HS9000 SERIES

Multi-Channel RF Synthesizers

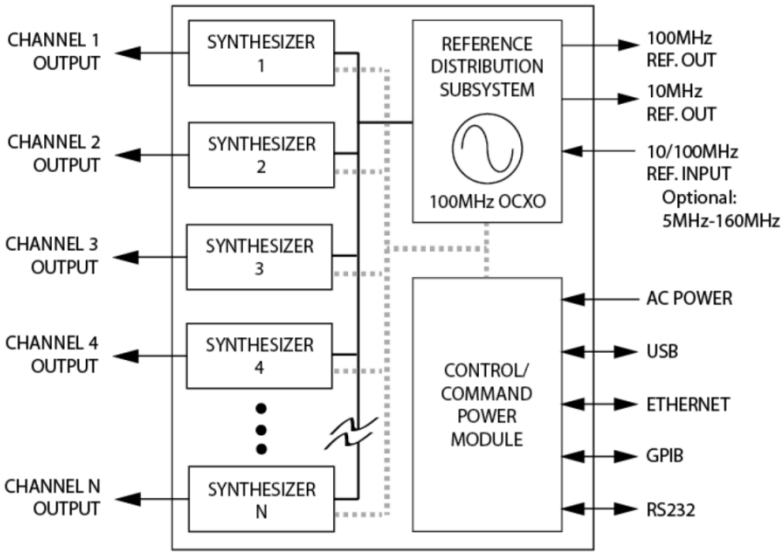
The Holzworth HS9000 Seriesmulti-channel platform is designed to achieve optimal channel-to-channel stability across all integrated channel synthiesizers via a conductively cooled, fan-less enclosure. Specific attention is paid to phase coherency between the independely controllable channels.

CE
RoHS

The HS9000 Series is a unique platform allowing the user to specify custom configurations for a COTS product. Units are loaded with anywhere from 1 to 16 channels[1], with the additional flexibility to specify each channel's frequency limits and performance options. The result is a high performance, multi-channel synthesizer that is tailored to an application with an optimal price point.

FULLY INDEPENDENT CHANNELS

Each RF output is driven by a separate, internally loaded synthesizer module. Up to 8[1] independently tunable synthesizers can be specified per 1U chassis allowing for the highest integrated channel density available in its class. With an average power dissipation of 9 Watts per channel, the HS9000 series is highly efficient.



PHASE COHERENT CHANNELS

Holzworth Multi-channel RF Synthesizers offer the benefits of a proprietary NON-PLL based synthesis architecture. Coupling the NON-PLL architecture with a centralized reference distribution subsystem enables a truly phase coherent relationship across all integrated channels.

THE ULTIMATE IN CHANNEL-TO-CHANNEL STABILITY

Different from traditional PLL based synthesizers, Holzworth's proprietary architecture creates precisely synthesized signals that exhibit both instantaneous and long term stability. Temperature variations between the channels remain the only contribution to drift. The thermally optimized, fan-less chassis was specifically developed for maintaining the lowest possible thermal gradients from channel-to-channel.

Holzworth multi-channel designs are integrated into precision applications that range from particle accelerator timing clocks to satellite position tracking. Due to the necessity for the ultimate in signal stability, Holzworth synthesizers also come standard with thermal monitor outputs to track the relative channel temperature of each loaded channel.

[1]Number of channels per 1U chassis may be limited based on selected options.

ELECTRICAL SPECIFICATIONS - FREQUENCY

The specified parameters for the HS9000 Series RF Synthesizers are fully verified at final performance test and 100% guaranteed for the warranted life of the product. Performance specifications listed on this page are specific to Frequency.

FREQUENCY PERFORMANCE (channels up to 6.7 GHz)[1]

PARAMETER	MIN[2]	TYPICAL[3]	MAX[2]	COMMENTS
Frequency Option Ranges[4]				
OPT-A1 thru OPT-A8	10 MHz		1.024 GHz	Settable from 5MHz to 1.024GHz
OPT-B1 thru OPT-B8	10 MHz		2.048 GHz	Settable from 5MHz to 2.048GHz
OPT-C1 thru OPT-C8	10 MHz		3.072 GHz	Settable from 5MHz to 3.072GHz
OPT-D1 thru OPT-D8	10 MHz		4.096 GHz	Settable from 5MHz to 4.096GHz
OPT-E1 thru OPT-E8	10 MHz		6.400 GHz	Settable from 5MHz to 6.720GHz
Frequency Resolution		0.001 Hz		
Phase Offset Resolution				**Offset Accuracy:**
10MHz – 512 MHz		0.1 deg		±0.05 deg
512 MHz – 1.024 GHz		0.2deg		±0.10 deg
1.024 GHz – 2.048 GHz		0.4deg		±0.20 deg
2.048 GHz – 4.096 GHz		0.8 deg		±0.40 deg
4.096 GHz – 6.40 GHz		1.6 deg		±0.80 deg
Switching Speed (Frequency)				
SPI Mode (ASCII)	300 µs maximum by design.			
SPI Mode (Binary)	< 3.072 GHz, 100 µs maximum by design. 75 µs typical. ≥3.072 GHz, 100 µs by design.			
List/Step Sweep Mode (WB)	100 µs by design. Wideband Steps (full bandwidth)			
List/Step Sweep Mode (NB)	6 µs by design. Narrowband Steps (<5% bandwidth)			
Temperature Effects		± 1 ppm		0 to 55 °C
Line Voltage Effects (12V)		± 0.1 ppm		• ±5%
Digital Sweep Modes				
Operating Modes				Step sweep (linear, internal) List Sweep (arbitrary list of freq steps) Simultaneous Amplitude sweep (list)
Sweep Range	10 MHz		6.720 GHz	
Dwell Time	100 µs		100 s	1 µs increments
Number of Points (STEP)	2		65535	
Number of Points (LIST)	2		3201	
Triggering				Free Run, External Trigger

[1] Specifications are subject to change per the discretion of Holzworth Instrumentation, Inc.
[2] All MIN/ MAX (Minimum/ Maximum) performance parameters are guaranteed and 100% verified during final performance test.
[3] Typical performance is "by design" and consistent with field performance data.
[4] Option OPT-PWR18 limits calibrated minimum frequency to 32MHz

ELECTRICAL SPECIFICATIONS - FREQUENCY (continued)

FREQUENCY PERFORMANCE (12.5 and 20 GHz channels)[1]

PARAMETER	MIN[2]	TYPICAL[3]	MAX[2]	COMMENTS
Frequency Range **OPT-X1 thru OPT-X4** **OPT-F1 thru OPT-F4**	 10 MHz 10 MHz		 12 GHz 18 GHz	 VHF through X Band (Settable to 12.5GHz) VHF through K_u Band (Settable to 20.48GHz)
Frequency Step Size		0.001 Hz		
Phase Offset	0 deg		+360 deg	
Phase Offset Resolution 10 MHz – 512 MHz 512 MHz – 1.024 GHz 1.024 GHz – 2.048 GHz 2.048 GHz – 4.096 GHz 4.096 GHz – 5.0 GHz 5.0 GHz – 10 GHz 10 GHz – 20GHz		 0.1 deg 0.2deg 0.4deg 0.8 deg 1.6 deg 3.2 deg 6.4 deg		**Offset Accuracy:** ±0.05 deg ±0.10 deg ±0.20 deg ±0.40 deg ±0.80 deg ±1.60 deg ±3.20 deg
Switching Speed (Frequency) SPI Mode (ASCII) SPI Mode (Binary)			 300us 100us	
Temperature Effects		± 1 ppm		0 to 55 °C
Line Voltage Effects (12V)		± 0.1 ppm		±5%

[1] Specifications are subject to change per the discretion of Holzworth Instrumentation, Inc.
[2] All MIN/ MAX (Minimum/ Maximum) performance parameters are guaranteed and 100% verified during final performance test.
[3] Typical performance is "by design" and consistent with field performance data.
[4] Option OPT-PWR18 limits calibrated minimum frequency to 32MHz

REFERENCE SPECIFICATIONS

PARAMETER	MIN[2]	TYPICAL[3]	MAX[2]	COMMENTS
Internal Time Base Reference Frequency Oscillator Aging Rate		 100MHz ± 1 ppm/yr		 Precision OCXO 1st year. ±0.5 ppm/yr each subsequent year
10MHz Reference Output Amplitude Impedance	 +2 dBm	 50 Ω	 +6 dBm	 Nominal Nominal
100MHz Reference Output Amplitude Impedance	 +2 dBm	 50 Ω	 +6 dBm	 Nominal Nominal
External Reference Input (standard) Input Frequency Input Amplitude Lock Range Impedance Waveform	 0 dBm	 10 / 100 MHz ± 4 ppm 50 Ω	 +10 dBm ± 1 ppm	 10MHz or 100MHz, software selectable 20Hz Locking BW Sine
OPT-REFX: Ext. Ref. Input (optional) Input Frequency Range Lock Range Amplitude Impedance Waveform	 5 MHz 0 dBm	 ± 4 ppm 50 Ω	 160 MHz ± 1 ppm +10 dBm	 Any 100kHz increment within range Sine or square

ELECTRICAL SPECIFICATIONS - AMPLITUDE

The specified parameters for the HS9000 Series RF Synthesizers are fully verified at final performance test and 100% guaranteed for the warranted life of the product. Performance specifications listed on this page are specific to Amplitude.

