

DATASHEET APVSG(-X) Specification V1.28

Single- and Multi-Channel Ultra-Agile Vector Signal Generators

Models up to 4, 6, 12, 20, and 40 GHz





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32 content pages

DEFINITIONS

The specifications in the following pages describe the warranted performance of the instrument for 23 ±5 °C after a 30-minute warm-up period.

Typical: Expected mean values, not warranted performance

Min and max: Parameter range that is guaranteed by product design, and/or production tested. Warranted performance specifications include guard-bands to account for the expected statistical performance distribution, measurement uncertainties, and changes in performance due to environmental conditions.

INTRODUCTION

Ultra-Agile Vector Signal Generator

The APVSG is an ultra-fast-switching vector-modulated signal generator series covering continuous frequency ranges from 10 MHz to 4, 6, 12, 20, or 40 GHz, respectively, with 0.001 Hz resolution, and 400 MHz RF modulation bandwidth.

The APVSG-X is the corresponding multi-channel product series – up to 4 channels per device.

A high performance internal I/Q modulator enables customized waveforms as modulation signals and supports variety of modulation schemes including avionics modulation. The digital I/Q modulator ensures excellent carrier suppression and a very high image suppression.
The standard APVSG enables ultra-fast CW frequency sweeping, chirping, intra-pulse modulation, pulse shaping with very low phase noise.

Among others, the following use cases are supported:

- Upload multiple formats of I/Q Data into APVSG Memory. An APVSG GUI supports data formats from various vendors. The internal RAM can store up to 512 MS (32 bits per I/Q sample) of I/Q data. The APVSG internal AWG can play selected sections of the RAM upon a user trigger.
- Use APVSG to synthesize and play predefined digital modulation formats (option IVM)
- Use the analog I & Q inputs (option AIQ) with up to 50 MHz analog bandwidth.
- Use FCP interface (option FCP) to:
  - live stream digital I/Q data.
  - instantaneously switch between pre-loaded I/Q data segments.
  - control for ultra-fast frequency hopping (additionally, option UFS required).

All APVSGs operate with an ultra-stable temperature compensated frequency reference (OCXO) that can be phase-locked to an external reference.

The compact device can be controlled by the touch display and a PC user interface.

RF Signal Specifications

PARAMETER	MIN	TYPICAL	MAX	NOTE
Frequency Range	100 kHz			Option 100K
	10 MHz		4 GHz	APVSG04
			6 GHz	APVSG06
			12 GHz	APVSG12
			20 GHz	APVSG20
			40 GHz	APVSG40
Settable Frequency Range	100 kHz			Option 100K
	10 MHz		4.15 GHz	APVSG04
			6.6 GHz	APVSG06
			12 GHz	APVSG12
			20 GHz	APVSG20
			43.5 GHz	APVSG40
Frequency Resolution		0.001 Hz		
Phase Resolution		0.01 deg		
Frequency & Amplitude Switching Time		1.5 ms		valid signal after SCPI received
		500 µs		List sweep
		<100 ns		within 400 MHz BW, Option UFS
		<1 µs		APVSG04, Option UFS
		<2 µs		APVSG20 & APVSG40, Option UFS
Output Power Level APVSG				
100 kHz to 10 MHz	-20 dBm		+15 dBm	Option 100K
Output Power Level APVSG04				
10 to 100 MHz	-20 dBm		+15 dBm	
	-55 dBm		+13 dBm	Option PE4
	-90 dBm		+13 dBm	Option PE2
	-120 dBm		+13 dBm	Option PE
0.1 to 4 GHz	-20 dBm		+18 dBm	
	-55 dBm		+17 dBm	Option PE4
	-90 dBm		+17 dBm	Option PE2
	-120 dBm		+17 dBm	Option PE
Output Power Level APVSG06				
10 to 100 MHz	-20 dBm		+15 dBm	
	-55 dBm		+13 dBm	Option PE4
	-90 dBm		+13 dBm	Option PE
	-120 dBm		+13 dBm	Option PE2
0.1 to 6 GHz	-20 dBm		+15 dBm	
	-55 dBm		+15 dBm	Option PE4
	-90 dBm		+15 dBm	Option PE
	-120 dBm		+15 dBm	Option PE2
Output Power Level APVSG12				
10 to 100 MHz	-20 dBm		+15 dBm	
	-65 dBm		+13 dBm	Option PE4
	-90 dBm		+13 dBm	Option PE
	-120 dBm		+13 dBm	Option PE2
0.1 to 12 GHz	-20 dBm		+15 dBm	
	-55 dBm		+15 dBm	Option PE4
	-90 dBm		+15 dBm	Option PE
	-120 dBm		+15 dBm	Option PE2
Output Power Level APVSG20				
10 to 100 MHz	-20 dBm		+15 dBm	
	-90 dBm		+15 dBm	Option PE
	-120 dBm		+15 dBm	Option PE2
0.1 to 20 GHz	-20 dBm		+17 dBm	
	-90 dBm		+16 dBm	Option PE
	-120 dBm		+16 dBm	Option PE2
Output Power Level APVSG40				

