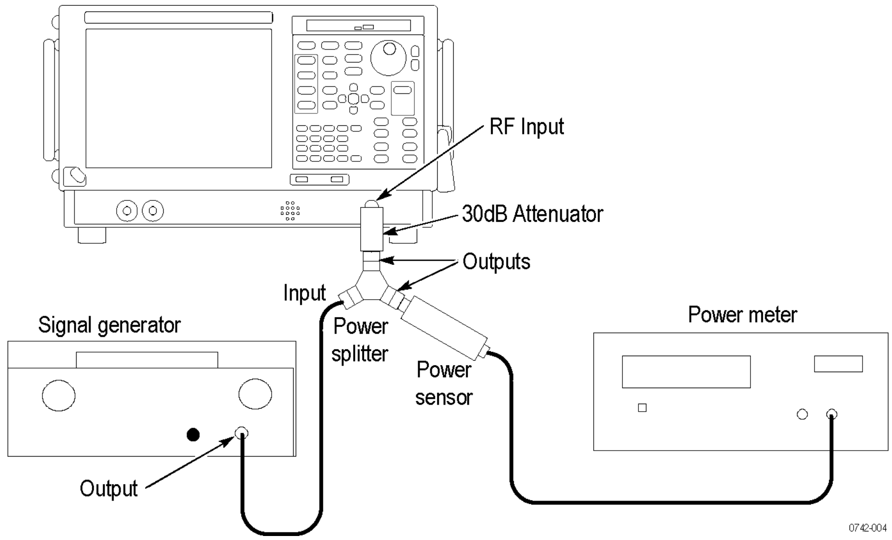

Figure 15: Equipment connections for Low Frequency (LF) input path accuracy check

NOTE. *The power splitter outputs should connect directly to the SPECMON analyzer RF Input and to the Power Sensor, without using cables. The 30 dB attenuator is connected between the power splitter and the SPECMON analyzer RF input connector.*

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

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

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 SPECMON analyzer Center Frequency to the first frequency shown in the table *Low Frequency Input Path Flatness (Preamp ON)* (See Table 65.). This is the reference frequency.
7. Select the **Markers Peak** key to set the Reference Marker (MR) to the carrier peak.
8. Adjust the RF signal generator level for a marker reading of –50 ±0.5 dBm
9. Record the Power Meter reading and the SPECMON analyzer marker reading in the following table. (See Table 65.)
10. Set both the RF generator output frequency and the SPECMON analyzer Center Frequency to the next frequency in the table. (See Table 65.)
11. Select the **Markers Peak** key to set the Reference Marker (MR) to the carrier peak.
12. Record the Power Meter reading and the SPECMON analyzer marker reading in the following table. (See Table 65.)
13. Calculate the ΔPower Meter number: subtract the Power Meter reading at 10 MHz from the Power Meter reading at this frequency.
14. Calculate the ΔRTSA number: subtract the RTSA reading at 10 MHz from the RTSA reading at this frequency.
15. Calculate the RF Flatness Error:

    RF Flatness Error = ΔRTSA at this freq - ΔPower Meter at this frequency + delta 30 dB attenuator at this frequency

    Readings are in dBm and error is in dB.
16. Repeat steps 10 through 15 for each of the center frequencies shown in the following table.

Table 65: Low Frequency Input Path Flatness (Preamp ON)

Attenuator = 10 dB

Frequency	Power meter reading	Δ Power meter (vs. 10 MHz)	RTSA reading	Δ RTSA reading (vs. 10 MHz)	30 dB attenuator	Δ30 dB attenuator	RF flatness error [1]
10 MHz			0			0	0
11 MHz							
12 MHz							
13 MHz							
14 MHz							
15 MHz							

Table 65: Low Frequency Input Path Flatness (Preamp ON) (cont.)

Attenuator = 10 dB

Frequency	Power meter reading	∆ Power meter (vs. 10 MHz)	RTSA reading	∆ RTSA reading (vs. 10 MHz)	30 dB attenuator	∆30 dB attenuator	RF flatness error [1]
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							

1 Use the formula in Step 15

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

    10 MHz - 32 MHz (Preamp ON)

Absolute Accuracy at Calibration Point, RF Path

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

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 SPECMON analyzer marker amplitude.
9. Calculate the Absolute Amplitude Accuracy:

   Delta = SPECMON reading - 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 25.1 MHz (Option 40 or 110).