AMPLITUDE PERFORMANCE (channels up to 6.7GHz)[1]

PARAMETER	MIN[2]	TYPICAL[3]	MAX[2]	COMMENTS
Output Power (Calibrated)	-50 dBm		+18 dBm	Settable from -90dBm to +25dBm Refer to typical data: Page 6
Resolution		0.01 dB		
Absolute Level Accuracy 10MHz < f < 6.4GHz +18 to -10dBm 10MHz < f < 6.4GHz -10 to -50dBm		 ± 0.25 dB ± 0.50 dB	 ± 0.5 dB ± 1.5 dB	 Refer to typical data: Page 6 25C to 35C (case temperature)
Connector		50 Ω		SMA
SWR (S_{22}) f < 32MHz 32MHz < f < 1.024GHz 1.024GHz < f < 6.4GHz		 1.4 (-15.6 dB) 1.15 (-23.0 dB) 1.3 (-17.7 dB)	 1.7 (-11.7 dB) 1.4 (-15.6 dB) 1.5 (-14 dB)	 Refer to typical data: Page 7
Maximum Reverse Power Max DC Voltage > 10 MHz	25 VDC maximum by design. 10 mW (+16dBm) max by design. *** Some applications may require reverse power protection.			
Switching Speed (Amplitude) SPI Mode List / Step Sweep Mode	300 µs maximum by design. Settling to within 0.1 dB. 100 µs maximum by design.			
SSB Phase Noise 100 MHz, 10kHz offset 500 MHz, 10kHz offset 1.0 GHz, 10kHz offset 2.0 GHz, 10kHz offset 3.0 GHz, 10kHz offset 4.0 GHz, 10kHz offset 6.0 GHz, 10kHz offset		 ≤ -153 dBc/Hz ≤ -139 dBc/Hz ≤ -133 dBc/Hz ≤ -127 dBc/Hz ≤ -123 dBc/Hz ≤ -121 dBc/Hz ≤ -117 dBc/Hz	 ≤ -145 dBc/Hz ≤ -134 dBc/Hz ≤ -128 dBc/Hz ≤ -122 dBc/Hz ≤ -117 dBc/Hz ≤ -115 dBc/Hz ≤ -111 dBc/Hz	Refer to typical data: Pages 7 ≤ -152 dBc/Hz @ 20kHz offset ≤ -140 dBc/Hz @ 20kHz offset ≤ -134 dBc/Hz @ 20kHz offset ≤ -128 dBc/Hz @ 20kHz offset ≤ -124 dBc/Hz @ 20kHz offset ≤ -122 dBc/Hz @ 20kHz offset ≤ -118 dBc/Hz @ 20kHz offset
Harmonics (CW mode) 100 MHz to 6.4GHz		**(2^{ND} / 3^{RD})** -40 / -60 dBc	**(All)** -30 dBc	Refer to typical data: Page 8 @ +10dBm
Sub-Harmonics (CW mode) 10 MHz to 1.024 GHz 1.024 GHz to 4.2 GHz 4.2 GHz to 6.4 GHz		**($^{1}/_{2}$ / $^{3}/_{2}$)** -85 / -75 dBc -70 / -55 dBc -65 / -70 dBc	**(All)** -60 dBc -40 dBc -50 dBc	 Refer to typical data: Page 8 @ +10 dBm
Non-Harmonics / Spurious Broadband (CW mode) 10 MHz to 1.5 GHz 1.5 GHz to 6.4 GHz		 -80 dBc -70 dBc	 -70 dBc -60 dBc	Refer to typical data: Page 7 @ +10 dBm @ +10 dBm
Jitter 155 MHz 622 MHz 2.488 GHz		 60 fs 61 fs 55 fs	 NS NS NS	 100Hz < BW < 1.5MHz 1kHz < BW < 5MHz 5kHz < BW < 20MHz

[1] Specifications are subject to change per the discretion of Holzworth Instrumentation, Inc.
[2] All MIN/ MAX (Minimum/ Maximum) performance parameters are guaranteed and 100% verified during final performance test.
[3] Typical performance is "by design" and consistent with field performance data.

ELECTRICAL SPECIFICATIONS - AMPLITUDE (continued)

AMPLITUDE PERFORMANCE(12.5GHz and 20GHz channels)[1]

PARAMETER	MIN[2]	TYPICAL[3]	MAX[2]	COMMENTS
Output Power (Calibrated) 10 MHz to 12 GHz 12 GHz to 18 GHz	 -20 dBm -20 dBm		 +18 dBm +16 dBm	 Refer to typical data: Page 10 Settable -20 to +25 dBm
Resolution		0.01 dB		
Absolute Level Accuracy 10 MHz - 6 GHz 6 GHz - 12 GHz -10 dBm to 5 dBm 5dBm to 18 dBm 12 GHz - 18 GHz -10 dBm to 5 dBm 5 dBm to 16 dBm		 ± 0.5 dB ± 0.5 dB ± 1 dB ± 0.6 dB ± 1.1 dB		 Refer to data. Page 10. 25C to 35C (case temperature)
Connector		50 Ω		SMA
SWR (S_{22}) 10 MHz < f ≤ 6 GHz 6 GHz < f ≤ 18 GHz		 1.33 (-17.0 dB) 1.43 (-15.0 dB)		
Maximum Reverse Power Max DC Voltage > 100 kHz	*** Some applications may require reverse power protection. 25 V_{DC} maximum by design. 16 dBm max by design.			
Switching Speed (Amplitude) SPI Mode (Binary)			100us	Settling to within 0.1dB
SSB Phase Noise 2.0 GHz, 10 kHz offset 4.0 GHz, 10 kHz offset 8.0 GHz, 10 kHz offset 12.0 GHz, 10 kHz offset 18.0 GHz, 10 kHz offset		 ≤ -128 dBc/Hz ≤ -122 dBc/Hz ≤ -114 dBc/Hz ≤ -110 dBc/Hz ≤ -106 dBc/Hz		Refer to Figure 11
Harmonics(CW mode) 10 MHz to 8 GHz 8 GHz to 18 GHz		 -30 dBc		Refer to typical data: Page 12
Sub-Harmonics(CW mode) 10 MHz to 8 GHz 8 GHz to 18 GHz		 -60 dBc -50 dBc		Refer to typical data: Page 12
Non-Harmonics / Spurious Broadband (CW mode) 10 MHz to 8 GHz 8 GHz to 18 GHz		 -60 dBc -50 dBc		Refer to typical data: Page 13
Non-Harmonics / Spurious Narrowband (CW mode) 10 MHz to 8 GHz 8 GHz to 18 GHz		 TBD TBD		Refer to typical data: Page 13
Jitter (RMS) at 18 GHz		55 fs		5 kHz < BW < 20 MHz

[1] Specifications are subject to change per the discretion of Holzworth Instrumentation, Inc.
[2] All MIN/ MAX (Minimum/ Maximum) performance parameters are guaranteed and 100% verified during final performance test.
[3] Typical performance is "by design" and consistent with field performance data.

OUTPUT POWER DATA (channels operating up to 6.7GHz)

The data contained in this section demonstrates the typical output power performance of the HS9000 Series designs.

OUTPUT POWER MAXIMUM

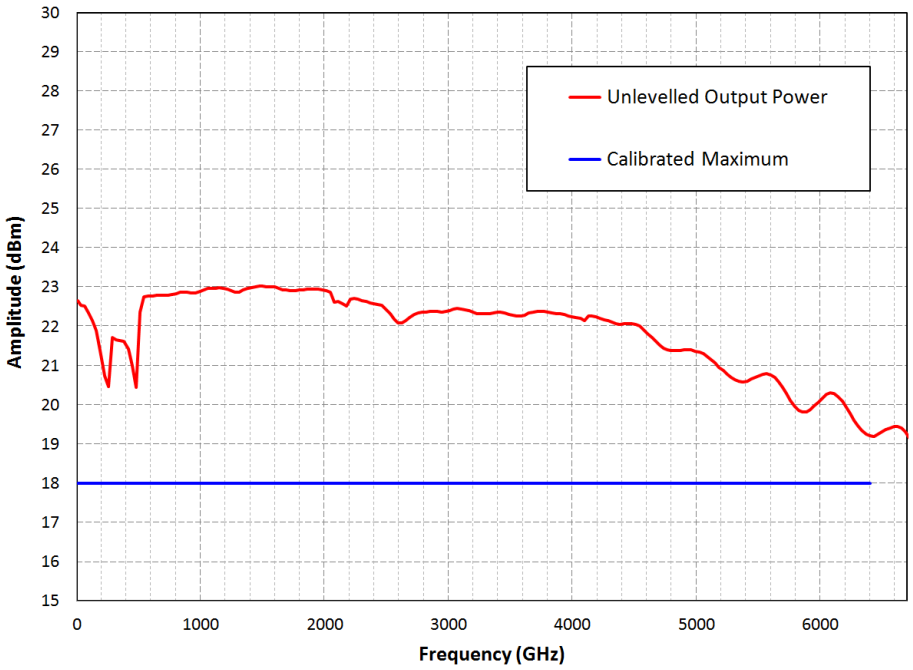
FIGURE 1:

Maximum Output Power (unleveled)

Typical Performance

10MHz - 6.7GHz

P_{OUT} Setting: +25dBm



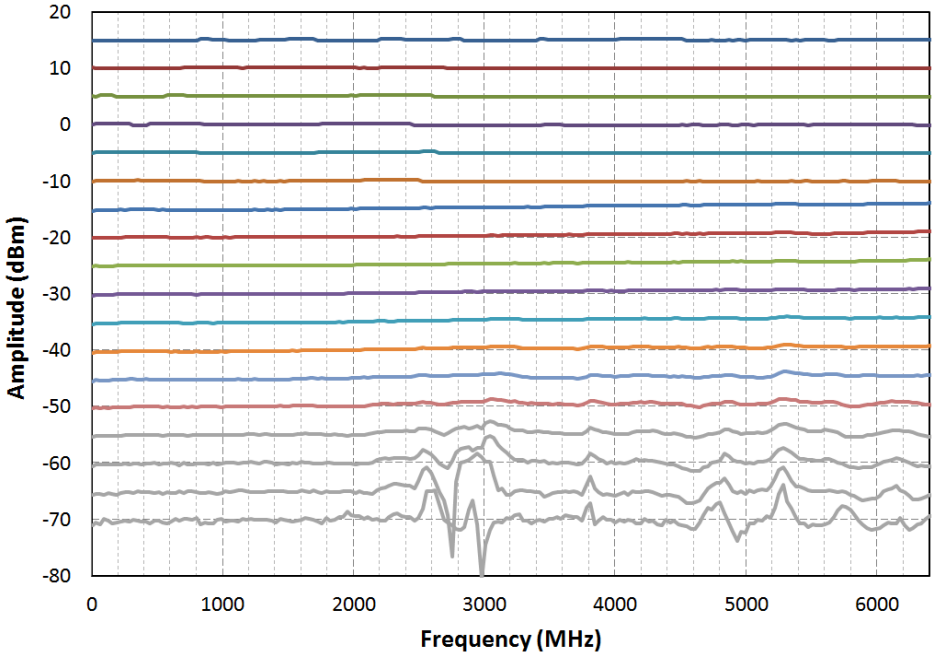
CALIBRATED OUTPUT POWER

FIGURE 2:

Calibrated Output Power

Power Range: +15dBm to -50dBm

Frequency Range: 10MHz - 6.4GHz z



PHASE NOISE DATA (channels operating up to 6.7GHz)

The raw data contained in this section demonstrates the typical phase noise performance of the HS9000 Series designs.