10 to 100 MHz	-20 dBm -90 dBm -120 dBm		+15 dBm +15 dBm +15 dBm	 Option PE Option PE2
0.1 to 20 GHz	-20 dBm -90 dBm -120 dBm		+17 dBm +16 dBm +16 dBm	 Option PE Option PE2
20 to 26 GHz	-20 dBm -90 dBm -120 dBm		+16 dBm +15 dBm +14 dBm	 Option PE Option PE2
26 to 40 GHz	-20 dBm -90 dBm -120 dBm		+15 dBm +13 dBm +12 dBm	 Option PE Option PE2
Power Resolution		0.01 dB		
Power Level Uncertainty				See Figure 5
<4 GHz		0.25 dB	0.7 dB	>-20dBm
4 to 6 GHz		0.3 dB	1.0 dB	
6 to 20 GHz		0.3 dB	1.3 dB	
20 to 40 GHz			1.5 dB	
<4 GHz		0.3 dB	0.8 dB	Pmin to -20 dBm
4 to 6 GHz		0.35 dB	1.2 dB	
6 to 20 GHz		0.4 dB	1.4 dB	
20 to 40 GHz		0.5 dB	1.6 dB	
Reverse Power Protection				
DC Voltage			±10 V	
RF Power			26 dBm	
Output Impedance		50 Ω		
VSWR		1.8		See Figure 20
SSB Phase Noise at 1 GHz , 10 dBm				See Figures 1, 2
at 10 Hz from Carrier		-87 dBc/Hz -100 dBc/Hz		 Option LN
at 1 kHz from Carrier		-130 dBc/Hz		
at 20 kHz from Carrier		-145 dBc/Hz		
at 100 kHz from Carrier		-150 dBc/Hz		
SSB Phase Noise at 4 GHz , 10 dBm				See Figures 1, 2
at 10 Hz from Carrier		-74 dBc/Hz -90 dBc/Hz		 Option LN
at 1 kHz from Carrier		-121 dBc/Hz		
at 20 kHz from Carrier		-133 dBc/Hz		
at 100 kHz from Carrier		-138 dBc/Hz		

APVSG20G & APVSG40G **SSB Phase Noise at 10 GHz, 10 dBm**				See Figures 1, 2
at 10 Hz from Carrier		-70 dBc/Hz -78 dBc/Hz		 Option LN
at 1 kHz from Carrier		-104 dBc/Hz		
at 20 kHz from Carrier		-115 dBc/Hz		
at 10 MHz from Carrier		-118 dBc/Hz		
SSB Phase Noise at 20 GHz, 10 dBm				See Figures 1, 2
at 10 Hz from Carrier		-63 dBc/Hz -73 dBc/Hz		 Option LN
at 1 kHz from Carrier		-104 dBc/Hz		
at 20 kHz from Carrier		-115 dBc/Hz		
at 10 MHz from Carrier		-118 dBc/Hz		
Harmonics @ 0 dBm 0.01 to 2 GHz 2 to 4 GHz		 -55 dBc -45 dBc	 -48 dBc -40 dBc	**APVSG4**
Harmonics @ 0 dBm 0.01 to 4 GHz 4 to 7 GHz 7 to 12 GHz		 -45 dBc -35 dBc -55 dBc	 -40 dBc -30 dBc -50 dBc	**APVSG6 & APVSG12**