Absolute Accuracy at Calibration Point, LF path

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

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	*Use Low Freq signal path* checked
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 SPECMON analyzer marker amplitude.

8. Calculate the Absolute Amplitude Accuracy:

   Delta = SPECMON reading - 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.)

Noise and Distortion

Third Order Intermodulation Distortion

1. Set up the RF sinewave generators, Lowpass filters, Signal Combiner, and SPECMON analyzer as shown in the following figure.

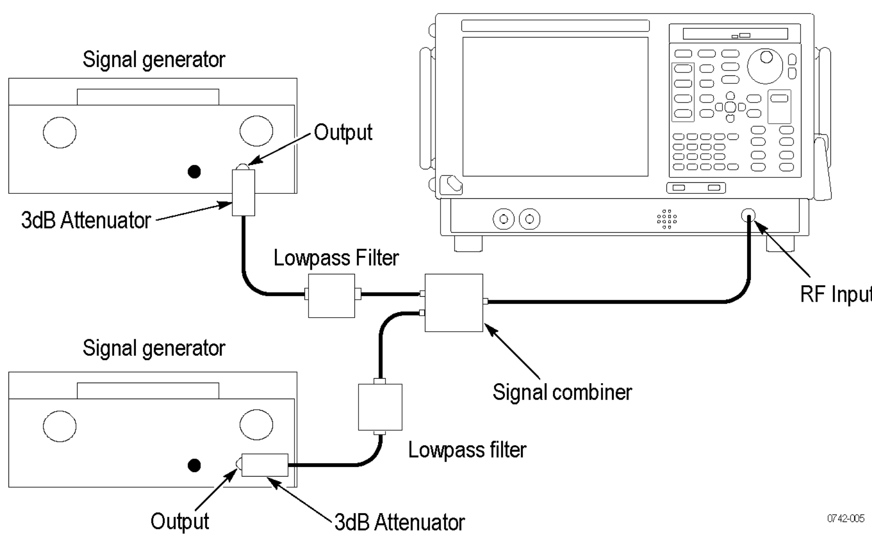

Figure 16: Equipment connections for Third Order Intermodulation Distortion check

2. Reset the SPECMON analyzer to factory defaults: select **Setup > Preset (Main)**.

3. Select **Tools** > **Alignments** and select **Align Now**.

4. Set the SPECMON analyzer:

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 SPECMON analyzer Function to Normal (Setup > Settings > Traces > Function > Normal).

   c. Set the SPECMON analyzer Center frequency to 2.1295 GHz. Press the **Markers Peak** key. Adjust the first generator output level for a marker reading of –25.0dBm. Record this as carrier #1.

   d. Set the SPECMON analyzer 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 SPECMON analyzer 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:

      TOI = step a – step b

DANL - Preamp OFF, LF Path

1. Terminate the SPECMON analyzer RF Input with a 50 Ω terminator.

2. Reset the SPECMON analyzer to factory defaults: select **Setup > Preset (Main)**.

3. Select **Tools** > **Alignments** and select **Align Now**.

4. Set the SPECMON analyzer:

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

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 SPECMON analyzer 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.). Also, refer to the Spurious Response section of this procedure to determine whether or not a residual spur is within the specification.* *(See page 94, Spurious Response.)*

Table 66: 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 SPECMON analyzer to factory defaults: select **Setup** > **Preset (Main)**.

2. Select **Tools** > **Alignments** and select **Align Now**.

3. Set the SPECMON analyzer:

Reference Level Setup > Amplitude > Internal Settings > Ref Level	–50 dBm
Internal Attenuator Setup > Amplitude > Internal Settings > Internal Attenuator	0 dB (Auto unchecked)

RF & IF Optimization Setup > Amplitude > RF & IF Optimization	Minimize Noise
Center Frequency Setup > Settings > Freq & Span > Center	10 MHz
Span Setup > Settings > Freq & Span > span	100 kHz
RBW Setup > Settings > BW > RBW	Auto (box checked)
Detection Setup > Settings > Traces > Detection	Avg (of logs)
Function Setup > Settings > Traces > Function	Avg (of logs)
Count Setup > Settings > Traces > Function	1000 (Count box checked)
LF Path Setup > Acquire > Input Params	*Use Low Freq Signal path* box 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 SPECMON analyzer 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 67: Frequencies of interest for DANL (RF Path)

Center frequency	Marker noise level	Frequency range
1.1 MHz		1 MHz — 10 MHz
9.9 MHz		
10 MHz		10 MHz - 2.0 GHz
1.99 GHz		
2.01 GHz		2.0 GHz - 3.0 GHz
2.99 GHz		

Table 67: Frequencies of interest for DANL (RF Path) (cont.)

