

**RSA5100A Series
Real-Time Signal Analyzer
Specifications and Performance Verification
Technical Reference**



077-0520-01

Tektronix

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Real-Time Signal Analyzer
Specifications and Performance Verification
Technical Reference**

Warning

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

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077-0520-01

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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:



CAUTION
Refer to Manual



Protective Ground
(Earth) Terminal



Chassis Ground



Standby

Preface

This document contains the Specifications and the Performance Verification for the RSA5100A Series 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 *RSA6100A Series Real-Time Spectrum Analyzers, RSA5100A Series Real-Time Signal Analyzers Quick Start User Manual* describes how to use your analyzer.
- The *RSA6100A Series Real-Time Spectrum Analyzers, RSA5100A Series Real-Time Signal Analyzers Application Examples Manual*, provides tutorial examples of how to take measurements in different application areas.
- The *RSA6100A Series Real-Time Spectrum Analyzers, RSA5100A Series Real-Time Signal Analyzers Programmers Manual* describes how to use a computer to control the analyzer through the GPIB interface.
- The *RSA5100A Series Service Manual* provides information for maintaining and servicing your analyzer to the module level.

Specifications

This section lists the RSA5100A Series Real Time-Signal 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 signal analyzer must have been calibrated and adjusted at an ambient temperature between +20 °C and +30 °C.
- The signal analyzer must be in an environment with temperature, altitude, humidity, and vibration within the operating limits described in these specifications.
- The signal analyzer must have had a warm-up period of at least 20 minutes after starting the RSA5100A application.

Electrical Specifications

Table 1: Frequency

Characteristic		Description
Measurement frequency		
Frequency range, nominal	RSA5103A (RF band)	9 kHz to 3 GHz
	RSA5106A (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	2×10^{-8}
	Adjustment Range	$\pm 5.5 \times 10^{-7}$
	✓ Initial Accuracy at Cal	Within 1×10^{-7} (after a 10 min warmup)
Aging	Per day	$\pm 1 \times 10^{-9}$ (after 30 days of operation)
	Long term	$\pm 3 \times 10^{-7}$ (10 years)
	Cumulative Error, typical (Temperature + Aging)	4×10^{-7} (10 years)
	Temperature drift	1×10^{-7} (10 °C to 40 °C)
Reference	✓ Internal or External	>0 dBm
Output Level	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	$\pm 3 \times 10^{-7}$
	✓ 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
		−134 dBc/Hz	6 MHz
		−135 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	<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 85)	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 ±0.7 dB 10 MHz to 3 GHz ±0.5 dB 3 GHz to 6.2 GHz (RSA5106A only) ±1.0 dB
✓ 10 dB RF attenuator setting, Preamp ON (Option 50)	10 MHz to 32 MHz, LF Band ±1.0 dB 10 MHz to 3 GHz ±0.7 dB 3 GHz to 6.2 GHz (RSA5106A only) ±1.3 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 (RSA5106A 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 (RSA5106A 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 (RSA5106A 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 (RSA5106A 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 (RSA5106A only) –84 dBc
Each signal level –25 dBm at the RF input. 1 MHz tone separation. Attenuator = 0, Ref Level = –20 dBm.	
2 nd 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 2 kHz, LF Band	-124 dBm/Hz	-130 dBm/Hz
	2 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 (RSA5106A only)	-151 dBm /Hz	-154 dBm /Hz
	4 GHz to 6.2 GHz (RSA5106 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 (RSA5106A 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 85)

Frequency range	Span	Amplitude flatness		Phase flatness
		✓ Specification	Typical, RMS	Typical, RMS
0.07 GHz to 3 GHz	≤85 MHz	±0.50 dB	±0.30 dB	±1.5°
3 GHz to 6.2 GHz	≤85 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 ≤ 20 MHz ²	±0.4 dB
	20 MHz < BW ≤ 25/40 MHz ²	±0.4 dB
	40 MHz < BW ≤ 85 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 ≤ 20 MHz ²	±0.75°
	20 MHz < BW ≤ 25/40 MHz ²	±0.75°
	40 MHz < BW ≤ 85 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: Channel response (center frequency ≤ 3.0 GHz) ¹

Characteristic	Description	
Amplitude Flatness	Specification	Typical
	BW ≤ 300 kHz, CF > 0.01 GHz ²	± 0.1 dB ³ 0.05 dB _{RMS} ⁴
	BW $\leq 25/40$ MHz, CF > 0.03 GHz	± 0.3 dB ³ 0.18 dB _{RMS} ⁴
	BW ≤ 80 MHz, CF > 0.07 GHz	± 0.5 dB ³ 0.3 dB _{RMS} ⁴
	BW ≤ 85 MHz, CF > 0.07 GHz	± 0.5 dB ³ 0.3 dB _{RMS} ⁴
Phase Linearity, typical		
	BW ≤ 300 kHz, CF > 0.01 GHz ²	0.1° _{RMS} ⁴
	BW $\leq 25/40$ MHz, CF > 0.03 GHz	0.5° _{RMS} ⁴
	BW ≤ 80 MHz, CF > 0.07 GHz	1.0° _{RMS} ⁴
	BW ≤ 85 MHz, CF > 0.07 GHz	1.5° _{RMS} ⁴

¹ The BW value used in this table is the bandwidth of the channel. Atten = 10 dB. Use Flattop Window for maximum CW amplitude verification accuracy.

² High Dynamic Range mode.

³ After calibration and alignment.

⁴ After calibration and alignment.

Table 14: Channel response (3.0 GHz $<$ center frequency ≤ 6.2 GHz) ¹

Characteristic	Description	
Amplitude Flatness	Specification	Typical
	BW ≤ 300 kHz ²	± 0.1 dB ³ 0.05 dB _{RMS} ⁴
	BW $\leq 25/40$ MHz	± 0.3 dB ³ 0.20 dB _{RMS} ⁴
	BW ≤ 80 MHz	± 0.5 dB ³ 0.3 dB _{RMS} ⁴
	BW ≤ 85 MHz	± 0.5 dB 0.4 dB _{RMS} ⁴
Phase Linearity, typical		
	BW ≤ 300 kHz ²	± 0.1 ° _{RMS} ⁴
	BW $\leq 25/40$ MHz	0.5° _{RMS} ⁴
	BW ≤ 80 MHz	1.0° _{RMS} ⁴
	BW ≤ 85 MHz	1.0° _{RMS} ⁴

¹ The BW value used in this table is the bandwidth of the channel. Atten = 10 dB. Use Flattop Window for maximum CW amplitude verification accuracy.

² High Dynamic Range mode.

³ After calibration and alignment.

⁴ After calibration and alignment.

Table 15: Channel response (LF band, 11 MHz < center frequency ≤ 22 MHz;)¹

Characteristic	Description	
Amplitude Flatness	Specification	Typical
	BW ≤ 20 MHz	±0.5 dB ³
		0.4 dB _{RMS} ⁴
Phase Linearity, typical		
	BW ≤ 20 MHz	1.0° _{RMS} ⁴

¹ The BW value used in this table is the bandwidth of the channel. Atten = 10 dB. Use Flattop Window for maximum CW amplitude verification accuracy.

² High Dynamic Range mode.

³ After calibration and alignment.

⁴ After calibration and alignment.

Table 16: Pulse measurements, typical

Characteristic	Description	
	85 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
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}	85 MHz BW	25 MHz BW
	2 GHz	±0.72°
		±0.35°
	60 MHz BW	20 MHz BW
	2 GHz	±0.7°
		±0.3°

Table 16: Pulse measurements, typical (cont.)

Characteristic	Description	
Pulse-to-Pulse carrier phase, typical ^{3 4}	85 MHz BW	25 MHz BW
	2 GHz	±0.5°
	60 MHz BW	20 MHz BW
	2 GHz	±0.5°
Pulse-to-Pulse carrier frequency, typical ^{5 6}	85 MHz BW	20 MHz BW
	2 GHz	±225 kHz
	60 MHz BW	
	2 GHz	±80 kHz
Pulse-to-Pulse carrier frequency, typical ^{7 8}	85 MHz BW	20 MHz BW
	2 GHz	±200 kHz
	60 MHz BW	
	2 GHz	±130 kHz
Pulse frequency linearity (Absolute frequency error RMS), typical ^{9 10}	85 MHz BW	20 MHz BW
	2 GHz	±65 kHz
	60 MHz BW	25 MHz
	2 GHz	±26 kHz
Chirp frequency linearity (Absolute frequency error RMS), typical ^{11 12}	85 MHz BW	25 MHz BW
	2 GHz	±50 kHz
	60 MHz BW	20 MHz BW
	2 GHz	±30 kHz

¹ For 60 MHz / 85 MHz bandwidths, and conditions of:

Pulse ON power ≥ -20 dBm

Frequency Estimation = Manual

CW (non-chirped) pulses

Signal peak at Ref Lvl.

Atten = Auto

Pulse width ≥ 200 ns.

PRI ≤ 300 us.

Duty cycle ≥ 0.0007

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

Phase measurement includes 100 pulses minimum.

Measured pulses to be adjacent.

Measurement time position excludes the beginning and ending of the pulse extending for a time = (10/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 μ s.

Duty cycle ≥ 0.001

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

Phase measurement includes 100 pulses minimum.

Measured pulses to be adjacent.

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

3 For 85 MHz / 60 MHz bandwidths, and conditions of:

Linear Chirped pulses

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

Frequency Estimation = Manual

Pulse ON power ≥ -20 dBm

Signal peak at Ref Lvl.

Atten = 0 dB

Pulse width ≥ 100 ns.

PRI ≤ 300 μ s.

Duty cycle ≥ 0.0003

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

Measurement time position excludes the beginning and ending of the pulse extending for a time = (10/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: $\leq (0.8 \times \text{Measurement bandwidth})$

Frequency Estimation = Manual

Pulse ON power ≥ -20 dBm

Signal peak at Ref Lvl.

Atten = 0 dB

Pulse width ≥ 300 ns.

PRI ≤ 1000 μ s.

Duty cycle ≥ 0.0003

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

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

5 For 85 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 μ s.

Duty cycle ≥ 0.0007

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

Measurement time position excludes the beginning and ending of the pulse extending for a time = (10/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 μ s.

Duty cycle ≥ 0.001

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

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

- 7 For 20 MHz bandwidth, and conditions of:

Linear chirped pulses

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

Frequency Estimation = Manual

Pulse ON power ≥ -20 dBm

Signal peak at Ref Lvl.

Atten = 0 dB

Pulse width ≥ 100 ns.

PRI ≤ 300 μ s.

Duty cycle ≥ 0.0003

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

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

- 8 For 20 MHz bandwidth, and conditions of:

Linear chirped pulses

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

Frequency Estimation = Manual

Pulse ON power ≥ -20 dBm

Signal peak at Ref Lvl.