Harmonics @ 0 dBm				
0.01 to 4.5 GHz		-50 dBc	-45 dBc	**APVSG20**
4.5 to 10.5 GHz		-40 dBc	-35 dBc	
>10.5 GHz		-55 dBc	-48 dBc	
Harmonics @ 0 dBm				
0.01 to 4.5 GHz		-50 dBc	-45 dBc	**APVSG40**
4.5 to 20 GHz		-35 dBc	-30 dBc	
>20 GHz		-35 dBc	-30 dBc	
Non-Harmonic Spurious		-90 dBc	-75 dBc	< 1.2 GHz
(at 0 dBm Output, > 10 kHz Offset)		-80 dBc	-70 dBc	1.2 to 2.5 GHz
		-80 dBc	-55 dBc	2.5 to 4 GHz
		-70 dBc	-50 dBc	4 to 12 GHz
		-60 dBc	-50 dBc	12 to 20 GHz
		-55 dBc	-45 dBc	> 20 GHz

I/Q Modulator

PARAMETER	MIN	TYPICAL	MAX	NOTE
RF modulation bandwidth		400 MHz		
I/Q Frequency Response over full I/Q Bandwidth		<±1.0 dB <±2.0 dB <±3.5 dB		< 10 GHz 10 to 30 GHz 30 to 40 GHz
Carrier Leakage		-90 dBc	-70 dBc	
Image Sideband Rejection		-85 dBc	-65 dBc	

Internal I/Q Baseband Generator

PARAMETER	MIN	TYPICAL	MAX	NOTE
Sample Resolution		16 bits		each I and Q
Clock Source		Internal		
Sample Rate	10 Hz		500 MHz	
Sample Rate Resolution		1 Hz		
Waveform length, Number of Samples	96 * 246 *		512 M 334 M	Marker signals active
Segment Mode				
Number of Segments	1		65k	
Segment Changeover		Seamless, immediate		
Trigger Modes		Same segment, next segment, addressed segment		
Sequencer Play List Length	1		2048	
Sequence Segment Repetitions	1		10 M	
Changeover Time		2 µs		500 MHz sample rate, after trigger event received, immediate segment changeover
Arbitrary Trigger				
Trigger Type		Normal, Next segment, next sequence		Check with Anapico support
Trigger Parameters		See chapter "Trigger Capability"		
External Trigger Event to RF Output Delay		0.5 µs +/-100 ns		500 MHz sample rate
Marker Signals		Markers are defined during the waveform generation process.		
Number of Markers		4		
Type		Waveform		
Marker Delay Setting Range		tbd		
Marker Delay Setting Resolution		tbd		
Marker Duration Minimum Value		1 sample 4 samples		Sample rate ≤ 125 MHz Sample rate > 125 MHz
Marker Duration Variation			+/- 1 sample +/- 8 ns	Sample rate < 125 MHz Sample rate ≥ 125 MHz
Marker Jitter			+/- 1 sample +/- 8 ns	Sample rate < 125 MHz Sample rate ≥ 125 MHz
Marker Polarity		Normal, inverted		
Marker Output to RF Output Delay		tbd		

* Shorter Waveforms will be automatically extended by cyclically repeating the waveform.

Internal Vector Modulation (Option IVM)

PARAMETER	MIN	TYPICAL	MAX	NOTE
Modulation Schemes	8QAM, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 512QAM, 1024QAM, 2048QAM, 4096QAM			
Symbol Rate	10 S/s		200 MS/s	
Filter Type	cosine, root cosine, gaussian, rectangular, dirac, rectangular asymmetric			
Filter Parameter Range	0.05 0.05		1 2.5	Cosine, Root Cosine (Parameter α) Gaussian (Parameter B × T)
Data Source	PRBS generator, user data list, external real-time data			Optional, check with Anapico support
Data Lists	8 bits		256 Mbits	Optional, check with Anapico support

Multicarrier Generation (Option IVM)

PARAMETER	MIN	TYPICAL	MAX	NOTE
Number of Carriers	1		1k	
Frequency Offset	-200 MHz		200 MHz	
Power Offset	-60 dB		0 dB	0.1 dB resolution
Tone Initial Phase Offset	0 deg		360 deg	0.1 deg resolution

Avionics Modulation (Option AVIO)