Center frequency	Marker noise level	Frequency range
3.01 GHz		3.0 GHz - 4.0 GHz (SPECMON6 only)
3.99 GHz		
4.01 GHz		4 GHz - 6.2 GHz (SPECMON6 only)
6.2 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 Only)

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

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

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 SPECMON analyzer 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 94, Spurious Response.)*

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

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

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

1. Reset the SPECMON analyzer to factory defaults: select **Setup** > **Preset (Main)**.

2. Select **Tools** > **Alignments** and select **Align Now**.

3. Set the SPECMON analyzer:

Reference Level Setup > Amplitude > Internal Settings > Ref Level	–50 dBm
Internal Attenuator Setup > Amplitude > Internal Settings > Internal Attenuator	0 dB (Auto unchecked)
RF & IF Optimization Setup > Amplitude > RF & IF Optimization	Minimize Noise

Internal Preamp Setup > Amplitude > Internal Settings > Internal Preamp	ON (Internal Preamp box checked)
Center Frequency Setup > Settings > Freq & Span > Center	1.1 MHz
Span Setup > Settings > Freq & Span > span	100 kHz
RBW Setup > Settings > BW > RBW	Auto (box checked)
Detection Setup > Settings > Traces > Detection	Avg (of logs)
Function Setup > Settings > Traces > Function	Avg (of logs)
Count Setup > Settings > Traces > Function	100 (Count box checked)
LF Path Setup > Acquire > Input Params	*Use Low Freq Signal path* box 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 SPECMON analyzer 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 94, Spurious Response.)*

Table 69: Frequencies of interest for DANL check (Option 50)

Center frequency	Marker Noise level	Frequency range
1.1 MHz		1 MHz - 10 MHz
9.9 MHz		
10.1 MHz		10 MHz - 2 GHz
1.99 GHz		
2.01 GHz		2 GHz - 3 GHz
2.99 GHz		
3.01 GHz		3 GHz - 6.2 GHz (SPECMON6 only)
6.2 GHz		

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 SPECMON analyzer as shown in the following figure.

