SignalCore™

PRESERVING SIGNAL INTEGRITY

Datasheet

SC5317A & SC5318A

6 GHz to 26.5 GHz RF Downconverter

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1. Definition of Terms

The following terms are used throughout this datasheet to define specific conditions:

Specification (spec)	Defines expected statistical performance within specified parameters which account for measurement uncertainties and changes in performance due to environmental conditions. Protected by warranty.
Typical Data (typ)	Defines the expected performance of an average unit without specified parameters. Not protected by warranty.
Nominal Values (nom)	Defines the average performance of a representative value for a given parameter. Not protected by warranty.
Measured Values (meas.)	Defines the expected product performance from the measured results gained from individual samples.

Specifications are subject to change without notice. For the most recent product specifications, visit www.signalcore.com.

2. Description

The SC5318A is a C to K broadband single stage downconverter, with input RF range from 6 GHz to 26.5 GHz, external LO frequency range from 6 GHz to 14 GHz, and output IF range from 50 MHz to 3 GHz. This module features an internal synthesized local oscillator, RF preamplifier, and variable gain control, making it a compact and versatile standalone downconverter module. With the option for an external LO signal, the SC5318A may be configured for SISO applications or paired together with multiple units for MIMO applications such as ground-based satellite communications, point-to-point radio, and test instrument systems.

The SC5318A also features a bypass path for lower frequencies so it can be combined with the C band downconverters such as the SignalCore SC5308A to form a broadband 100kHz to 26.5 GHz downconverter system.

For systems requiring spectral selectivity, especially those used in open environments such as spectral monitoring, RF and IF bandpass filters may be placed at the RF input and IF output ports respectively to suppress unwanted signals and improve out-of-band noise. An external IF filter will also provide further suppression of out-of-band internally generated spurious signals and LO leakages.

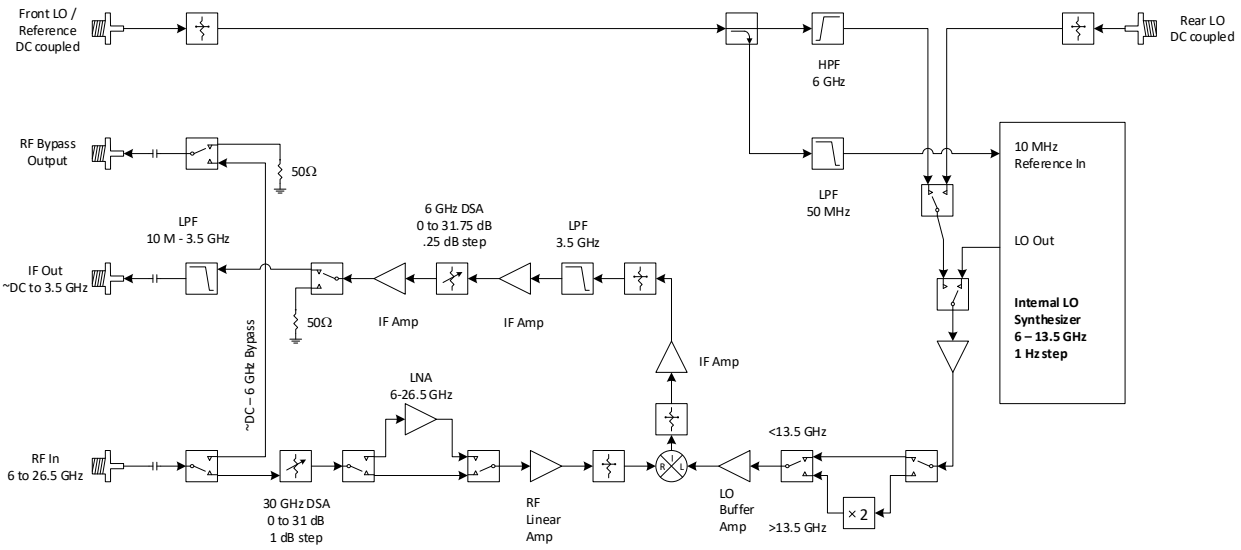

Figure 1. SC5318A Block Diagram

3. Conversion Specifications

RF Input Range		
Conversion Path	LO > RF	6 GHz to (26.5 GHz – IF)
	LO < RF	(6 GHz + IF) to 26.5 GHz
Direct Path		100 kHz to 8 GHz
External LO range		6 GHz to 14 GHz
IF output frequency[1]		50 MHz to 3000 MHz
IF output Polarity[2]	LO > RF	Inverted
	LO < RF	Non-inverted
IF bandwidth (3 dB)[3]		1500 MHz Typical

