

**RSA6100A Series  
Real-Time Spectrum Analyzer  
Specifications and Performance Verification  
Technical Reference**



077-0251-01

**Tektronix**



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Real-Time Spectrum Analyzer  
Specifications and Performance Verification  
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**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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077-0251-01

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## **Contacting Tektronix**

Tektronix, Inc.  
14200 SW Karl Braun Drive  
P.O. Box 500  
Beaverton, OR 97077  
USA

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

- In North America, call 1-800-833-9200.
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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.*

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

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**Symbols and Terms on the Product**

These terms may appear on the product:

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

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



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# Preface

This document contains the Specifications and the Performance Verification for the RSA6100A 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 Quick Start User Manual* describes how to use your analyzer.
- The *RSA6100A Series Real-Time Spectrum Analyzers Application Examples Manual*, provides tutorial examples of how to take measurements in different application areas (Tektronix part number 071-2590-XX).
- The *RSA6100A Series Real-Time Spectrum Analyzers Printable Online Help*, provides a PDF version of the online help (Tektronix part number 077-0249-XX).
- The *RSA6100A Series Programmers Manual* describes how to use a computer to control the analyzer through the GPIB interface (Tektronix part number 071-2590-XX).
- The *RSA6100A Series Service Manual* provides information for maintaining and servicing your analyzer to the module level (Tektronix part number 077-0250-XX).
- The *RSA6100A Series Real-Time Spectrum Analyzers Declassification and Security Instructions*, describes how to sanitize or remove memory devices from the instrument, Tektronix part number 077-0170-XX.



# Specifications

This section lists the RSA6100A Series Real Time-Spectrum Analyzer specifications. Items listed in the Performance Requirement column are generally quantitative, and are either tested by the *Performance Verification* procedure or are guaranteed by design. Items listed in the Reference Information column are useful operating parameters that have typical values; information in this column is not guaranteed.

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

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## Performance Conditions

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

- The spectrum analyzer must have been calibrated and adjusted at an ambient temperature between +20 °C and +30 °C.
- The spectrum analyzer must be in an environment with temperature, altitude, humidity, and vibration within the operating limits described in these specifications.
- The spectrum analyzer must have had a warm-up period of at least 20 minutes after starting the RSA6100A application.

## Electrical Specifications

Table 1: Frequency

Characteristic	Description	
Measurement frequency		
Frequency range, nominal	RSA6106A	9 kHz to 6.2 GHz
	RSA6114A	9 kHz to 14 GHz
	RSA6120A	9 kHz to 20 GHz
Frequency Marker	Readout Accuracy	$\pm(\text{RE} \times \text{MF} + 0.001 \times \text{Span} + 2)$ Hz RE: Reference Frequency Error MF: Marker Frequency [Hz]
	Readout Resolution	Reference level dependent As small as 0.0001 $\mu\text{V}$
Residual FM, typical		<2 Hz <sub>p-p</sub> in 1 second at 200 MHz CF, 100 Hz span, Freq vs Time mode, Autoscale (95% confidence)
Span Accuracy		$\pm 0.3\%$ of span (Auto mode)
Reference Frequency		

**Table 1: Frequency (cont.)**

Characteristic		Description
Stability, nominal		$2 \times 10^{-8}$
Adjustment Range		$\pm 5.5 \times 10^{-7}$
✓ Initial Accuracy at Cal		Within $1 \times 10^{-7}$ (after a 10 min warmup)
Aging	Per day	$\pm 1 \times 10^{-9}$ (after 30 days of operation)
	Long term	$\pm 2 \times 10^{-7}$ (10 years)
	Cumulative Error, typical (Temperature + Aging)	$\pm 2.5 \times 10^{-7}$ (10 years)
Temperature drift		$\pm 2 \times 10^{-8}$ (0 °C to 50 °C)
Reference output Level	✓ Internal Reference selected	>0 dBm
	External Reference selected, nominal	Approximately 0 dB gain from Reference input (+15 dBm Max output)
External Reference Input, nominal		BNC Connector, 50 Ω
External Reference Input Frequency, nominal		Every 1 MHz from 1 MHz to 25 MHz plus 1.2288 MHz, 4.8 MHz, & 19.6608 MHz. Spurious level on input signal must be <-80 dBc within 100 kHz offset to avoid on-screen spurious
External Reference Input Range		$\pm 3 \times 10^{-7}$
✓ External Reference Input Level		-10 dBm to +6 dBm

**Table 2: Phase noise**

Characteristic	Description	
✓ Specified	Noise sideband	Offset
Frequency = 1000 MHz	-80 dBc/Hz	100 Hz
	-100 dBc/Hz	1 kHz
	-106 dBc/Hz	10 kHz
	-107 dBc/Hz	100 kHz
	-128 dBc/Hz	1 MHz
	-134 dBc/Hz	6 MHz
	-134 dBc/Hz	10 MHz
Typical		
Frequency = 1000 MHz	-86 dBc/Hz	100 Hz
	-106 dBc/Hz	1 kHz
	-110 dBc/Hz	10 kHz
	-113 dBc/Hz	100 kHz
	-134 dBc/Hz	1 MHz
	-142 dBc/Hz	6 MHz
	-142 dBc/Hz	10 MHz



Table 2: Phase noise (cont.)

Characteristic	Description	
Frequency = 2000 MHz	-80 dBc/Hz	100 Hz
	-106 dBc/Hz	1 kHz
	-110 dBc/Hz	10 kHz
	-111 dBc/Hz	100 kHz
	-133 dBc/Hz	1 MHz
	-142 dBc/Hz	6 MHz
	-142 dBc/Hz	10 MHz
Frequency = 6000 MHz	-70 dBc/Hz	100 Hz
	-96 dBc/Hz	1 kHz
	-107 dBc/Hz	10 kHz
	-107 dBc/Hz	100 kHz
	-132 dBc/Hz	1 MHz
	-142 dBc/Hz	6 MHz
	-142 dBc/Hz	10 MHz
Frequency = 10000 MHz (RSA6114A only)	-64 dBc/Hz	100 Hz
	-91 dBc/Hz	1 kHz
	-106 dBc/Hz	10 kHz
	-106 dBc/Hz	100 kHz
	-132 dBc/Hz	1 MHz
	-142 dBc/Hz	6 MHz
	-142 dBc/Hz	10 MHz
Frequency = 10000 MHz (RSA6120A only)	-77 dBc/Hz	100 Hz
	-95 dBc/Hz	1 kHz
	-111 dBc/Hz	10 kHz
	-112 dBc/Hz	100 kHz
	-130 dBc/Hz	1 MHz
	-142 dBc/Hz	6 MHz
	-142 dBc/Hz	10 MHz
Frequency = 18000 MHz (RSA6120A only)	-70 dBc/Hz	100 Hz
	-93 dBc/Hz	1 kHz
	-108 dBc/Hz	10 kHz
	-111 dBc/Hz	100 kHz
	-130 dBc/Hz	1 MHz
	-142 dBc/Hz	6 MHz
	-142 dBc/Hz	10 MHz

**Table 3: RF input**

Characteristic		Description
RF Input Connector, nominal		N type
RF Input Impedance, nominal		50 $\Omega$
RF VSWR, typical		<1.6 (9 kHz to 10 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 4 GHz	<1.6
	>4 GHz to 6.2 GHz	<1.8
	>6.2 GHz to 14 GHz (RSA6114A)	<1.9
	>6.2 GHz to 20 GHz (RSA6120A, RF ATT = 10 dB)	<1.9
Option 01 Preamp ON	10 MHz to 3 GHz	<1.9

**Table 4: Maximum input level**

Characteristic	Description
Maximum DC voltage	$\pm 40$ V (RF Input)
Maximum safe input power	+30 dBm (RF Input, RF ATT $\geq 10$ dB) +75 Watts peak (RF Input, RF ATT $\geq 30$ dB, <10 $\mu$ s Pulse Width, 1% Duty Cycle repetitive Pulses)
Maximum Measureable input power	+ 30 dBm (RF Input, RF ATT Auto) + 75 Watts peak (RF Input, RF ATT Auto), (<10 $\mu$ s Pulse Width, 1% Duty Cycle repetitive pulses)

**Table 5: Input attenuator**

Characteristic	Description
RF Attenuator (9 kHz to 20 GHz)	0 dB to 75 dB (5 dB step), nominal

**Table 6: Amplitude and RF flatness (excluding mismatch error) <sup>1</sup>**

Characteristic	Description
Reference level setting range, nominal	-170 dBm to +50 dBm, 0.1 dB step, (Standard RF input) Minimum ref level -50 dBm at CF < 70 MHz

**Table 6: Amplitude and RF flatness (excluding mismatch error) <sup>1</sup> (cont.)**

Characteristic	Description	
Frequency response (18 °C to 28 °C)		
✓ 10 dB RF attenuator setting	10 MHz to 3 GHz Preamp OFF	±0.5 dB
	10 MHz to 3 GHz Preamp ON (Option 01 only)	±0.7 dB
	3 GHz to 6.2 GHz	±0.8 dB
	6.2 GHz to 14 GHz (RSA6114A only)	±1.0 dB
	6.2 GHz to 20 GHz (RSA6120A only)	±1.0 dB
All RF attenuator settings, typical	9 kHz to 10 MHz	±0.7 dB
Frequency response (0 °C to 50 °C), typical		
All RF attenuator settings	9 kHz to 10 MHz	±0.7 dB
	10 MHz to 3 GHz	±0.7 dB
	3 GHz to 6.2 GHz	±0.8 dB
	6.2 GHz to 14 GHz (RSA6114A only)	±2.0 dB
	6.2 GHz to 20 GHz (RSA6120A only)	±2.0 dB
Input attenuator switching uncertainty		±0.2 dB

**Table 6: Amplitude and RF flatness (excluding mismatch error) <sup>1</sup> (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) <sup>2</sup> , 95% confidence	
10 MHz to 3 GHz	±0.5 dB
3 GHz to 6.2 GHz	±0.8 dB
6.2 GHz to 14 GHz (RSA6114A only)	±1.5 dB
6.2 GHz to 20 GHz (RSA6120A only)	±1.5 dB
Level Linearity	±0.1 dB (0 dB to –70 dB Below Reference Level)

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

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

**Table 7: Noise and distortion**

Characteristic	Description		
1 dB Compression Input	100 MHz to 3 GHz	>+9 dBm	
	3 GHz to 6.2 GHz	>+12 dBm	
	6.2 GHz to 14 GHz (RSA6114A only)	>+12 dBm	
	6.2 GHz to 20 GHz (RSA6120A only)	>+12 dBm	
3rd Order IM Intercept	At 2.130 GHz	+15 dBm	+17 dBm, typical

Table 7: Noise and distortion (cont.)

Characteristic	Description	
<b>3rd Order Intermodulation Distortion</b>		
✓ Specified (RSA6106A and RSA6114A)	2.130 GHz	-80 dBc
	Each signal level -25 dBm at the RF input. 1 MHz tone separation. Attenuator = 0, Ref Level = -20 dBm. Maximize Dynamic Range <i>RF/IF Optimization</i> mode	
✓ Specified (RSA6120A)	2.130 GHz	-88 dBc
	Each signal level -25 dBm at the RF input. 1 MHz tone separation. Attenuator = 0, Ref Level = -20 dBm. Maximize Dynamic Range <i>RF/IF Optimization</i> mode	
Typical (RSA6106A and RSA6114A)	9 kHz to 100 MHz	<-77 dBc
	100 MHz to 3 GHz	<-80 dBc
	3 GHz to 6.2 GHz	<-84 dBc
	6.2 GHz to 14 GHz (RSA6114A only)	<-84 dBc
Each signal level -25 dBm at the RF input. 1 MHz tone separation. Attenuator = 0, Ref Level = -20 dBm. Maximize Dynamic Range <i>RF/IF Optimization</i> mode.		
Typical (RSA6120A)	9 kHz to 100 MHz	<-79 dBc
	100 MHz to 3 GHz	<-90 dBc
	3 GHz to 6.2 GHz	<-88 dBc
	6.2 GHz to 14 GHz (RSA6114A only)	<-88 dBc
Each signal level -25 dBm at the RF input. 1 MHz tone separation. Attenuator = 0, Ref Level = -20 dBm. Maximize Dynamic Range <i>RF/IF Optimization</i> mode.		
<b>2<sup>nd</sup> Harmonic Distortion, typical. Preamp OFF</b>		
10 MHz to 3.1 GHz (-40 dBm at RF Input, Atten = 0)	<-80 dBc	
3.1 GHz to 7 GHz (RSA6114A Only) (-25 dBm at RF Input, Atten = 0)	<-80 dBc	
3.1 GHz to 10 GHz (RSA6120A Only) (-25 dBm at RF Input, Atten = 0, Preamp OFF)	<-80 dBc	

**Table 7: Noise and distortion (cont.)**

Characteristic	Description		
Displayed Average Noise Level (DANL) Normalized to 1 Hz RBW			
Preamp OFF (best noise mode)		✓ <i>Specification</i>	<i>Typical</i>
	9 kHz to 10 MHz	-97 dBm/Hz	-100 dBm/Hz
	10 MHz to 100 MHz	-147 dBm/Hz	-149 dBm/Hz
	100 MHz to 2.3 GHz	-149 dBm/Hz	-151 dBm/Hz
	2.3 GHz to 4 GHz	-147 dBm /Hz	-149 dBm /Hz
	4 GHz to 6.2 GHz	-143 dBm /Hz	-145 dBm /Hz
	6.2 GHz to 7 GHz (RSA6114A only)	-143 dBm /Hz	-145 dBm /Hz
	7 GHz to 14 GHz (RSA6114A only)	-135 dBm /Hz	-137 dBm /Hz
	Preamp ON (option 1 only)	✓ <i>Specification</i>	<i>Typical</i>
10 MHz to 50 MHz	-160 dBm/Hz	-170 dBm/Hz	
50 MHz to 1 GHz	-165 dBm/Hz	-170 dBm/Hz	
1 GHz to 2 GHz	-166 dBm/Hz	-170 dBm/Hz	
2 GHz to 3 GHz	-164 dBm/Hz	-170 dBm/Hz	

**Table 8: 3rd Order intermodulation distortion – RSA6120A**

Characteristic	Description	
Typical	9 kHz to 100 MHz	<-77 dBc
	100 MHz to 3 GHz	<-80 dBc
	3 GHz to 6.2 GHz	<-84 dBc
	6.2 GHz to 20 GHz	<-84 dBc

Each signal level -25 dBm at the RF input. 1 MHz tone separation. Attenuator = 0, Ref Level = -20 dBm. Maximize Dynamic Range *RF & IF Optimization* mode.