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

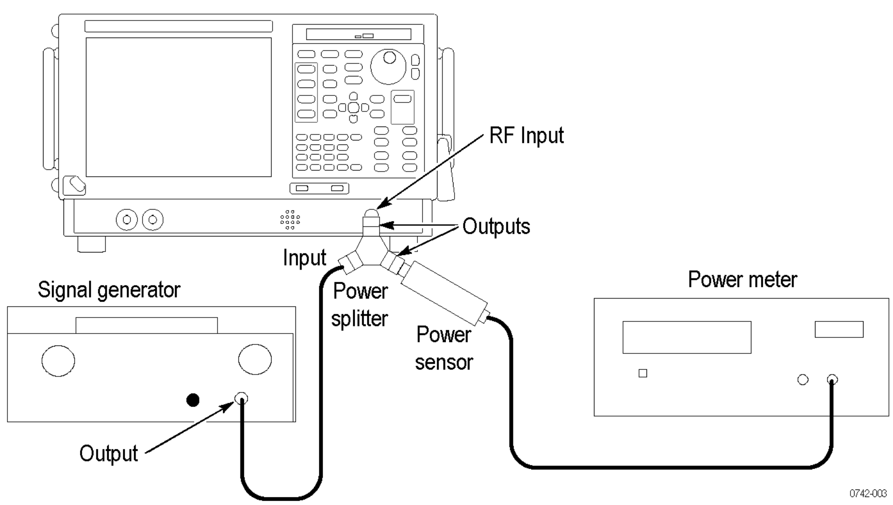

Figure 17: Equipment connections for IF Flatness check

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

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 SPECMON analyzer marker reading in the IF Flatness table. (See Table 70.).
9. Set the RF generator output frequency to the next frequency in the IF Flatness table that follows.
10. Leave the SPECMON analyzer center frequency at 200 MHz and press the **Markers Peak** key.
11. Record the Power Meter reading and the SPECMON analyzer marker reading in the IF Flatness table.
12. Calculate the Δ Power Meter number: subtract the Power Meter reading at 200 MHz from the Power Meter reading at this frequency.
13. Calculate the Δ RTSA number: subtract the SPECMON analyzer marker reading at 200 MHz from the SPECMON analyzer marker reading at this frequency.
14. Calculate the IF Flatness Error using the formula:

    RF Flatness Error = Δ RTSA at this freq - Δ 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 110 only.) Repeat steps 4 through 16 for a 110 MHz Span setting.

Table 70: IF Flatness

Generator Frequency	RTSA reading	Δ RTSA reading (vs. 200 MHz)	Power meter reading	Δ power meter reading (vs. 200 MHz)	Calculated IF Flatness Error
Span = 300 kHz					
200 MHz		0		0	0
199.85 MHz					
199.88 MHz					
199.91 MHz					
199.94 MHz					
199.97 MHz					
200.03 MHz					
200.06 MHz					
200.09 MHz					
200.12 MHz					
200.15 MHz					
Span = 20 MHz					
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					
Span = 25 MHz					
187.5 MHz		0		0	0
190 MHz					
192.5 MHz					
195 MHz					
197.5 MHz					
200 MHz					
202.5 MHz					
205 MHz					
207.5 MHz					
210 MHz					

Table 70: IF Flatness (cont.)

Span = 25 MHz			
210.5 MHz			
212.5 MHz			
Span = 110 MHz (Option 110 only)			
200 MHz	0	0	0
157.5 MHz			
166 MHz			
174.5 MHz			
183 MHz			
191.5 MHz			
208.5 MHz			
217 MHz			
225.5 MHz			
234 MHz			
242.5 MHz			

Spurious Response

Residual Response

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

Ref Level	–50 dBm
Setup > Amplitude >	
Internal Attenuator	0 dB (Auto unchecked)
Setup > amplitude > Internal Settings > Internal Attenuator	
Span	25 MHz
Setup > Settings > Freq & Span > span	
RBW	1 kHz
Setup > Settings > BW > RBW	
Function	Avg (VRMS)
Setup > Settings > Traces > Function	
Count	20 (Count checked)
Setup > Settings > Traces	

5. Set the Frequency (Freq key) to each frequency in the Residual Response Center Frequencies table. (See Table 71.) Wait for the 20 averages to complete, then press the **Markers** > **Peak** key and record the marker amplitude in the following table, , from 200 MHz to 3.0 GHz (SPECMON3) or 200 MHz to 6.2 GHz (SPECMON6).

6. Enter the highest of these signal levels into the test record.

Table 71: Residual Response Center Frequencies

MHz	GHz	GHz	GHz	GHz
200	1.500	2.800	4.100	5.400
225	1.525	2.825	4.125	5.425
250	1.550	2.850	4.150	5.450
275	1.575	2.875	4.175	5.475
300	1.600	2.900	4.200	5.500
325	1.625	2.925	4.225	5.525
350	1.650	2.950	4.250	5.550
375	1.675	2.975	4.275	5.575
400	1.700	3.000	4.300	5.600
425	1.725	3.025	4.325	5.625
450	1.750	3.050	4.350	5.650
475	1.775	3.075	4.375	5.675
500	1.800	3.100	4.400	5.700
525	1.825	3.125	4.425	5.725
550	1.850	3.150	4.450	5.750
575	1.875	3.175	4.475	5.775
600	1.900	3.200	4.500	5.800
625	1.925	3.225	4.525	5.825
650	1.950	3.250	4.550	5.850
675	1.975	3.275	4.575	5.875
700	2.000	3.300	4.600	5.900
725	2.025	3.325	4.625	5.925
750	2.050	3.350	4.650	5.950
775	2.075	3.375	4.675	5.975
800	2.100	3.400	4.700	6.000
825	2.125	3.425	4.725	6.025
850	2.150	3.450	4.750	6.050
875	2.175	3.475	4.775	6.075
900	2.200	3.500	4.800	6.100
925	2.225	3.525	4.825	6.125
950	2.250	3.550	4.850	6.150

Table 71: Residual Response Center Frequencies (cont.)