Atten = 0 dB

Pulse width ≥ 300 ns.

PRI ≤ 1000 μ s.

Duty cycle ≥ 0.0003

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

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

- 9 For 60/85 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 μ s.

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 μ s.

Duty cycle ≥ 0.001

Absolute frequency error determined over center 50% of pulse

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

Linear chirped pulses

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

Frequency Estimation = Manual

Pulse ON power ≥ -20 dBm

Signal peak at Ref Lvl.

Atten = 0 dB

Pulse width ≥ 100 ns.

PRI ≤ 300 μ s.

Duty cycle ≥ 0.0003

$t_{\text{meas}} - t_{\text{reference}} \leq 10$ 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: $\leq (0.8 \times \text{Measurement bandwidth})$

Frequency Estimation = Manual

Pulse ON power ≥ -20 dBm

Signal peak at Ref Lvl.

Atten = 0 dB

Pulse width ≥ 300 ns.

PRI ≤ 1000 μ s.

Duty cycle ≥ 0.0003

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

Absolute Frequency Error determined over center 50% of pulse.

Table 17: Impulse response

Characteristic	Description
Impulse Response Measurement Range (nominal)	15 to 40 dB Across the width of the chirp
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 μ s, minimum signal delay 1% of pulse width or 10/(chirp bandwidth), whichever is greater, and minimum 2000 sample points during pulse on-time.

Table 18: Spurious response

Characteristic	Description
Residual Response (Atten = 0 dB, Ref = -30dBm, RBW = 1 kHz)	✓ 200 MHz to 3 GHz < -95 dBm
	✓ 3 GHz to 6.2 GHz < -95 dBm (RSA5106A only)
	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

Table 18: Spurious response (cont.)

Characteristic		Description
Residual DC Offset after Normalization (LF Path), typical		<-40 dBm (Ref level $\leq$ 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) <-80 dBc (30 MHz to 3 GHz, Ref= -30 dBm, Atten = 10 dB, RF Input Level = -30 dBm, RBW = 10 Hz) <-80 dBc (3 GHz to 6.2 GHz, Ref= -30 dBm, Atten = 10 dB, RF Input Level = -30 dBm, RBW = 10 Hz)(RSA5106A only)
Spurious Response with Signal at Center Frequency	✓ CF = 1 MHz to 6.2 GHz, offset $\geq$ 400 kHz	(See Table 19.)
	✓ CF = 1 MHz to 6.2 GHz, offset $\leq$ 400 kHz	(See Table 20.)
Spurious Response with Signal at Frequency other than Center Frequency	300 MHz to 6.2 GHz	(See Table 21.)
✓ Spurious Response with Signal at 3.5125 GHz - Half-IF(RSA5103A)		<-54 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.
✓ Spurious Response with Signal at 3.5125 GHz - Half IF (RSA5106A)		<-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 19: Spurious response with signal at center frequency (offset $\geq$ 400 kHz)

Frequency	Span $\leq$ 25 MHz, Swept Spans > 25 MHz		For Option 40/85 ¹ 25 MHz < Span $\leq$ 85 MHz	
	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 (RSA5106A only)	-73 dBc	-78 dBc	-73 dBc	-75 dBc

¹ 1 Center frequency $\geq$ 90 MHz for Options 40/85.

Table 20: Spurious response with signal at center frequency ($10 \text{ kHz} \leq \text{offset} \leq 400 \text{ kHz}$)

Frequency	Span $\leq 25 \text{ MHz}$, Swept Spans $> 25 \text{ MHz}$		For Option 40/85 ¹ 25 MHz $<$ Span $\leq 85 \text{ MHz}$	
	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 (RSA5106A only)	--	-73 dBc	--	-73 dBc

¹ 1 Center frequency $\geq 90 \text{ MHz}$ for Options 40/85.

Table 21: Spurious response with signal at other than CF

Frequency	Span $\leq 25 \text{ MHz}$, Swept Spans $> 25 \text{ MHz}$		For Option 40/85 ¹ 25 MHz $<$ Span $\leq 85 \text{ MHz}$	
	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 (RSA5106A only)	--	-73 dBc	--	-73 dBc

¹ 1 Center frequency $\geq 90 \text{ MHz}$ for Options 40/85.

Table 22: Acquisition

Characteristic	Description
Real-time Capture Bandwidth, nominal	25 MHz (RF, Standard Version)
	40 MHz (RF, Option 40 Version)
	85 MHz (RF, Option 85 Version)
Demodulation Bandwidth	25 MHz (RF, Standard Version)
	40 MHz (RF, Option 40 Version)
	85 MHz (RF, Option 85 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 85)

Table 22: 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)
		85 MHz (Option 85)	150 MS/s	1.79 s	7.15 s
		40 MHz (Option 40/85)	75 MS/s	3.57 s	14.31 s
			50 MS/s	5.28 s	21.1 s
		25 MHz	25 MS/s	10.5 s	42.2 s
		20 MHz	12.5 MS/s	21.1 s	84.5 s
		10 MHz	6.25 MS/s	42.2 s	169.1 s
		5 MHz	3.125 MS/s	42.9 s	171.7 s
		2 MHz	1.56 MS/s	85.8 s	343.5 s
		1 MHz	781 kS/s	171.7 s	687.1 s
		500 kHz	390 kS/s	343.5 s	1374 s
		200 kHz	195 kS/s	687.1 s	2748 s
		100 kHz	97.6 kS/s	1374 s	5497 s
		50 kHz	48.8 kS/s	2748 s	10955 s
		20 kHz	24.4 kS/s	5497 s	21990 s
		10 kHz	12.2 kS/s	10955 s	43980 s
		5 kHz	3.05 kS/s	43980 s	175921 s
		2 kHz	1.52 kS/s	87960 s	351843 s
		1 kHz	762 S/s	175921 s	703687 s
		500 Hz	381 S/s	351843 s	1407374 s
		200 Hz	190 S/s	703686 s	2814749 s
100 Hz					
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			
	Acq BW ≤ 2.5 MHz (1 GB) (Std)	128 MSamples			

Table 22: Acquisition (cont.)

Characteristic	Description
Acq BW > 2.5 MHz (4 Gbyte) (Option 53)	1 GSamples
Acq BW ≤ 2.5 MHz (4 Gbyte) (Option 53)	512 MSamples

Table 23: Amplitude vs. time

Characteristic	Description
Time Scale (Zero Span), nominal	400 ns min to 2000 s max (Option 85) 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 24: 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
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

Table 24: Trigger (cont.)

Characteristic	Description
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 85 MHz Acq BW using no trigger RBW ± 5 ns for 85 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 02), 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 ≤ 85 MHz (Option 85)
Frequency Mask Trigger Level Resolution (Option 02), nominal	0.1 dB
Frequency Mask Trigger Level Accuracy (Option 02) (with respect to Reference Level)	$\pm$ (Channel Response Flatness + 1 dB) (for mask levels ≥ -50 dB) for masks >30 dB above the noise floor $\pm$ (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 02), nominal	25 MHz (1024 point FFT, 50% overlapping, Standard) 40 MHz (1024 point FFT, 50% overlapping, Option 40) 85 MHz (1024 point FFT, 50% overlapping, Option 85)
Frequency Mask Trigger Real-time Event Minimum Duration for 100% probability of trigger (Option 02), nominal	30.7 μ s at 25 MHz span (Standard) 10.3 μ s at 85 MHz span (Option 85)
Frequency Mask Trigger Timing Uncertainty	± 12.8 μ s at 25 MHz span (Standard) ± 5.12 μ s at 85 MHz span (Option 85)
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 k Ω
External Trigger 2 Input Impedance, nominal	Fixed: 5 k Ω
External Trigger 1 Minimum Pulse Width (applies to 50 Ω Impedance only), nominal	> 5 ns

Table 24: 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)	
>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.

Table 25: Trigger (without Option 200)

Characteristic	Description	Reference information
Trigger Event Types	Power Level (IF Span BW after RBW and VBW filters); Frequency Mask (Option 02)	
Frequency Mask Trigger Real-time Event Minimum Duration for 100% probability of trigger (Option 02), nominal	30.7 μ s at 25 MHz span (Standard) 10.3 μ s at 85 MHz span (Option 85)	
Frequency Mask Trigger Timing Uncertainty	± 12.8 μ s at 25 MHz span (Standard) ± 5.12 μ s at 85 MHz span (Option 85)	Measured with mask level set at 6 dB below signal peak, RBW = AUTO

Table 26: 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 = 85 MHz, no TDBW, Option 85) 25 ns (Acq BW = 40 MHz, no TDBW, Option 40) 40 ns (Acq BW = 25 MHz, no TDBW, Standard)
Frequency Edge Trigger Range, nominal	$\pm(1/2 \times (\text{ACQ BW or TDBW if TDBW is active}))$
Frequency Edge Trigger Timing Uncertainty, nominal	Same as power trigger position timing uncertainty.
Frequency Mask Trigger Maximum Real-time Event Detection Bandwidth (Op.52)	25 MHz (1024 point FFT, 50% overlapping, Standard) 85 MHz (1024 point FFT, 50% overlapping, Option 85)
Frequency Mask Trigger Real-time Event Minimum Duration for 100% probability of trigger (Option 52), nominal	Option 85, span = 85 MHz
	FMT RBW
	Minimum event duration (μs)
	10 MHz
	3.7
	1 MHz
	5.8
	100 kHz
	37.6
	Standard Unit, span = 25 MHz
	FMT RBW
	Minimum event duration (μs)
	5 MHz
	4
	1 MHz
	5.8
	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	$\pm 7 \mu\text{s}$ at 25 MHz span ($\text{RBW} \geq 300 \text{ kHz}$, Standard Unit) $\pm 4 \mu\text{s}$ at 85 MHz span ($\text{RBW} \geq 1 \text{ MHz}$, Option 85) 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 26: 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: $\pm 0.25\%$ of Span Vertical: $\pm (2 \times \text{DPX amplitude accuracy})$
DPX Statistics Trigger Timing Uncertainty, nominal	For a signal events less than 40 ms, where DPX RBW = AUTO and Density = Higher: Uncertainty = $-(\text{Signal Event Duration} + \text{DPX Minimum Event Duration})$ to $+(\text{DPX Minimum Event Duration})$ For Span = 85 MHz: Uncertainty = $-(\text{Signal Event Duration} + 10.3 \mu\text{s})$ to $+10.3 \mu\text{s}$ For Span = 25 MHz: Uncertainty = $-(\text{Signal Event Duration} + 23.9 \mu\text{s})$ to $+23.9 \mu\text{s}$ 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 26: 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 $\leq$ 25 MHz: 20 ns 25 MHz < SPAN $\leq$ 85 MHz: 6.7 ns
Time Qualified Trigger (minimum or maximum) Time Accuracy, nominal	For Power Trigger: $\pm[(2 \times \text{Power Trigger Position Timing Uncertainty}) + 6.7 \text{ ns}]$; All conditions for Power Trigger Position timing uncertainty must be met For FMT: $\pm[(2 \times \text{Frequency Mask Timing Uncertainty}) + 6.7 \text{ ns}]$; All conditions for Frequency Mask Trigger timing uncertainty must be met For DPX Statistics Trigger: $\pm 42 \text{ ms}$; For External Trigger SPAN $\leq$ 25 MHz: $\pm[(2 \times \text{External Trigger Timing Uncertainty}) + 20 \text{ ns}]$; All conditions for External Trigger Timing uncertainty must be met For External Trigger 25 MHz < SPAN $\leq$ 85 MHz: $\pm[(2 \times \text{External Trigger Timing Uncertainty}) + 6.7 \text{ ns}]$; 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 26: 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 $\leq$ 40 MHz: 20 ns 40 MHz < SPAN $\leq$ 85 MHz: 6.7 ns
Holdoff Trigger Time Accuracy, nominal	For Power Trigger: $\pm$ (Power Trigger Position Timing Uncertainty + 6.7 ns); All conditions for Power Trigger Position Timing Uncertainty must be met For FMT: $\pm$ (Frequency Mask Trigger Timing Uncertainty + 6.7 ns); All conditions for Frequency Mask Trigger Timing Uncertainty must be met For DPX Statistics Trigger: $\pm$ 42 ms; For External Trigger SPAN $\leq$ 25 MHz: $\pm$ (External Trigger Timing Uncertainty + 20 ns); All conditions for External Trigger Timing uncertainty must be met For External Trigger 25 MHz < SPAN $\leq$ 85 MHz: $\pm$ (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 27: 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) ($\pm 10\%$)