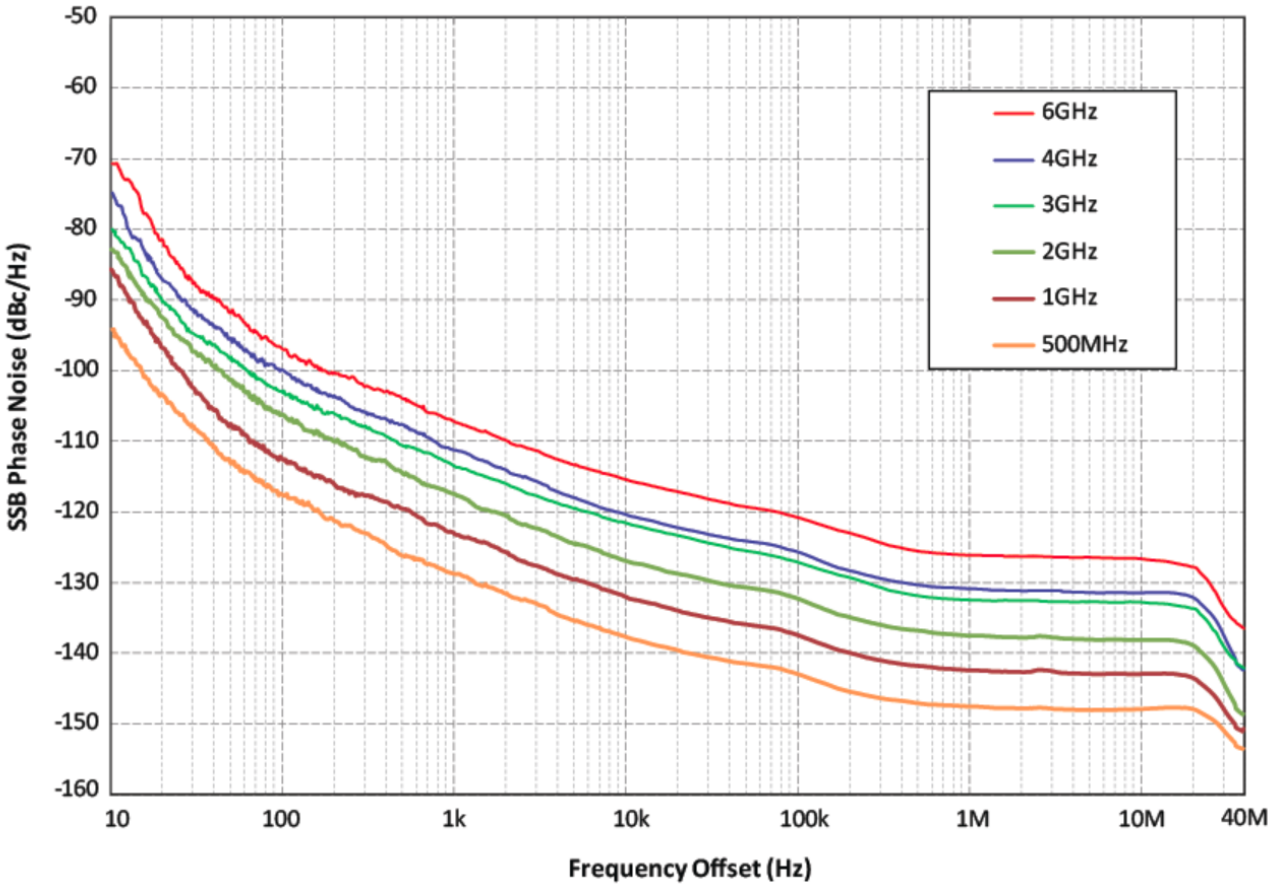


FIGURE 3: Phase Noise Performance (typical), P_{OUT} Setting: +10dBm

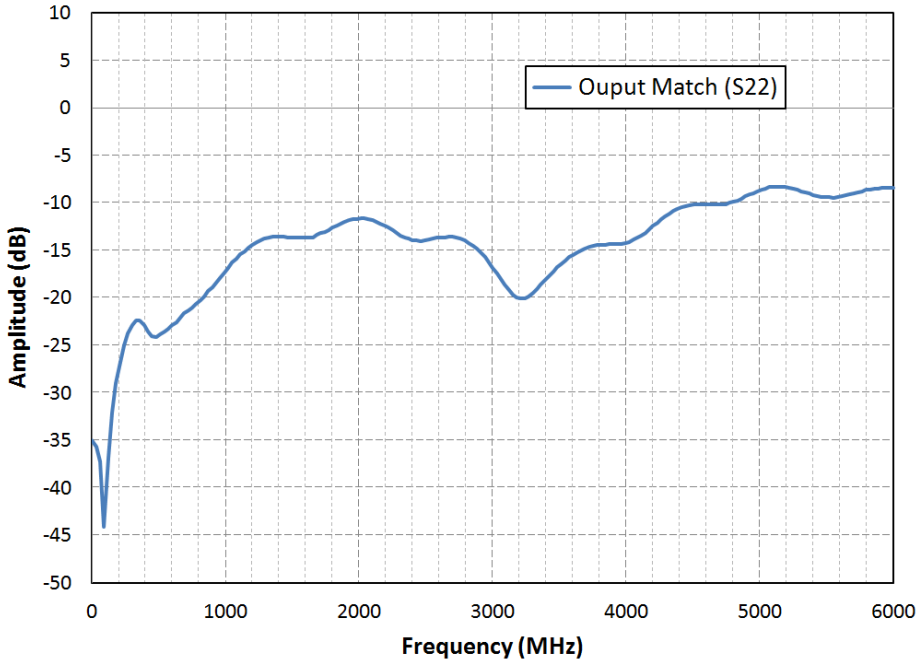
SWR (S_{22}) OUTPUT MATCH

FIGURE 4:

Broadband Match

Typical Performance

10MHz - 6.0GHz



SPECTRAL PURITY DATA (channels operating up to 6.7GHz)

The data contained in this section demonstrates the typical spurious performance of the HS9000 Series designs.

NARROWBAND NON-HARMONICS / SPURIOUS

FIGURE 5:

Narrowband
Spurious Performance

Typical Performance

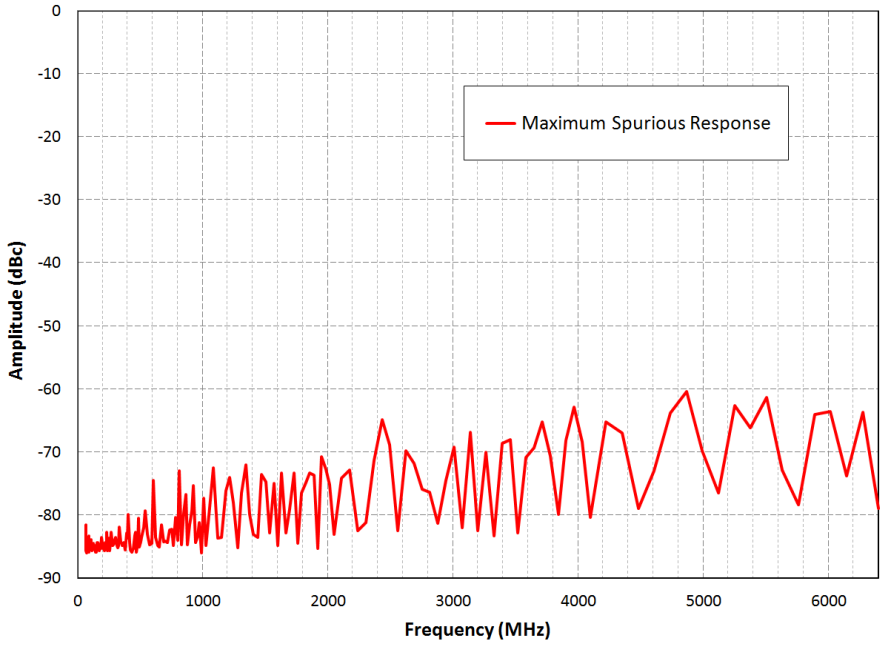
10MHz - 6.4GHz

P_{OUT} Setting: +10dBm

Span/pt: 10MHz

RBW: 3kHz

VBW: 3kHz



SPECTRAL PURITY DATA (channels operating up to 6.7GHz)

The data contained in this section demonstrates the typical spectral purity performance of the HS9000 Series designs.

HARMONICS

FIGURE 6:

Harmonics Performance

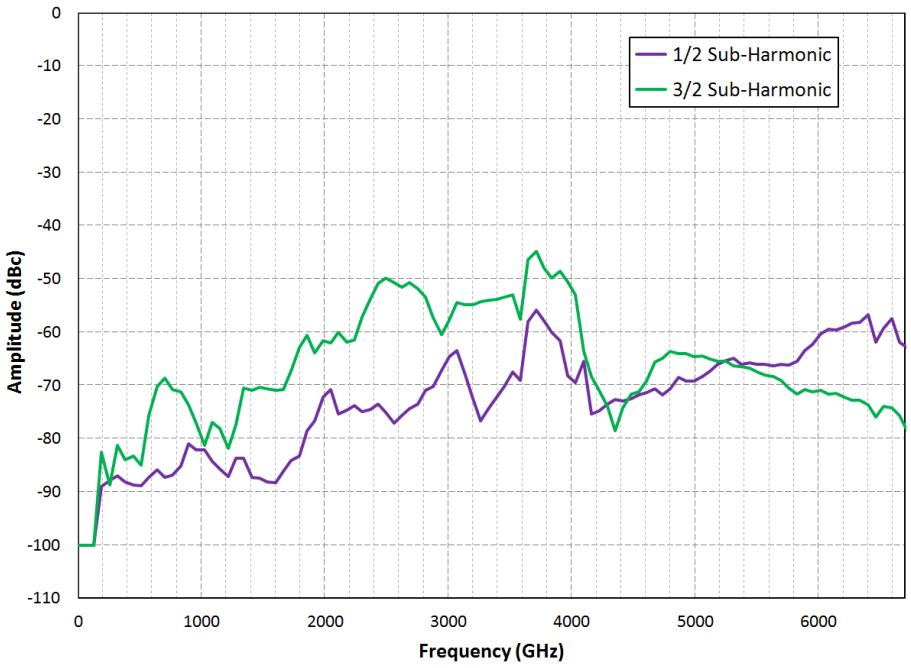
Typical Performance

10MHz - 6.7GHz

P_{OUT} Setting: +10dBm

RBW: 3kHz

VBW: 3kHz



SUB-HARMONICS

FIGURE 7:

Sub-Harmonics Performance

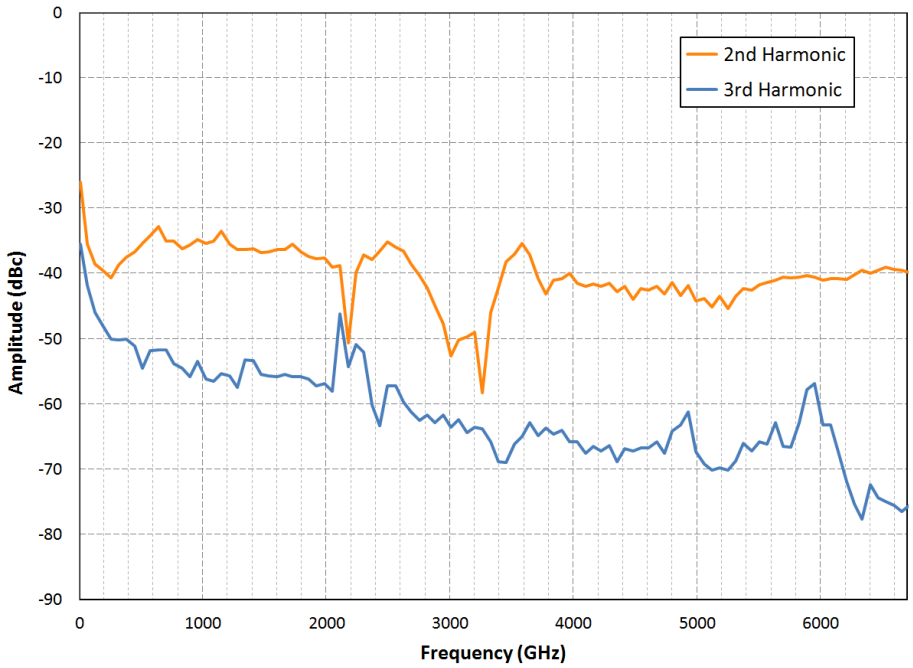
Typical Performance

10MHz - 6.7GHz

P_{OUT} Setting: +10dBm

RBW: 3kHz

VBW: 3kHz



OUTPUT POWER DATA (channels operating up to 20GHz)

The data contained in this section demonstrates the typical output power performance of the HS9000 Series designs.