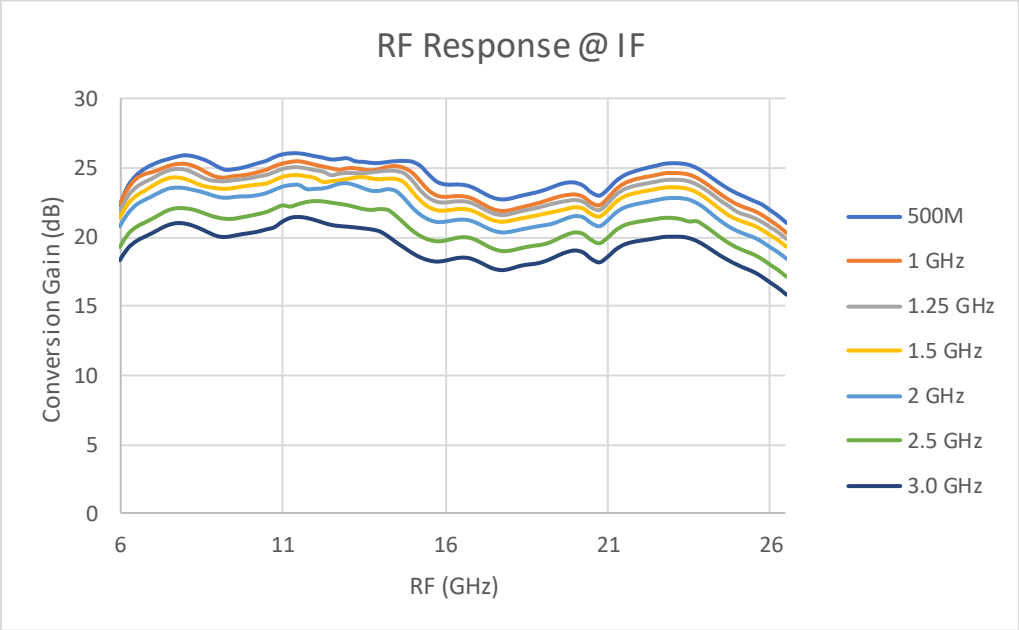

Figure 2. Measured conversion path RF response for different IF with LO > RF; LO < RF when LO > 26.5 GHz. If an external LO is used, the power is set at 5 dBm.

[1] IF output frequency is defined as the usable frequency range for all differences of | LO – RF | and that LO and RF is limited to 6 to 26.5 GHz.
[2] The IF output polarity is inverted when the IF spectrum sense is in the opposite direction with respect to the input RF spectrum. This happens when the LO frequency is higher than the input RF.
[3] The range of the IF bandwidth is determined by the boundaries of the spectrum whose amplitude varies less than 3 dB.