**Table 9: Displayed average noise level (DANL) normalized to 1 Hz RBW – RSA6120A only**

Characteristic	Description		
Displayed Average Noise Level (DANL) Normalized to 1 Hz RBW	Auto RF/IF Optimization or Minimize Noise Mode		
	Preamp OFF (best noise mode)	<i>✓ Specification</i>	<i>Typical</i>
	9 kHz to 10 MHz	-97 dBm/Hz	-100 dBm/Hz
	10 MHz to 100 MHz	-147 dBm/Hz	-149 dBm/Hz
	100 MHz to 2.3 GHz	-149 dBm/Hz	-151 dBm/Hz
	2.3 GHz to 4 GHz	-147 dBm /Hz	-149 dBm /Hz
	4 GHz to 6.2 GHz	-143 dBm /Hz	-145 dBm /Hz
	6.2 GHz to 17.5 GHz	-143 dBm /Hz	-145 dBm /Hz
	17.5 GHz to 20 GHz	-138 dBm /Hz	-140 dBm /Hz

**Table 10: Channel response <sup>1</sup>**

Characteristic	Description	
<i>✓</i> Amplitude Flatness	BW $\leq$ 300 kHz <sup>2</sup>	$\pm 0.2$ dB
	300 kHz < BW $\leq$ 10 MHz <sup>2</sup>	$\pm 0.2$ dB
	10 MHz < BW $\leq$ 20 MHz <sup>2</sup>	$\pm 0.4$ dB
	20 MHz < BW $\leq$ 40 MHz <sup>2</sup>	$\pm 0.5$ dB
	40 MHz < BW $\leq$ 110 MHz <sup>2</sup>	$\pm 0.9$ dB
Phase Linearity, typical	BW $\leq$ 300 kHz <sup>2</sup>	$\pm 0.5^\circ$
	300 kHz < BW $\leq$ 10 MHz <sup>2</sup>	$\pm 0.5^\circ$
	10 MHz < BW $\leq$ 20 MHz <sup>2</sup>	$\pm 1.0^\circ$
	20 MHz < BW $\leq$ 40 MHz <sup>2</sup>	$\pm 2.0^\circ$
	40 MHz < BW $\leq$ 110 MHz <sup>2</sup>	$\pm 2.0^\circ$

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

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

**Table 11: Channel response (center frequency  $\leq 3.0$  GHz; applies to instruments manufactured before June 2009) <sup>1</sup>**

Characteristic	Description		
	<i>Specification</i>	<i>Typical</i>	
Amplitude Flatness	BW $\leq 300$ kHz, CF $> 0.01$ GHz <sup>2</sup>	$\pm 0.2$ dB <sup>3</sup>	0.05 dB <sub>RMS</sub> <sup>4</sup>
	BW $\leq 40$ MHz, CF $> 0.03$ GHz	$\pm 0.5$ dB <sup>3</sup>	0.18 dB <sub>RMS</sub> <sup>4</sup>
	BW $\leq 80$ MHz, CF $\leq 0.07$ GHz	$\pm 0.9$ dB <sup>3</sup>	0.4 dB <sub>RMS</sub> <sup>4</sup>
	BW $\leq 110$ MHz, CF $> 0.07$ GHz		
Phase Linearity, typical			
	BW $\leq 300$ kHz, CF $\leq 0.01$ GHz <sup>2</sup>	0.5° <sub>RMS</sub> <sup>4</sup>	
	BW $\leq 40$ MHz, CF $\leq 0.03$ GHz	1.0° <sub>RMS</sub> <sup>4</sup>	
	BW $\leq 80$ MHz, CF $\leq 0.07$ GHz	1.5° <sub>RMS</sub> <sup>4</sup>	
	BW $\leq 110$ MHz, CF $\leq 0.07$ GHz	2.25° <sub>RMS</sub> <sup>4</sup>	

<sup>1</sup> 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.

<sup>2</sup> High Dynamic Range mode.

<sup>3</sup> After calibration and normalization.

<sup>4</sup> After calibration and alignment.



**Table 12: Channel response (center frequency  $\leq 3.0$  GHz; applies to instruments manufactured after June 2009) <sup>1</sup>**

Characteristic	Description	
Amplitude Flatness	Specification	Typical
BW $\leq 300$ kHz, CF $\leq 0.01$ GHz <sup>2</sup>	$\pm 0.1$ dB <sup>3</sup>	0.05 dB <sub>RMS</sub> <sup>4</sup>
BW $\leq 40$ MHz, CF $\leq 0.03$ GHz	$\pm 0.3$ dB <sup>3</sup>	0.2 dB <sub>RMS</sub> <sup>4</sup>
BW $\leq 80$ MHz, CF $\leq 0.07$ GHz	$\pm 0.5$ dB <sup>3</sup>	0.3 dB <sub>RMS</sub> <sup>4</sup>
BW $\leq 110$ MHz, CF $\leq 0.07$ GHz		
Phase Linearity, typical		
BW $\leq 300$ kHz, CF $\leq 0.01$ GHz <sup>2</sup>	0.1° <sub>RMS</sub> <sup>4</sup>	
BW $\leq 40$ MHz, CF $\leq 0.03$ GHz	0.5° <sub>RMS</sub> <sup>4</sup>	
BW $\leq 80$ MHz, CF $\leq 0.07$ GHz	1.0° <sub>RMS</sub> <sup>4</sup>	
BW $\leq 110$ MHz, CF $\leq 0.07$ GHz	1.0° <sub>RMS</sub> <sup>4</sup>	

<sup>1</sup> 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.

<sup>2</sup> High Dynamic Range mode.

<sup>3</sup> After calibration and normalization.

<sup>4</sup> After calibration and alignment.

**Table 13: Channel response (3.0 GHz < center frequency  $\leq 6.2$  GHz; applies to instruments manufactured before June 2009) <sup>1</sup>**

Characteristic	Description	
Amplitude Flatness	Specification	Typical
BW $\leq 300$ kHz <sup>2</sup>	$\pm 0.2$ dB <sup>3</sup>	0.05 dB <sub>RMS</sub> <sup>4</sup>
BW $\leq 40$ MHz	$\pm 0.5$ dB <sup>3</sup>	0.26 dB <sub>RMS</sub> <sup>4</sup>
BW $\leq 80$ MHz	$\pm 0.9$ dB <sup>3</sup>	0.6 dB <sub>RMS</sub> <sup>4</sup>
BW $\leq 110$ MHz		
Phase Linearity, typical		
BW $\leq 300$ kHz <sup>2</sup>	0.5° <sub>RMS</sub> <sup>4</sup>	
BW $\leq 40$ MHz	1.0° <sub>RMS</sub> <sup>4</sup>	
BW $\leq 80$ MHz	1.5° <sub>RMS</sub> <sup>4</sup>	
BW $\leq 110$ MHz	2.25° <sub>RMS</sub> <sup>4</sup>	

<sup>1</sup> 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.

<sup>2</sup> High Dynamic Range mode.

<sup>3</sup> After calibration and normalization.

<sup>4</sup> After calibration and alignment.

**Table 14: Channel response (3.0 GHz < center frequency ≤ 6.2 GHz; applies to instruments manufactured after June 2009) <sup>1</sup>**

Characteristic	Description	
Amplitude Flatness	Specification	Typical
	BW ≤ 300 kHz <sup>2</sup>	±0.1 dB <sup>3</sup> 0.05 dB <sub>RMS</sub> <sup>4</sup>
	BW ≤ 40 MHz	±0.3 dB <sup>3</sup> 0.20 dB <sub>RMS</sub> <sup>4</sup>
	BW ≤ 80 MHz	±0.5 dB <sup>3</sup> 0.3 dB <sub>RMS</sub> <sup>4</sup>
	BW ≤ 110 MHz	±0.5 dB <sup>3</sup> 0.4 dB <sub>RMS</sub> <sup>4</sup>
Phase Linearity, typical		
	BW ≤ 300 kHz <sup>2</sup>	0.1° <sub>RMS</sub> <sup>4</sup>
	BW ≤ 40 MHz	0.5° <sub>RMS</sub> <sup>4</sup>
	BW ≤ 80 MHz	1.0° <sub>RMS</sub> <sup>4</sup>
	BW ≤ 110 MHz	1.0° <sub>RMS</sub> <sup>4</sup>

<sup>1</sup> 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.

<sup>2</sup> High Dynamic Range mode.

<sup>3</sup> After calibration and normalization.

<sup>4</sup> After calibration and alignment.

**Table 15: Channel response (6.2 GHz < center frequency ≤ 14 GHz, RSA6114A only; applies to instruments manufactured before June 2009) <sup>1</sup>**

Characteristic	Description	
Amplitude Flatness	Specification	Typical
	BW ≤ 300 kHz <sup>2</sup>	±0.2 dB <sup>3</sup> 0.05 dB <sub>RMS</sub> <sup>4</sup>
	BW ≤ 40 MHz	±0.8 dB <sup>3</sup> 0.40 dB <sub>RMS</sub> <sup>4</sup>
	40 MHz ≤ BW ≤ 80 MHz	±1.5 dB <sup>3</sup> 0.7 dB <sub>RMS</sub> <sup>4</sup>
	40 MHz ≤ BW ≤ 110 MHz	
Phase Linearity, typical		
	BW ≤ 300 kHz <sup>2</sup>	1.0° <sub>RMS</sub> <sup>4</sup>
	BW ≤ 40 MHz	1.0° <sub>RMS</sub> <sup>4</sup>
	40 MHz ≤ BW ≤ 80 MHz	1.5° <sub>RMS</sub> <sup>4</sup>
	40 MHz ≤ BW ≤ 110 MHz	2.25° <sub>RMS</sub> <sup>4</sup>

<sup>1</sup> 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.

<sup>2</sup> High Dynamic Range mode.

<sup>3</sup> After calibration and normalization.

<sup>4</sup> After calibration and alignment.

**Table 16: Channel response (6.2 GHz < center frequency ≤ 20 GHz, RSA6114A and RSA6120A; applies to instruments manufactured after June 2009) <sup>1</sup>**

Characteristic	Description		
Amplitude Flatness	<i>Specification</i>	<i>Typical</i>	
	BW ≤ 300 kHz <sup>2</sup>	±0.1 dB <sup>3</sup>	0.05 dB <sub>RMS</sub> <sup>3</sup>
	BW ≤ 40 MHz	±0.5 dB <sup>3</sup>	0.40 dB <sub>RMS</sub> <sup>3</sup>
	40 MHz ≤ BW ≤ 80 MHz	±0.75 dB <sup>3</sup>	0.7 dB <sub>RMS</sub> <sup>3</sup>
	40 MHz ≤ BW ≤ 110 MHz	±1.0 dB <sup>3</sup>	
Phase Linearity, typical			
	BW ≤ 300 kHz <sup>2</sup>	0.1° <sub>RMS</sub> <sup>3</sup>	
	BW ≤ 40 MHz	1.0° <sub>RMS</sub> <sup>3</sup>	
	40 MHz ≤ BW ≤ 80 MHz	1.5° <sub>RMS</sub> <sup>3</sup>	
	40 MHz ≤ BW ≤ 110 MHz	1.5° <sub>RMS</sub> <sup>3</sup>	

<sup>1</sup> 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.

<sup>2</sup> High Dynamic Range mode.

<sup>3</sup> After calibration and normalization.

**Table 17: Pulse measurements, typical**

Characteristic	Description	
	110 MHz BW	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 pulsewidths ≥100 ns, duty cycles of 0.5 to 0.001, and S/N ratio = 30 dB	For pulsewidths ≥300 ns, and signal levels >70 dB below Ref Level
Duty Factor, typical	±3% of reading	
	For pulsewidths ≥150 ns, duty cycles of 0.5 to 0.001, and S/N ratio = 30 dB	For pulsewidths ≥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 pulsewidths ≥100 ns, duty cycles of 0.5 to 0.001, and S/N ratio = 30 dB	For pulsewidths ≥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 pulsewidths ≥100 ns, duty cycles of 0.5 to 0.001, and S/N ratio = 30 dB	For pulsewidths ≥300 ns, duty cycles of 0.5 to 0.001, and S/N ratio = 30 dB

**Table 17: Pulse measurements, typical (cont.)**

Characteristic		Description	
Pulse Width, typical		±3% of reading	
		For pulsewidths ≥150 ns, duty cycles of 0.5 to 0.001, and signal levels >50 dB below Ref Level	For pulsewidths ≥450 ns, duty cycles of 0.5 to 0.001, and S/N ratio = 30 dB
System Rise time, typical		<10 ns	<25 ns
Pulse-to-Pulse carrier phase, typical <sup>1 2</sup>		<b>110 MHz BW</b>	<b>40 MHz BW</b>
For instruments manufactured before June 2009.	2 GHz	±2°	±1.7°
	10 GHz	±5°	±3.5°
	<b>60 MHz BW</b>		<b>20 MHz BW</b>
	2 GHz	±1.8°	±1.5°
	10 GHz	±4°	±2.9°
	<b>110 MHz BW</b>		<b>40 MHz BW</b>
For instruments manufactured after June 2009.	2 GHz	±0.6°	±0.35°
	10 GHz	±0.75°	±0.75°
	20 GHz	±1.5°	±1.3°
	<b>60 MHz BW</b>		<b>20 MHz BW</b>
	2 GHz	±0.5°	±0.3°
	10 GHz	±0.75°	±0.6°
	20 GHz	±1.5°	±1.3°

<sup>1</sup> For 60 MHz / 110 MHz bandwidths, and conditions of:

Pulse ON power ≥ -20 dBm

Frequency Estimation = Manual

CW (non-chirped) pulses

Signal peak at Ref Lvl.

Atten = Auto

Pulse width ≥ 200 ns.

PRI ≤ 300 us.

Duty cycle ≥ 0.0007

$t_{meas} - t_{reference} \leq 10$  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.

<sup>2</sup> For 20 MHz / 40 MHz bandwidths, and conditions of:

Pulse ON power ≥ -20 dBm

Frequency Estimation = Manual

CW (non-chirped) pulses

Signal peak at Ref Lvl.

Atten = Auto

Pulse width ≥ 300 ns.

PRI ≤ 300 us.

Duty cycle ≥ 0.001

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

Phase measurement includes 100 pulses minimum.

Measured pulses to be adjacent.