Table 28: Range and settable RBW (SA mode)

Acquisition BW	Frequency Domain Resolution Bandwidth Range	
	Maximum RBW	Minimum RBW
85 MHz (Option 85)	5 MHz	100 Hz
60 MHz (Option 85)	5 MHz	100 Hz
25 MHz	5 MHz	100 Hz
20 MHz	5 MHz	100 Hz

Table 28: Range and settable RBW (SA mode) (cont.)

Acquisition BW	Frequency Domain Resolution Bandwidth Range	
	Maximum RBW	Minimum RBW
10 MHz	2 MHz	10 Hz
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	1 Hz
78.125 kHz	20 kHz	1 Hz
39.0625 kHz	10 kHz	1 Hz
19.53125 kHz	5 kHz	1 Hz
9.765625 kHz	2 kHz	1 Hz
4.8828125 kHz	1 kHz	1 Hz
2.44140625 kHz	610 Hz	1 Hz
1.220703125 kHz	305 Hz	1 Hz
610.3515625 Hz	152 Hz	1 Hz
305.17578125 Hz	76 Hz	1 Hz
152.587890625 Hz	38 Hz	1 Hz

Table 29: Resolution bandwidth filter (time-domain mode)

Characteristic	Description
Filter Shape, nominal	Gaussian-like (Actual filter shape is Kaiser with $b = 16.72$)
Shape Factor, typical	4.1:1 (60 dB:3 dB) ($\pm 10\%$) for filters up to 10 MHz < approximately 2.5:1 (60 dB:3 dB) for filters >10 MHz to 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 85) (for sequence selection) 1% (for user-entry mode)
Minimum Settable RBW, nominal	See the following table

Table 30: Range and settable RBW (time-domain mode)

Acquisition BW	Time Domain Trigger And	
	Maximum TDBW	Minimum TDBW
85 MHz (Opt 85)	60 MHz	11 kHz
60 MHz (Opt 85)	7.5 MHz	6 kHz
25 MHz	20 MHz	4 kHz
20 MHz	2.5 MHz	2 kHz

Table 30: Range and settable RBW (time-domain mode) (cont.)

Acquisition BW	Time Domain Trigger And	
	Maximum TDBW	Minimum TDBW
10 MHz	1.25 MHz	1 kHz
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 31: 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 32: Digital IQ output

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

¹ LVDS signaling - ANSI EIA/TIA-644 standard

Table 33: 28 Volt noise source drive output

Characteristic	Description
Output Level, nominal	28 VDC @ 140 mA

Electrical Functional Specifications

Table 34: 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 ($\pm$ peak, +peak to –peak, rms, peak-peak/2, frequency error) Phase Modulation ($\pm$ peak,, rms, +peak to –peak)
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 34: 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 35: 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 36: Analog demodulation accuracy

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

Table 37: General Purpose Analog modulation accuracy

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

Table 38: General purpose digital modulation analysis (Option 21)

Characteristic	Description
Carrier Type, nominal	Continuous, Burst (5 μ s 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 39: Digital demodulation accuracy (Option 21)

Characteristic	Description
QPSK Residual	CF
EVM, typical	2 GHz
	Symbol Rate
	100 kHz
	1 MHz
	10 MHz
	30 MHz
	60 MHz
	0.35%
	0.35%
	0.5%
	1.5% (Option 85 only)
	2.0% (Option 85 only)

Table 39: 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 85 only)
		60 MHz	1.5% (Option 85 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		
OS-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		
CPM (MIL) Residual EVM, typical	CF		250 MHz
	Symbol Rate	4 kHz	0.3%
	Reference Filter: MIL STD, Measurement Filter: None		

Table 39: Digital demodulation accuracy (Option 21) (cont.)

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

Table 40: 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 41: 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 μ s (Standard, Option 40)			
	10.3 μ s (Option 85, instrument center frequency $\geq$ 50 MHz)			
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 85, Span = 85 MHz ¹			
	DPX RBW	Minimum event duration (μs)		
	10 MHz	3.7		
	1 MHz	5.8		
	100 kHz	37.6		

Table 41: Digital phosphor spectrum processing (DPx) (cont.)

Characteristic	Description			
Span Range, nominal	100 Hz to 25 MHz (Standard) 100 Hz to 40 MHz (Option 40) 100 Hz to 85 MHz (Option 85)			
RBW Settings, nominal	Acquisition Bandwidth	RBW (Min)	RBW (Min) Option 200	RBW (Max) Option 200
	85 MHz (Option 85)	640 kHz	20 kHz	10 MHz
	55 MHz (Option 85)	320 kHz	10 kHz	5 MHz
	40 MHz (Option 40/85)	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 $0 \leq N \leq 20$			

Table 41: Digital phosphor spectrum processing (DPx) (cont.)

Characteristic	Description
Zerospan, Frequency, or Phase Time Domain BW (TDBW) Range, nominal	Maximum – (See Table 30.) 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	$\pm 1\%$
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	$\pm(0.5\% + \text{Reference Frequency Accuracy})$
Zerospan Amplitude Range, nominal	+130 dBm to -270 dBm
Zerospan Trigger Timing Uncertainty, nominal	$\pm (\text{Zerospan Sweep Time}/800)$ 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 μ s/800 or ± 125 ps for a 100 μ s sweep time
DPX Frequency Range	± 100 MHz
DPX Frequency Timing Uncertainty, nominal	$\pm (\text{Frequency Sweep Time}/800)$ Reference Information: Only valid if using Frequency Edge Trigger and only valid at the trigger point. For example: ± 100 ns/800 or ± 125 ps for a 100 ns sweep time ± 100 ns/800 or ± 125 ps for a 100 μ s sweep time
Phase Range	± 200 degrees

¹ Instrument Center Frequency ≥ 50 MHz

Table 42: Frequency Settling Time Measurement (Option 12) ¹

Measurement frequency, averages	Frequency Uncertainty at stated measurement bandwidth			
	85 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

Table 42: Frequency Settling Time Measurement (Option 12) ¹ (cont.)

Measurement frequency, averages	Frequency Uncertainty at stated measurement bandwidth			
	85 MHz BW	10 MHz BW	1 MHz BW	100 kHz BW
1 GHz				
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 43: OBW measurement

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

Table 44: xdB Bandwidth Measurement

Characteristic	Description
xdB Bandwidth, typical	±3%

Table 45: Settled Phase Uncertainty (Option 12) ¹

Measurement frequency, averages	Phase uncertainty (degrees) at stated measurement bandwidth		
	85 MHz BW	10 MHz BW	1 MHz BW
1 GHz			
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 46: 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 47: Data Transfer/Masurement 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 48: 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 49: 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)
GPIO	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 49: 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 *RSA6100A Series Real-Time Spectrum Analyzers*, *RSA5100A Series Real-Time Signal Analyzers Quick Start User Manual*, Tektronix part number 071-2838-XX.

Certifications and Compliances

For detailed information on Certifications and Compliances, see the *RSA6100A Series Real-Time Spectrum Analyzers*, *RSA5100A Series Real-Time Signal Analyzers Quick Start User Manual*, Tektronix part number 071-2838-XX.

Environmental Characteristics

Table 50: 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 50: 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 51: 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)

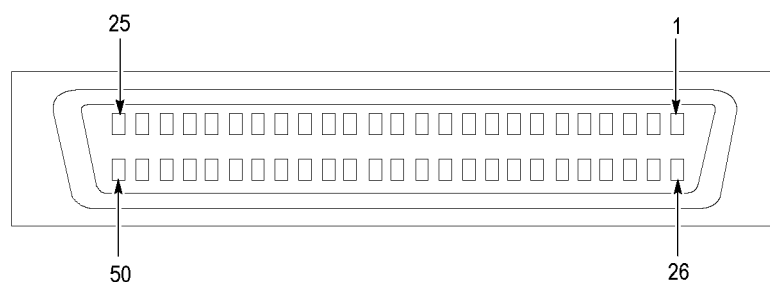


Figure 1: Digital IQ output connector pin assignment

Table 52: 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 52: 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 53: 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 53: 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 53: 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 54: 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 RSA5100A. (See Table 56.)

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 55: 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 55: 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.