OUTPUT POWER MAX / MIN

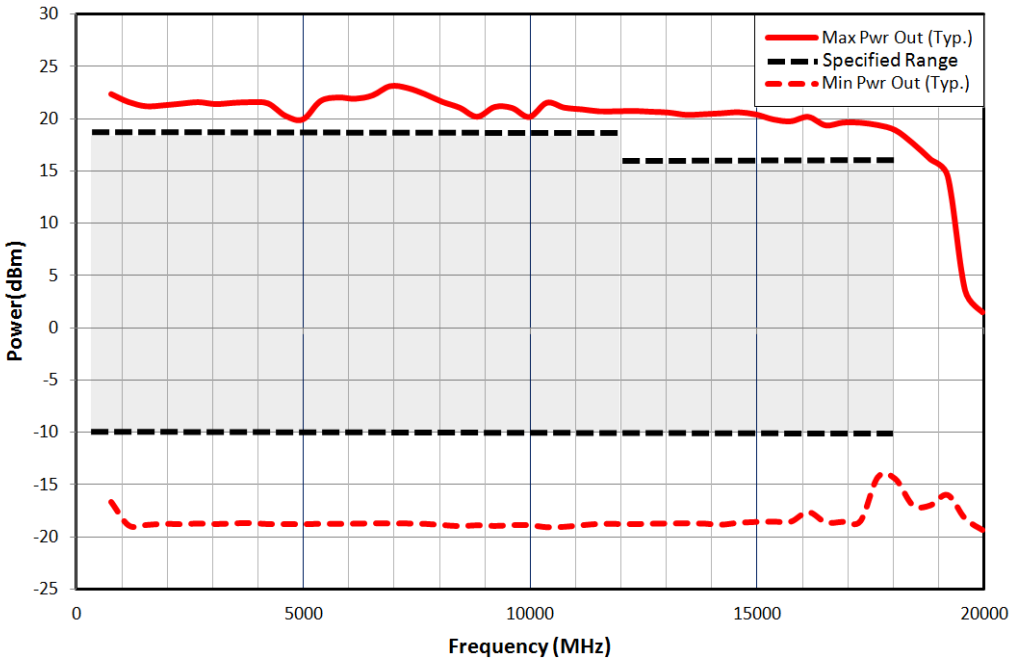
FIGURE 8:

Max./Min. Output Power (unleveled)

Typical Performance

10MHz - 20GHz

P_{OUT} Setting: +25dBm



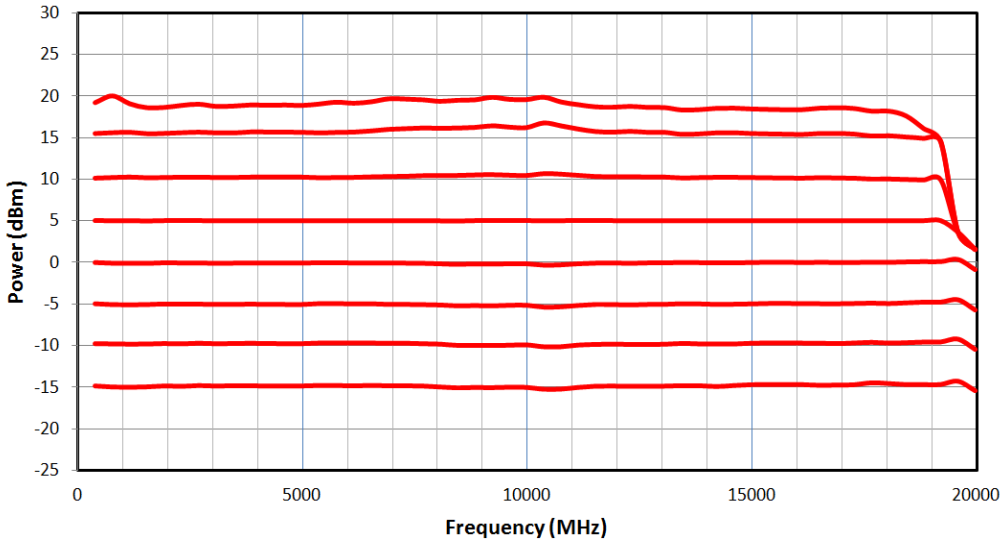
CALIBRATED OUTPUT POWER

FIGURE 9:

Calibrated Output Power

+15dBm to -15dBm

10MHz - 20GHz



PHASE NOISE PERFORMANCE (channels operating up to 20GHz)

Holzworth products are well known for their ultra low phase noise characteristics. All products undergo 100% phase noise performance verification prior to shipment.

SYNTHESIZER CHANNEL PERFORMANCE

The raw data displayed in Figure 2 is of SSB Phase Noise vs. Frequency Offset as measured for the HS9000 Series RF Synthesizers. All data was collected with output power set at +10dBm.

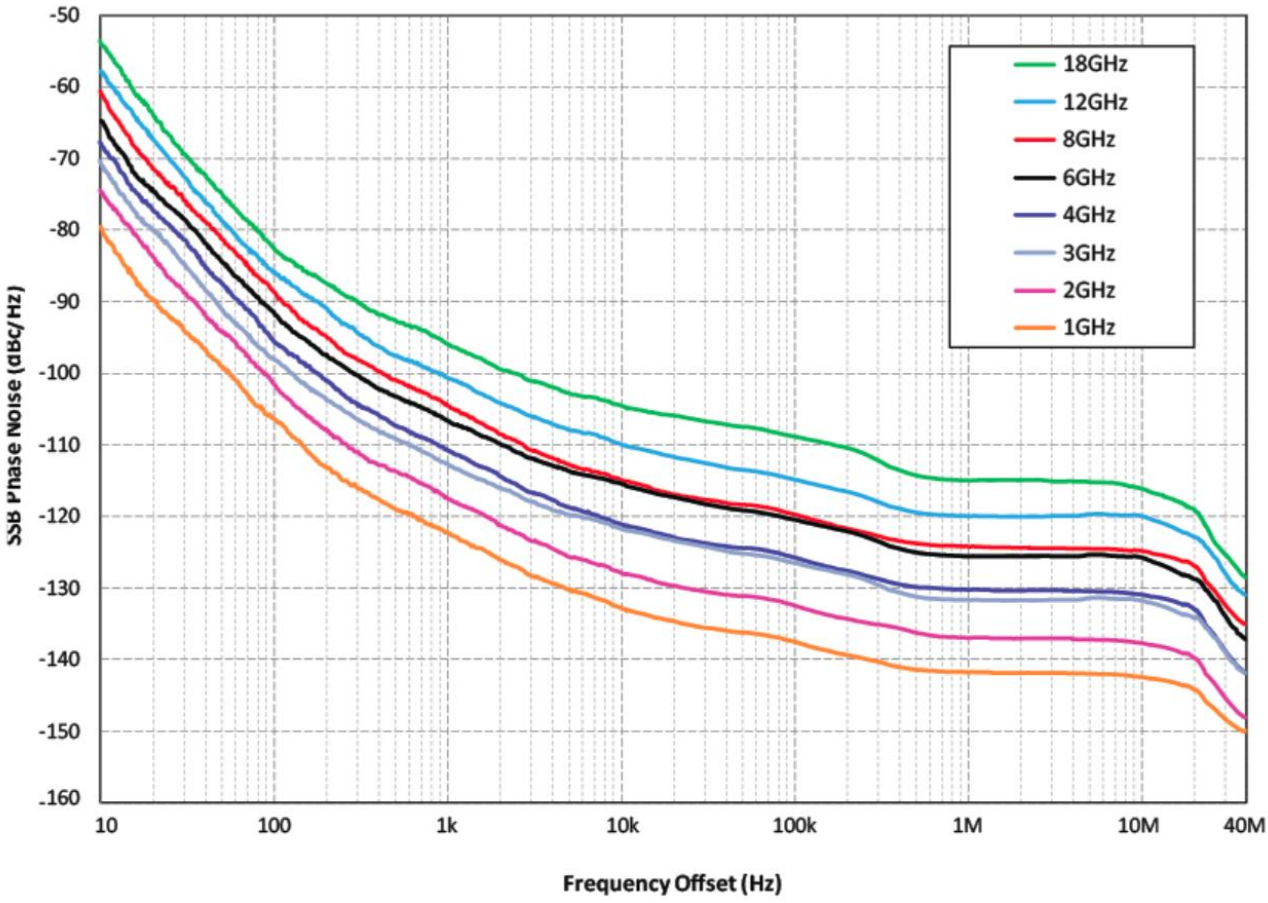


Figure 10: Phase Noise Performance (typical), P_{OUT} Setting: +10dBm

SPECTRAL PURITY DATA (channels operating up to 20GHz)

The data contained in this section demonstrates the typical spurious performance of the HS9000 Series designs.