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

**Table 18: Spurious response**

Characteristic		Description
Residual Response (Atten = 0 dB)	40 MHz to 200 MHz, typical	<-90 dBm (Ref = -30 dBm, RBW = 1 kHz)
	✓ 200 MHz to 6.2 GHz	<-95 dBm (Ref = -30 dBm, RBW = 1 kHz)
	6.2 GHz to 20 GHz, typical	<-95 dBm (Ref = -30 dBm, RBW = 1 kHz)
✓ Spurious Response with Signal (Image Suppression)		<-80 dBc (9 kHz to 8 GHz, Ref= -30 dBm, Atten = 10 dB, RF Input Level = -30 dBm, RBW = 10 Hz) <-76 dBc (8 GHz to 14 GHz, Ref= -30 dBm, Atten = 10 dB, RF Input Level = -30 dBm, RBW = 10 Hz)
Spurious Response with Signal	✓ 30 MHz to 14 GHz	See the following table.
✓ Spurious Response with Signal (4.75 GHz - Half-IF)		<-57 dBc (CF 9 kHz to 8 GHz, Ref = -30 dBm, Atten = 10 dB, RBW = 1 kHz) Signal frequency range = 4.7225 to 4.7775 GHz, RF input level = -30 dBm
Local Oscillator Feed-through to Input Connector (Spurious Leakage), typical		<-65 dBm (Attenuator = 10 dB)

**Table 19: Spurious response with signal**

Frequency	Span ≤ 40 MHz, Swept Spans < 40 MHz		For Option 110 <sup>1</sup> 40 MHz Span ≤ 110 MHz	
	Specification	Typical	Specification	Typical
30 MHz - 6.2 GHz	-73 dBc	-78 dBc	-73 dBc	-75 dBc
≥6.2 GHz - 20 GHz (RSA6114A and RSA6120A only)	-70 dBc	-75 dBc	-70 dBc	-75 dBc

<sup>1</sup> 1 In 110 mode CF > 80 MHz, after alignment.

**Table 20: Acquisition**

Characteristic	Description
Real-time Capture Bandwidth, nominal	40 MHz (RF, 40 MHz Version)
	110 MHz (RF, 110 MHz Version)
Demodulation Bandwidth	40 MHz (RF, 40 MHz Version)
	110 MHz (RF, 110 MHz Version)

**Table 20: Acquisition (cont.)**

<b>Characteristic</b>	<b>Description</b>			
A/D Converter, nominal	14 bits, 100 Ms/s (40 MHz Version) 14 bits, 100 Ms/s & 12 bits, 300 Ms/s (110 MHz Version, Serial Numbers B010XXX) 14 bits, 100 Ms/s, 300 Ms/s (110 MHz Version, RSA6106A and RSA6114A Serial Number B020XXX and above, all RSA6120A)			
Sampling Rate and Available Memory time in RTSA/Time/Demod Mode, nominal	<b>Acquisition BW</b>	<b>Sample Rate (for I and Q)</b>	<b>Record Length</b>	<b>Record Length (option 02)</b>
	110 MHz (Option 110)	150 MS/s	0.426 s	1.706 s
	60 MHz (Option 110)	75 MS/s	0.852 s	3.413 s
	40 MHz	50 MS/s	1.28 s	5.12 s
	20 MHz	25 MS/s	2.56 s	10.2 s
	10 MHz	12.5 MS/s	5.12 s	20.5 s
	5 MHz	6.25 MS/s	10.2 s	41.0 s
	2 MHz	3.125 MS/s	10.2 s	41.0 s
	1 MHz	1.56 MS/s	20.5 s	81.9 s
	500 kHz	781 kS/s	41 s	164 s
	200 kHz	390 kS/s	81.9 s	328 s
	100 kHz	195 kS/s	164 s	655 s
	50 kHz	97.6 kS/s	328 s	1310 s
	20 kHz	48.8 kS/s	655 s	2620 s
	10 kHz	24.4 kS/s	1310 s	10500 s
	5 kHz	12.2 kS/s	2620 s	21000 s
	2 kHz	3.05 kS/s	10500 s	41900 s
	1 kHz	1.52 kS/s	21000 s	83900 s
	500 Hz	762 S/s	41900 s	168300 s
	200 Hz	381 S/s	83900 s	336000 s
	100 Hz	190 S/s	168300 s	671000 s
Minimum Acquisition Length in RTSA/Time/Demod Mode, nominal	64 samples			
Maximum Acquisition Length in RTSA/Time/Demod Mode (Acquisition BW Dependent), nominal	53,687,000 samples (Std.) 214,748,000 samples (Option 02)			
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 (256 Mbyte) (Std)	64 MSamples		

Table 20: Acquisition (cont.)

Characteristic	Description
Acq BW $\leq$ 2.5 MHz (256 Mbyte) (Std)	32 MSamples
Acq BW > 2.5 MHz (1 Gbyte) (Option02)	256 MSamples
Acq BW $\leq$ 2.5 MHz (1 Gbyte) (Option02)	128 MSamples

Table 21: Amplitude vs. time

Characteristic	Description
Time Scale (Zero Span), nominal	400 ns min to 2000 s max (Option 110) 1 $\mu$ s min to 2000 s max (Option 40)
Time Accuracy	$\pm 0.5\%$ of total time
Time Resolution	0.1% of total time
Time Linearity	$\pm 0.5\%$ of total time (measured at 11 equally-spaced points across the display, including the ends)

Table 22: Trigger

Characteristic	Description
Trigger Mode, Type, & Source, nominal	<p>Modes:</p> <ul style="list-style-type: none"> <li>Free Run (Triggered by the end of the preceding acquisition)</li> <li>Triggered (Triggered by Event)</li> <li>Fast Frame (Triggered by Event, sequential storage of acquisitions)</li> </ul> <p>Types:</p> <ul style="list-style-type: none"> <li>Single (one acquisition from one trigger)</li> <li>Continuous (repeated acquisitions from repeating triggers)</li> </ul> <p>Sources:</p> <ul style="list-style-type: none"> <li>RF Input</li> <li>Trigger 1 (Front)</li> <li>Trigger 2/ Gate (Rear)</li> <li>Gated (Logical AND of the selected edge [rising or falling] of TRIG 1 and the selected level [LOW or HIGH] of TRIG 2)</li> <li>Line</li> </ul>
Trigger Event Delay Range, nominal	20 ns to 60 s
Trigger Event Delay Resolution, nominal	20 ns
Trigger Event Delay Uncertainty, nominal	$\pm 20$ ns

Table 22: Trigger (cont.)

Characteristic	Description
Pre/Post Trigger Setting, nominal	Trigger Position is settable within 0% to 99% of Total Data Length
Power Trigger Level Range, nominal	0 dB to -100 dB from Reference Level
Power Trigger Level Resolution, nominal	0.1 dB
Power Trigger Level Accuracy	±0.5 dB (level ≥ -50 dB from Reference Level) for trigger levels >30 dB above the noise floor ±1.5 dB (from -50 dB to -70 dB from Reference Level) for trigger levels >30 dB above the noise floor This applies when the Trigger Level is between 10% and 90% of the signal amplitude
Power Trigger Position Timing Uncertainty, typical	±10 ns for 40 MHz Acq BW using no trigger RBW ±15 ns for 40 MHz Acq BW using 20 MHz trigger RBW ±3.3 ns for 110 MHz Acq BW using no trigger RBW ±5 ns for 110 MHz Acq BW using 60 MHz trigger RBW
Trigger Rearm Time, minimum (FastFrame ON)	
10 MHz acquisition BW	≤25 μs
40 MHz acquisition BW	≤10 μs
110 MHz acquisition BW (Opt. 110)	≤5 μs
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 ≤40 MHz (RSA6106A, RSA6114A) for spans ≤110 MHz (Option 110)
Frequency Mask Trigger Level Resolution (Option 02), nominal	0.1 dB
Frequency Mask Trigger Level Accuracy (Option 02) (with respect to Reference Level)	±(Channel Response Flatness + 1 dB) (for mask levels ≥ -50 dB) for masks >30 dB above the noise floor ±(Channel Response Flatness + 2.5 dB) (for mask levels of -50 dB to -70 dB) for masks >30 dB above the noise floor
Frequency Mask Trigger Max Real-time Event Detection Bandwidth (Option 02), nominal	40 MHz (1024 point FFT, 50% overlapping, Base Unit) 110 MHz (1024 point FFT, 50% overlapping, Option 110)
Frequency Mask Trigger Real-time Event Minimum Duration for 100% probability of trigger (Option 02), nominal	30.7 μs at 40 MHz span (Base Unit) 10.3 μs at 110 MHz span (Option 110)
Frequency Mask Trigger Timing Uncertainty	±12.8 μs at 40 MHz span (Base Unit) ±5.12 μs at 110 MHz span (Option 110)
External Trigger 1 Threshold Voltage, nominal	Variable: -2.5 V to +2.5 V settable
External Trigger 2 Threshold Voltage, nominal	Fixed: TTL



Table 22: Trigger (cont.)

Characteristic	Description
External Trigger 1 Threshold Voltage Setting Resolution, nominal	0.01 V
External Trigger 1 Input Impedance, nominal	Selectable: 50 $\Omega$ or 5 k $\Omega$
External Trigger 2 Input Impedance, nominal	Fixed: 5 k $\Omega$
External Trigger 1 Minimum Pulse Width (applies to 50 $\Omega$ Impedance only), nominal	> 5 ns
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 $\Omega$ impedance only)	
>75 MHz to 110 MHz acquisition BW	$\pm 12$ ns
>40 MHz to 75 MHz acquisition BW	$\pm 15$ ns
>20 MHz to 40 MHz acquisition BW	$\pm 20$ ns
Trigger Output Voltage, nominal (Output Current < 1mA)	HIGH: > 2.0 V LOW: < 0.4 V
Trigger Output Impedance, nominal	50 $\Omega$
Power Trigger Output Position Timing Uncertainty	$\pm 2$ 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 23: 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 $\mu$ s at 40 MHz span (Base Unit) 10.3 $\mu$ s at 110 MHz span (Option 110)	
Frequency Mask Trigger Timing Uncertainty	$\pm 2$ $\mu$ s at 40 MHz span (Base Unit) $\pm 2$ $\mu$ s at 110 MHz span (Option 110)	Measured with mask level set at 6 dB below signal peak, RBW = AUTO

**Table 24: Trigger (with Option 200)**

Characteristic	Description			
Trigger Event Types	Power Level (IF Span BW after RBW and VBW filters) Frequency Mask (Option 02) DPX density Trigger Runt Trigger (applies to Power Level Trigger) Time-Qualified Trigger Holdoff Trigger			
Frequency Mask Trigger	40 MHz (1024 point FFT, 50% overlapping, Base Unit)			
Maximum Real-time Event Detection Bandwidth(Op.02)	110 MHz (1024 point FFT, 50% overlapping, Option 110)			
Frequency Mask Trigger Real-time Event Minimum Duration for 100% probability of trigger (Option 02), nominal	Option 110, span = 110 MHz	Base Unit, span = 40 MHz		
	FMT RBW	Minimum event duration ( $\mu$ s)	FMT RBW	Minimum event duration ( $\mu$ s)
	10 MHz	10.3	10 MHz	23.9
	1 MHz	10.3	1 MHz	23.9
	100 kHz	41	100 kHz	47.8
		10 kHz	382.3	
Frequency Mask Trigger Timing Uncertainty	$\pm 2 \mu$ s at 40 MHz span ( $RBW \geq 500$ kHz, Base Unit) $\pm 2 \mu$ s at 110 MHz span ( $RBW \geq 1$ MHz, Option 110) Measured with Mask Level set at 6 dB below signal peak. Uncertainty will vary with Mask Level setting relative to peak signal level.			
Runt Trigger Level Range, nominal	Same as Power Trigger Level Range			
Runt Trigger Level Resolution, nominal	Same as Power Trigger Level Resolution			
Runt Trigger Polarity, nominal	Too short Not fully off			
Runt Trigger Level Accuracy	Same as Power Trigger Level Accuracy This applies when the Runt Trigger Level is between 10% and 90% of the signal amplitude.			
Runt Trigger Position Timing Uncertainty	Same as Power Trigger Position Timing Uncertainty			
DPX Density Trigger Minimum Detectable Trigger Event Duration, typical	Same as DPX Min Signal Duration for 100% probability of intercept			
DPX Density Trigger Threshold Setting Range, nominal	0%—100%			
DPX Density Trigger Area of Interest Range, nominal	2 to 801 pixels (horizontal) x 2 to 201 pixels (vertical)			
DPX Density Trigger Area of Interest Resolution, nominal	2 pixels, horizontal or vertical			

Table 24: Trigger (with Option 200) (cont.)

Characteristic	Description
DPX Density Trigger Area of Interest Accuracy, nominal	Horizontal: $\pm 0.25\%$ of Span Vertical: $\pm(2 \times \text{DPX amplitude accuracy})$
DPX Density 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 = 110 MHz: Uncertainty = $-(\text{Signal Event Duration} + 10.3 \mu\text{s})$ to $+10.3 \mu\text{s}$ For Span = 40 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 Density Trigger or Runt Trigger or External Trigger or Gated
Time Qualified Trigger Type, nominal	Shorter or Longer or Inside or Outside Reference information: INSIDE means the measured time of the source event is greater than or equal to the minimum time AND less than or equal to the maximum time. OUTSIDE means the measured time of the source event is less than the minimum time OR greater than the maximum time
Time Qualified Trigger (minimum or maximum) Time Range, nominal	0 ns to 10 s
Time Qualified Trigger (Minimum or Maximum) Time Resolution	Trigger Source is not EXTERNAL: 6.7 ns Trigger Source is EXTERNAL: SPAN $\leq 40$ MHz: 20 ns 40 MHz < SPAN $\leq 110$ MHz: 6.7 ns

**Table 24: Trigger (with Option 200) (cont.)**

<b>Characteristic</b>	<b>Description</b>
Time Qualified Trigger (minimum or maximum) Time Accuracy, nominal	<p>For Power Trigger:  <math>\pm[(2 \times \text{Power Trigger Position Timing Uncertainty}) + 6.7 \text{ ns}]</math>;                      All conditions for Power Trigger Position timing uncertainty must be met</p> <p>For FMT:  <math>\pm[(2 \times \text{Frequency Mask Timing Uncertainty}) + 6.7 \text{ ns}]</math>;                      All conditions for Frequency Mask Trigger timing uncertainty must be met</p> <p>For DPX Density Trigger:  <math>\pm 42 \text{ ms}</math>;</p> <p>For External Trigger SPAN <math>\leq 40 \text{ MHz}</math>:  <math>\pm[(2 \times \text{External Trigger Timing Uncertainty}) + 20 \text{ ns}]</math>;                      All conditions for External Trigger Timing uncertainty must be met</p> <p>For External Trigger <math>40 \text{ MHz} &lt; \text{SPAN} \leq 110 \text{ MHz}</math>:  <math>\pm[(2 \times \text{External Trigger Timing Uncertainty}) + 6.7 \text{ ns}]</math>;                      All conditions for External Trigger Timing uncertainty must be met</p>
Holdoff Trigger	<p>ON or OFF</p> <p>Reference Information: Holdoff Trigger means triggers will be held off until a period of time equal to or greater than the Holdoff Trigger Time occurs with no trigger events; once the Holdoff timer has expired, a trigger will be generated on the next trigger event</p>
Holdoff Trigger Source	Applied to any allowed combination of trigger source and time qualification
Holdoff Trigger Time Range, nominal	20 ns to 10 s

**Table 24: Trigger (with Option 200) (cont.)**

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

**Table 25: Decimated clock period**

Power Trigger Time Domain Bandwidth	Decimated clock period	
	Standard (40 MHz span)	Option 110 (110 MHz span)
60 MHz (Option 110 only)	NA	6.67 ns
20 MHz	20 ns	6.67 ns
10 MHz	20 ns	6.67 ns
1 MHz	80 ns	53.4 ns
100 kHz	640 ns	854 ns
10 kHz	5.12 μs	N/A

<sup>1</sup> The decimated clock period is used for determining the Power Trigger Output Position Timing Uncertainty. See Power Trigger Output Position Timing Uncertainty. (See Table 22.)