PARAMETER	MIN	TYPICAL	MAX	NOTE
AVIO Modulation DME				
Operating Modes	interrogation & reply			
DME Channel	X, Y			
Frequency Range	960 MHz		1215 MHz	
Pulse On/Off ratio		80 dB	70 dB	
Pulse Rise/Fall times	100 ns		50 µs	100 ns resolution
Pulse Width	100 ns		50 µs	100 ns resolution
Pulse Spacing	100 ns		300 µs	100 ns resolution
Pulse Rate	10 Hz		10 kHz	1 Hz resolution
Pulse Shaping	cos, cos^2 linear, gauss			individually settable for rising & falling edge
AVIO Modulation VOR	108 MHz		118 MHz	
Bearing Accuracy	±2% / ±0.5 deg			
Subcarrier Frequency Accuracy	9960 ± 2 Hz			
AM Accuracy	30 ± 1%			
AM Distortion (THD)			2%	
FM Accuracy	480 ± 1 Hz			
IDENT AM depth	10 %		30 %	
AVIO Modulation ILS	108 MHz		112 MHz	
AM Accuracy	40 ± 1%			
AM Distortion			0.5%	
DDM Resolution		0.0002 0.0004		Localizer Glide Slope
DDM Accuracy		0.0004 0.0008		Localizer Glide Slope
Marker Beacon				
AM Tone Accuracy (95% AM)		5% of setting		
AM Tone Distortion (95% AM)		5%		

Analog Modulation (Option MOD)

PARAMETER	MIN	TYPICAL	MAX	NOTE
Pulse Modulation				
Modulation Source		Internal pulse generator, external		
Modulator		RF, BB (baseband)		
Pulse Rise/Fall Time		5 ns		10% / 90% of amplitude
On/Off Ratio	40 dB 90 dB 50 dB tbd dB	45 dB 95 dB 50 dB tbd dB		BB pulse modulator <4 GHz RF pulse modulator >4 GHz RF pulse modulator
Pulse Overshoot			1 dB	
Video Feedthrough		tbd		
Polarity / Video Polarity		Normal, inverted		independently selectable
External Pulse Input to Video Output Delay		20ns (meas)		
Video Output to RF Output Delay		5ns (meas) 400ns (meas)		RF modulator BB modulator
External Trigger to Video Output Delay		tbd		
Pulse Jitter		 <10 ps +/-8 ns	<1 ps	Internal External, RF pulse modulator External, BB pulse modulator
Internal Pulse Generator				
Pulse Mode		single pulse		
Pulse Period Setting Range	16ns		10s	
Pulse Period Setting Resolution		8ns		
Pulse Width Setting Range	0ns		10s	
Pulse Width Setting Resolution		8ns		
Pulse Width Accuracy		same as time base		
Amplitude Modulation				
Modulation Source		Internal External		Option AIQ
Modulation Depth	0%		99.9%	Output is clipped at max power level
Deviation Accuracy		0.1%	1%	1 kHz rate, 80% depth
Deviation Resolution		0.1%		
Distortion (THD)			1%	1 kHz rate, 80% depth
Modulation Frequency Range	0.1 Hz		100 MHz	
Modulation Waveforms		Sine		
Frequency Modulation				
Modulation Source		Internal External		Option AIQ
Maximum Frequency Deviation (peak)		200 MHz		
Deviation Accuracy		0.5%	1%	
Distortion (THD)		< 1%		1 kHz rate, 10 kHz deviation
Modulation Frequency Range	0.1 Hz		100 MHz	
Modulation Waveforms		Sine		
Phase Modulation				
Modulation Source		Internal External		Option AIQ
Phase Deviation (peak)	0		100 rad	
Deviation Accuracy		0.5%	1%	
Modulation Frequency Range	0.1 Hz		100 MHz	
Modulation Waveforms		Sine		
Distortion (THD)		< 1%		1 kHz rate & N x rad deviation

Frequency Reference

PARAMETER	MIN	TYPICAL	MAX	NOTE
Internal Reference Frequency		100 MHz 10 MHz		 Options LN / LN+
Initial Calibrated Accuracy			±10 ppb	At 23 ± 3 °C
Temperature Stability 0 to 50 °C			±100 ppb ±20 ppb	 Options LN / LN+
Aging after 1st Year			1 ppm 30 ppb 20 ppb	 Option LN Option LN+
Aging per Day			5 ppb 0.5 ppb	after 30 days operation Options LN / LN+
Warm-up Time		5 min		
Reference Output				
Output Frequency		10 MHz, 100 MHz		
Output Power		0 dBm 9 dBm		10 MHz 100 MHz
Output Impedance		50 Ω		
External Reference Input				
Input Frequency Range	5 MHz	10 MHz	250 MHz	Option VREF
Frequency Resolution		1 MHz		Option VREF
Input Impedance		50 Ω		
Input Power Level	-5 dBm	0 dBm	+10 dBm	
Lock Range			±1.5 ppm	