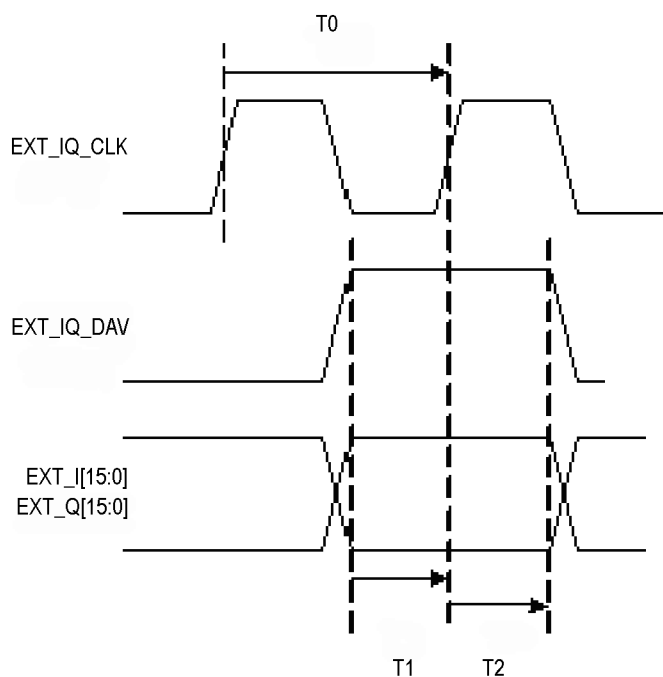


Figure 2: IQ Timing

Table 56: 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 RSA5100A 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 RSA5100A.

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 55.) 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 RSA5100A is performing an alignment or a control change. If the EXT_IQ_DAV signal is inactive for longer than 10 ms, then the RSA5100A digital I/Q output data stream has been interrupted.

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

Digital IQ Output Scaling

Output power in dBm for a sinusoidal input

Where:

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

Where:

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

Valid for center frequencies that exceed:

- Center frequency ≥ 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 RSA5100A application, and must be operating at an ambient temperature. (See Table 50.)

Required Equipment

The procedures, use external, traceable signal sources to directly check warranted characteristics. (See page 51, *Warranted Characteristics Tests*.) The following table lists the equipment required for this procedure.

Table 57: Equipment required for Performance Verification

Item number and	Minimum requirements	Example	Purpose
1. Frequency Counter	Frequency Range: 10 MHz; Accuracy: 1×10^{-9}	Agilent 53132A Option 10	Checking reference output frequency accuracy
2. RF Power Meter		Agilent E4418B	Adjusting signal generator output level,
3. RF Power Sensor	9 kHz to 18 GHz RF Flatness: <3% Calibration factor data uncertainty: <2% (RSS)	Agilent E9304A Option H18	checking reference output power level
4. Signal Generator	Frequency Accuracy: $\pm 3 \times 10^{-7}$ 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 57: 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	Checking phase noise and intermodulation distortion
	Phase Noise at Center Frequency = 1 GHz	Options 2A, 3A, 4, 15A, 16, 22, SM5821	
	Offset		
	SSB Phase Noise (F) dBc/Hz		
	10 Hz	-71	
	100 Hz	-93	
	1 kHz	-118	
	10 kHz	-121	
6. Precision Attenuator	30 dB		
7. Network Analyzer	10 MHz to 3 GHz	Agilent 8757D with directional bridge ¹	Checking VSWR
	10 MHz to 14 GHz		
8. Power Splitter		Agilent 11667A	Adjusting signal generator output level
9. Power Combiner	Range: 0 to 14 GHz	Agilent 11667A with attenuators ²	Checking intermodulation distortion
	Isolation: >18 dB		
	Insertion loss: 6 dB		
	3 dB = 2200 MHz		
10. Low Pass Filters (2)	< 3 dB loss DC –3 GHz >50 dB rejection 4 GHz to 14 GHz		Checking intermodulation
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 RSA5100A 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		
20. N-Male to 3.5 mm male adapter			

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 RSA5100A, power it on, and check that the fans located on the left side of the RSA5100A are operating.



CAUTION. Turn the RSA5100A off immediately if the fans are not operating. Operating the Signal Analyzer without fans will damage the instrument.

Warm-up Make sure the RSA5100A 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 the **Diagnostics** tab.
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 RSA5100A rear-panel.
 - Check with a voltmeter that the voltage is 28 V $\pm$ 2 V.
 - b. The LED Check diagnostic will ask you to verify that all the highlighted LEDs are turned on:
 - Compare the LEDs highlighted in the diagnostic display with the buttons on the front panel.
 - Press each of the keys and rotate the knob on the front panel. You should see the corresponding key in the diagnostic display turn green. Verify that each key is recognized.
 - Click the PASS or FAIL button when done.
 - c. The Display Pixel Test will ask you to look for video problems on the test patterns:
 - Check the Green screen for any stuck or missing pixels. Any keypress, click, or touch will move to the next screen.
 - Repeat with the Red screen, the Blue Screen, and the Gray scale screen. Select Yes or No when the LCD Test dialog asks “Did you see any video problems”.
4. When all diagnostics tests have completed, check that there is a check mark beside each diagnostic name. An X instead of a check mark indicates that the diagnostic had a failure.
5. Click the **Diagnostics Failure** Info tab and verify there is no failure information listed.
6. Click the **Exit Diagnostics** button to exit diagnostics.

Alignment

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

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

Warranted Characteristics Tests

The following procedures verify the RSA5100A Series Signal Analyzer performance is within the warranted specifications.

Frequency Accuracy

Check Reference Output Frequency Accuracy

1. Connect **REF OUT** on the RSA5100A 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.

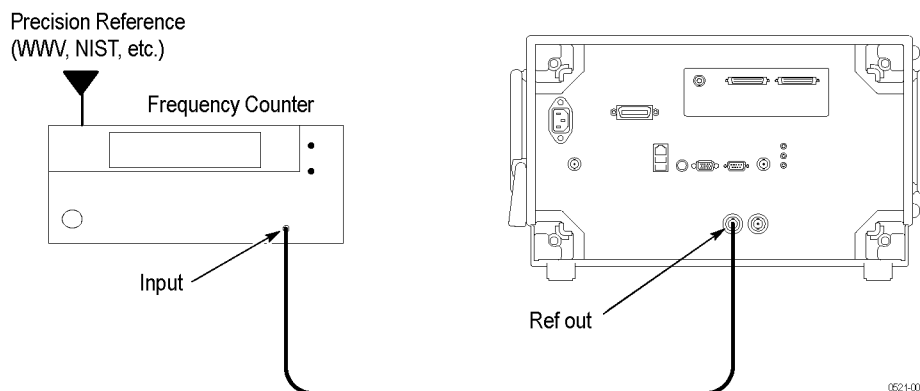


Figure 3: Connections for Reference Frequency Output Accuracy check

3. Set the Frequency counter:

Function	Frequency
Gate time	2 s

4. Check that the frequency counter reads 10 MHz $\pm$ 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.

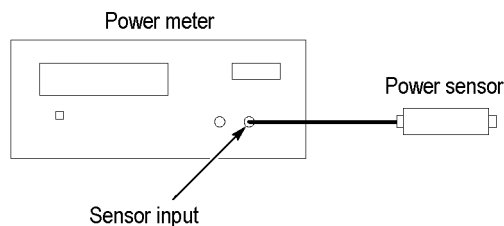


Figure 4: Power meter setup

- b. Press **ZERO** 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.

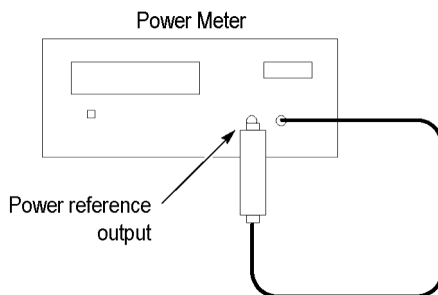


Figure 5: Power meter calibration

- d. Turn on **Power Ref** and 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 RSA5100A rear-panel, using the N-female to BNC male adapter (see the following figure).
 3. Check that the Ref Out signal is >0 dBm. Enter this level in the test record.

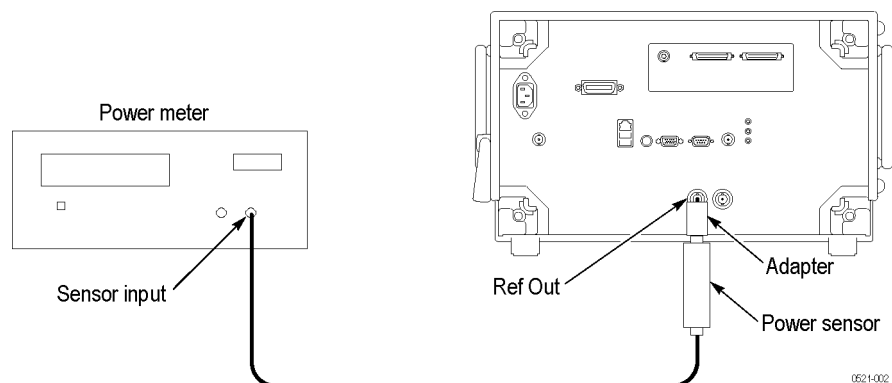


Figure 6: Equipment connections for Ref Out power level check

External Reference Input Level

1. Connect the signal generator output to the **Ref In** connector on the RSA5100A rear panel, using a 50 Ω N-N coaxial cable and N-female to BNC male adapter (see the following figure).

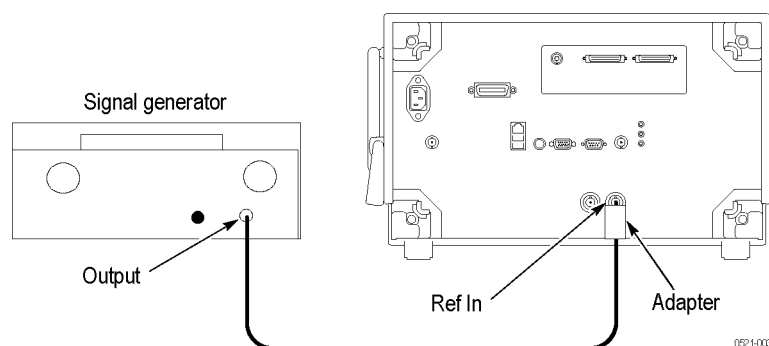


Figure 7: Equipment connections for Ref In power level check

2. Set the Signal generator controls:

Frequency	10 MHz
Level	0 dBm

3. Set the RSA5100A to use the external reference:
 - a. Select **Setup > Configure In/Out**.
 - b. Select the **Frequency Reference** tab.
 - c. 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** (select Setup > Configure In/Out, select the Frequency Reference tab, and select the Internal (10 MHz) radio button).
- 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).