**Table 26: 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

**Table 26: Resolution bandwidth filter (SA mode) (cont.)**

Characteristic	Description
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 27: Range and settable RBW (SA mode)**

Acquisition BW	Frequency Domain Resolution Bandwidth Range	
	Maximum RBW	Minimum RBW
110 MHz (Option 110)	5 MHz	100 Hz
60 MHz (Option 110)	5 MHz	100 Hz
40 MHz	5 MHz	100 Hz
20 MHz	5 MHz	100 Hz
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 28: 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

**Table 28: Resolution bandwidth filter (time-domain mode) (cont.)**

Characteristic	Description
Bandwidth Accuracy	1 Hz to 10 MHz = 1% (Auto-coupled) 20 MHz & 60 MHz = 10%
Resolution, nominal	1, 2, 3, 5 (plus 60 MHz for Option 110) (for sequence selection) 1% (for user-entry mode)
Minimum Settable RBW, nominal	See the following table

**Table 29: Range and settable RBW (time-domain mode)**

Acquisition BW	Time Domain Trigger And	
	Maximum TDBW	Minimum TDBW
110 MHz (Opt 110)	60 MHz	11 kHz
60 MHz (Opt 110)	7.5 MHz	6 kHz
40 MHz	20 MHz	4 kHz
20 MHz	2.5 MHz	2 kHz
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

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

**Table 30: Video bandwidth filters**

Characteristic	Description
Range, typical	1 Hz to 5 MHz, or no VBW filtering at all.
RBW/VBW Ratio, typical	10,000:1, maximum 20 MHz & 60 MHz = 10%

**Table 30: Video bandwidth filters (cont.)**

Characteristic	Description
Resolution, typical	5% of entered value
Accuracy, typical	±10%

**Table 31: Preamp (Option 01)**

Characteristic	Description
Noise Figure	<4 dB at 2 GHz
Bandwidth	10 MHz to 3 GHz

**Table 32: IF output (Option 05)**

Characteristic	Description
Output Level, typical	-10 dBm to +3 dBm for peak level of -20 dBm at the RF Mixer
Output Frequency, typical	500 MHz. Varies ±1 MHz with changes in center frequency
IF Filter, typical	Selectable: 60 MHz Gaussian to -12 dB, or 150 MHz "wide-open"
Spurious	May contain spurious signals as high as -75 dBc

**Table 33: Digital IQ output**

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

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

**Table 34: 28 Volt noise source drive output**

Characteristic	Description
Output Level, nominal	28 VDC @ 140 mA



## Electrical Functional Specifications

Table 35: 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)

**Table 35: Measurement function (cont.)**

<b>Characteristic</b>	<b>Description</b>
Advanced Measurements Suite (Option 20), nominal	Average On Power, Pulse Peak Power, Average Transmitted Power Pulse Width, Rise Time, Fall Time, Repetition Interval (seconds) Repetition Interval (Hz) Duty Factor (%) Duty Factor (ratio) Ripple Droop 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 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 36: Views by domain**

<b>Characteristic</b>	<b>Description</b>
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 Phase Noise
Time and Statistics, nominal	Frequency vs. Time Amplitude vs. Time Phase vs. Time RF I&Q vs. Time Time Overview CCDF Peak-Average-Ratio
Advanced Measurements Suite (Option 20), nominal	Pulse Results Table Pulse Trace (Selectable by pulse number) Pulse Statistics (Trend of Pulse Results and FFT of Trend)
General Purpose Digital Modulation Analysis (Option 21), nominal	Constellation Diagram I/Q vs. Time EVM vs. Time Symbol Table (Binary or Hexadecimal) Demodulated IQ vs. Time Eye Diagram Trellis Diagram Frequency Deviation vs. Time

**Table 37: Analog demodulation accuracy**

<b>Characteristic</b>	<b>Description</b>
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 38: 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)
PM Demodulation Accuracy, typical	$\pm 3^\circ$ (0 dBm Input at center)
FM Demodulation Accuracy, typical	$\pm 1\%$ of Span (0 dBm Input at center)

**Table 39: Frequency and phase error referenced to non-chirped signal; applies to instruments manufactured before June 2009**

Bandwidth	Center Frequency = 2 GHz			Center Frequency = 10 GHz		
	Abs. Freq.	Pulse-Pulse Frequency	Pulse-Pulse Phase	Abs. Freq.	Pulse-Pulse Frequency	Pulse-Pulse Phase
BW: 20 MHz	$\pm 50$ kHz	$\pm 100$ kHz	$\pm 1.7^\circ$	$\pm 100$ kHz	$\pm 50$ kHz	$\pm 3.2^\circ$
BW: 40 MHz	$\pm 50$ kHz	$\pm 100$ kHz	$\pm 1.7^\circ$	$\pm 125$ kHz	$\pm 50$ kHz	$\pm 3.7^\circ$
BW: 60 GHz (Opt. 110)	$\pm 200$ kHz	$\pm 350$ kHz	$\pm 1.9^\circ$	$\pm 450$ kHz	$\pm 50$ kHz	$\pm 4^\circ$
BW: 110 MHz (Opt. 110)	$\pm 300$ kHz	$\pm 550$ kHz	$\pm 2^\circ$	$\pm 700$ kHz	$\pm 1.3$ MHz	$\pm 5^\circ$

**Table 40: Frequency and phase error referenced to non-chirped signal; applies to instruments manufactured after June 2009**

Bandwidth	Center Frequency = 2 GHz			Center Frequency = 10 GHz		
	Abs. Freq.	Pulse-Pulse Frequency	Pulse-Pulse Phase	Abs. Freq.	Pulse-Pulse Frequency	Pulse-Pulse Phase
20 MHz	$\pm 7$ kHz	$\pm 13$ kHz	$\pm 0.3^\circ$	$\pm 16$ kHz	$\pm 40$ kHz	$\pm 0.95^\circ$
40 MHz	$\pm 10$ kHz	$\pm 30$ kHz	$\pm 0.35^\circ$	$\pm 30$ kHz	$\pm 105$ kHz	$\pm 1.1^\circ$
60 GHz (Opt. 110)	$\pm 26$ kHz	$\pm 80$ kHz	$\pm 0.7^\circ$	$\pm 55$ kHz	$\pm 190$ kHz	$\pm 1.3^\circ$
110 MHz (Opt. 110)	$\pm 65$ kHz	$\pm 225$ kHz	$\pm 0.72^\circ$	$\pm 125$ kHz	$\pm 530$ MHz	$\pm 1.8^\circ$

**Table 41: Frequency and phase error referenced to a linear chirp; applies to instruments manufactured before June 2009 <sup>1</sup>**

Bandwidth	Center Frequency = 2 GHz			Center Frequency = 10 GHz		
	Abs. Freq.	Pulse-Pulse Frequency	Pulse-Pulse Phase	Abs. Freq.	Pulse-Pulse Frequency	Pulse-Pulse Phase
BW: 20 MHz	±200 kHz	±100 kHz	±2.2 °	±300 kHz	±200 kHz	±4 °
BW: 40 MHz	±300 kHz	±100 kHz	±2.2 °	±400 kHz	±250 kHz	±5 °
BW: 60 GHz (Opt. 110)	±900 kHz	±550 kHz	±2.4 °	±1.3 MHz	±1.1 MHz	±6.5 °
BW: 110 MHz (Opt. 110)	±1.9 MHz	±650 kHz	±2.5 °	±2.0 MHz	±1.6 MHz	±7.0 °

<sup>1</sup> At the following frequencies and bandwidths, 95% confidence. Pulse ON power ≥ -20 dBm, signal peak at reference level, Attenuator = Auto, t<sub>meas</sub> - t<sub>reference</sub> ≤ 10 ms, Frequency Estimation: Manual. Pulse-to-Pulse measurement time position excludes the beginning and ending of the pulse extending for a time = (10/Measurement BW) as measured from 50% of the t(rise) or t(fall). Absolute Frequency Error determined over center 50% of pulse.

**Table 42: Frequency and phase error referenced to a linear chirp; applies to instruments manufactured after June 2009 <sup>1</sup>**

Bandwidth	Center Frequency = 2 GHz			Center Frequency = 10 GHz		
	Abs. Freq.	Pulse-Pulse Frequency	Pulse-Pulse Phase	Abs. Freq.	Pulse-Pulse Frequency	Pulse-Pulse Phase
BW: 20 MHz	±5 kHz	±12 kHz	±0.3 °	±20 kHz	±40 kHz	±0.75 °
BW: 40 MHz	±6 kHz	±25 kHz	±0.3 °	±25 kHz	±100 kHz	±0.9 °
BW: 60 GHz (Opt. 110)	±30 kHz	±130 kHz	±0.5 °	±95 kHz	±370 kHz	±1.2 °
BW: 110 MHz (Opt. 110)	±50 kHz	±200 kHz	±0.5 ° ±25 kHz	±155 kHz	±510 kHz	±1.4 °

<sup>1</sup> At the following frequencies and bandwidths, 95% confidence. Pulse ON power ≥ -20 dBm, signal peak at reference level, Attenuator = Auto, t<sub>meas</sub> - t<sub>reference</sub> ≤ 10 ms, Frequency Estimation: Manual. Pulse-to-Pulse measurement time position excludes the beginning and ending of the pulse extending for a time = (10/Measurement BW) as measured from 50% of the t(rise) or t(fall). Absolute Frequency Error determined over center 50% of pulse.

**Table 43: General purpose digital modulation analysis (Option 21)**

Characteristic	Description
Carrier Type, nominal	Continuous, Burst (5 $\mu$ s minimum on-time)
Analysis Period, nominal	Up to 80,000 samples
Modulation Format Presets, nominal	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 110)
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 44: Digital demodulation accuracy (Option 21); applies to instruments manufactured before June 2009**

Characteristic	Description		
QPSK Residual EVM, typical	CF	2 GHz	
	Symbol Rate	100 kHz	0.6%
		1 MHz	0.7%
		10 MHz	1.0%
		30 MHz	3.0%
		80 MHz	3.0%

Table 44: Digital demodulation accuracy (Option 21); applies to instruments manufactured before June 2009 (cont.)

Characteristic		Description
256 QAM Residual EVM, typical	CF	2 GHz
	Symbol Rate	10 MHz
		30 MHz
		80 MHz
OQPSK Residual EVM, typical	CF	2 GHz
	Symbol Rate	100 kHz
		1 MHz
		10 MHz
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
	Reference Filter: MIL STD, Measurement Filter: None	
S-OQPSK (MIL) Residual EVM, typical	CF	2 GHz
	Symbol Rate	20 kHz
		100 kHz
		1 MHz
Reference Filter: MIL STD, Measurement Filter: None		
S-OQPSK (ARTM) Residual EVM, typical	CF	250 MHz
	Symbol Rate	4 kHz
	Reference Filter: ARTM STD, Measurement Filter: None	
S-OQPSK (ARTM) Residual EVM, typical	CF	2 GHz
	Symbol Rate	20 kHz
		100 kHz
		1 MHz
Reference Filter: ARTM STD, Measurement Filter: None		
S-BPSK (MIL) Residual EVM, typical	CF	250 MHz
	Symbol Rate	4 kHz
	Reference Filter: MIL STD, Measurement Filter: None	
S-BPSK (MIL) Residual EVM, typical	CF	2 GHz
	Symbol Rate	20 kHz
		100 kHz
		1 MHz
Reference Filter: MIL STD, Measurement Filter: None		
CPM (MIL) Residual EVM, typical	CF	250 MHz
	Symbol Rate	4 kHz
	Reference Filter: MIL STD, Measurement Filter: None	

**Table 44: Digital demodulation accuracy (Option 21); applies to instruments manufactured before June 2009 (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 45: Digital demodulation accuracy (Option 21); applies to instruments manufactured after June 2009**

Characteristic		Description
QPSK Residual EVM, typical	CF	2 GHz
	Symbol Rate	100 kHz
		1 MHz
		10 MHz
		30 MHz
		80 MHz
256 QAM Residual EVM, typical	CF	2 GHz
	Symbol Rate	10 MHz
		30 MHz
		80 MHz
OQPSK Residual EVM, typical	CF	2 GHz
	Symbol Rate	100 kHz
		1 MHz
		10 MHz
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
	Reference Filter: MIL STD, Measurement Filter: None	
S-OQPSK (MIL) Residual EVM, typical	CF	2 GHz
	Symbol Rate	20 kHz
		100 kHz
		1 MHz
Reference Filter: MIL STD, Measurement Filter: None		



Table 45: Digital demodulation accuracy (Option 21); applies to instruments manufactured after June 2009 (cont.)

Characteristic		Description
S-OQPSK (ARTM) Residual EVM, typical	CF	250 MHz
	Symbol Rate	4 kHz
	Reference Filter: ARTM STD, Measurement Filter: None	
S-OQPSK (ARTM) Residual EVM, typical	CF	2 GHz
	Symbol Rate	20 kHz
		100 kHz
		1 MHz
Reference Filter: ARTM STD, Measurement Filter: None		
S-BPSK (MIL) Residual EVM, typical	CF	250 MHz
	Symbol Rate	4 kHz
	Reference Filter: MIL STD, Measurement Filter: None	
S-BPSK (MIL) Residual EVM, typical	CF	2 GHz
	Symbol Rate	20 kHz
		100 kHz
		1 MHz
Reference Filter: MIL STD, Measurement Filter: None		
CPM (MIL) Residual EVM, typical	CF	250 MHz
	Symbol Rate	4 kHz
	Reference Filter: MIL STD, Measurement Filter: None	
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 46: 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)
ACLR (3GPP TM1 64 channel) (2130 MHz), typical	-69 dBc (Adjacent Channel)
	-78 dBc w/Noise Correction ACPR (Adjacent Channel)
	-69 dBc (First Alternate Channel)
	-78 dBc w/Noise Correction (First Alternate Channel)

**Table 47: 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	31 $\mu$ s (Base Unit)
	24 $\mu$ s (Option 110)
	23.9 $\mu$ s (Base Unit with Option 200)
	10.3 $\mu$ s (Option 110 and Option 200)
Span Range, nominal	100 Hz to 40 MHz
	100 Hz to 110 MHz (Option 110)

Table 47: Digital phosphor spectrum processing (DPx) (cont.)