Sweeping Capability

PARAMETER	MIN	TYPICAL	MAX	NOTE
Sweep Type		Digital sweep in discrete steps		
Automatic Level Control Mode		OFF		
Power Level Uncertainty		0.5 dB	1 dB	APVSG04
Sweep Spacing		Linear		
Sweep Shape		Sawtooth		
Sweep Parameters		Frequency, power		
Sweep Range		Full specified range -20 to +15 dBm		Frequency sweep Power sweep, APVSG04
Step Size Setting Resolution		0.001 Hz 0.01 dB		Frequency sweep Power sweep
Dwell Time Setting Range	500 µs 800 ns TBD		34.35 s 34.35 s 34.35 s	 APVSG04, Option UFS APVSG20, APVSG40, Option UFS
Delay Time Setting Range	200 ns 200 ns		34.35 s 34.35 s	APVSG04 APVSG20, APVSG40
Dwell/Delay Time Resolution		8 ns		
Sweep Count		Infinite, 1 to 1 M		
Sweep Trigger				
Trigger Type		Normal (full sweep), Point (one step)		 Check with Anapico support
Trigger Parameters		See chapter “Trigger Capability”		
Retrigger Setup Time		200 ns		
External Trigger Event to RF Output Delay		TBD ns typ TBD		APVSG04, Option UFS APVSG20, APVSG40, Option UFS

Trigger Capability

PARAMETER	MIN	TYPICAL	MAX	NOTE
Trigger Mode		Single, continuous		
Trigger Source		Internal (Immediate, bus), external		
External Trigger Input				
Connector Type		MF1 IN, MF2 IN		See chapter "External Multi-Function Inputs"
Delay Setting Range	0 s		8.5 s	
Delay Setting Resolution		2 ns		
Jitter		+/-2 ns		
Slope		Rising, falling		
Trigger Output				
Connector Type		MF1 OUT, MF2 OUT		See chapter "External Multi-Function Outputs"
Polarity		Normal, inverted		
Delay Setting Range	0 s		2 µs	
Delay Setting Resolution		2 ns		
Pulse Width Setting Range	8 ns		16 µs	
Pulse Width Setting Resolution		8 ns		

Additive White Gaussian Noise (Option AWGN)

PARAMETER	MIN	TYPICAL	MAX	NOTE
Noise				
Distribution Density		Gaussian, statistical, $\mu = 0$, $\sigma^2 = 1$		Separate for I and Q
Crest Factor		≤ 21.07 dBm		Depending on C/N ratio
Periodicity		> 7×10^{44} s		
Carrier to Noise Ratio C/N				
Range	-60 dB		90 dB	Limited by the RF output power
Resolution		0.01 dB		See application note "AN6005"
Noise Bandwidth				
Dependency		0.8 of I/Q baseband generator sample rate Manually		Any modulation active All modulations inactive
Range	10 Hz		400 MHz	
Resolution		1 Hz		
Power Control Mode		Total, carrier, noise		

External Multi-Function Inputs

PARAMETER	MIN	TYPICAL	MAX	NOTE
Connector		MF1 IN, MF2 IN		see chapter "I/O CONNECTOR"
Application		External pulse modulation, external trigger		
Nominal Input Impedance		DC 10k Ω and AC 50 Ω		
Threshold Voltage	0.85V	0.9 V	0.95 V	
Nominal Input Voltage	0 V		3.3 V	TTL compatible
Hysteresis		60 mV		

External Multi-Function Outputs

PARAMETER	MIN	TYPICAL	MAX	NOTE
Connector		MF1 OUT, MF2 OUT		see chapter "I/O CONNECTOR"
Application		Pulse video signal, trigger, marker signals (1-4)		
Nominal Output Impedance		tbd		
Nominal Output Voltage	0 V		3.3 V	LVTTL

Fast Control Port (Option FCP)