MHz	GHz	GHz	GHz	GHz
975	2.275	3.575	4.875	6.175
1000	2.300	3.600	4.900	6.200
1025	2.325	3.625	4.925	– – –
1050	2.350	3.650	4.950	– – –
1075	2.375	3.675	4.975	– – –
1100	2.400	3.700	5.000	– – –
1125	2.425	3.725	5.025	– – –
1150	2.450	3.750	5.050	– – –
1175	2.475	3.775	5.075	– – –
1200	2.500	3.800	5.100	– – –
1225	2.525	3.825	5.125	– – –
1250	2.550	3.850	5.150	– – –
1275	2.575	3.875	5.175	– – –
1300	2.600	3.900	5.200	– – –
1325	2.625	3.925	5.225	– – –
1350	2.650	3.950	5.250	– – –
1375	2.675	3.975	5.275	– – –
1400	2.700	4.000	5.300	– – –
1425	2.725	4.025	5.325	– – –
1450	2.750	4.050	5.350	– – –
1475	2.775	4.075	5.375	– – –

Image Suppression

1. Connect the RF generator capable of at least 20 GHz to the SPECMON analyzer RF Input, as shown in the following figure.

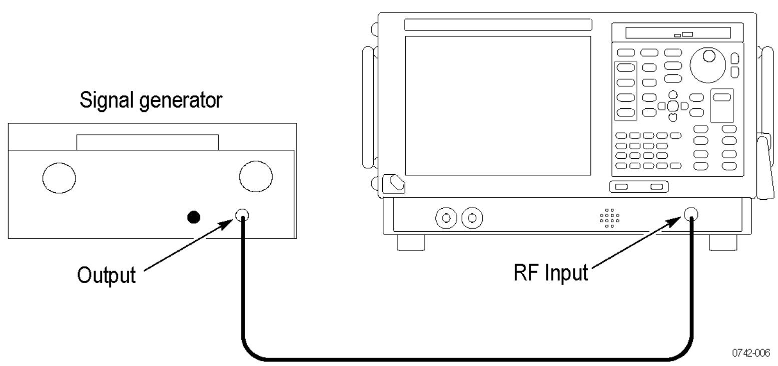

Figure 18: Equipment connections for Image Suppression check

2. Reset the SPECMON analyzer to factory defaults: select **Setup** > **Preset (Main)**.

3. Select **Tools** > **Alignments** and select **Align Now**.

4. Set the SPECMON analyzer:

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

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):

   a. Set the SPECMON analyzer to the Center Frequency shown in the first column.

   b. Set the RF signal generator frequency to that shown in the first column.

   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 generator output frequency to the Image Frequency shown in the second column.

   g. Set **Function** to **Avg(VRMS)** (Setup>Settings>Traces>Function).

   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 screen. Subtract the carrier level (step e) from the signal image amplitude (step h), to convert it to dBc.

   j. Enter this value in the test record.

7. Repeat steps 4 through 6 for each frequency in the following table.

Table 72: Image Suppression Settings

SPECMON Center Frequency	RF Generator Output Frequency (Image)
29 MHz (LF Path)	229 MHz
2.0 GHz	16.03 GHz
3.0 GHz	17.03 GHz
SPECMON6 only	
5.95 GHz	19.98 GHz

NOTE. *The intent of the image spurious test is to measure spurious responses caused by the injection 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 Spectrum 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 spectrum analyzer terminated in 50 ohms. Residual spurs are subject to separate specification limits.