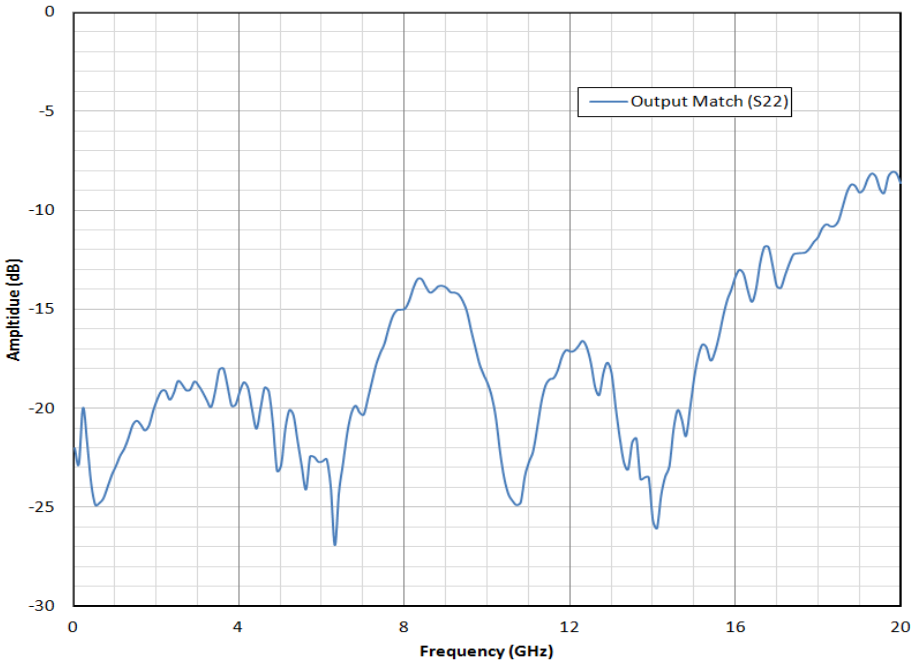
SWR (S_{22}) OUTPUT MATCH

FIGURE 11:

Broadband Match

Typical Performance

10MHz - 18GHz



NARROWBAND NON-HARMONICS / SPURIOUS

FIGURE 12:

Narrowband
Spurious Performance

Typical Performance

10MHz - 20GHz

P_{OUT} Setting: +10dBm

Span/pt: 10MHz

RBW: 3kHz

VBW: 3kHz

SPECTRAL PURITY DATA (channels operating up to 20GHz)

The data contained in this section demonstrates the typical spectral purity performance of the HS9000 Series designs.

HARMONICS

FIGURE 13:

Harmonics Performance

Typical Performance

10MHz - 20GHz

P_{OUT} Setting: +10dBm

RBW: 3kHz

VBW: 3kHz

SUB-HARMONICS

FIGURE 14:

Sub-Harmonics Performance

Typical Performance

10MHz - 20GHz

P_{OUT} Setting: +10dBm

RBW: 3kHz

VBW: kHz

INTENTIONALLY BLANK

DATA COMING SOON

PHASE NOISE PERFORMANCE (Reference Outputs)

The HS9000 Series come equipped with fixed 10MHz and 100MHz reference outputs. The fixed reference output signals are derived directly from the internal reference standard (100MHz OCXO).

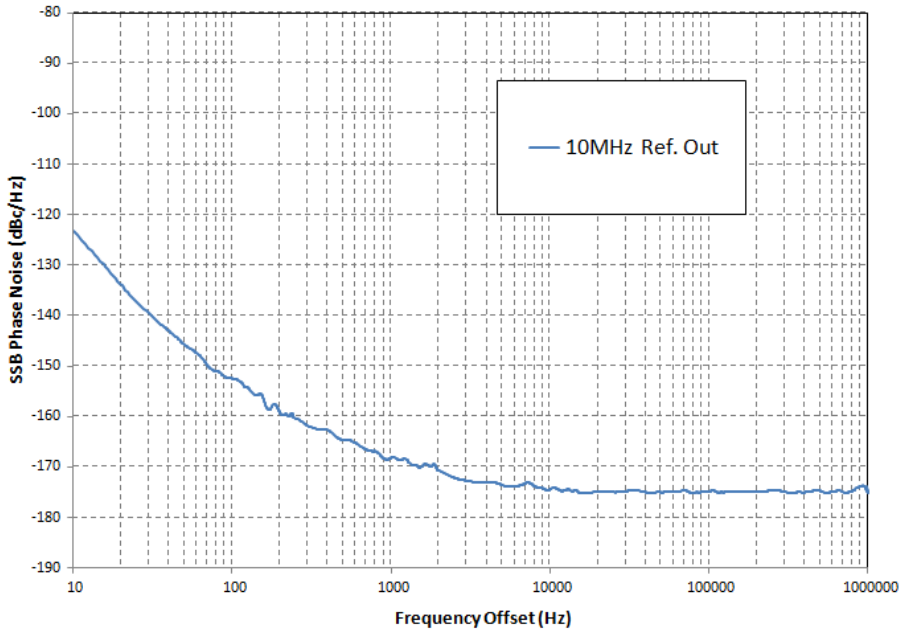


Figure 15: 10MHz Reference Output SSB Phase Noise

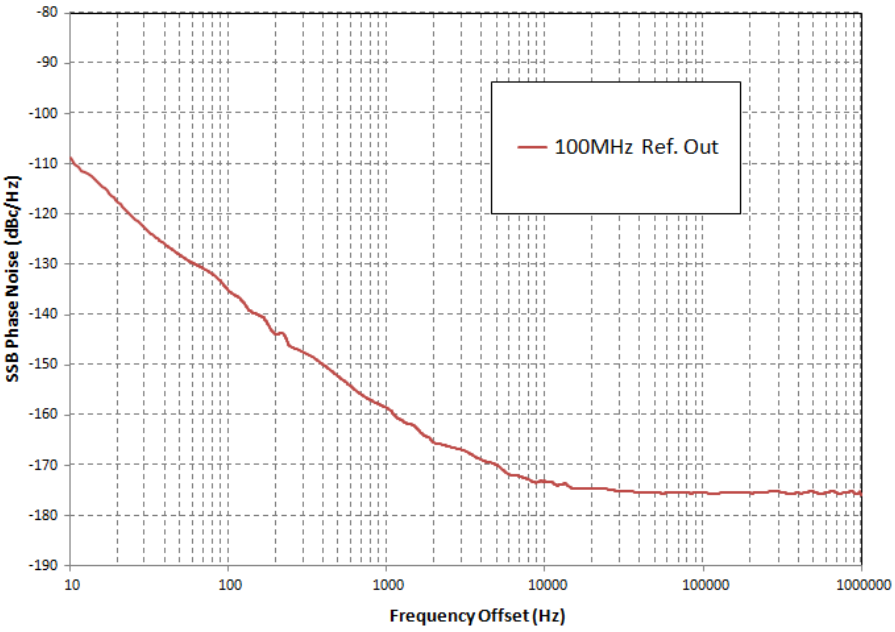


Figure 16: 100MHz Reference Output SSB Phase Noise

ELECTRICAL SPECIFICATIONS - MODULATION

The external stimulus modulation parameters are only available on units equipped with option OPT-EXTMOD. Units with OPT-EXTMOD have channel dedicated modulation input ports installed.

EXTERNAL MODULATION(channels up to 6.7 GHz)[1]

PARAMETER	PERFORMANCE	COMMENTS
FREQUENCY MODULATION (Analog)		
Max Deviation	100 kHz	
Resolution	0.01% or 1mHz, whichever is greater	
Deviation Accuracy	< ± 2%	
Modulation Freq. Response	DC to 20 kHz (-3dB)	DC Coupled
Sensitivity when using Ext. Input	± 1V peak into 50Ω	+ 1V: Maximum Positive Deviation 0V: Zero Deviation from Carrier - 1V: Maximum Negative Deviation
PHASE MODULATION (Analog)		
Modulation Deviation	±1.6 deg to ±180 deg	
Frequency Response	DC to 20 kHz (-3dB)	DC Coupled
Resolution	Frequency Dependent	See Phase Offset Specification
Sensitivity when using Ext. Input	± 1V peak into 50Ω	+ 1V: Maximum Positive Deviation 0V: Zero Deviation from Carrier - 1V: Maximum Negative Deviation
AMPLITUDE MODULATION (Analog)		
AM Depth Type	Linear	
Depth Maximum Resolution Depth Accuracy	 5% to 75% <3% of Maximum Depth 5% of Maximum Depth	0.45 dB to 12 dB
Modulation Rate	DC to 10 kHz (-3dB)	DC Coupled
Sensitivity when using Ext. Input	± 1V peak for indicated Depth (into 50Ω)	+ 1V: Maximum Amplitude 0V: 50% of Maximum Depth - 1V: Maximum Depth
PULSE MODULATION (Analog)		
Risetime (T_r)	<100 ns	
Falltime (T_f)	<100 ns	
On/Off Ratio	> 70dB	
Minimum Pulse Width	200 ns	
ALC Loop Deviation (ALC disabled)	1dB difference from ALC enabled	

[1] Specifications are subject to change per the discretion of Holzworth Instrumentation, Inc

PARAMETER	PERFORMANCE	COMMENTS
External Trigger Threshold	+1.2V	±5% into 50Ω

ELECTRICAL SPECIFICATIONS - MODULATION (continued)

HS9000 Series synthesizers are capable of operating in internal pulse modulation mode, which does not require an external stimulus signal.

SELF PULSE MODULATION [1]

PARAMETER	PERFORMANCE	COMMENTS
Risetime (T_r) **fc < 512MHz** **fc > 512 MHz**	11ns (typical)	
Falltime (T_f)	<100 ns	
On/Off Ratio	> 70dB	
Minimum Pulse Width	200 ns	
ALC Loop Deviation (ALC disabled)	1dB difference from ALC enabled	

[1] Specifications are subject to change per the discretion of Holzworth Instrumentation, Inc