Characteristic	Description			
RBW Settings, nominal	<b>Acquisition Bandwidth</b>	<b>RBW (Min)</b>	RBW (Min) Option 200	RBW (Max) Option 200
	110 MHz	640 kHz	20 kHz	10 MHz
	55 MHz	320 kHz	10 kHz	5 MHz
	40 MHz	214 kHz	10 kHz	3 MHz
	20 MHz	107 kHz	5 kHz	3 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	300 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	30 kHz
	100 kHz	833 kHz	20 Hz	10 kHz
	50 kHz	417 Hz	10 Hz	5 kHz
	20 kHz	209 Hz	5 Hz	3 kHz
	10 kHz	105 Hz	2 Hz	1 kHz
	5 kHz	52 Hz	1 Hz	500 Hz
	2 kHz	13.1 Hz	1 Hz	300 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	30 Hz
100 Hz	0.819 Hz	1 Hz	10 Hz	
RBW Accuracy	+1% - -7%			
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.			

## Physical Characteristics

**Table 48: Physical characteristics**

<b>Characteristic</b>	<b>Description</b>	
<b>Dimensions</b>	<b>mm</b>	<b>in.</b>
Width (handles folded in)	473	18.6
Height (with feet, without accessory pouch)	282	11.1
Length	531	20.9
<b>Weight (without accessories)</b>	<b>kg</b>	<b>lb.</b>
Net	26.3	58.0

**Table 49: Display/computer**

<b>Characteristic</b>	<b>Description</b>
LCD Panel Size	264 mm (10.4 in)
Display Resolution	1024 x 768 pixels
Colors	256 colors (Maximum)
CPU	Intel Celeron M 1.3 GHz
DRAM	512 MB DIMM (Standard) 1 GB DIMM (Opt 02)
OS	Windows XP Embedded
System Bus	PCI
Hard Disk Drive	3.5 inch IDE
Printer Port	USB
GPIB	IEEE488.2
LAN	10/100/1000 Base-T
Mouse	USB
Keyboard	USB or PS2
Monitor Out	VGA (D-SUB 15 pin)

## Safety

For detailed information on Safety, see the *RSA6100A Series Real-Time Spectrum Analyzers Quick Start User Manual*, Tektronix part number 071-1909-06 or later.

## Certifications and Compliances

For detailed information on Certifications and Compliances, see the *RSA6100A Series Real-Time Spectrum Analyzers Quick Start User Manual*, Tektronix part number 071-1909-06 or later.

## Environmental Characteristics

Table 50: Environmental characteristics

Characteristic	Description
Temperature range <sup>1</sup>	
Operating	+5 °C to +50 °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	
Operating	0.22 Grms. Profile = 0.00010 g <sup>2</sup> /Hz at 5 Hz to 350 Hz, -3dB/Octave slope from 350 Hz to 500 Hz, 0.00007 g <sup>2</sup> /Hz at 500 Hz, 3 Axes at 10 min/axis (Except when equipped with Option 06 Removable HDD, or when accessing DVD/CD)  When equipped with Option 08, Removable Solid State Hard Drive 0.24 Grms. Profile – 0.000125 g <sup>2</sup> /Hz at 5 Hz to 350 Hz, -3dB/Octave slope from 350 Hz to 500 Hz, 0.0000876 g <sup>2</sup> /Hz at 500 Hz, 3 Axes at 10 min/axis
Non-operating	2.28 Grms. Profile = 0.015 g <sup>2</sup> /Hz at 5 Hz to 100 Hz, -3 dB/Octave slope from 100 Hz to 200 Hz, 0.075 g <sup>2</sup> /Hz at 200 Hz to 350 Hz, -3dB/Octave slope from 350 Hz to 500 Hz, 0.00526 g <sup>2</sup> /Hz at 500 Hz, 3 Axes at 10 min/axis
Shock	

**Table 50: Environmental characteristics (cont.)**

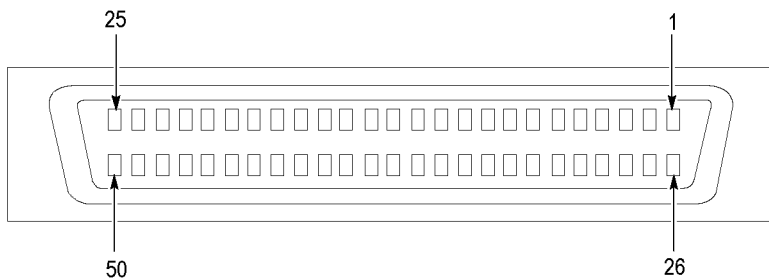
Characteristic	Description
Operating	(15 G), half-sine, 11 ms duration. Three shocks per axis in each direction (18 shocks total) (1 G max when accessing DVD) (DVD tray ejection may occur)
Non-operating	296 m/s <sup>2</sup> (30 G), half-sine, 11 ms duration. Three shocks per axis in each direction (18 shocks total) (DVD tray ejection may occur)
Cooling Clearance	
Bottom	20 mm (0.79 in)
Both Sides	50 mm (1.97 in)
Back	50 mm (1.97 in)

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

**Table 51: Power requirements**

Characteristic	Description
Voltage range	50 Hz/60 Hz 90 V - 264 V
	400 Hz 90 V - 132 V
Maximum Power dissipation (fully loaded)	Maximum power 450 W
	Maximum line current 5.5 Amps at 50 Hz, 90 V line
Surge Current	MAX 52 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 05 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	
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	

**Table 52: I OUTPUT connector pin assignment (cont.)**

Pin number	Signal name	Description
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+	
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+	



**Table 53: Q OUTPUT connector pin assignment (cont.)**

Pin number	Signal name	Description
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+	
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 RSA6100A. (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 (%)
110 MHz	150	100.0
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
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.

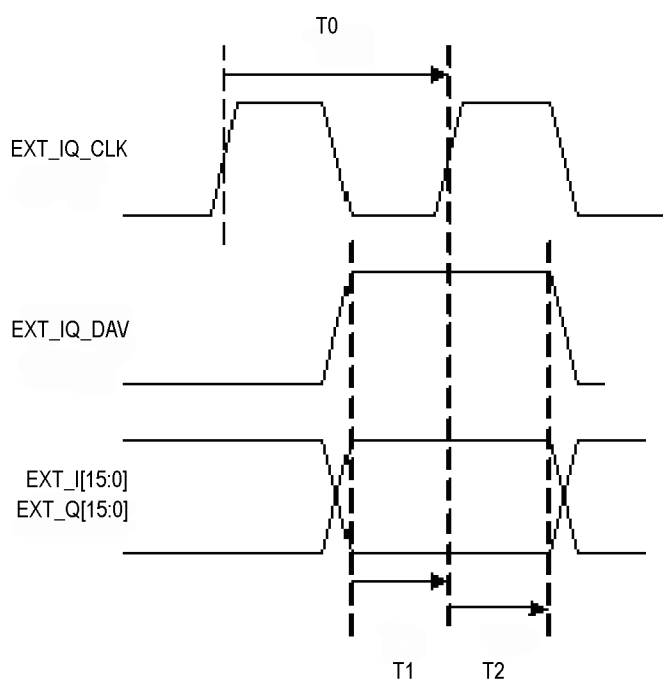


Figure 2: IQ Timing

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 RSA6100A 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 RSA6100A.

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  $\approx 5.28$  ms.

The length of time that the EXT\_IQ\_DAV signal is inactive can be used to determine if the RSA6100A is performing an alignment or a control change. If the EXT\_IQ\_DAV signal is inactive for longer than 10 ms, then the RSA6100A digital I/Q output data stream has been interrupted.

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

### Digital IQ Output Scaling

Output power in dBm for a sinusoidal input

Where:

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

Where:

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

Valid for center frequencies that exceed:

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

# Performance Verification

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

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## Prerequisites

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

- The cabinet must be installed on the instrument.
- The instrument must have passed the Power On Self Tests (POST).
- The instrument must have been last adjusted at an ambient temperature between +18 °C (+64 °F) and +28 °C (+82 °F), must have been operating for a warm-up period of at least 20 minutes after starting the RSA6100A 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: $1 \times 10^{-9}$	Agilent 53132A Option 10	Checking reference output frequency accuracy
2. RF Power Meter		Agilent E4418B	Adjusting signal generator output level, checking reference output power level
3. RF Power Sensor	10 MHz to 20 GHz RF Flatness: <3% Calibration factor data uncertainty: <2% (RSS)	Agilent E9304A Option H18	Checking RF flatness, intermodulation distortion, image suppression, and external reference lock check.
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	

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	
	<b>Offset</b>	<b>SSB Phase Noise (F) dBc/Hz</b>	
	10 Hz	-71	
	100 Hz	-93	
	1 kHz	-118	
	10 kHz	-121	
	100 kHz	-119	
1 MHz	-138		
6. Precision Attenuator	30 dB		
7. Network Analyzer	10 MHz to 3 GHz	Agilent 8757D with directional bridge <sup>1</sup>	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 <sup>2</sup>	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		Checking intermodulation
	>50 dB rejection 4 GHz to 14 GHz		
11. Voltmeter	Capable of measuring 30 VDC	Standard Equipment	Checking Noise Source
12. BNC Cable	50 $\Omega$ , 36 in. male to male BNC connectors	Tektronix part number 011-0049-01	Signal interconnection
13. N-N Cable	50 $\Omega$ , 36 in. male to male N connectors		Signal interconnection
14. N-SMA Cable	50 $\Omega$ , 36 in. male N to male SMA connectors		Signal interconnection
15. Termination, Precision 50 $\Omega$	Impedance: 50 $\Omega$ Type N male		Signal interconnection
16. N-Female to BNC male Adapter		Tektronix part number 103-0058-00	N cable to RSA6100A connections
17. Termination, Precision 50 $\Omega$	3.5 mm (M) Termination		Termination for RSA6120A
18. 3.5 mm (F) to 3.5 mm (F) coaxial adapter		Tektronix part number 131-8508-00	
19. N-3.5mm cable	50 $\Omega$ , 36 in. male N to male SMA connectors		
20. N-Male to 3.5 mm male adapter			

<sup>1</sup> For the RSA6106A and RSA6114A, the Agilent 85027A Directional Bridge can be used. For the RSA6120A, the Agilent 85027B Directional Bridge is required.

<sup>2</sup> For the RSA6106A and RSA6114A, the Agilent 11667A Power Splitter can be used. For the RSA6120A, the Agilent 11667B Power Splitter is required.

## Preliminary Checks

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

**Fan Check** Plug in the RSA6100A, power it on, and check that the fans located on the left side of the RSA6100A are operating.



**CAUTION.** Turn the RSA6100A off immediately if the fans are not operating. Operating the spectrum analyzer without fans will damage the instrument.

---

**Warm-up** Make sure the RSA6100A 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 07 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.

**Power-On Self Tests** Verify that all Power-On Self Tests (POST) passed:

1. Open the Diagnostics page by selecting **Diagnostics** in the **Tools** menu.
2. Select the **Power-On Self Tests** tab, and check that all tests passed.

- 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 RSA6100A rear-panel.
      - Check with a voltmeter that the voltage is  $28\text{ V} \pm 1\text{ V}$ .
    - 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 RSA6100A Series Spectrum Analyzer performance is within the warranted specifications.

### Frequency Accuracy

#### Check Reference Output Frequency Accuracy

1. Connect **REF OUT** on the RSA6100A rear-panel through a 50  $\Omega$  precision coaxial cable to the frequency counter input. See the following figure.
2. Connect a precision frequency reference to the frequency counter.

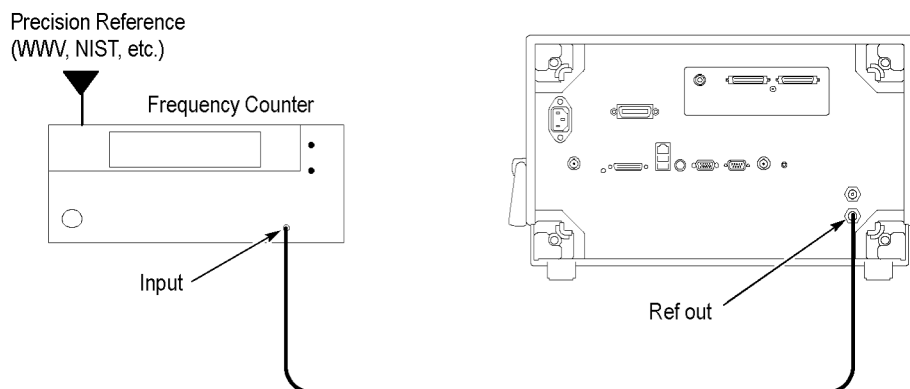


Figure 3: Connections for Reference Frequency Output Accuracy check

3. Set the Frequency counter:

Function	Frequency
Gate time	2 s

4. Check that the frequency counter reads 10 MHz  $\pm$ 3 Hz. Enter the frequency in the test record.

#### Check Reference Output Power Level

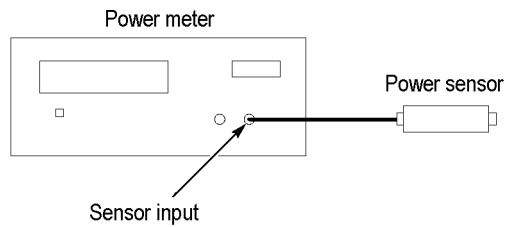
1. Set up the power meter and sensor.