Spurious Response with Signal

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

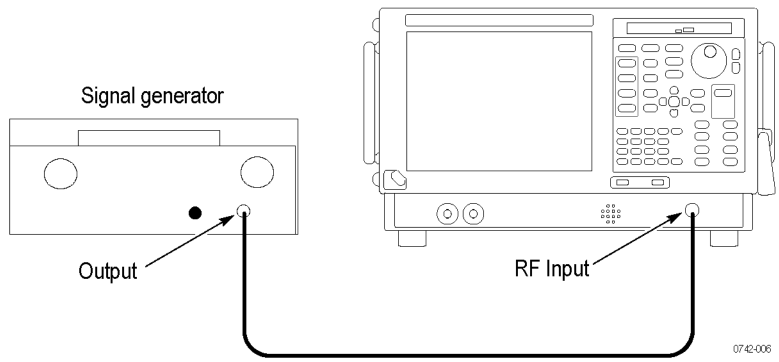

Figure 19: Equipment connections for Signal Spurious check

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

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 110: -42.5 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 110: -42.5 MHz) to -400 kHz and 400 kHz to 12.5 MHz (Option 110: 42.5 MHz).
12. (Option 110 only) Set the SPECMON analyzer Span (Setup > Settings > Freq & Span > Span) to 110 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 SPECMON analyzer RF Input. (See Figure 19.)

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

---

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

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

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

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 73.)

b. Set the SPECMON analyzer Center Frequency to the frequency in the *Center Frequencies for Half-IF* table. (See Table 73.)

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 3.5075 GHz.

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.

Table 73: Center Frequencies for Half-IF

1 GHz	4 GHz (SPECMON6 only)
2 GHz	5 GHz (SPECMON6 only)
3 GHz	6 GHz (SPECMON6 only)

7. Repeat step for each entry in the table.

Test Record

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

SPECMON 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 [1]	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

1 Phase noise = –(cursor measurement – carrier power)

Input VSWR		Test Result	High limit
Preamp OFF			
	10 MHz - 3 GHz		1.4
	>3 GHz - 6.2 GHz (SPECMON6 only)		1.6

Input VSWR		Test Result	High limit
Preamp ON (Option 50 only)			
	10 MHz - 3 GHz (SPECMON3)		1.6
	10 MHz – 6.2 GHz (SPECMON6)		1.6

RF Input Flatness		Low limit	Test Result	High limit
Attenuator = 10 dB				
	10 MHz - 3 GHz (Preamp OFF)	–0.35 dB		+0.35 dB
	10 MHz - 3 GHz (Preamp ON)	–0.5 dB		+0.5 dB
	3 GHz - 6.2 GHz (Preamp OFF, SPECMON6 only)	–0.5 dB		+0.5 dB
	3 GHz – 6.2 GHz (Preamp ON, SPECMON6 only)	–0.7 dB		+0.7 dB

LF Input Path Flatness		Low limit	Test Result	High limit
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

Absolute accuracy at calibration point	Low limit	Test Result	High limit
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

Third Order Intermodulation Distortion	Test Result	High limit
2.130 GHz		–84 dBc

Displayed Average Noise Level (DANL)		Test Result	High limit
Preamp OFF			
	4 kHz – 10 kHz (LF Path)		–141 dBm/Hz
	10 kHz – 32 MHz (LF Path)		–150 dBm/Hz
	1 MHz – 10 MHz		–136 dBm/Hz
	10 MHz – 2 GHz		–154 dBm/Hz
	2 GHz – 3 GHz		–153 dBm/Hz
	3 GHz – 4 GHz (SPECMON6)		–151 dBm/Hz
	4 GHz – 6.2 GHz (SPECMON6 only)		–149 dBm/Hz
Preamp ON (Option 50 only)			
	1 MHz - 32 MHz (LF Path)		–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 (SPECMON6 only)		–161 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
	110 MHz (Option 110 only)	–0.5 dB		+0.5 dB

Residual Response	Test Result	High limit
200 MHz - 3 GHz (SPECMON3)		–95 dBm
200 MHz – 6.2 GHz (SPECMON6)		–95 dBm

Image Suppression		Test Result	High limit
All Models			
	29 MHz (LF Path)		–75 dBc
	2 GHz		–75 dBc
	3 GHz		–75 dBc
SPECMON6 only			
	5.95 GHz (SPECMON6 only)		–70 dBc

Spurious Response with Signal	Low limit	Test Result	High limit
>400 kHz of Center Frequency	Fail		Pass
>400 kHz of Center Frequency (Option 110 only)	Fail		Pass

Spurious Response with Signal (Half IF)	Test Result	High limit
1 GHz		
2 GHz		
3 GHz		
4 GHz (SPECMON6 only)		
5 GHz (SPECMON6 only)		
6 GHz (SPECMON6 only)		