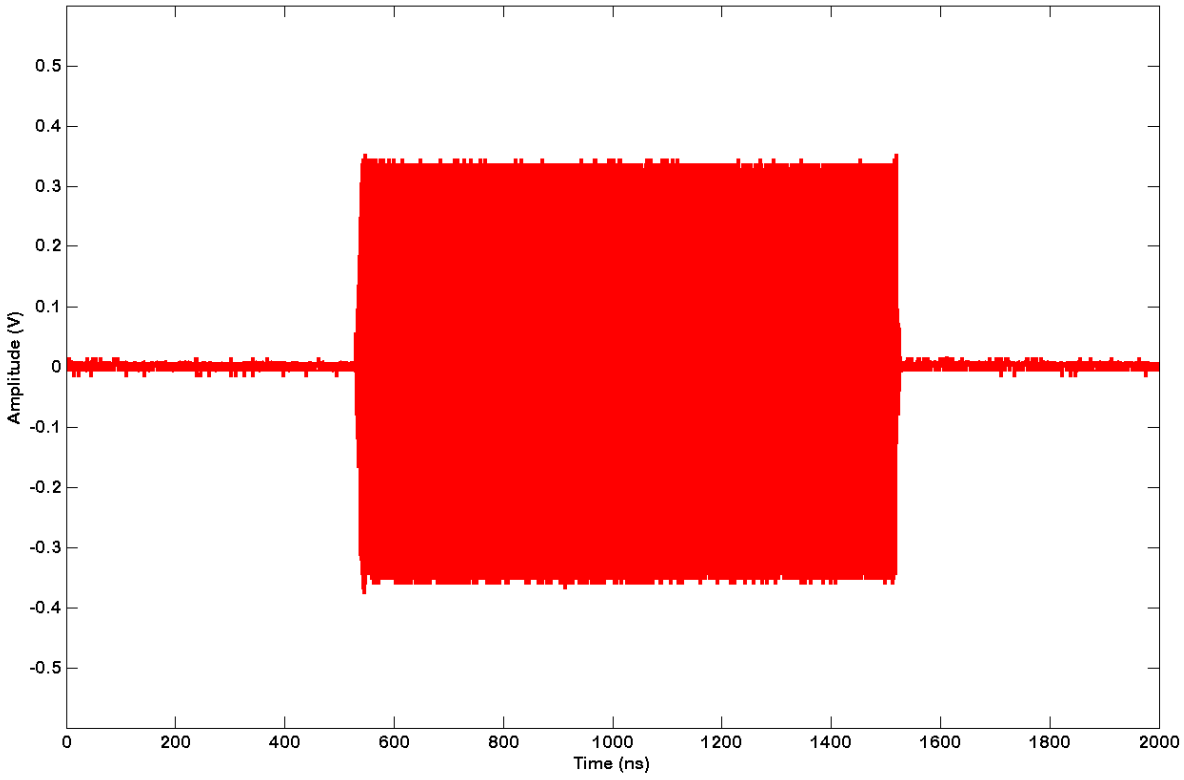


Figure 17: SelfPulse Mod f_c = 500MHz, 2us Pulse[2]

[1] Specifications are subject to change per the discretion of Holzworth Instrumentation, Inc
[2]Internal pulse modulation for frequencies greater than 512MHz will exhibit increased settling time. Contact Holzworth customer support for additional data.

ELECTRICAL SPECIFICATIONS - MODULATION (continued)

SELF PULSE MODULATION (continued)

Pulse modulation will exhibit longer rise/fall times for frequencies greater than 512MHz. Figures 18 and 19 below demonstrate this difference in risetime and falltime between the set frequencies.

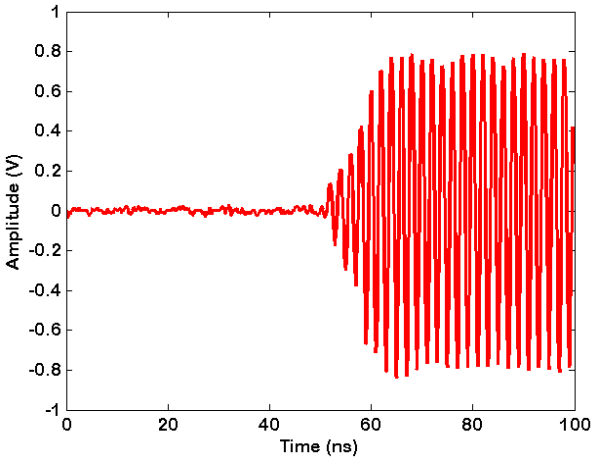


Figure 18a: Pulse Mod Rise Time, f_c = 500MHz

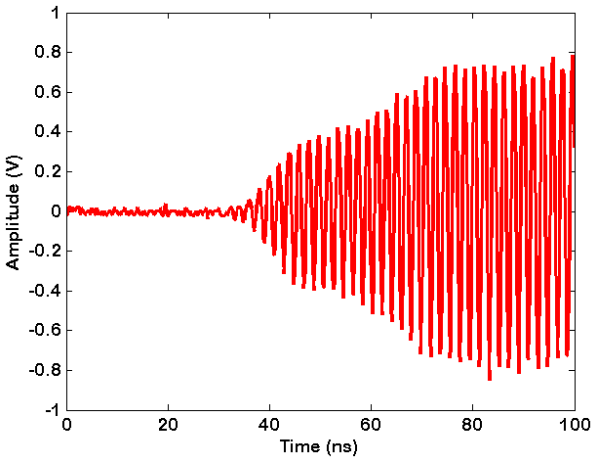


Figure 18b: Pulse Mod Rise Time, f_c = 530MHz

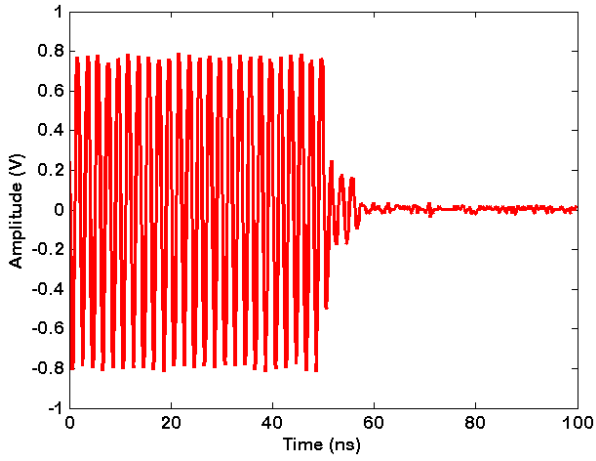


Figure 19a: Pulse Mod Fall Time, f_c = 500MHz

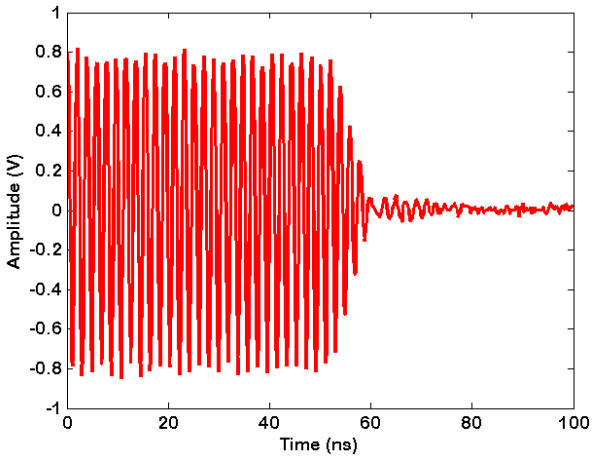


Figure 19b: Pulse Mod Fall Time, f_c = 530MHz

ELECTRICAL SPECIFICATIONS - MODULATION (continued)

Modulation capabilities on channels equipped with OPT-X1 or OPT-F1 are different than those on the lower frequency channels. Currently modulation is limited to externally driven pulse modulation. This pulse modulation exhibits better performance than the same capability on the lower frequency channels, however.

EXTERNAL MODULATION(12.5GHz and 20GHz channels)

PARAMETER	PERFORMANCE	COMMENTS
Risetime (T_r)	<20 ns	
Falltime (T_f)	<20 ns	
On/Off Ratio 10MHz to 10GHz 10GHz to 20GHz	 > 80dB >50dB	
Minimum Pulse Width	50 ns	
ALC Loop Deviation (ALC disabled)	1dB difference from ALC enabled	

[1] Specifications are subject to change per the discretion of Holzworth Instrumentation, Inc

PARAMETER	PERFORMANCE	COMMENTS
External Trigger Threshold	+1V	±5% into 50Ω

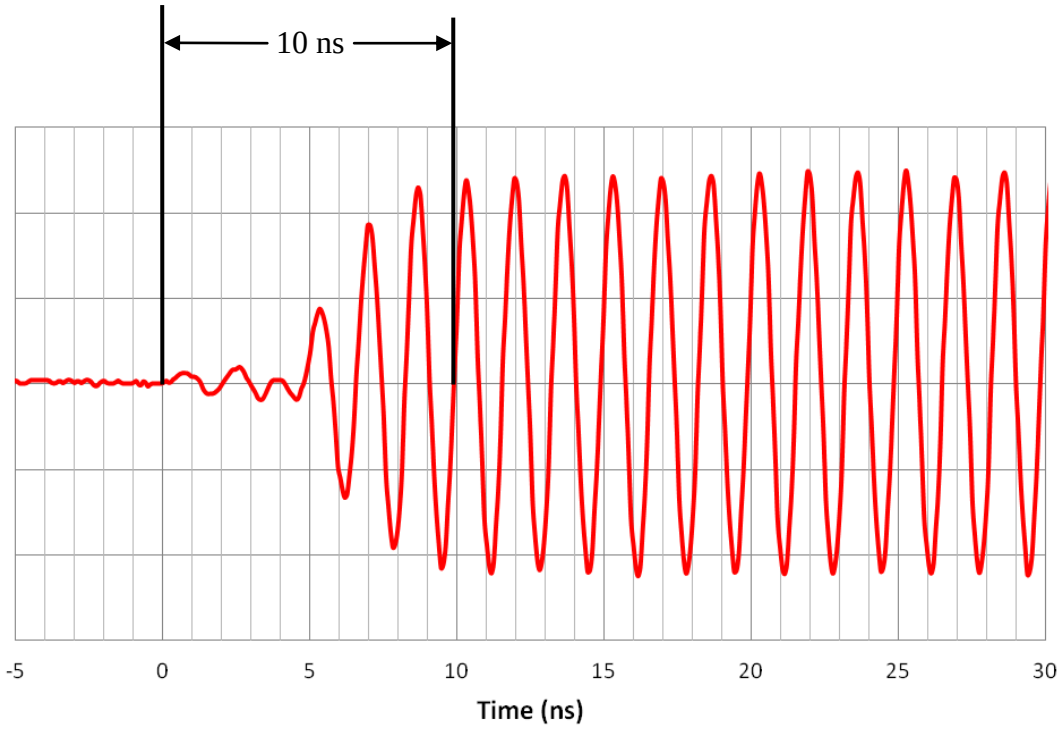


Figure 20: External Pulse Modulation Rise Time (seconds)

ENVIRONMENTAL SPECIFICATIONS[1]

Environmental specifications are based on component margins, thermal verification testing and current draw tests. Production unit performance is not verified over temperature.