---

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

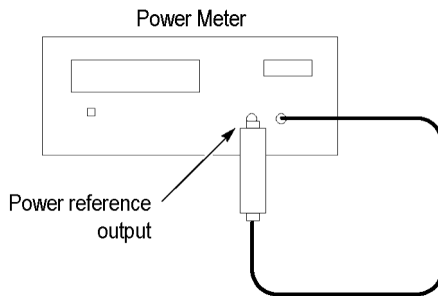
---

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



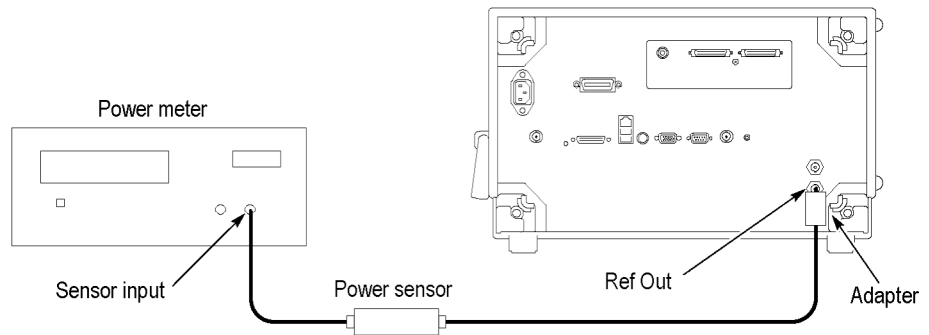
**Figure 4: Power meter setup**

- 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**

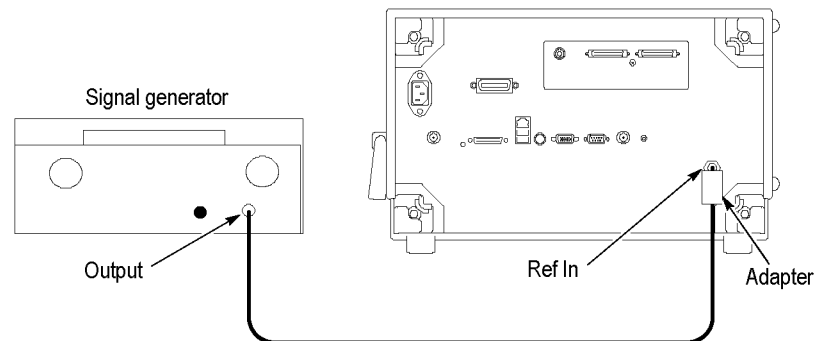
- d. Turn on **Power Ref** and execute the calibration.
  - e. Disconnect the RF input of the power sensor from the power meter reference output.
2. Connect the power sensor RF input to the Ref Out connector on the RSA6100A rear-panel, using the N-female to BNC male adapter (see the following figure).
  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 RSA6100A rear panel, using a 50  $\Omega$  N-N coaxial cable and N-female to BNC male adapter (see the following figure).



**Figure 7: Equipment connections for Ref In power level check**

2. Set the Signal generator controls:

Frequency	10 MHz
Level	0 dBm

3. Set the RSA6100A to use the external reference:
  - a. Select **Configure In/Out** in the **Setup** menu.
  - 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**.
  - 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).

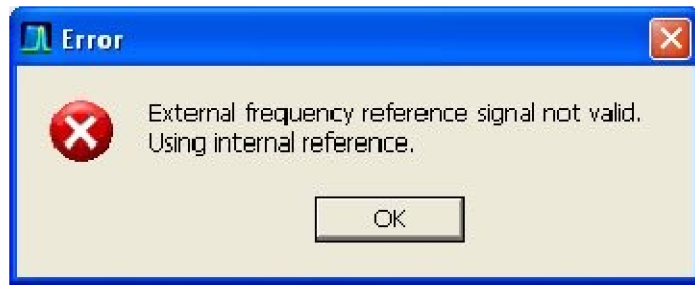


Figure 8: Error message showing loss of lock to External Reference signal

- 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

### Check Phase Noise

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

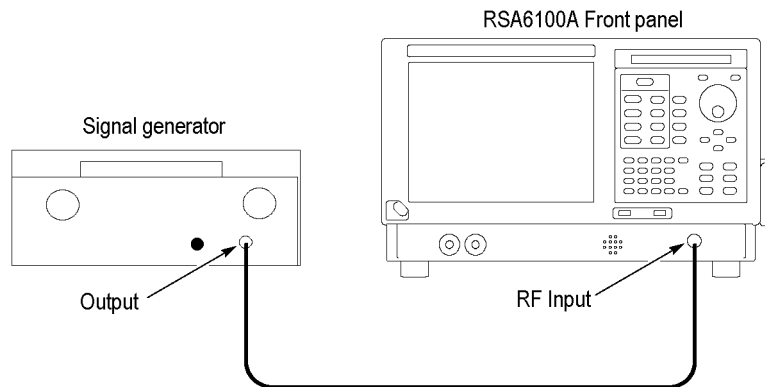


Figure 9: Equipment connections for phase noise checks

2. Reset the RSA6100A to factory defaults; by pressing the **Preset** button, or selecting **Preset** from the **Setup** menu.
3. Modify the default settings:

Center Frequency	1000 MHz
Span	100 kHz
Ref Level	5 dBm

RF & IF Optimization  
(Settings > BW tab) Minimize Noise

4. Set the RSA6100A for a single acquisition:
  - a. Select the **ACQ** soft key.
  - b. Select **Single** from the **Run:** dropdown menu.
5. Select the **Traces** tab in the **Settings** menu and set for 100 averages:

Trace	Trace 1
Detection	Average
Function	Average
Averages	100

6. Set the generator controls:

Frequency	1000 MHz
Amplitude	5 dBm
RF output	On

7. 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.
8. Press **Run**.
9. Select the Reference Marker (MR) with the marker select key and touch the **peak** soft key, to set MR to the carrier peak (1 GHz).
10. Adjust the generator output amplitude so the display on-screen is within 1 dB of the top of the screen.
11. Set the RSA6100A to each of the spans shown in the following table in turn.

**Table 58: Phase noise offsets (Low range)**

Span	M1 Offset
400 Hz	CF + 100 Hz
4 kHz	CF + 1 kHz
40 kHz	CF + 10 kHz

**Table 58: Phase noise offsets (Low range) (cont.)**

<b>Span</b>	<b>M1 Offset</b>
300 kHz	CF + 100.125 kHz

**12.** Repeat these steps for each span setting:

- a. Press **Run**.
- 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 rotary knob to 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.)

**13.** Record the generator signal amplitude:

- 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 **MR** and is used below.

**14.** Obtain the phase noise at 1 MHz offset. Start by setting the RSA6100A to the settings listed below:

- a. Center Frequency: 1000.99 MHz
- b. Span: 10 kHz
- c. Center the markers in the middle of the screen:

Select **Markers** to display the Markers toolbar. Select **Define** from the toolbar.

Select **Readouts > Absolute**.

Select **All Off**.

Select **Add**.

Select **Add** a second time.

The two markers are now located at the center frequency position.

- d. Set input attenuation for manual control.

Select the **Ampl** softkey.

Deselect the **Auto** radio button.

The attenuator now can be manually controlled.

Set **Internal Attenuator** to 20 dB.

- e. Press **Run**.
- f. Check for an **RF ADC overrange** message at the bottom edge of the display.
- g. If the overrange message does not appear, reduce the internal attenuation by 5 dB and go to step e above. Continue to step h if the overrange message appears or if attenuation is 0 dB.

---

**NOTE.** *Overrange errors typically occur at Attenuation = 10 dB in this step.*

---

- h. If the overrange message does appear, then add 5 dB of internal attenuation and continue. For example, if the overrange error happens when attenuation is set to 10 dB, then set the attenuation to 15 dB.
- i. Press **Run**.
- j. Read the noise amplitude on Marker **M1**, in dBm/Hz.
- k. Subtract the value of **MR** obtained in step 13 to obtain the phase noise amplitude at +990 kHz.  
  
For example, if  $MR = 4.7$  dBm and  $M1 = -129.6$  dBm/Hz, then  $M1 - MR = -134.3$  dBc/Hz.
- l. Enter the value obtained at 990 KHz in the test record for phase noise at 1 MHz.

---

**NOTE.** *Note that the phase noise at 990 kHz is slightly greater than at 1 MHz, but does not include power from narrow-band spurs that tend to reside at even MHz intervals.*

---

15. Obtain the phase noise at 6 MHz offset. Start by setting the RSA6100A to the settings listed below:
  - a. Center Frequency: 1005.99 MHz.
  - b. Span: 10 kHz.
  - c. Center Markers in the middle of the screen.

Select **Markers** to display the Markers toolbar. Select **Define** from the toolbar.

Select **Readouts > Absolute**.

Select **All Off**.

Select **Add**.

Select **Add** a second time.

The two markers are now located at the center frequency position.

- d. Reduce the internal attenuation by 5 dB from the value obtained in step 14 h.
- e. Press **Run**.
- f. Check for an **RF ADC overrange** message at the bottom edge of the display.
- g. If the RF ADC overrange message does not appear, reduce the internal attenuation by 5 dB and go back to step e above. Continue to step h if attenuation is 0 dB.

---

**NOTE.** Typically, overrange errors do not occur at 0 dB attenuation.

---

- h. If the RF ADC overrange does appear, then add 5 dB of internal attenuation and continue.
- i. Press **Run**.
- j. Read the noise level on Marker **M1** in dBm/Hz.
- k. Subtract the value of MR obtained in step 13 in order to obtain the phase noise amplitude at +5.99 MHz.  
  
For example, if MR = 4.7 dBm and M1 = -145.1 dBm/Hz, then M1-MR = - 49.8 dBc/Hz.
- l. Enter the value obtained at 5.99 MHz in the test record for phase noise at 6 MHz.

---

**NOTE.** Note that the phase noise at 5.99 MHz is slightly greater than at 6 MHz, but does not include power from narrow-band spurs that tend to reside at even MHz intervals.

---

16. Obtain the phase noise at 10 MHz offset. Start by setting the RSA6100A to the settings below:
  - a. Center Frequency: 1009.99 MHz.
  - b. Span: 10 kHz.
  - c. Center Markers in the middle of the screen.



Select **Markers** to display the Markers toolbar. Select **Define** from the toolbar.

Select **Readouts > Absolute**.

Select **All Off**.

Select **Add**.

Select **Add** a second time.

The two markers are now located at the center frequency position.

- d. If the internal attenuation is set to be  $>0$  dB, then reduce the internal attenuation by 5 dB from the value obtained in step 15 h, otherwise, keep the internal attenuation set to 0 dB.
- e. Press **Run**.
- f. Check for an **RF ADC overrange** error message at the bottom edge of the display.
- g. If an RF ADC overrange error message does not appear, reduce the internal attenuation by 5 dB and go to step e. (Continue to step h if attenuation is 0 dB).

---

**NOTE.** Typically, overrange errors do not occur at 0 dB attenuation.

---

- h. If an RF ADC overrange error message does appear, then add 5 dB of internal attenuation and continue.
- i. Press **Run**.
- j. Read the noise amplitude on marker **M1** in dBm/Hz.
- k. Subtract the value of the MR marker obtained in step 13 to obtain the phase noise amplitude at +9.99 MHz.

For example, if  $MR = 4.7$  dBm and  $M1 = -146.1$  dBm/Hz,

Then  $M1-MR = -150.8$  dBc/Hz.

- l. Enter the value obtained at 9.99 MHz in the test record for phase noise at 10 MHz.

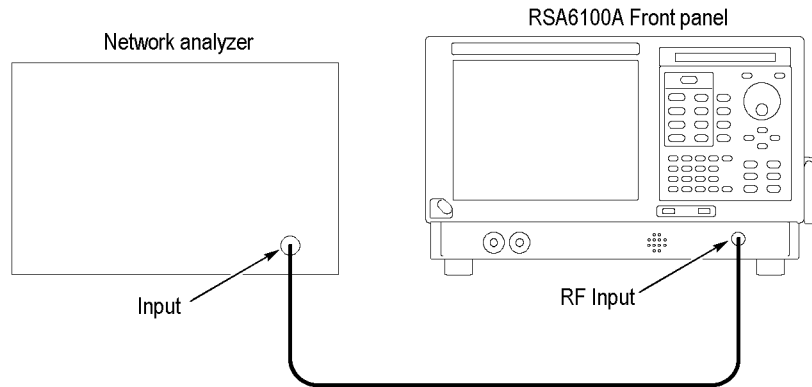
Note that the phase noise at 5.99 MHz is slightly greater than at 6 MHz, but does not include power from narrow-band spurious that tend to reside at even MHz intervals.

## RF Input

### Input VSWR (Preamp OFF)

1. Connect the RSA6100A 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 RSA6100A.



**Figure 10: Equipment connections for VSWR check**

2. Reset the RSA6100A to factory defaults; by pressing the **Preset** button, or selecting **Preset** from the **Setup** menu.
3. Select the **Ampl** softkey, select the **Manual** radio button, and set the **Internal attenuator** to 10 dB.
4. Set the START/STOP frequency of the Network Analyzer to 10 MHz/4 GHz.
5. Set the Center Frequency to  $\pm 200$  MHz of the Network Analyzer frequency to be measured.
6. Change the Center frequency from 10 MHz to 4 GHz by 400 MHz steps.
7. Check that the VSWR of the RSA6100A is  $< 1.6$  for frequencies from 10 MHz to 4 GHz, making sure that the RSA6100A center frequency and the Network Analyzer frequency remain within  $\pm 200$  MHz of each other. Enter the highest VSWR in the test record. (Limits are shown in the test record.)
8. Set the START/STOP frequency of the Network Analyzer to 4 GHz/6.2 GHz and change the center frequency of the RSA6100A from 4 GHz to 6.2 GHz by 400 MHz steps.
9. Check that the VSWR of the RSA6100A is  $< 1.8$  for frequencies from 4 GHz to 6.2 GHz, making sure that the RSA6100A center frequency and the Network Analyzer frequency remain within  $\pm 200$  MHz of each other. Enter the highest VSWR in the test record. (Limits are shown in the test record.)

10. RSA6114A Only: Set the START/STOP frequency of the Network Analyzer to 6.2 GHz/ 14 GHz and change the center frequency of the RSA6100A from 6.2 GHz to 14 GHz by 400 MHz steps.
11. RSA6120A Only: Set the START/STOP frequency of the Network Analyzer to 6.2 GHz/ 20 GHz and change the center frequency of the RSA6100A from 6.2 GHz to 20 GHz by 400 MHz steps.
12. Check (RSA6114A only) that the VSWR of the RSA6100A is  $<1.9$  for frequencies from 6.2 GHz to 14 GHz, making sure that the RSA6100A center frequency and the Network Analyzer frequency remain within  $\pm 200$  MHz of each other. Enter the highest VSWR in the test record. (Limits are shown in the test record.)
13. Check (RSA6120A only) that the VSWR of the RSA6100A is  $<1.9$  for frequencies from 6.2 GHz to 20 GHz, making sure that the RSA6100A center frequency and the Network Analyzer frequency remain within  $\pm 200$  MHz of each other. Enter the highest VSWR in the test record. (Limits are shown in the test record.)