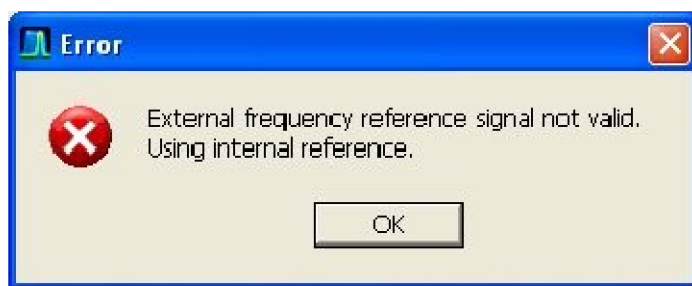


Figure 8: Error message showing loss of lock to External Reference signal

- 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 56, *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 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 80, Spurious Response.)*

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

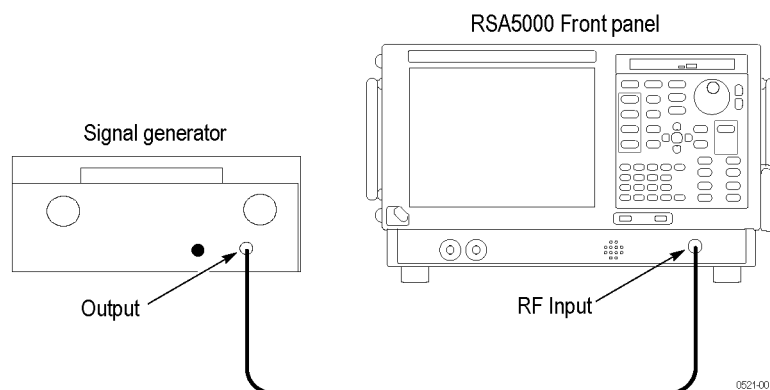


Figure 9: Equipment connections for phase noise checks

2. Reset the RSA5100A to factory defaults; by pressing the **Preset** button, or selecting **Preset (Main)** from the **Setup** menu.
3. Modify the default settings:

Center Frequency	1.00 GHz
Span	1 MHz
Ref Level	+5 dBm

4. Set the generator as follows:

Center Frequency	1.00 GHz
Output level	+8 dBm

Increase the generator level in 1 dB steps until you see **Digital Gain Overflow** at the bottom-left side of the display, then reduce the amplitude by 2 dB.

5. Press Run/Stop to stop acquisitions.
6. Display the Phase Noise measurement:
 - Press the Displays button.
 - Select the RF Measurements folder.
 - Add the Phase Noise display.
 - Remove the Spectrum display.
 - Press OK.
7. Select **Setup > Amplitude**. Verify that the **Auto** checkbox is enabled (checked). Set the **RF/IF Optimization** to **Minimum Noise**.
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 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. Read the value for the 6 MHz offset from the Offset readout.
17. Press the Single button and wait for 20 averages to complete.
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 54, *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 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 80, Spurious Response.)*

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

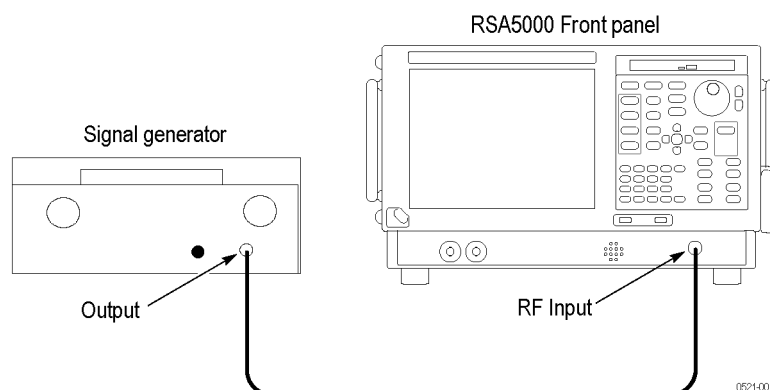


Figure 10: Equipment connections for phase noise checks

2. Reset the RSA5100A to factory defaults; by pressing the **Preset** button, or selecting **Preset (Main)** from the **Setup** menu.
3. Modify the settings:

Center Frequency	1.00 GHz
Span	1 MHz
RF & IF Optimization (Setup > Amplitude > Internal Settings tab)	Minimize Noise
Reference level	+5 dBm

4. Set the generator as follows:

Center Frequency	1.00 GHz
Output level	+8 dBm

Increase the generator level in 1 dB steps until you see **Digital Gain Overflow** at the bottom-left side of the display, then reduce the amplitude by 2 dB.

5. Select the **Traces** tab in the **Settings** menu and set the parameters as follows:

Trace	Trace 1
Detection	Avg (VRMS)
Function	Avg (VRMS)
Count	100

6. Select the **Prefs** tab in the Settings control panel. Set **Trace points** to 2401. Select the Marker Noise Mode checkbox to enable noise mode.
7. Select the VBW checkbox next to the graph. Set the VBW value to 10 Hz.

8. Turn on the Reference Marker (MR) and Marker 1 (M1), and set them for Delta operation and Noise Mode.
 - a. Select **Define Markers** in the **Markers** menu.
 - 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.
 - e. Select the **Settings** button, click the **Prefs** tab, and then select the **Marker Noise Mode** checkbox so it is checked.
9. Set the RSA5100A to each of the spans shown in the following table in turn.

Table 58: 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

10. Repeat these steps for each span setting:
 - a. Press **Single**.
 - b. Select the Reference Marker with the marker select key and press the Peak key.
 - c. Select Marker 1 (M1) with the marker select key.
 - d. Set Marker 1 (M1) using the up/down arrow keys next to the knob to adjust the offset frequency. (See Table 58.) The offset frequency is indicated by the M1 Delta Marker readout.
 - e. Read the 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.)
11. Record the generator signal amplitude in the Test Record:
 - a. Select Marker (MR) with the marker select key.
 - b. Select Peak 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.
12. Obtain the phase noise at 1 MHz offset. Start by setting the RSA5100A to the settings listed below:
 - a. Center Frequency: 1001 MHz
 - b. Span: 10 kHz

- c. Offset: -30 dBm
 - d. Set input attenuation for manual control.
Select the **Ampl** softkey.
Deselect the **Auto** check box.
The attenuator now can be manually controlled.
Set **Internal Attenuator** to 0 dB.
 - e. Press **Single**.
 - f. Center the M1 marker in the middle of the screen:
Select **Markers** to display the Markers toolbar. Select **Define** from the toolbar.
Select **Readouts > Absolute**.
Select **M1**.
Select **Marker Frequency**. Set to 1001 MHz.
The marker is now located at the center frequency position.
 - g. Read the noise amplitude on Marker **M1**, in dBm/Hz.
 - h. Subtract the value of **MR** obtained in step 11 to obtain the phase noise amplitude at 1 MHz.
For example, if $MR = 4.7 \text{ dBm}$ and $M1 = -129.6 \text{ dBm/Hz}$, then $M1 - MR = -134.3 \text{ dBc/Hz}$.
 - i. Enter the value obtained at 1 MHz in the test record for phase noise at 1 MHz.
13. Obtain the phase noise at 6 MHz offset. Start by setting the RSA5100A to the settings listed below:
- a. Center Frequency: 1006 MHz.
 - b. Span: 10 kHz.
 - c. Press **Single**.
 - d. Center M1 in the middle of the screen.
 - e. Read the noise level on Marker **M1** in dBm/Hz.
 - f. Subtract the value of Carrier Power obtained in step 11 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.
- 14.** Obtain the phase noise at 10 MHz offset. Start by setting the RSA5100A to the settings below:
- a. Center Frequency: 1010 MHz.
 - b. Span: 10 kHz.
 - c. Press **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 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 80, 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 11 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 RSA5100A 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 RSA5100A.

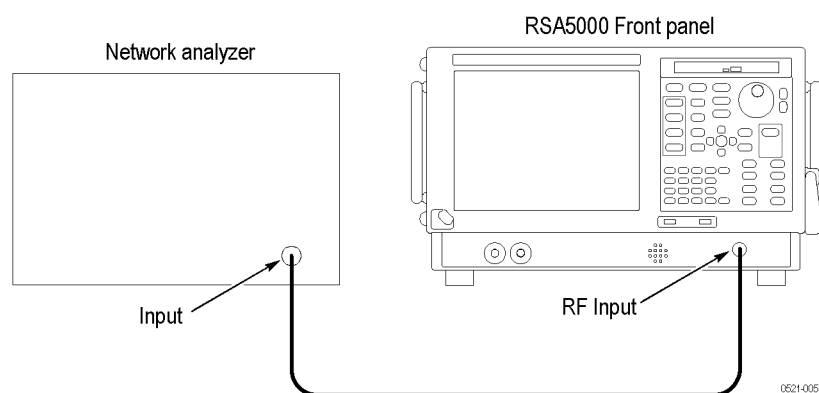


Figure 11: Equipment connections for VSWR check

2. Reset the RSA5100A to factory defaults; by pressing the **Preset** button, or selecting **Preset (Main)** from the **Setup** menu.
3. Select the **Ampl** softkey, deselect the **Auto** check box, and set the **Internal Attenuator** to 10 dB.
4. Set the START/STOP frequency of the Network Analyzer to 10 MHz/3 GHz.
5. Set the Center Frequency to ± 200 MHz of the Network Analyzer frequency to be measured.
6. Change the Center frequency from 10 MHz to 3 GHz by 400 MHz steps.
7. Check that the VSWR of the RSA5100A is < 1.4 for frequencies from 10 MHz to 3 GHz, making sure that the RSA5100A center frequency and the Network Analyzer frequency remain within ± 200 MHz of each other. Enter the highest VSWR in the test record. (Limits are shown in the test record.)
8. RSA5106A only: Set the START/STOP frequency of the Network Analyzer to 3 GHz/6.2 GHz and change the center frequency of the RSA5100A from 3 GHz to 6.2 GHz by 400 MHz steps.
9. RSA5106A only: Check that the VSWR of the RSA5100A is < 1.6 for frequencies from 3 GHz to 6.2 GHz, making sure that the RSA5100A center frequency and the Network Analyzer frequency remain within ± 200 MHz of each other. Enter the highest VSWR in the test record. (Limits are shown in the test record.)

**Input VSWR (Preamp ON -
Option 50 Only)**

1. Turn the Preamp on.

NOTE. *Preamp control is located on the Amplitude menu.*

2. Set the RSA5100A Center frequency to 1.5 GHz.
3. Set the Network Analyzer span to 10 MHz to 3.0 GHz (RSA5103A) or 6.2GHz (RSA5106A).
4. Set the RSA5100A Attenuator level to 10 dB:
 - a. Select **Amplitude** from the **Setup** menu.
 - b. Click the **Auto** radio button in the **Internal attenuator** section.
 - c. Set the attenuator to 10 dB.
5. Check that the VSWR of the RSA5100A is <1.6 across the entire frequency span. Enter the maximum VSWR in the test record. (Limits are shown 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 RSA5100A, as shown in the following figure. The 30 dB attenuator is only used when testing Option 50, with the preamp ON.