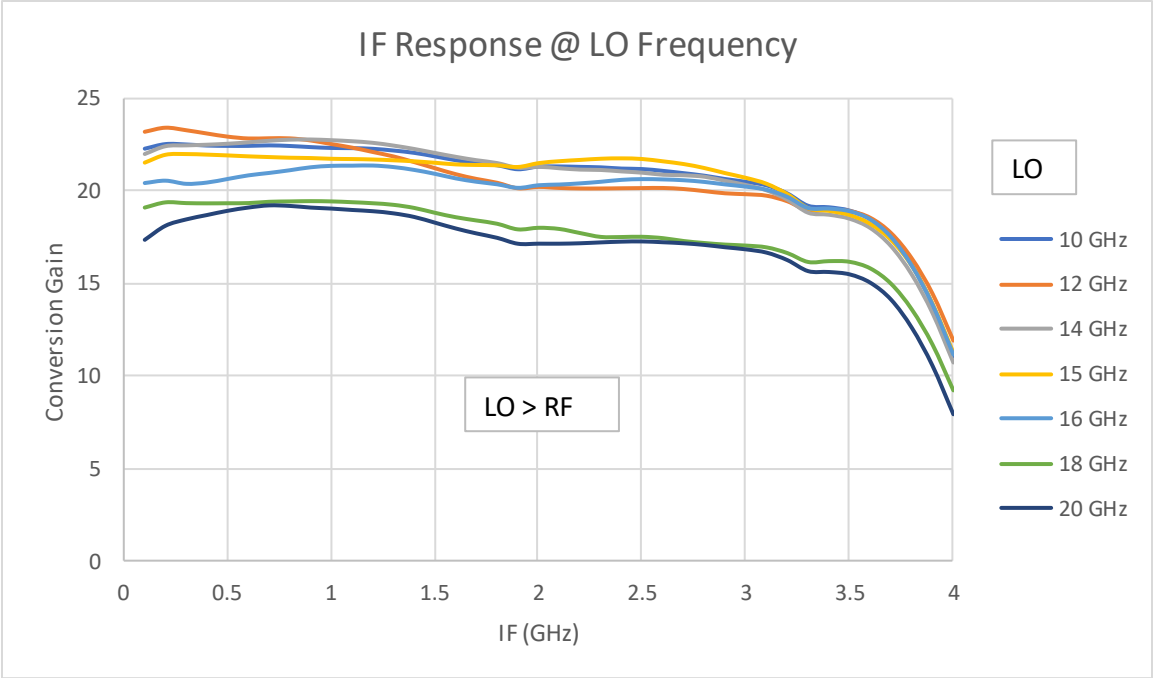

Figure 3. Measured IF response for different LO frequencies. RF < LO is varied. When an external LO is used, the power is set at 5 dBm.

4. Amplitude Specifications

Input Range	AC (preamplifier disabled)	+23 dBm max
	AC (preamplifier enabled)	+20 dBm max
	DC[4]	0 V
Attenuation Range	RF	0 to 30 in 1 dB steps
	IF	0 to 30 in 1 dB steps
Input Voltage Standing Wave Ratio (VSWR)		
Preamp off, 0 dB input RF attenuation	6.0 GHz to 15.0 GHz	< 1.7
	15.0 GHz to 26.5 GHz	< 1.9
Preamp on, 0 dB input RF attenuation	6.0 GHz to 15.0 GHz	< 2.0
	15.0 GHz to 26.5 GHz	< 2.2

[4] Large and fast DC transients could damage the input solid state devices. Slow ramp up of DC to 10 V is sustainable.

Gain Range	Minimum[5]	-40 dB Nom
	Maximum (preamplifier disabled)[6]	23 dB Nom
	Maximum (preamplifier enabled)[6]	42 dB Nom
Preamplifier Gain		20 dB Nom
Direct Path Loss		1.5 dB typical
RF Amplitude Response (25°C to 45°C device temperature)	RF Gain Flatness Response at Fixed IF	5 dB Nom
IF Flatness (25°C to 45°C device temperature)	IF In-Band Response Flatness Over 1.5 GHz	3 dB typical

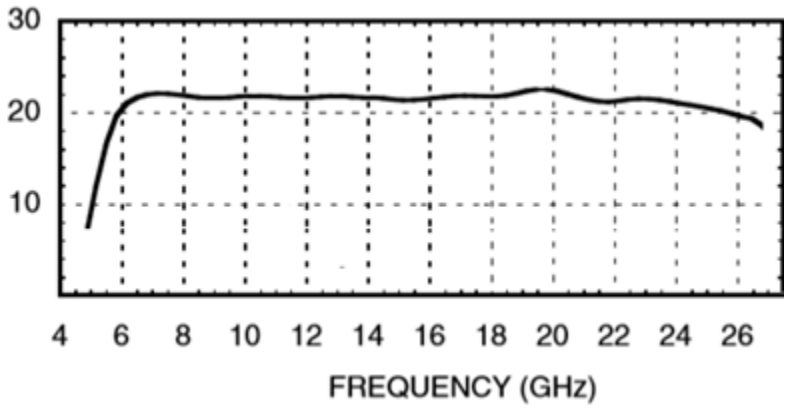

Figure 4. Nominal RF pre-amplifier response.