### Input VSWR (Preamp ON - Option 01 Only)

1. Turn the Preamp on.

---

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

---

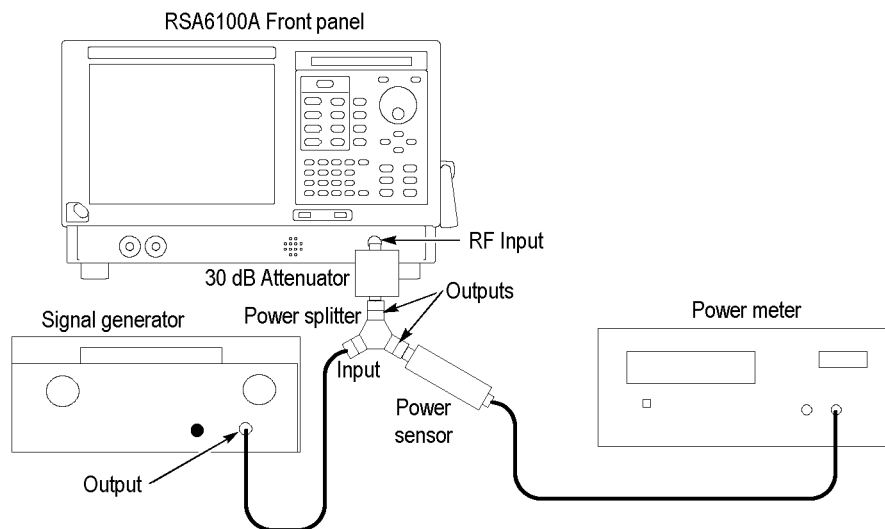
2. Set the RSA6100A Center frequency to 1.5 GHz.
3. Set the Network Analyzer span to 10 MHz to 3.0 GHz.
4. Check that the VSWR of the RSA6100A is  $<1.9$  across the entire frequency span. Enter the maximum VSWR in the test record. (Limits are shown in the test record.)

## Amplitude

### RF Flatness (Frequency Response) 10 MHz to 20 GHz

1. Connect the RF generator, power splitter, power meter, and RSA6100A, as shown in the following figure. The 30 dB attenuator is only used when testing Option 01, with the preamp ON.

The power splitter outputs should connect directly to the RSA6100A RF Input (or the 30 dB attenuator) and to the Power Sensor, without using cables.



**Figure 11: Equipment connections for RF Flatness check**

2. To record the test readings, you can take a printout of the table. (See Table 59.)
3. Reset the RSA6100A to factory defaults; by pressing the **Preset** button, or selecting **Preset** from the **Setup** menu.
4. Set the RSA6100A Attenuator level to 10 dB:
  - a. Select **Amplitude** from the **Setup** menu.
  - b. Click the **Manual** radio button in the **Internal attenuator** section.
  - c. Set the attenuator to 10 dB.
5. Select the **Traces** tab in the **Settings** menu and set for 10 averages:

Trace	Trace1
Detection	+Peak
Function	Average
Averages	10

6. Set the Option 01 Preamp OFF (if installed).
7. Set the RF generator for a  $-15$  dBm output amplitude.
8. Set both the RF generator output frequency and the RSA6100A Center Frequency to 100 MHz. This is the reference frequency.
9. Select the **Markers** button, and then select the **Peak** soft key to set the Reference Marker (MR) to the carrier peak.
10. Record the Power Meter reading and the RSA6100A reading in the following table.

11. Set both the RF generator output frequency and the RSA6100A Center Frequency to 10 MHz.
12. Select the **Peak** soft key to set the Reference Marker (MR) to the carrier peak.
13. Record the Power Meter reading and the RSA6100A reading in the following table.
14. Calculate the  $\Delta$  Power Meter number: subtract the Power Meter reading at 100 MHz from the Power Meter reading at this frequency.
15. Calculate the  $\Delta$  RTSA number: subtract the RTSA reading at 100 MHz from the RTSA reading at this frequency.
16. 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.
17. Repeat parts 11 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	$\Delta$ Power meter (vs. 100 MHz)	RTSA reading	$\Delta$ RTSA reading (vs. 100 MHz)	RF flatness error <sup>1</sup>
100 MHz		0		0	0
10 MHz					
20 MHz					
30 MHz					
40 MHz					
50 MHz					
60 MHz					
70 MHz					
80 MHz					
90 MHz					
200 MHz					
300 MHz					
400 MHz					
500 MHz					
600 MHz					
700 MHz					
800 MHz					
900 MHz					
1.0 GHz					

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

**Attenuator = 10 dB**

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

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

Attenuator = 10 dB

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

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

**Attenuator = 10 dB**

Frequency	Power meter reading	$\Delta$ Power meter (vs. 100 MHz)	RTSA reading	$\Delta$ RTSA reading (vs. 100 MHz)	RF flatness error <sup>1</sup>
<b>RSA6114A and RSA6120A only</b>					
6.3 GHz					
6.4 GHz					
6.5 GHz					
6.6 GHz					
6.7 GHz					
6.8 GHz					
6.9 GHz					
7.0 GHz					
7.1 GHz					
7.2 GHz					
7.3 GHz					
7.4 GHz					
7.5 GHz					
7.6 GHz					
7.7 GHz					
7.8 GHz					
7.9 GHz					
8.0 GHz					
8.1 GHz					
8.2 GHz					
8.3 GHz					
8.4 GHz					
8.5 GHz					
8.6 GHz					
8.7 GHz					
8.8 GHz					
8.9 GHz					
9.0 GHz					
9.1 GHz					
9.2 GHz					
9.3 GHz					
9.4 GHz					
9.5 GHz					
9.6 GHz					



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

Attenuator = 10 dB

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

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

**Attenuator = 10 dB**

<b>Frequency</b>	<b>Power meter reading</b>	<b><math>\Delta</math> Power meter (vs. 100 MHz)</b>	<b>RTSA reading</b>	<b><math>\Delta</math> RTSA reading (vs. 100 MHz)</b>	<b>RF flatness error <sup>1</sup></b>
13.2 GHz					
13.3 GHz					
13.4 GHz					
13.5 GHz					
13.6 GHz					
13.7 GHz					
13.8 GHz					
13.9 GHz					
14.0 GHz					

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

Attenuator = 10 dB

Frequency	Power meter reading	$\Delta$ Power meter (vs. 100 MHz)	RTSA reading	$\Delta$ RTSA reading (vs. 100 MHz)	RF flatness error <sup>1</sup>
<b>RSA6120A Only</b>					
14.1 GHz					
14.2 GHz					
14.3 GHz					
14.4 GHz					
14.5 GHz					
14.6 GHz					
14.7 GHz					
14.8 GHz					
14.9 GHz					
15.0 GHz					
15.1 GHz					
15.2 GHz					
15.3 GHz					
15.4 GHz					
15.5 GHz					
15.6 GHz					
15.7 GHz					
15.8 GHz					
15.9 GHz					
16.0 GHz					
16.1 GHz					
16.2 GHz					
16.3 GHz					
16.4 GHz					
16.5 GHz					
16.6 GHz					
16.7 GHz					
16.8 GHz					
16.9 GHz					
17.0 GHz					
17.1 GHz					
17.2 GHz					
17.3 GHz					
17.4 GHz					

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

**Attenuator = 10 dB**

Frequency	Power meter reading	$\Delta$ Power meter (vs. 100 MHz)	RTSA reading	$\Delta$ RTSA reading (vs. 100 MHz)	RF flatness error <sup>1</sup>
17.5 GHz					
17.6 GHz					
17.7 GHz					
17.8 GHz					
17.9 GHz					
18.0 GHz					
18.1 GHz					
18.2 GHz					
18.3 GHz					
18.4 GHz					
18.5 GHz					
18.6 GHz					
18.7 GHz					
18.8 GHz					
18.9 GHz					
19.0 GHz					
19.1 GHz					
19.2 GHz					
19.3 GHz					
19.4 GHz					
19.5 GHz					
19.6 GHz					
19.7 GHz					
19.8 GHz					
19.9 GHz					

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

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

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

- 18.** For spectrum analyzers with Option 01 installed, add the precision 30 dB attenuator as shown in figure (See Figure 11.) and repeat this process for the range of 10 MHz to 3 GHz with the Preamp ON.

**Table 60: RF Flatness (Option 01 Preamp ON)****Attenuator = 10 dB**

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

**Table 60: RF Flatness (Option 01 Preamp ON) (cont.)**

**Attenuator = 10 dB**

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

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

**19.** 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 01 only)
- 3 GHz - 6.2 GHz
- 6.2 GHz - 14 GHz (RSA6114A only)
- 6.2 GHz - 20 GHz (RSA6120A only)

**Absolute Accuracy at Calibration Point**

- 1.** Connect the RF generator, power splitter, power meter, and RSA6100A. (See Figure 11.)
- 2.** Reset the RSA6100A to factory defaults by pressing the **Preset** button, or selecting **Preset** from the **Setup** menu.
- 3.** Set the RSA6100A:

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 RSA6100A:**

**a.** Select **Alignments** in the **Tools** menu.

**b.** Click the **Align Now** button.

**6.** Select the **Markers** button, and then 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 RSA6100A.

**8.** Calculate the Absolute Amplitude Error:

$$\text{Error} = \text{RSA6100A reading} - \text{Power Meter reading}$$

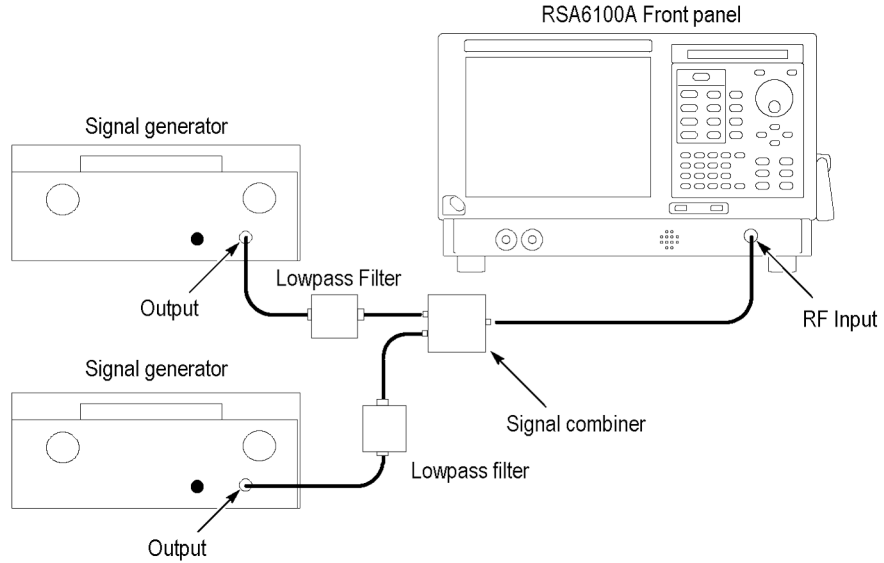
Readings are in dBm, error is in dB.

**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 RSA6100A, as shown in the following figure.



**Figure 12: Equipment connections for Third Order Intermodulation Distortion check**

2. Set the RSA6100A:

Reference Level	-20 dBm
Span	10 kHz
RBW	Auto
Attenuator	0 dB
Preamp	OFF (Option 01 only)



Averaging 10

3. Select the **Settings** button, and then the **BW** tab.
4. Select **Maximum Dynamic Range** in the **RF & IF Optimization** dropdown 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 RSA6100A 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 RSA6100A 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 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 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  $<-80$  dBc (RSA6106A and RSA6114A) or  $<-88$  dBc (RSA6120A) against the carrier signal. It should be approximately  $-105$  dBm or less of the absolute power readings on the screen.

#### DANL - Preamp OFF

---

**NOTE.** Take care when taking this measurement to ensure that the signal generators do not create intermodulation distortion products with each other. If necessary, increase the output attenuation on the generators to at least 10 dB.

---

1. Terminate the RSA6100A RF Input with a  $50 \Omega$  terminator.
2. Reset the RSA6100A to factory defaults by pressing the **Preset** button, or selecting **Preset** from the **Setup** menu.
3. Set the RSA6100A:

Reference Level	$-50$ dBm
Center Frequency	9 kHz
Span	100 kHz
RBW	1 kHz

Averages	100
Attenuator	0 dB
Preamp (Option 01 only)	OFF

4. Set the markers for Noise Mode operation:
  - a. Select the **Markers** button or soft key.
  - b. Select the **Define** soft key.
  - c. Select the **Add** soft key to add the Reference marker (MR).
  - d. Set the Reference marker to 0 Hz.
  - e. Select the **Add** soft key again to add Marker 1 (M1).
  - f. Select the **Settings** button, click the **Prefs** tab, and then select the **Marker Noise Mode** checkbox so it is checked.
  
5. Set the RSA6100A to each of the Center Frequencies listed in the following table in turn, and use Marker 1 to measure the noise level at the center frequency, in dBm/Hz (Absolute readout).

---

**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 81, Spurious Response.)*

---

**Table 61: Frequencies of interest for DANL check**

Center frequency	Noise level	Frequency range
9 kHz		9 kHz - 10 MHz
9.9 MHz		
10.1 MHz		10 MHz -100 MHz
99 MHz		
101 MHz		100 MHz - 2.3 GHz
2.29 GHz		
2.31 GHz		2.3 GHz - 4.0 GHz
3.99 GHz		
4.01 GHz		4.0 GHz - 6.2 GHz
6.2 GHz		

**Table 61: Frequencies of interest for DANL check (cont.)**

Center frequency	Noise level	Frequency range
6.21 GHz		6.2 GHz - 7.0 GHz
6.99 GHz		(RSA6114A only and RSA6120A only)
7.01 GHz		7.0 GHz - 14.0 GHz
8.0 GHz		(RSA6114A and RSA6120A only)
9.0 GHz		
10.0 GHz		
11.0 GHz		
12.0 GHz		
13.0 GHz		
14.0 GHz		
15.0 GHz		15.0 GHz - 20.0 GHz
16.0 GHz		(RSA6120A only)
17.0 GHz		
18.0 GHz		
19.0 GHz		
20.0 GHz		

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

### DANL - Preamp ON (Option 01 Only)

1. Continuing from the previous step, change the RSA6100A 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 62: Frequencies of interest for DANL check (Option 01)**

Center frequency	Noise level	Frequency range
10 MHz		10 MHz - 50 MHz
49 MHz		
51 MHz		50 MHz - 1 GHz
990 MHz		
1.01 GHz		1 GHz - 2 GHz
1.99 GHz		

Table 62: Frequencies of interest for DANL check (Option 01) (cont.)

Center frequency	Noise level	Frequency range
2.01 GHz		2 GHz - 3 GHz
3 GHz		

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 RSA6100A as shown in the following figure.

The power splitter outputs should connect directly to the RSA6100A RF Input and to the Power Sensor.

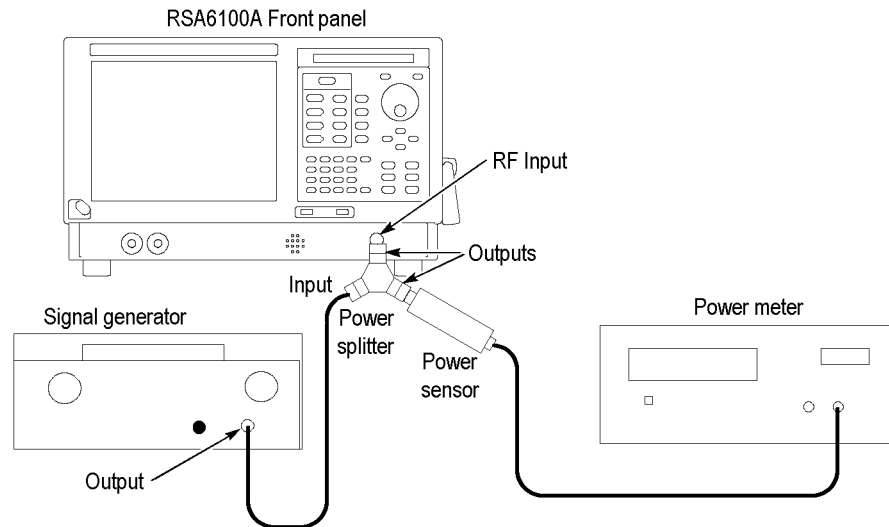


Figure 13: Equipment connections for IF Flatness check

2. Reset the RSA6100A to factory defaults; by pressing the **Preset** button, or selecting **Preset** from the **Setup** menu.