The power splitter outputs should connect directly to the RSA5100A RF Input (or the 30 dB attenuator) and to the Power Sensor, without using cables.

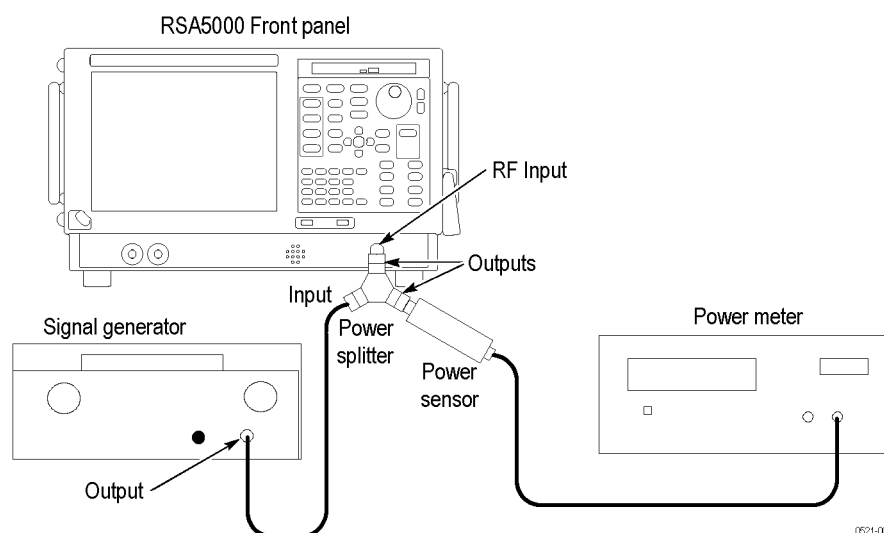


Figure 12: Equipment connections for RF Flatness check

2. To record the test readings, you can make a printout of the following table. (See Table 59.)
3. Reset the RSA5100A to factory defaults; by pressing the **Preset** button, or selecting **Preset** from the **Setup** menu.
4. Set the RSA5100A reference level to -15 dBm
5. Set the RSA5100A Attenuator level to 10 dB:
 - a. Select **Amplitude** from the **Setup** menu.
 - b. Deselect the **Auto** radio button in the **Internal attenuator** section.
 - c. Set the attenuator to 10 dB.
6. Set the Option 50 Preamp OFF (if installed).
7. Select the **Traces** tab in the **Settings** menu and set for 10 averages:

Trace	Trace1
Detection	+Peak
Function	Avg (VRMS)
Averages	10

8. Set the RF generator for a –15 dBm output amplitude.
9. Set both the RF generator output frequency and the RSA5100A Center Frequency to 100 MHz. This is the reference frequency.
10. Select the **Marker Peak** button to set the Reference Marker (MR) to the carrier peak.
11. Record the Power Meter reading and the RSA5100A reading in the following table.
12. Set both the RF generator output frequency and the RSA5100A Center Frequency to 10 MHz.
13. Select the **Peak** soft key to set the Reference Marker (MR) to the carrier peak.
14. Record the Power Meter reading and the RSA5100A reading in the following table.
15. Calculate the Δ Power Meter number: subtract the Power Meter reading at 100 MHz from the Power Meter reading at this frequency.
16. Calculate the Δ RTSA number: subtract the RTSA reading at 100 MHz from the RTSA reading at this frequency.
17. Calculate the RF Flatness Error:

$$RF \text{ Flatness Error} = \Delta \text{ RTSA at this freq} - \Delta \text{ Power Meter at this freq}$$
Readings are in dBm, error is in dB.
18. Repeat parts 12 through 13 for each of the center frequencies shown in the following table.

Table 59: RF Flatness (Preamp OFF, if installed)

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					

Table 59: RF Flatness (Preamp OFF, if installed) (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
300 MHz					
400 MHz					
500 MHz					
600 MHz					
700 MHz					
800 MHz					
900 MHz					
1.0 GHz					
1.1 GHz					
1.2 GHz					
1.3 GHz					
1.4 GHz					
1.5 GHz					
1.6 GHz					
1.7 GHz					
1.8 GHz					
1.9 GHz					
2.0 GHz					
2.1 GHz					
2.2 GHz					
2.3 GHz					
2.4 GHz					
2.5 GHz					
2.6 GHz					
2.7 GHz					
2.8 GHz					
2.9 GHz					
3.0 GHz					
RSA5106A only					
3.1 GHz					
3.2 GHz					
3.3 GHz					
3.4 GHz					
3.5 GHz					
3.6 GHz					

Table 59: RF Flatness (Preamp OFF, if installed) (cont.)**Attenuator = 10 dB**

Frequency	Power meter reading	Δ Power meter (vs. 100 MHz)	RTSA reading	Δ RTSA reading (vs. 100 MHz)	RF flatness error¹
3.7 GHz					
3.8 GHz					
3.9 GHz					
4.0 GHz					
4.1 GHz					
4.2 GHz					
4.3 GHz					
4.4 GHz					
4.5 GHz					
4.6 GHz					
4.7 GHz					
4.8 GHz					
4.9 GHz					
5.0 GHz					
5.1 GHz					
5.2 GHz					
5.3 GHz					
5.4 GHz					
5.5 GHz					
5.6 GHz					
5.7 GHz					
5.8 GHz					
5.9 GHz					
6.0 GHz					
6.1 GHz					
6.2 GHz					

¹ Use the formula in Step 17

- 19.** For signal analyzers with Option 50 installed, add the precision 30 dB attenuator as shown in figure (See Figure 12.).
- 20.** Set the reference level to -30 dBm.
- 21.** Increase the Signal Generator amplitude to -5 dBm. Repeat this check for the range of 10 MHz to 3 GHz for an RSA5103A or 10 MHz to 6.2 GHz for an RSA5106A with the Preamp ON.

Table 60: 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)	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					
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					

Table 60: RF Flatness (Option 50 Preamp ON) (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
2.6 GHz					
2.7 GHz					
2.8 GHz					
2.9 GHz					
3.0 GHz					
RSA5106A 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					
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					

Table 60: RF Flatness (Option 50 Preamp ON) (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
5.9 GHz					
6.0 GHz					
6.1 GHz					
6.2 GHz					

¹ Use the formula in Step 17

22. Enter the largest variation in each of the following frequency ranges into the test record:
- 10 MHz - 3 GHz (Preamp OFF)
 - 10 MHz - 3 GHz (Preamp ON, Option 50 only)
 - 3 GHz - 6.2 GHz (Preamp Off, RSA5106A only)
 - 3 GHz - 6.2 GHz (Preamp On, RSA5106A only)

Low Frequency (LF) Input Path Accuracy

1. Connect the RF generator, power splitter, power meter, and RSA5100A, as shown in the following figure.

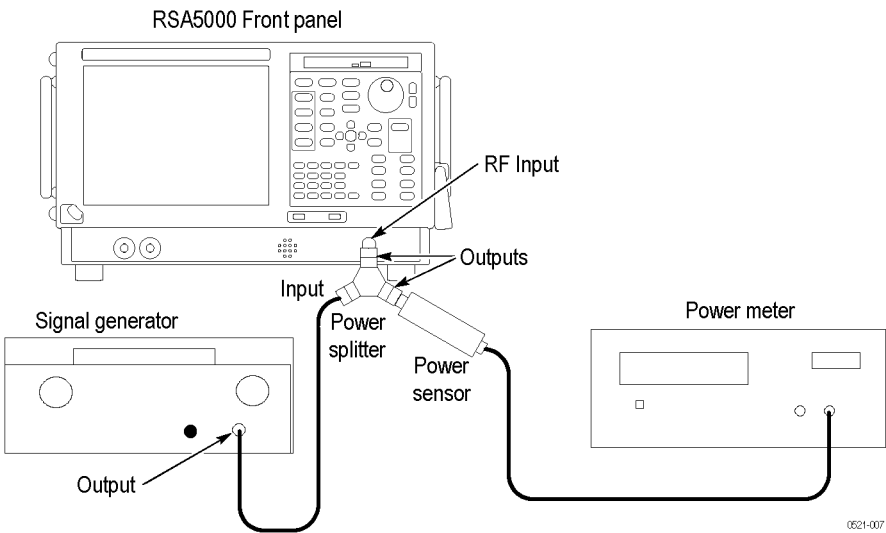


Figure 13: Equipment connections for Low Frequency (LF) input path accuracy check

2. The power splitter outputs should connect directly to the RSA5100A RF Input and to the Power Sensor, without using cables.

3. Reset the RSA5100A to factory defaults; by pressing the **Preset** button, or selecting **Preset** from the **Setup** menu.
4. Select the **Acquire** button.
5. In the **Acquire** control panel, select the **Input Params** tab.
6. Enable the “**Use Low Freq signal path**” check box.
7. Set the Ref Level to -15 dBm.
8. Set the RSA5100A Attenuator level to 10 dB:
 - a. Select **Amplitude** from the **Setup** menu.
 - b. Click the **Auto** radio button in the **Internal attenuator** section.
 - c. Set the attenuator to 10 dB.
9. Set the Option 50 Preamp OFF (if installed).
10. Select the **Traces** tab in the **Settings** menu and set for 10 averages:

Trace	Trace1
Detection	+Peak
Function	Avg (VRMS)
Averages	10

11. Set the RF generator for a –15 dBm output amplitude.
12. Set both the RF generator output frequency and the RSA5100A Center Frequency to 10 MHz. This is the reference frequency.
13. Select the **Marker Peak** button to set the Reference Marker (MR) to the carrier peak.
14. Record the Power Meter reading and the RSA5100A reading in the following table.
15. Set both the RF generator output frequency and the RSA5100A Center Frequency to 11 MHz.
16. Select the **Peak** soft key to set the Reference Marker (MR) to the carrier peak.
17. Record the Power Meter reading and the RSA5100A reading in the following table.
18. Calculate the Δ Power Meter number: subtract the Power Meter reading at 10 MHz from the Power Meter reading at this frequency.
19. Calculate the Δ RTSA number: subtract the RTSA reading at 10 MHz from the RTSA reading at this frequency.
20. Calculate the RF Flatness Error:

$$RF\ Flatness\ Error = \Delta\ RTSA\ at\ this\ freq - \Delta\ Power\ Meter\ at\ this\ freq$$

Readings are in dBm, error is in dB.