PARAMETER	
Interface	Parallel, bidirectional LVDS with 100 Ω termination at receiver
Common Mode Level	typ. 1.2V
Differential Input Threshold	typ. +/-100mV
Differential Output Voltage	typ. 300mV
Connector	FCP I/O - see chapter "I/O CONNECTOR"
Mode: I/Q Data Streaming	
Sample Rate ()	125 and 250 MHz
Input/Output Format	data (16 bits), clock signal, valid signal
Valid I/Q Data Input to RF Output Delay	typ. tbd ns
Mode: Segment ID Streaming	
Input Format	data (16 bits), valid signal (signal must be static low or high)
Valid Segment ID Input to RF Output Delay (immediate segment changeover)	typ. tbd ns
Valid Segment ID Jitter	+/- 8 ns
Mode: Parameter Streaming	
Parameter	Frequency (up to 48bit), amplitude, phase
Input Format	address (8 bits), data (8 bits), valid signal

Pin assignment

Pin (P/N)	Signal	Pin (P/N)	Signal	Pin (P/N)	Signal
1/19	data bit 0	2/20	data bit 1	3/21	data bit 2
4/22	data bit 3	5/23	data bit 4	6/24	data bit 5
7/25	data bit 6	8/26	data bit 7	9/27	data bit 8
10/28	data bit 9	11/29	data bit 10	12/30	data bit 11
13/31	data bit 12	14/32	data bit 13	15/33	data bit 14
16/34	data bit 15	17/35	valid	18/36	clock

External Analog Inputs (Option AIQ)

PARAMETER	MIN	TYPICAL	MAX	NOTE
Connector		I IN, Q IN		see chapter "I/O CONNECTOR"
Analog Bandwidth		50 MHz		
Maximum Input Voltage	-2 V		+ 2 V	
Nominal Input Voltage Range		+/- 0.5 V		90% full scale
Input Impedance		50 Ω		
Additional Features		Individual gain and DC offset adjustment, overrange detection		
Application		Analog I/Q data modulation external AM, FM, PM modulation		Option AIQ Option AIQ & MOD

Multi-Channel Performance

PARAMETER	MIN	TYPICAL	MAX	NOTE
Isolation between Channels		> 90 dB		
Relative Phase Stability		TBD		
Additional Features				
Trigger Source		Synchronous (initiate and trigger multiple channels)		
Additional Delay to Asynchronous Characterizations		1 µs +/- 100 ns		
Channel to Channel Jitter		+/- 10 ps typ.		

Multi-Device Performance

PARAMETER	MIN	TYPICAL	MAX	NOTE
Multi-Device Synchronization		TBD		Only available at 2U Multi-Channel models
Relative Phase Stability		TBD		

TYPICAL PERFORMANCE CURVES

Figure 1: SSB Phase Noise Performance, APVSG20/40, CW without option LN, Pout = 10 dBm