3. Set the RSA6100A:

Span	300 kHz
Reference Level	0 dBm

4. Set both the RF generator output frequency and the RSA6100A Center Frequency to 200 MHz. This is the reference frequency.
5. Select the **Markers** button 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 RSA6100A display.
7. Record the Power Meter reading and the RSA6100A marker reading in Table 2-7.
8. Set the RF generator output frequency to 199.85 MHz.
9. Leave the RSA6100A center frequency at 200 MHz and use the Reference marker to measure the amplitude at this new frequency.
10. Record the Power Meter reading and the RSA6100A reading in the following table.
11. Calculate the  $\Delta$  Power Meter number: subtract the Power Meter reading at 200 MHz from the Power Meter reading at this frequency.
12. Calculate the  $\Delta$  RTSA number: subtract the RSA6100A reading at 200 MHz from the RSA6100A 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 10 MHz, 20 MHz, and 40 MHz, using the appropriate span segment of the following table.
17. (Option 110 only.) Repeat this process for a 110 MHz Span setting.

Table 63: IF Flatness

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

**Table 63: IF Flatness (cont.)**

Generator Frequency	Power meter reading	$\Delta$ Power meter (vs. 200 MHz)	RTSA reading	$\Delta$ RTSA reading (vs. 200 MHz)	Calculated IF Flatness Error
<b>Span = 300 kHz</b>					
200.12 MHz					
200.15 MHz					
<b>Span = 10 MHz</b>					
200 MHz		0		0	0
195 MHz					
196 MHz					
197 MHz					
198 MHz					
199 MHz					
201 MHz					
202 MHz					
203 MHz					
204 MHz					
205 MHz					
<b>Span = 20 MHz</b>					
200 MHz		0		0	0
190 MHz					
192 MHz					
194 MHz					
196 MHz					
198 MHz					
202 MHz					
204 MHz					
206 MHz					
208 MHz					
210 MHz					
<b>Span = 40 MHz</b>					
200 MHz		0		0	0
180 MHz					
184 MHz					
188 MHz					
192 MHz					
196 MHz					
204 MHz					
208 MHz					

Table 63: IF Flatness (cont.)

**Span = 40 MHz**

212 MHz

216 MHz

220 MHz

**Span = 110 MHz (Option 110 only)**

200 MHz

0

0

0

145 MHz

156 MHz

167 MHz

178 MHz

189 MHz

211 MHz

222 MHz

233 MHz

244 MHz

255 MHz

## Spurious Response

**Residual Response**

1. Terminate the RSA6100A RF Input.
2. Reset the RSA6100A to factory defaults; by pressing the **Preset** button, or selecting **Preset** from the **Setup** menu.
3. Set the RSA6100A:

Center Frequency	See the following table
Reference Level	-30 dBm
Span	40 MHz
RBW	1 kHz
Averages	50

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

Table 64: Residual response center frequencies

MHz	GHz	GHz	GHz	GHz
200	1.44	2.68	3.92	5.16
240	1.48	2.72	3.96	5.20

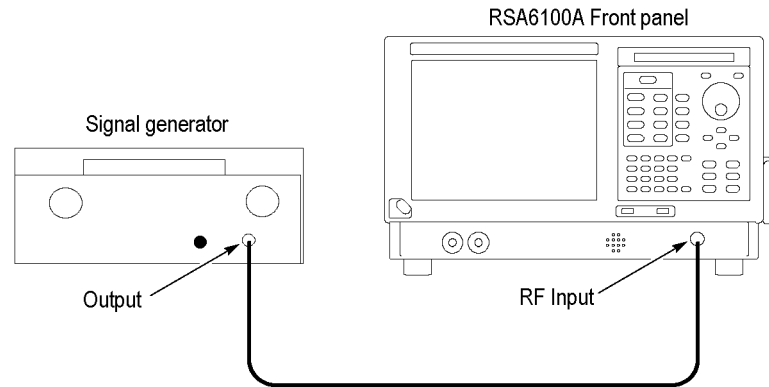
Table 64: Residual response center frequencies (cont.)

MHz	GHz	GHz	GHz	GHz
280	1.52	2.76	4.00	5.24
320	1.56	2.80	4.04	5.28
360	1.6	2.84	4.08	5.32
400	1.64	2.88	4.12	5.36
440	1.68	2.92	4.16	5.40
480	1.72	2.96	4.20	5.44
520	1.76	3.00	4.24	5.48
560	1.8	3.04	4.28	5.52
600	1.84	3.08	4.32	5.56
640	1.88	3.12	4.36	5.60
680	1.92	3.16	4.40	5.64
720	1.96	3.20	4.44	5.68
760	2.0	3.24	4.48	5.72
800	2.04	3.28	4.52	5.76
840	2.08	3.32	4.56	5.80
880	2.12	3.36	4.60	5.84
920	2.16	3.40	4.64	5.88
960	2.20	3.44	4.68	5.92
1000	2.24	3.48	4.72	5.96
1040	2.28	3.52	4.76	6.00
1080	2.32	3.56	4.80	6.04
1120	2.36	3.60	4.84	6.08
1160	2.40	3.64	4.88	6.12
1200	2.44	3.68	4.92	6.16
1240	2.48	3.72	4.96	6.20
1280	2.52	3.76	5.00	--
1320	2.56	3.80	5.04	--
1360	2.60	3.84	5.08	--
1400	2.64	3.88	5.12	--



**Image Suppression**

1. Connect the RF generator capable of at least 20 GHz to the RSA6100A RF Input, as shown in the following figure.
2. Reset the RSA6100A to factory defaults; by pressing the **Preset** button, or selecting **Preset** from the **Setup** menu.

**Figure 14: Equipment connections for Image Suppression check**

3. Set the RSA6100A:

Reference Level	-30 dBm
Attenuator	10 dB
Span	100 kHz
RBW	10 Hz
Averages	50

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.

**Table 65: Image suppression settings**

RSA6100A Center Frequency	RF Generator Output Frequency (Image)
<b>All Models</b>	
1 GHz	20 GHz
3.868 GHz	11.434 GHz
<b>RSA6114A only</b>	
8.2 GHz	16.2 GHz
9.1 GHz	17.1 GHz
10 GHz	18 GHz
11 GHz	19 GHz
12 GHz	20 GHz
<b>RSA6120A only</b>	
8.2 GHz	16.2 GHz

**Table 65: Image suppression settings (cont.)**

<b>RSA6100A Center Frequency</b>	<b>RF Generator Output Frequency (Image)</b>
9 GHz	17 GHz
10 GHz	18 GHz
11 GHz	19 GHz
12 GHz	20 GHz
14 GHz	6 GHz
15 GHz	7 GHz
16 GHz	8 GHz
17 GHz	9 GHz
18 GHz	8 GHz
19 GHz	9 GHz
20 GHz	10 GHz

5. For each row of the above table:
  - a. Set the RSA6100A 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. Read the signal amplitude, in dBm, at center screen. Subtract -30 dBm from the signal amplitude, to convert it to dBc.
  - d. Enter this value in the test record.

---

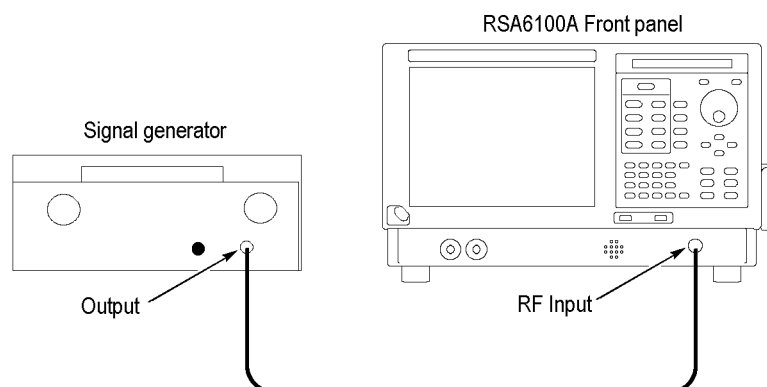
**NOTE.** *The intent of the image spurious test is to measure spurious responses caused by the injection an external signal that would induce an image product on the display. These images can be the same frequencies as residual spurs. In case of question, slightly change the frequency of the input tone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

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

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## Spurious Response with Signal

1. Connect the RF generator to the RSA6100A RF Input, as shown in the following figure.



**Figure 15: Equipment connections for Signal Spurious check**

2. Reset the RSA6100A to factory defaults; by pressing the **Preset** button, or selecting **Preset** from the **Setup** menu.

3. Set the RSA6100A:

Center Frequency	1 GHz
Reference Level	-15 dBm
Span	40 MHz
RBW	1 kHz
Attenuator	10 dB
Averages	100

4. Set the RF generator:

Output Level	-15 dBm
Output Frequency	1 GHz

5. Check that all signals within  $\pm 20$  MHz of the Center Frequency are  $< -73$  dBc.
6. (Option 110 only) Set the RSA6100A Span to 110 MHz.
7. Check that all signals within  $\pm 55$  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 RSA6100A RF Input. (See Figure 15.)

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**NOTE.** Use a low-pass filter if the RF generator has a 2<sup>nd</sup> harmonic performance more than 10 dB below the specification being measured.

---

2. Reset the RSA6100A to factory defaults; by pressing the **Preset** button, or selecting **Preset** from the **Setup** menu.

3. Set the RSA6100A:

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
Output Frequency	4.75 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 66: Center frequencies for Half-IF**

9 kHz	3 GHz	6 GHz
1 GHz	4 GHz	7 GHz (RSA6114A and RSA6120A only)
2 GHz	5 GHz	8 GHz (RSA6114A and RSA6120A 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 spectrum analyzer.

### RSA6100A Series Test Record

Model:

Serial Number:

Certificate Number:

Calibration Date:

Technician:

Frequency Accuracy	Low limit	Test Result	High limit
Reference output frequency accuracy	9,999,997 Hz		10,000,003 Hz
Reference output power level	0 dBm		
External reference input level	Fail		Pass

Phase Noise	Low limit	Test Result	High limit
Offset			
CF + 100 Hz			-80 dBc/Hz
CF + 1 kHz			-100 dBc/Hz
CF + 10 kHz			-106 dBc/Hz
CF + 100 kHz			-107 dBc/Hz
CF + 1 MHz			-128 dBc/Hz
CF + 6 MHz			-134 dBc/Hz
CF + 10 MHz			-134 dBc/Hz

Input VSWR	Low limit	Test Result	High limit
Preamp OFF			
10 MHz - 4 GHz			1.6
>4 GHz - 6.2 GHz			1.8
>6.2 GHz - 14 GHz (RSA6114A only)			1.9
>6.2 GHz - 20 GHz (RSA6120A only)			1.9
Preamp ON (Option 01 only)			
10 MHz - 3 GHz			1.9

RF Input Flatness	Low limit	Test Result	High limit
Attenuator = 10 dB			

## Performance Verification

RF Input Flatness	Low limit	Test Result	High limit
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	-0.8 dB		+0.8 dB
6.2 GHz - 14 GHz (RSA6114A only)	-1.0 dB		+1.0 dB
6.2 GHz - 20 GHz (RSA6120A only)	-1.0 dB		+1.0 dB

Absolute accuracy at calibration point	Low limit	Test Result	High limit
Absolute amplitude error	-0.31 dB		+0.31 dB

Third Order Intermodulation Distortion	Low limit	Test Result	High limit
2.130 GHz			-80 dBc

Displayed Average Noise Level (DANL)	Low limit	Test Result	High limit
Preamp OFF			
9 kHz - 10 MHz			-97 dBm/Hz
10 MHz - 100 MHz			-147 dBm/Hz
100 MHz - 2.29 GHz			-149 dBm/Hz
2.31 GHz - 3.99 GHz			-147 dBm/Hz
4.01 GHz - 7 GHz			-143 dBm/Hz
7 GHz - 14 GHz (RSA6114A only)			-135 dBm/Hz
7 GHz - 20 GHz (RSA6120A only)			-138 dBm/Hz
Preamp ON (Option 01 only)			
10 MHz - 50 MHz			-160 dBm/Hz
50 MHz - 1 GHz			-165 dBm/Hz
1 GHz - 2 GHz			-166 dBm/Hz
2 GHz - 3 GHz			-164 dBm/Hz

IF Flatness (Channel Response)	Low limit	Test Result	High limit
Span Setting			
300 kHz	-0.2 dB		+0.2 dB
10 MHz	-0.4 dB		+0.4 dB
20 MHz	-0.4 dB		+0.4 dB
40 MHz	-0.5 dB		+0.5 dB
110 MHz (Option 110 only)	-0.9 dB		+0.9 dB

<b>Residual Response</b>	<b>Low limit</b>	<b>Test Result</b>	<b>High limit</b>
200 MHz - 6.2 GHz			-95 dBm

<b>Image Suppression</b>	<b>Low limit</b>	<b>Test Result</b>	<b>High limit</b>
All Models			
1 GHz			-80 dBc
3.868 GHz			
RSA6114A only			
8.2 GHz			-76 dBc
9.1 GHz			
10 GHz			
11 GHz			
12 GHz			
RSA6120A only			
8.75 GHz			-76 dBc
9.6 GHz			
10.5 GHz			
11.45 GHz			
13 GHz			
13.5 GHz			
14.25 GHz			
15 GHz			
16.5 GHz			
17.5 GHz			
18 GHz			
19.5 GHz			

<b>Spurious Response with Signal</b>	<b>Low limit</b>	<b>Test Result</b>	<b>High limit</b>
<1 MHz of Center Frequency	Fail		Pass
>1 MHz of Center Frequency	Fail		Pass
>1 MHz of Center Frequency (Option 110 only)	Fail		Pass

## Performance Verification

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<b>Spurious Response with Signal (Half IF)</b>	<b>Low limit</b>	<b>Test Result</b>	<b>High limit</b>
9 kHz			-57 dBc
1 GHz			
2 GHz			
3 GHz			
4 GHz			
5 GHz			
6 GHz			
7 GHz (RSA6114A and RSA6120A only)			
8 GHz (RSA6114A and RSA6120A only)			