RF Port Local Oscillator Leakage	Preamplifier disabled, no RF attenuation	< -60 dBm typical
	Preamplifier enabled, no RF attenuation	< -75 dBm typical
IF Port Local Oscillator Leakage	IF enabled, no IF attenuation	< -60 dBm typical
	IF disabled, no IF attenuation	< -80 dBm typical

[5] Minimal gain is specified when all attenuators, both RF and IF attenuators, are set to their maximum values and the RF pre-amplifier is disabled.
[6] Maximum conversion gain is specified when all the attenuators are set to 0 dB attenuation.

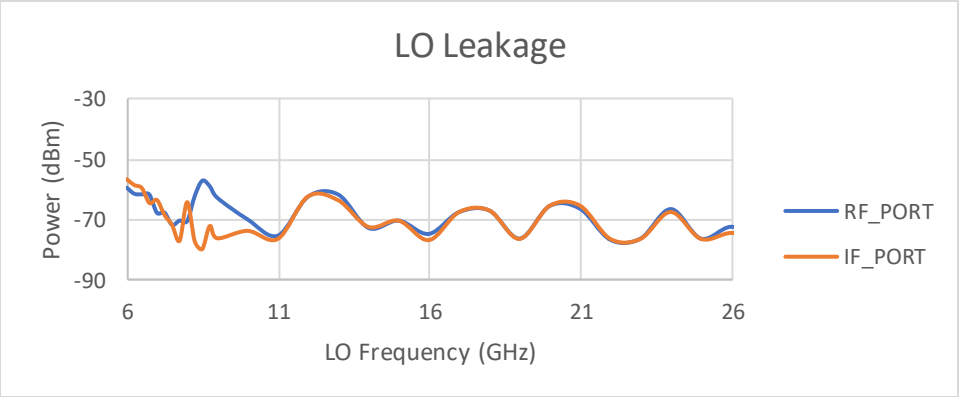

Figure 5. LO leakage measurement. Power meter limits measurement to -70 dBm.

5. Dynamic Range Specifications

Spurious Response		
Residual Spurious Signals[7]	RF < 10 GHz	< -70 dBm
	RF > 10 GHz	< -80 dBm
RF Induced Spurious Signals[8]		< -60 dBc

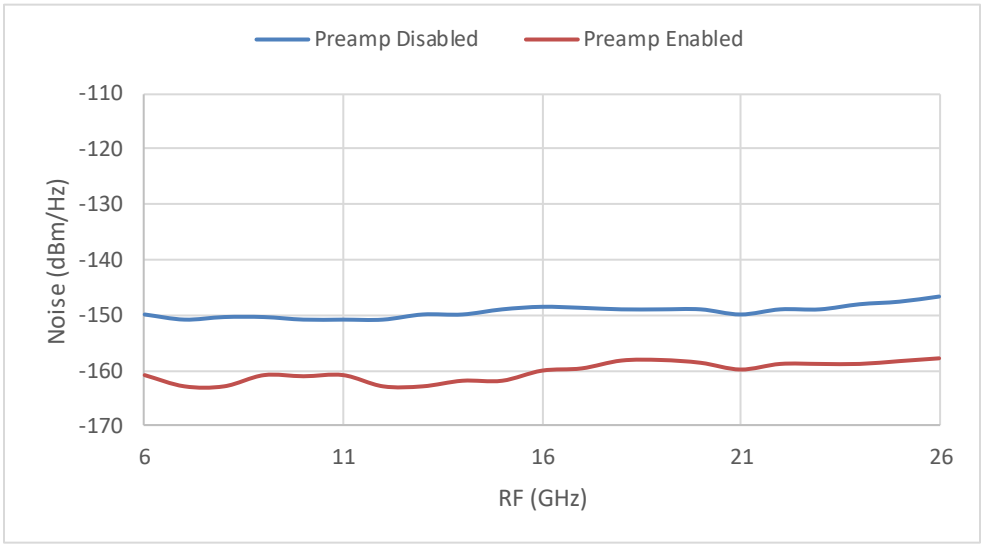

Figure 6. Measured input noise density

[7] Spurious signals at the IF port in the absence of RF input signals are due to internal LO associated signals.
[8] Spurious signals at the IF port induced by the presence of a RF signal.