PARAMETER	MIN	TYPICAL	MAX	COMMENTS
Operating Temperature	0 C		+55 C	
Temperature Monitor Range	-40 C		+85 C	Absolute, channel dedicated outputs
AC Power Supply	100 V_{AC}		240 V_{AC}	50 – 60Hz
Power Consumption **Chassis Power Consumption** **Channel ≤ 6.7 GHz** **12 or 20GHz Channel**		 5W 9W 15W		
Warm-Up Time		15 min	30 min	20 C (ambient temp. dependent)

[1] Specifications are subject to change per the discretion of Holzworth Instrumentation, Inc

DESCRIPTION	SPECIFICATION (by design)
Operating Environment **Humidity** **Altitude** **Vibration**	 RH 20% to 80% at wet bulb temp. <29C (non-condensing) 0 to 2,000m (0 to 6,561 feet) 0.21 G-rms maximum, 5Hz to 500Hz
Storage (Non-Operating) **Temperature** **Humidity** **Altitude** **Vibration**	 -10C to + 60C RH 20% to 80% at wet bulb temp. <40C (non-condensing) 0 to 4,572m (0 to 15,000 feet) 0.5 G-rms maximum, 5Hz to 500Hz

PHASE DRIFT PERFORMANCE

Holzworth non-PLL based multi-channel RF synthesizers provide superior channel-to-channel phase coherency. The unique architecture also leverages a channel-to-channel phase drift advantage over other synthesis solutions. Figures 21a and 21b demonstrate channel-to-channel phase drift over a 1 hour period under ambient laboratory conditions (20C ±2C).

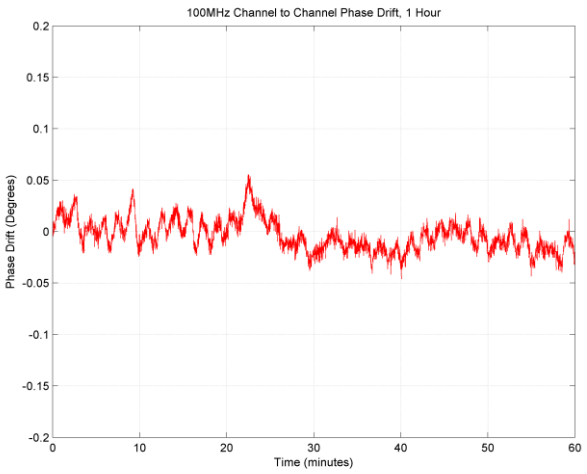


Figure 21a: 100MHz Phase Drift (1hr, 20C)

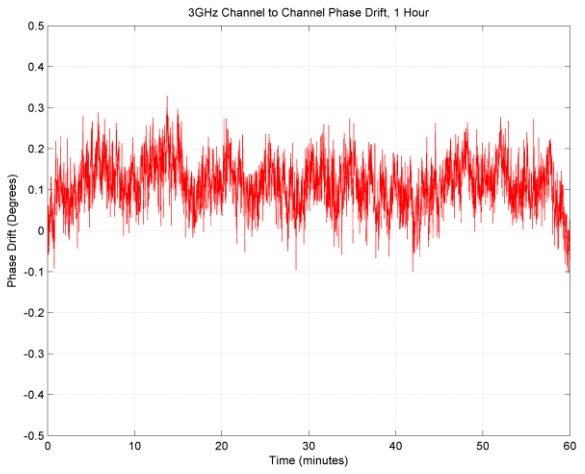


Figure 19b: 21GHz Phase Drift (1hr, 20C)

HS9000 SERIES CONFIGURATION GUIDE

The HS9000 Series synthesizer platform is designed to be user/application defined. Follow 4 easy steps to determine the part number with the required options.

STEP 1: SELECT TOTAL NUMBER OF CHANNELS

Select the base part number, strictly calling out the total number of channels to be loaded into the multi-channel chassis.

No. Channels	1	2	3	4	5	6	7	8
Part Number	HS9001B	HS9002B	HS9003B	HS9004B	HS9005B	HS9006B	HS9007B	HS9008B

STEP 2: SELECT CHANNEL FREQUENCY OPTIONS

Select any combination of channel frequency options. Note that the total number of channels specified here must equal the number of channels selected under STEP 1.

Frequency Range	Number of Channels per Frequency Range							
	1x	2x	3x	4x	5x	6x	7x	8x
CMOS 10MHz - 500MHz	OPT-CMOS1	OPT-CMOS2	OPT-CMOS3	OPT-CMOS4	OPT-CMOS5	OPT-CMOS6	OPT-CMOS7	OPT-CMOS8
10MHz - 1GHz	OPT-A1	OPT-A2	OPT-A3	OPT-A4	OPT-A5	OPT-A6	OPT-A7	OPT-A8
10MHz - 2GHz	OPT-B1	OPT-B2	OPT-B3	OPT-B4	OPT-B5	OPT-B6	OPT-B7	OPT-B8
10MHz - 3GHz	OPT-C1	OPT-C2	OPT-C3	OPT-C4	OPT-C5	OPT-C6	OPT-C7	OPT-C8
10MHz- 4GHz	OPT-D1	OPT-D2	OPT-D3	OPT-D4	OPT-D5	OPT-D6	OPT-D7	OPT-D8
10MHz- 6.7GHz	OPT-E1	OPT-E2	OPT-E3	OPT-E4	OPT-E5	OPT-E6	OPT-E7	OPT-E8
10MHz - 12.5GHz	OPT-X1	OPT-X2	OPT-X3	OPT-X4	NA	NA	NA	NA
10MHz - 20GHz	OPT-F1	OPT-F2	OPT-F3	OPT-F4	NA	NA	NA	NA

STEP 3: SELECT ADDITIONAL OPTIONS& ACCESSORIES

The options listed in this section are available for the multi-channel platform to comply with application specific requirements.

TYPE	Part Number	Description
OPTION	OPT-EXTMOD-n	Channel dedicated, external modulation input. n= 1, 2, 3, *etc*. (specify up to 6 ch)
OPTION	OPT-REFX	5MHz-160MHz Reference Input Capability (100kHz Increments)
ACCESSORY	RACK-1U	19" Rack Mount Bracket Kit, 90º rear bracket
ACCESSORY	RACK2-1U	19" Rack Mount Bracket Kit, straight rear bracket

[1] Available for channels up to 6.7GHz maximum output only.

PART NUMBER EXAMPLE

Ordering a 5 channel synthesizer with 1x CMOS channel, 1x 3GHz channels, 2x 6.7GHz channels, 2x 12GHz and a high performance OCXO would result in the following configuration:

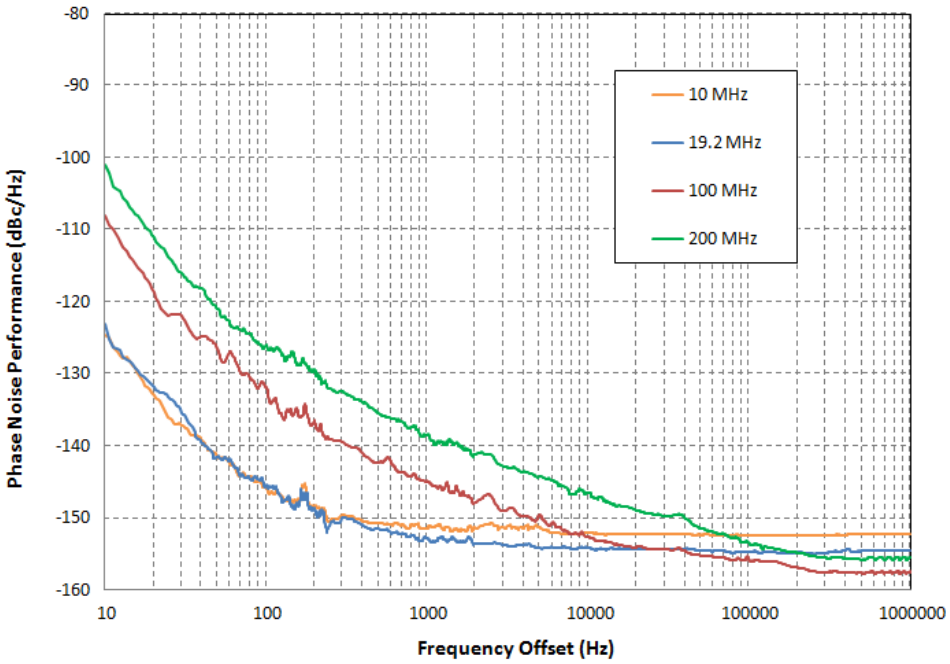
		Description:
Part Number:	**HS9005B**	5ch, Multi-Channel RF Synthesizer
Options:	**OPT-CMOS1**	1x CMOS Channel
	OPT-C1	1x 3GHz Channel
	OPT-E2	2x 6.7GHz Channels
	OPT-X1	1x 12.5GHz Channel

OPTION SPECIFICATIONS [1]

OPT-CMOS

Option OPT-CMOS is an additional channel (or channels)loaded into the multi-channel system. OPT-CMOS provides a CMOS logic output signal, which may be optimal for a system that requires square wave trigger or clock signals.