21. Repeat parts 15 through 17 for each of the center frequencies shown in the following table.

Table 61: Low Frequency Input Path Flatness (Preamp OFF, if installed)

Attenuator = 10 dB

Frequency	Power meter reading	Δ Power meter (vs. 10 MHz)	RTSA reading	Δ RTSA reading (vs. 100 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					
22 MHz					
23 MHz					
24 MHz					
25 MHz					
26 MHz					
27 MHz					
28 MHz					
29 MHz					
30 MHz					
31 MHz					

¹ Use the formula in Step 17

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

10 MHz - 31 MHz (Preamp OFF)

Absolute Accuracy at Calibration Point

1. Connect the RF generator, power splitter, power meter, and RSA5100A. (See Figure 12.)
2. Reset the RSA5100A to factory defaults by pressing the **Preset** button, or selecting **Preset** from the **Setup** menu.

3. Set the RSA5100A:

Reference Level	-20 dBm
Center Frequency	100 MHz
Span	1 MHz

4. Set the RF Generator:

Output Frequency	100 MHz
Output Level	-14 dBm

5. Align the RSA5100A:

- a.** Select **Alignments** in the **Tools** menu.
- b.** Click the **Align Now** button.

6. Select the **Peak soft key to set the Reference Marker (MR) to the carrier peak.**

7. Record the reading on the Power Meter and on the RSA5100A.

8. Calculate the Absolute Amplitude Error:

$$\text{Error} = \text{RSA5100A reading} - \text{Power Meter reading}$$

Readings are in dBm, error is in dB.

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

Noise and Distortion

Third Order Intermodulation Distortion

1. Set up the RF sinewave generators, Lowpass filters, Signal Combiner, and RSA5100A as shown in the following figure.

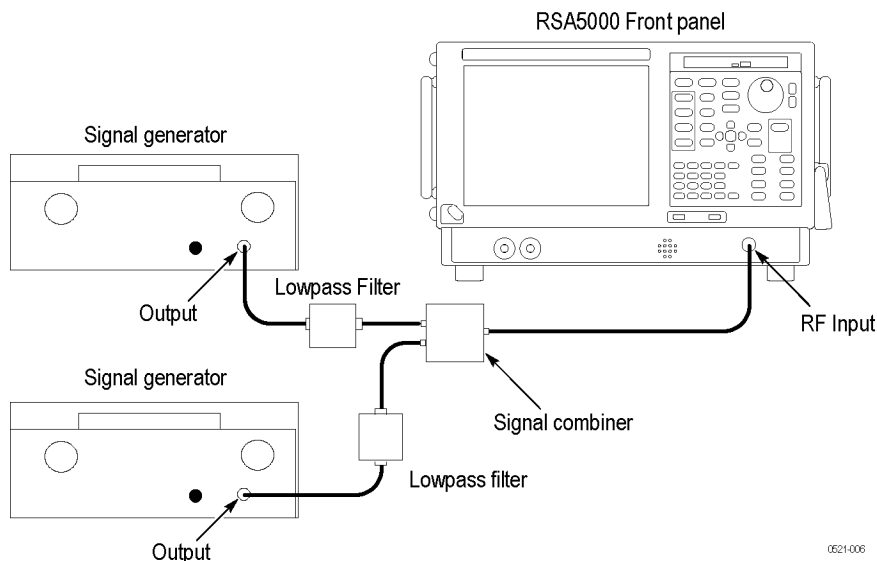


Figure 14: Equipment connections for Third Order Intermodulation Distortion check

2. Set the RSA5100A:

Reference Level	-20 dBm
Span	10 kHz
RBW	Auto
Attenuator	0 dB
Preamp	OFF (Option 50 only)
Averaging (Settings >Traces > Avg (VRMS))	10

3. Select the Amplitude icon, and then the **Internal Settings** tab.
4. Select **Maximize Dynamic Range** in the **RF & IF Optimization** drop-down menu.

5. Set each of the two generators to provide a power level of -28 dBm. The tones must be of equal amplitude.
 - a. Set the first generator output frequency to 2.1295 GHz, and the second generator output frequency to 2.1305 GHz.
 - b. Set the RSA5100A Center frequency to 2.1295 GHz and use the peak marker readout to set the first generator output level to -25.0 dBm on the display.
 - c. Set the RSA5100A Center frequency to 2.1305 GHz and use the peak marker readout to set the second generator output level to -25.0 dBm on the display.
6. Set the RTSA center frequency to 2.1285 GHz and use an amplitude marker (Marker > Peak) to read the amplitude level of the signal displayed at the center of the screen. Note this amplitude.
7. Set the RTSA center frequency to 2.1315 GHz and use an amplitude marker (Marker > Peak) to read the amplitude level of the signal displayed at the center of the screen. Note this amplitude.
8. Record the higher of these two center frequency readings in the test record. It should be ≤ -84 dBc relative to the carrier signal. It should be approximately -109 dBm or less using the absolute power readings on the screen.

DANL - Preamp OFF

1. Terminate the RSA5100A RF Input with a $50\ \Omega$ terminator.
2. Reset the RSA5100A to factory defaults by pressing the **Preset (Main)** button, or selecting **Preset (Main)** from the **Setup** menu.
3. Set the RSA5100A:

Reference Level	-50 dBm
Center Frequency	9 kHz
Span	1 kHz
RBW	Auto
Detection	Avg (of Logs)
Function: Avg (of Logs)	100
Internal Attenuator	0 dB
Preamp (Option 50 only)	OFF

4. Press the **Acquire** button to display the Acquire control panel.
5. Select the **Input Params** tab.
6. Verify that the **Use Low Freq signal path** setting is enabled (the box is checked).
7. Verify that **Currently using** displays **LF**.

8. Set the markers for Noise Mode operation:
 - a. Select the **Markers** soft key.
 - b. Select the **Define** soft key.
 - c. Select the **Add** soft key to add the Reference marker (MR).
 - d. Select **Add** again to add the M1 marker.
 - e. Select **Absolute** from the **Readouts** drop-down list.
 - f. Select the **Settings** button, click the **Prefs** tab, and then select the **Marker Noise Mode** checkbox so it is checked.
9. Press the **AMPL** soft key to display the Amplitude control panel.
10. On the **Internal Settings** tab, deselect the **Auto** check box. Set the **Internal Attenuator** to **0 dB**. Set **RF & IF Optimization** to **Minimize Noise**.
11. Set the RSA5100A to each of the Center Frequencies listed in the following table in turn, and after averaging is completed, press Marker Peak, 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.

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 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 80, Spurious Response.)

Table 62: Frequencies of interest for DANL check (LF Path)

Center frequency	Marker noise level	Frequency range
2.1 kHz		2 kHz -10 kHz
9.9 kHz		
10.1 kHz		10 kHz - 32 MHz
31 MHz		

12. Set the RSA5100A:

Reference Level	-50 dBm
Center Frequency	9 kHz
Span	1 kHz
RBW	Auto
Detection	Avg (of Logs)

Function: Avg (of Logs)	100
Internal Attenuator	0 dB
Preamp (Option 50 only)	OFF

13. Press the **Acquire** button to display the Acquire control panel.
14. Select the **Input Params** tab.
15. Verify that the **Use Low Freq signal path** setting is disabled (the box is not checked).
16. Verify that **Currently using** displays **RF**.
17. Set the markers for Noise Mode operation:
 - a. Select the **Markers** soft key.
 - b. Select the **Define** soft key.
 - c. Select **All Off**.
 - d. Select the **Add** soft key to add the Reference marker (MR).
 - e. Select **Add** again to add the M1 marker.
 - f. Select **Absolute** from the **Readouts** drop-down list.
 - g. Select the **Settings** button, click the **Prefs** tab, and then select the **Marker Noise Mode** checkbox so it is checked.
18. Select **Amplitude** from the Setup menu to display the Amplitude control panel.
19. On the **Internal Settings** tab, deselect the **Auto** check box. Set the **Internal Attenuator** to **0 dB**. Set **RF & IF Optimization** to **Minimize Noise**.
20. Set the RSA5100A to each of the Center Frequencies listed in the following table in turn, and after averaging is completed, press Marker Peak, 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 63: Frequencies of interest for DANL check (RF Path)

Center frequency	Marker noise level	Frequency range
10 MHz		10 MHz - 2.0 GHz
1.99 GHz		
2.01 GHz		2.0 GHz - 3.0 GHz
2.99 GHz		
3.01 GHz		3.0 GHz - 4.0 GHz
3.99 GHz		(RSA5106A only)

Table 63: Frequencies of interest for DANL check (RF Path) (cont.)

Center frequency	Marker noise level	Frequency range
4.01 GHz		4 GHz - 6.2 GHz
6.2 GHz		(RSA5106A only)

21. 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 (Option 50 Only)

1. Continuing from the previous step, change the RSA5100A settings:

Reference Level	-70 dBm
Preamp	ON

2. Use Marker 1 to measure the noise level, in dBm/Hz (Absolute readout), at each of the Center Frequencies shown in the following table:

Table 64: 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
6.2 GHz		(RSA5106A only)

3. 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 RSA5100A as shown in the following figure.

The power splitter outputs should connect directly to the RSA5100A RF Input and to the Power Sensor.

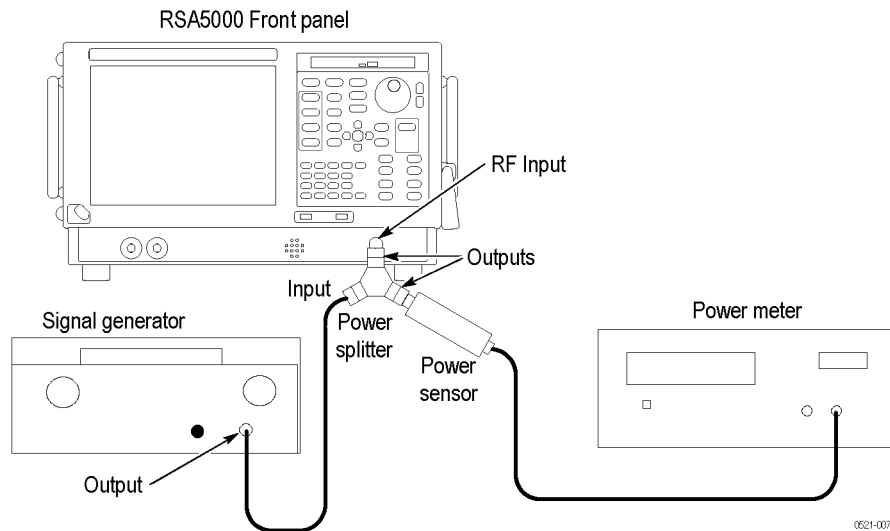


Figure 15: Equipment connections for IF Flatness check

2. Reset the RSA5100A to factory defaults; by pressing the **Preset** button, or selecting **Preset** from the **Setup** menu.
3. Set the RSA5100A:

Span	300 kHz
Reference Level	0 dBm

4. Set both the RF generator output frequency and the RSA5100A Center Frequency to 200 MHz. This is the reference frequency.
5. Select the **Markers** soft key and then select the **Peak** soft key to set the Reference marker to the carrier peak.
6. Set the signal generator output level to $-10 \text{ dBm} \pm 1 \text{ dBm}$, shown on the RSA5100A display.
7. Record the Power Meter reading and the RSA5100A marker reading in Table 2-7.
8. Set the RF generator output frequency to 199.85 MHz.
9. Leave the RSA5100A center frequency at 200 MHz and use the Reference marker (MR) to measure the amplitude at this new frequency.