Input Noise Density (25°C to 40°C device temperature nominal)[9]

Preamplifier Disabled	10 GHz	16 GHz	26 GHz
Noise Floor (dBm/Hz)	-151	-149	-144
Noise Figure (dB)	23	25	30

Preamplifier Enabled	10 GHz	16 GHz	26 GHz
Noise Floor (dBm/Hz)	-161	-160	-158
Noise Figure (dB)	13	14	16

Input Third-Order Intermodulation (IIP3, dBm)

	6 GHz – 12 GHz	14 GHz – 20 GHz	20 GHz – 26 GHz
Preamplifier disabled	18	18	15
Preamplifier enabled	-8	-6	-8

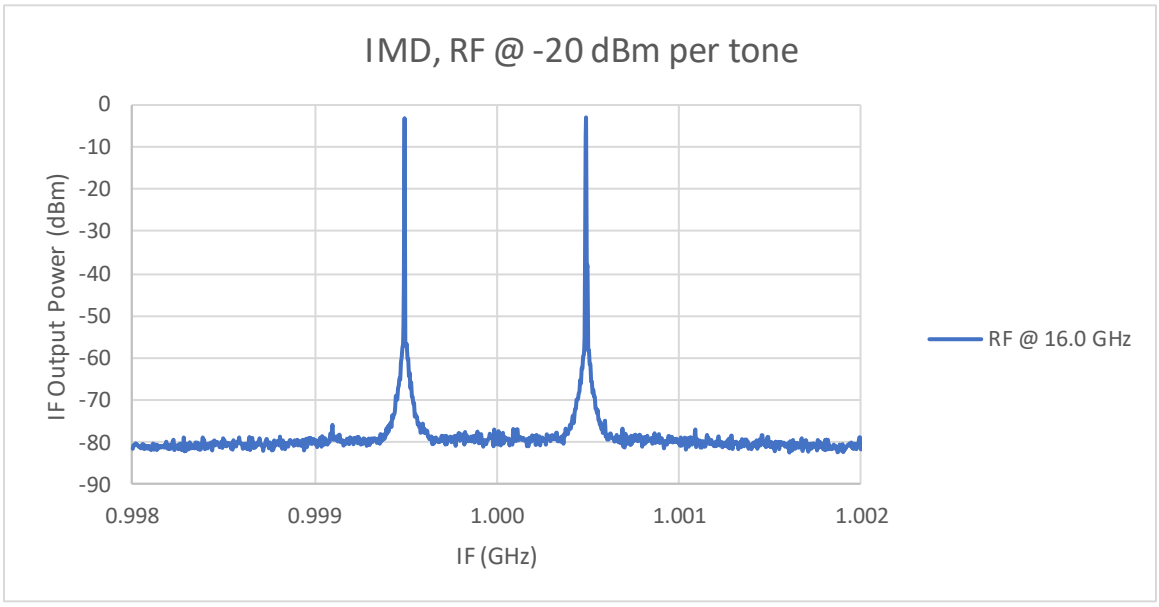

Figure 7. Plots show the typical IMD performance with two -20 dBm input signals centered at 16 GHz, 0 dB RF attenuation, preamp disabled, gain set for 17 dB, and IF frequency of 1.0 GHz.

[9] Noise (thermal) density is referred to the input of the device.

Input Second Harmonic Distortion (SHI, dBm nominal)

Input Second Harmonic Intercept Point (dBm)	6 GHz	13 GHz	
Preamplifier disabled	30	28	
Preamplifier enabled	10	9	

Input Compression Point (dBm)

	6 GHz – 12 GHz	13 GHz – 20 GHz	21 GHz – 26 GHz
Preamplifier disabled RF Atten = 0, Gain = 0	>10	>12	>10
Preamplifier enabled	-8	-8	-10

Output Compression Point (dBm)