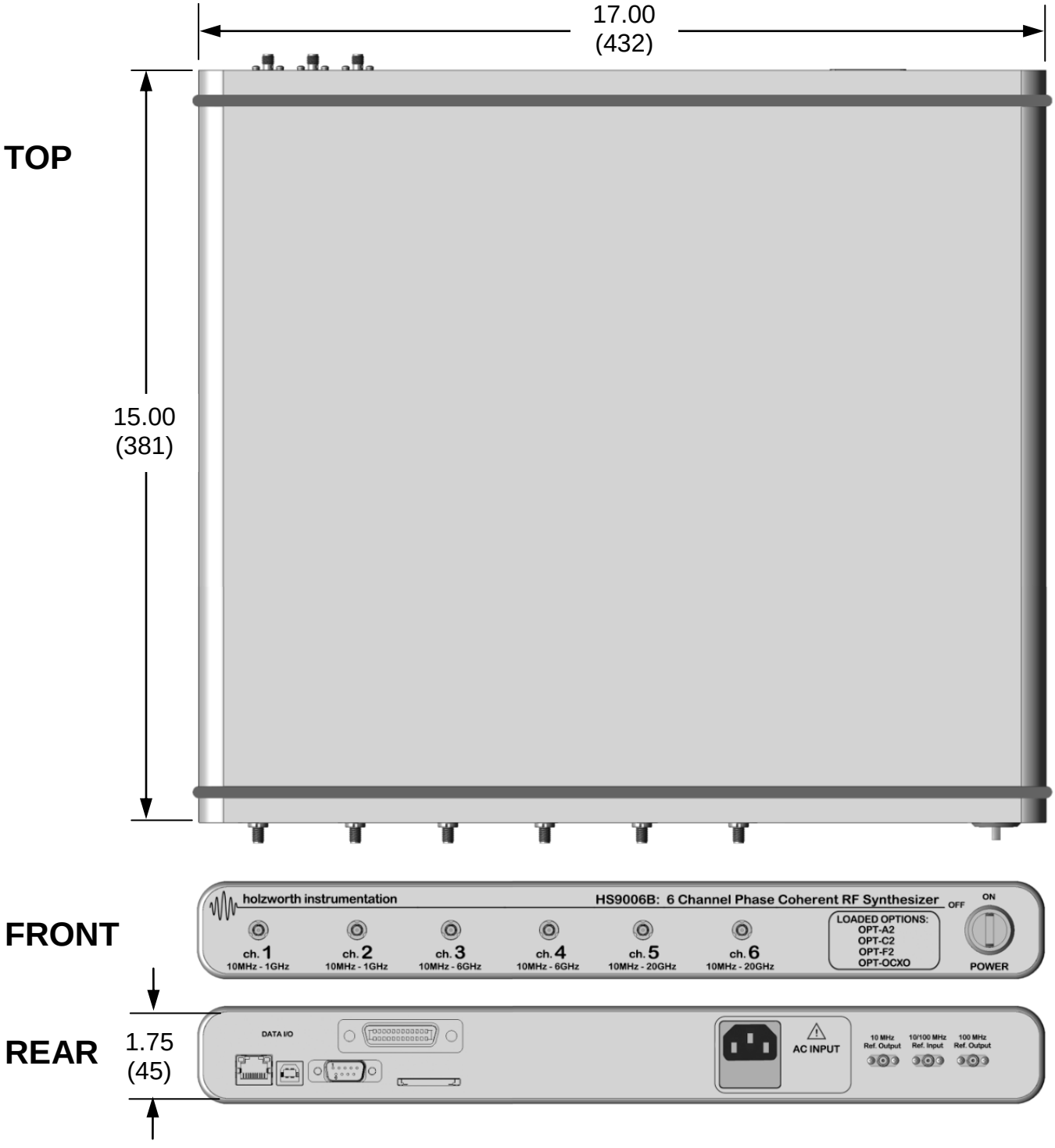
PARAMETER	MIN[2]	TYPICAL[3]	MAX[2]	COMMENTS
Frequency Range	10 MHz		500MHz	
Output Voltage (CMOS Logic)		0V - 5V		0V to 2.5V into 50Ω
Phase Noise 10MHz, 10kHz Offset 19.2MHz, 10kHz Offset 100MHz, 10kHz Offset 200MHz, 10kHz Offset		 -152dBc/Hz -154dBc/Hz -152dBc/Hz -146 dBc/Hz	 -145dBc/Hz -145dBc/Hz -143dBc/Hz -135 dBc/Hz	
Rise Time / Fall Time (Tr/ T_f)		900ps		
Output Impedance		50Ω		



[1] Specifications are subject to change per the discretion of Holzworth Instrumentation, Inc.
[2] All MIN/ MAX (Minimum/ Maximum) performance parameters are guaranteed and 100% verified during final performance test.
[3] Typical performance is "by design" and consistent with field performance data.

MECHANICAL CONFIGURATION

The HS9000 Series comes in a 1U high, rack mountable chassis. The example shown is of a 6 channel unit (front panel configuration may vary). A universal rack mount bracket kit is an available accessory (Part No.: RACK-1U or RACK2-1U). Mechanical dimensions are listed in inches (and millimeters).



INCLUDED HARDWARE AND CERTIFICATIONS

Each product delivery includes specific, standard hardware and certifications.

TYPE	DESCRIPTION	COMMENTS
HARDWARE	**HS9000 SERIES SYNTHESIZER**	DELIVERABLE
HARDWARE	**EXTERNAL AC POWER CORD**[1]	DELIVERABLE
HARDWARE	**10ft ETHERNET CABLE**	DELIVERABLE
HARDWARE	**10ft USB CABLE**	DELIVERABLE
WARRANTY	**3 YEAR MANUFACTURER'S WARRANTY**	NON-APPLICABLE
CERTIFICATE	**CALIBRATION CERTIFICATION**	DELIVERABLE
CERTIFICATE	**CE COMPLIANCE CERTIFICATE** *DIRECTIVE: 2004/108/EC, TEST STANDARD: EN 61326-1: 2006*	WEB DOWNLOAD
CERTIFICATE	**RoHS COMPLIANCE CERTIFICATE** *DIRECTIVE: 2002/95/EC*	WEB DOWNLOAD
CERTIFICATE	**WEEE COMPLIANCE STATEMENT** *DIRECTIVE: 2002/96/EC*	WEB DOWNLOAD

[1] Specify country code for power cord

CONNECTORS and PHYSICAL SPECIFICATIONS

FRONT PANEL

DESCRIPTION	CONFIGURATION
RF Output(s)	SMA Jack. 1-8 Output Ports, dependent on loaded options. 50ohm.
Modulation Input(s)	SMA Jack. 1-6 Output Ports, dependent on loaded options. 50ohm.

REAR PANEL

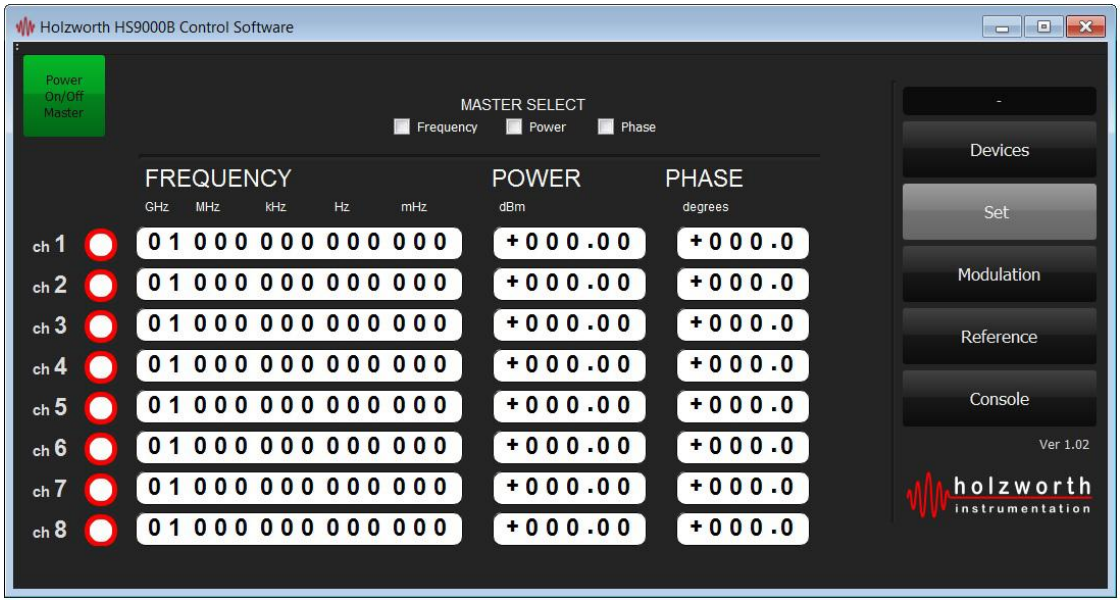
DESCRIPTION	CONFIGURATION
100MHz Reference Output	SMA Jack. 50ohm.
10MHz Reference Output	SMA Jack. 50ohm.
Reference Input Port	SMA Jack, 50ohm
AC Power Input AC Input Rating	IEC 320-C13 90-260V_{AC}, 47-63Hz. Specify country at time of order for proper power cord.
Data I/O Interface Connectivity Storage	 USB (B-Type), Ethernet, RS-232, GPIB SD Card Reader

PHYSICAL

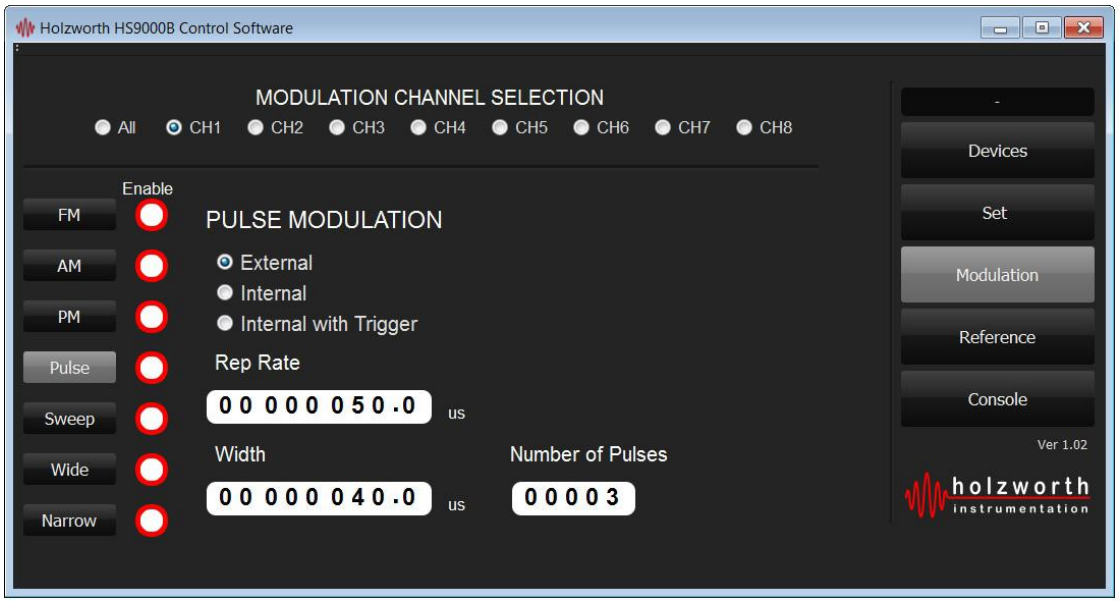
Dimensions (L x W x H)	1U high, 19" rack mount: 15in x 17in x 1.75in (381mm x 431.8mm x 44.5mm)
Weight	25 lb (10.9 kilograms) MAXIMUM

INTERFACE - GUI

The HS9000B Series hardware utilizes a virtual front panel as the control interface. Each unit comes with an open license to operate the application on any standard PC, including those equipped with touch screen monitors. The C++ based application GUI compliments the driver free instrument by being extremely reliable. The units can also be directly accessed via any data I/O interface for control via MATLAB™, LabVIEW™, C++ code, VB code, *etc.*



HS9000B SERIES MAIN CONTROL WINDOW

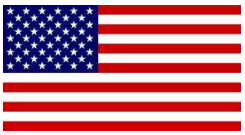


HS9000B SERIES MODULATION CONTROL WINDOW

WARRANTY

All Holzworth synthesizer products come with a standard 3 year 100% product warranty covering manufacturing defects. All product repairs and maintenance must be performed by Holzworth Instrumentation. Holzworth reserves the right to invalidate the warranty for any products that have been tampered with or used improperly. Refer to Holzworth Terms & Conditions of Sales for more details.

Holzworth products are proudly designed and manufactured in the USA.



CONTACT INFORMATION

Contact Holzworth directly for a product quotation, a product demonstration, or for technical inquiries.

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