10. Record the Power Meter reading and the RSA5100A reading in the following table.
11. Calculate the Δ Power Meter number: subtract the Power Meter reading at 200 MHz from the Power Meter reading at this frequency.
12. Calculate the Δ RTSA number: subtract the RSA5100A reading at 200 MHz from the RSA5100A reading at this frequency.
13. Calculate the IF Flatness Error using the formula:

$$RF \text{ Flatness Error} = \Delta \text{ RTSA at this freq} - \Delta \text{ Power Meter at this freq}$$
Readings are in dBm, error is in dB.
14. Repeat parts 8 through 13 for each of the remaining generator frequencies shown in the Span = 300 kHz portion of the following table.
15. Record the highest Calculated IF Flatness Error for the Span setting into the test record. (Limits are shown in the test record.)
16. Repeat this process for Span settings of 20 MHz and 25 MHz, using the appropriate span segment of the following table.
17. (Option 85 only.) Repeat this process for a 85 MHz Span setting.

Table 65: IF Flatness

Generator Frequency	Power meter reading	Δ Power meter (vs. 200 MHz)	RTSA reading	Δ RTSA 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					

Table 65: IF Flatness (cont.)

Span = 20 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

210.5 MHz

212.5 MHz

Span = 85 MHz (Option 85 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 RSA5100A RF Input.
2. Reset the RSA5100A to factory defaults; by pressing the **Preset** button, or selecting **Preset** from the **Setup** menu.

3. Set the RSA5100A:

Center Frequency	See the following table
Reference Level	–30 dBm
Span	25 MHz
RBW	1 kHz
Function	Avg (VRMS)
Averages	20
Internal Attenuator	0 dB

4. Note the maximum signal level across the span for each of the center frequencies shown in the following table, from 200 MHz to 3.0 GHz (RSA5103) or 200 MHz to 6.2 GHz (RSA5106A).
5. Enter the highest of these signal levels into the test record.

Table 66: 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

Table 66: Residual Response Center Frequencies (cont.)

MHz	GHz	GHz	GHz	GHz
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
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 RSA5100A RF Input, as shown in the following figure.
2. Reset the RSA5100A to factory defaults; by pressing the **Preset** button, or selecting **Preset** from the **Setup** menu.

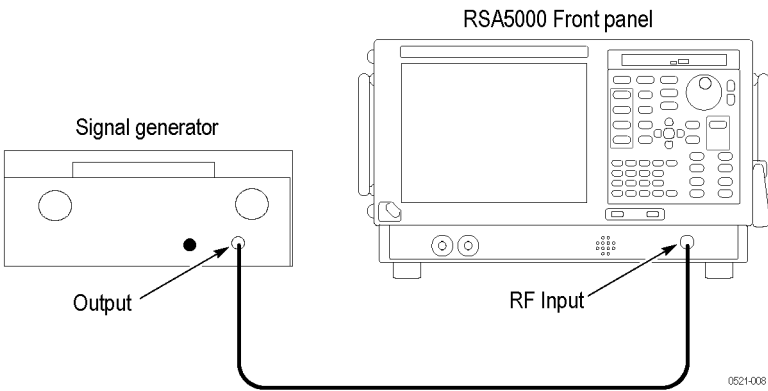


Figure 16: Equipment connections for Image Suppression check

3. Set the RSA5100A:

Reference Level	-30 dBm
Attenuator	10 dB
Span	500 kHz
RBW	10 Hz
Function	Avg (VRMS)
Averages	20

- 4.** Set the RF generator: Output Level to -30 dBm at the end of the cable. Verify the output level with the power meter, if necessary.
- 5.** Press **Add** to add the Marker Reference to the graph display.
- 6.** For each row of the table below (as appropriate to your instrument model):
 - a.** Set the RSA5100A to the Center Frequency shown in the first column.
 - b.** Set the RF generator output frequency to the Image Frequency shown in the second column.
 - c.** Press the **Peak** button to move the MR marker to the peak signal value.
 - d.** Read the marker amplitude, in dBm, at the upper-left on the screen. Subtract -30 dBm from the signal amplitude, to convert it to dBc.
 - e.** Enter this value in the test record.

Table 67: Image Suppression Settings

RSA5100A Center Frequency	RF Generator Output Frequency (Image)
RSA5103A and RSA5106A	
29 MHz (LF Path)	229 MHz
2.0 GHz	2.45 GHz

Table 67: Image Suppression Settings (cont.)

RSA5100A Center Frequency	RF Generator Output Frequency (Image)
3.0 GHz	17.05 GHz
RSA5106A only	
5.95 GHz	20 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 Signal Analyzer and/or filter the signal from the test generator to remove unwanted products.

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

Spurious Response with Signal

1. Connect the RF generator to the RSA5100A RF Input, as shown in the following figure.

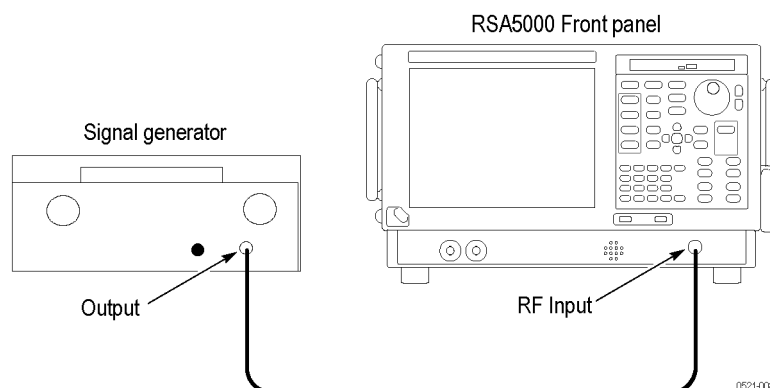


Figure 17: Equipment connections for Signal Spurious check

2. Reset the RSA5100A to factory defaults; by pressing the **Preset** button, or selecting **Preset (Main)** from the **Setup** menu.

3. Set the RSA5100A:

Center Frequency	1 GHz
Reference Level	-15 dBm
Span	25 MHz
RBW	1 kHz
Attenuator	10 dB
Averages	25

4. Set the RF generator:

Output Level	-15 dBm
Output Frequency	1 GHz

5. Check that all signals within ± 12.5 MHz of the Center Frequency are < -73 dBc.
6. (Option 85 only) Set the RSA5100A Span to 85 MHz.
7. Check that all signals within ± 42.5 MHz of the Center Frequency are < -73 dBc.
8. Enter Pass or Fail into the test record.

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

1. Connect the RF generator to the RSA5100A RF Input. (See Figure 17.)

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

2. Reset the RSA5100A to factory defaults; by pressing the **Preset** button, or selecting **Preset** from the **Setup** menu.
3. Set the RSA5100A:

Center Frequency	See the following table
Reference Level	-30 dBm
Span	10 kHz
Attenuator	10 dB
Averages	100

4. Set the RF generator:

Output Level	-30 dBm (at the end of the cable/filter)
Output Frequency	3.5125 GHz

5. Check the signal amplitude, in dBm, at each of the center frequencies shown in Table 2-10. Subtract -30 dBm from the signal amplitude to convert it to dBc.
6. Enter this value in the test record.

Table 68: Center Frequencies for Half-IF

33 MHz	3 GHz	6 GHz (RSA5106A only)
1 GHz	4 GHz (RSA5106A only)	
2 GHz	5 GHz (RSA5106A only)	

7. Enter the signal amplitude for each center frequency into the test record. (Limits are shown in the test record.)

Test Record

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

RSA5100A 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		-134 dBc/Hz
CF + 10 MHz		-135 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				-134 dBc/Hz
CF + 10 MHz				-135 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 (RSA5106A only)		1.6

Input VSWR		Test Result	High limit
Preamp ON (Option 50 only)			
	10 MHz - 3 GHz (RSA5103A)		1.6
	10 MHz – 6.2 GHz (RSA5106A)		1.6
RF Input Flatness		Test Result	High limit
Attenuator = 10 dB			
	10 MHz - 3 GHz (Preamp OFF)	–0.5 dB	+0.5 dB
	10 MHz - 3 GHz (Preamp ON)	–0.7 dB	+0.7 dB
	3 GHz - 6.2 GHz (Preamp OFF, RSA5106A only)	–1.0 dB	+1.0 dB
	3 GHz – 6.2 GHz (Preamp ON, RSA5106A only)	–1.3 dB	+1.3 dB
LF Input Path Flatness		Test Result	High limit
Attenuator = 10 dB			
	10 MHz - 31 MHz	-0.7 dB	+0.7 dB
Absolute accuracy at calibration point		Test Result	High limit
Absolute amplitude error		–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			
	2 kHz – 10 kHz (LF Path)		–141 dBm/Hz
	10 kHz – 32 MHz (LF Path)		–150 dBm/Hz
	10 MHz – 2 GHz		–154 dBm/Hz
	2 GHz – 3 GHz		–153 dBm/Hz
	3 GHz – 4 GHz (RSA5106A)		–151 dBm/Hz
	4 GHz – 6.2 GHz (RSA5106A only)		–149 dBm/Hz

Displayed Average Noise Level (DANL)	Test Result	High limit
Preamp ON (Option 50 only)		
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 (RSA5106A 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
85 MHz (Option 85 only)	-0.5 dB		+0.5 dB

Residual Response	Test Result	High limit
200 MHz - 3 GHz (RSA5103A)		-95 dBm
200 MHz - 6.2 GHz (RSA5106A)		-95 dBm

Image Suppression	Test Result	High limit
All Models		
29 MHz (LF Path)		-75 dBc
2 GHz		-80 dBc
3 GHz		-80 dBc
RSA5106A only		
5.95 GHz (RSA5106A only)		-80 dBc

Spurious Response with Signal	Low limit	Test Result	High limit
<1 MHz of Center Frequency	Fail		Pass
>1 MHz of Center Frequency	Fail		Pass
>1 MHz of Center Frequency (Option 85 only)	Fail		Pass

Spurious Response with Signal (Half IF)	Test Result	High limit
33 MHz		-80 dBc
1 GHz		
2 GHz		
3 GHz		
4 GHz (RSA5106A only)		
5 GHz (RSA5106A only)		
6 GHz (RSA5106A only)		