	6 GHz – 18 GHz	18.0 GHz – 26.0 GHz	
RF Atten = 0, IF Atten = 0, Preamplifier disabled	>18	>16	

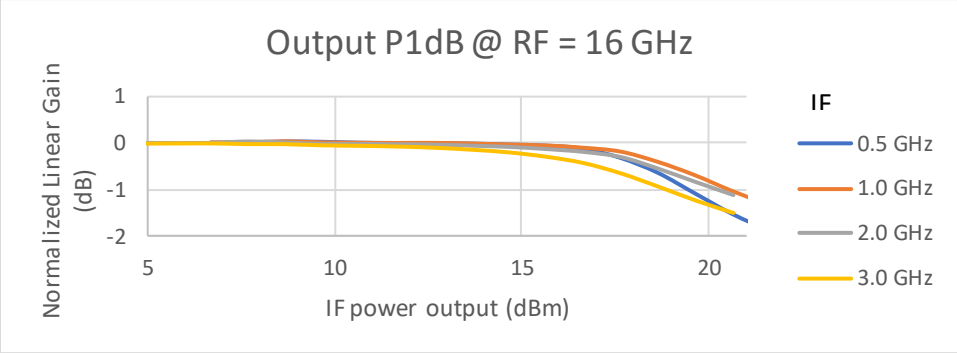

Figure 8. Output IF P1dB measurement: RF Atten = 0, IF Atten = 0.

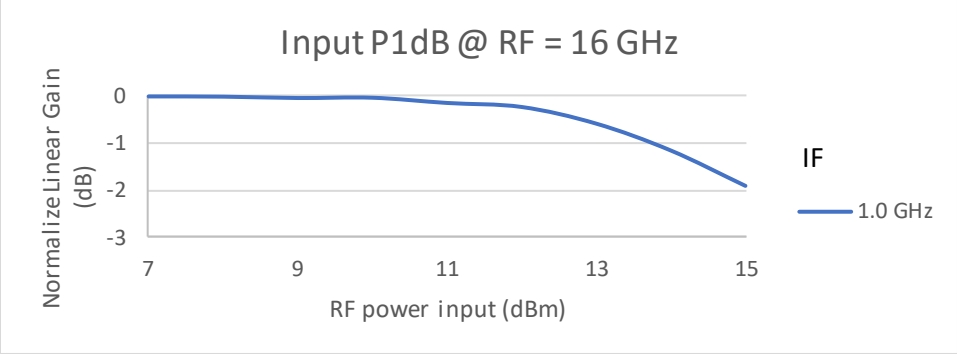

Figure 9. Input RF P1dB measurement: RF Atten = 0, IF Atten = 25.

6. Internal LO Specifications

LO Frequency Range	Frequency Doubler Off	6.0 GHz to 13.5 GHz
	Frequency Doubler On	6.0 GHz to 27.0 GHz
LO Tuning	Frequency Step Resolution	1 Hz
	Lock and Settling Times	1 ms typical
Frequency Reference[10]		
Technology		Temperature compensated crystal oscillator
Accuracy		± [(aging x last adjustment time lapse) + temp stability + cal accuracy]
Initial Calibration Accuracy		± 0.05 ppm
Temperature Stability[11]	20°C to 50°C	± 0.25 ppm
	0°C to 80°C	± 1.0 ppm
Aging		± 1 ppm for first year @ 25°C
Frequency Accuracy		± (frequency reference accuracy in Hz * RF frequency) Hz

Sideband Noise

Offset/LO	6 GHz	13 GHz	20 GHz	26 GHz
100 Hz	-80	-72	-68	-65
1 kHz	-100	-93	-89	-86
10 kHz	-104	-98	-93	-90
100 kHz	-104	-98	-93	-90
1 MHz	-119	-116	-109	-110
10 MHz	-141	-139	-134	-133

[10] The frequency reference refers to the device's internal 10 MHz TCXO time-base. Accuracy is in parts-per-million or ppm ($1x10^{-6}$).
[11] These are device temperatures as read back for its internal temperature sensor.

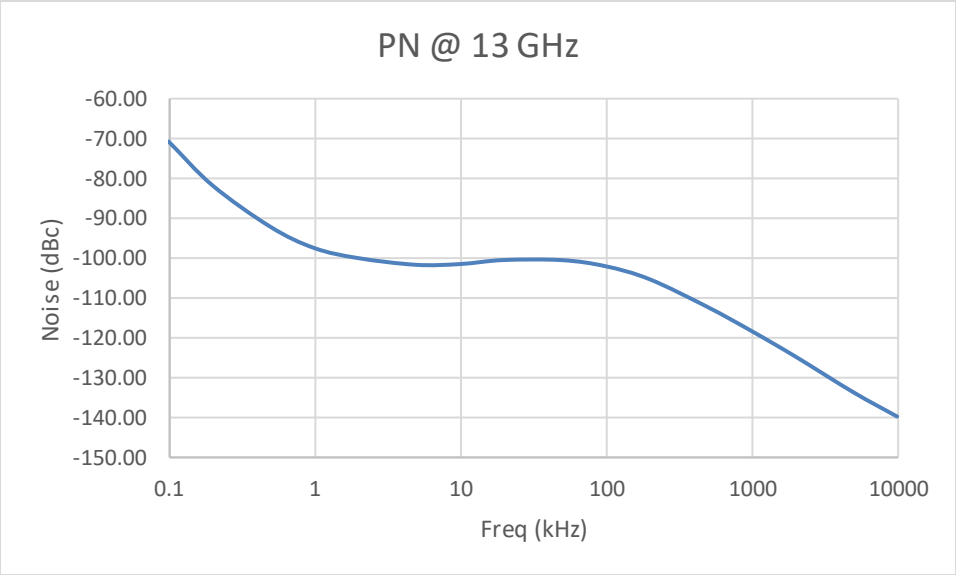

Figure 10. Typical measured sideband noise @ 13 GHz

LO Related Sideband Spurious Signals	< 200 kHz	-55 dBc
	> 200 kHz	-60 dBc

7. Port Specifications

LO Input / Reference Input		
Reference	Reference Center Frequency	10 MHz
	Amplitude	-3 dBm min / +10 dBm max
	Phase-Lock Range	± 3 ppm (typ)
External LO	Frequency Range	6 GHz to 15 GHz
	Amplitude	+0 dBm min / +7 dBm max
Impedance		50 Ω nominal
Coupling		AC
Connector Type		SMA female

RF Input	Input Impedance	50 Ω
	Coupling	AC
	Input Amplitude	23 dBm max
	Connector Type	SMA female
IF Output	Output Impedance	50 Ω
	Coupling	AC
	Connector Type	SMA female
	Output Amplitude	20 dBm max

8. General Specifications

Environmental		
Device Operating Temperature		0°C to +75°C
Storage Temperature		-40°C to +100°C
Operating Relative Humidity		10% to 90%, non-condensing
Storage Relative Humidity		5% to 90%, non-condensing
Operating Shock		30 g, half-sine pulse, 11 ms duration
Storage Shock		50 g, half-sine pulse, 11 ms duration
Operating Vibration		5 Hz to 500 Hz, 0.31 g_{rms}
Storage Vibration		5 Hz to 500 Hz, 2.46 g_{rms}
Altitude		2,000 m maximum (maintain 25°C maximum ambient temperature)
Physical		
Dimensions (W x H x D, max envelope)		3.7” x 0.75” x 6.1”
Weight		1.0 lb.
Input Voltage		12 VDC
Power Consumption	Internal LO Disabled	10 W max
	Internal LO Enabled	18 W max
Communication Interface		USB and RS-232 / SPI

Safety	Designed to meet the requirements of:	IEC 61010-1 EN 61010-1 UL 61010-1 CSA 61010-1
Electromagnetic Compatibility (EMC)	Designed to meet the requirements of:	EN 61326-1 (IEC 61326-1): Class A emissions Basic immunity 1 EN 55011 (CISPR 11) Group 1, Class A emissions AS/NZS CISPR 11: Group 1, Class A emissions FCC 47 CFR Part 15B: Class A emissions ICES-001: Class A emissions
CE	Meets the requirements of:	2006/95/EC Electromagnetic Compatibility Directive (EMC Directive)
Warranty		3 years parts and labor on defects in materials or workmanship

9. Revision Table

Revision	Revision Date	Description
0.1	5/14/2018	Document Created
1.0	9/12/2018	Initial Release
2.0	4/30/2019	Revised Definition of Terms
2.1	6/16/2020	Revised VSWR values
2.2	7/24/2020	Removed Low-Voltage Directive from CE requirements met.

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