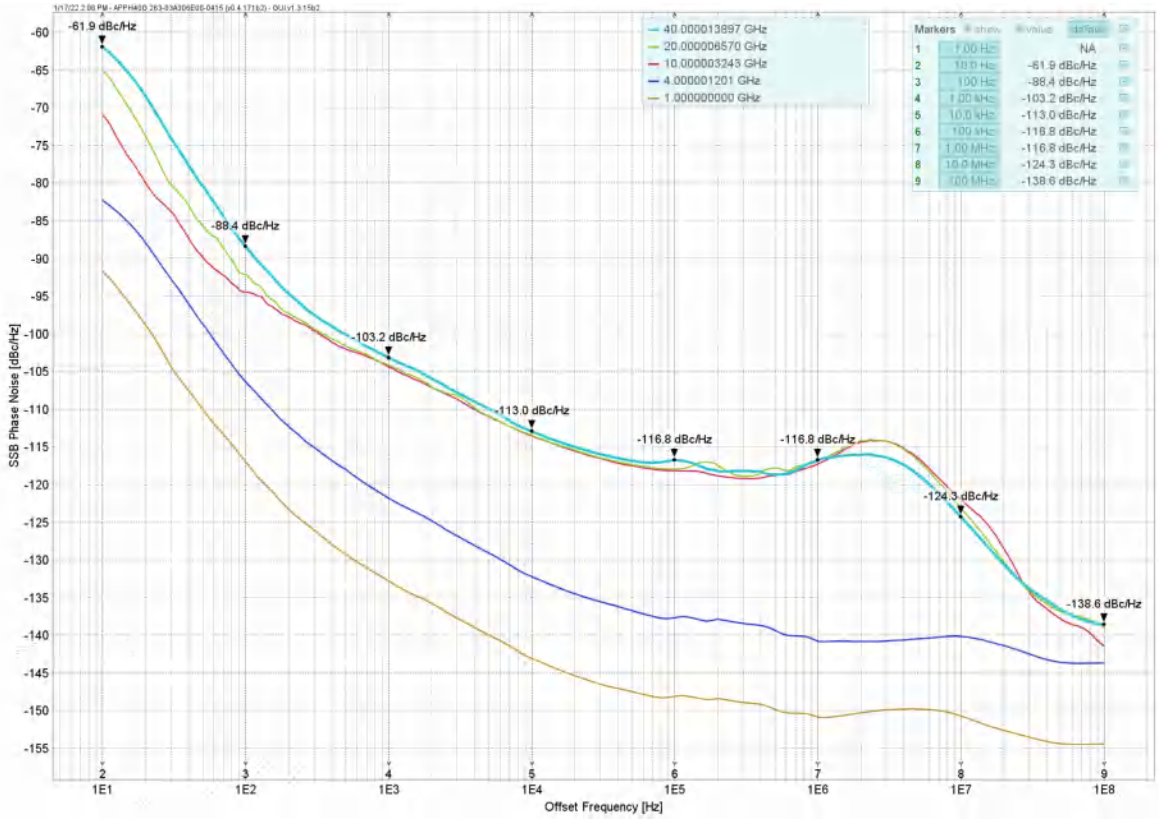


Figure 2: SSB Phase Noise Performance, APVSG06, CW without option LN, Pout = 10 dBm

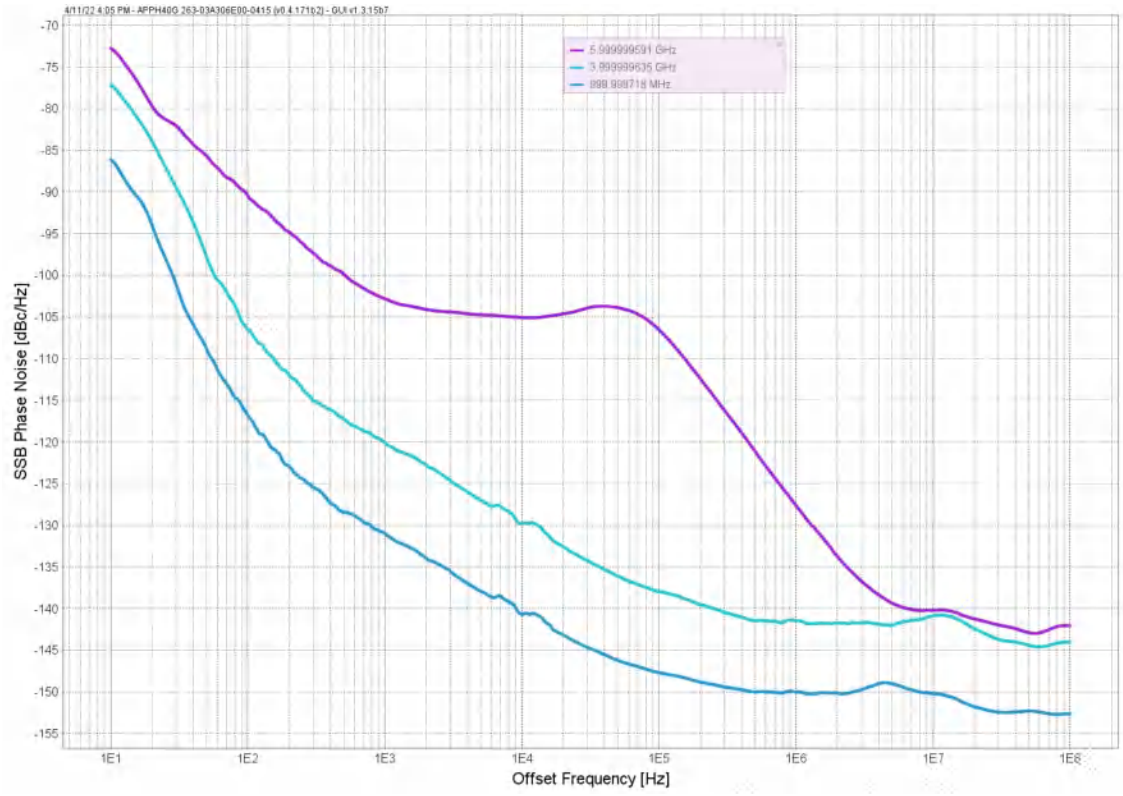
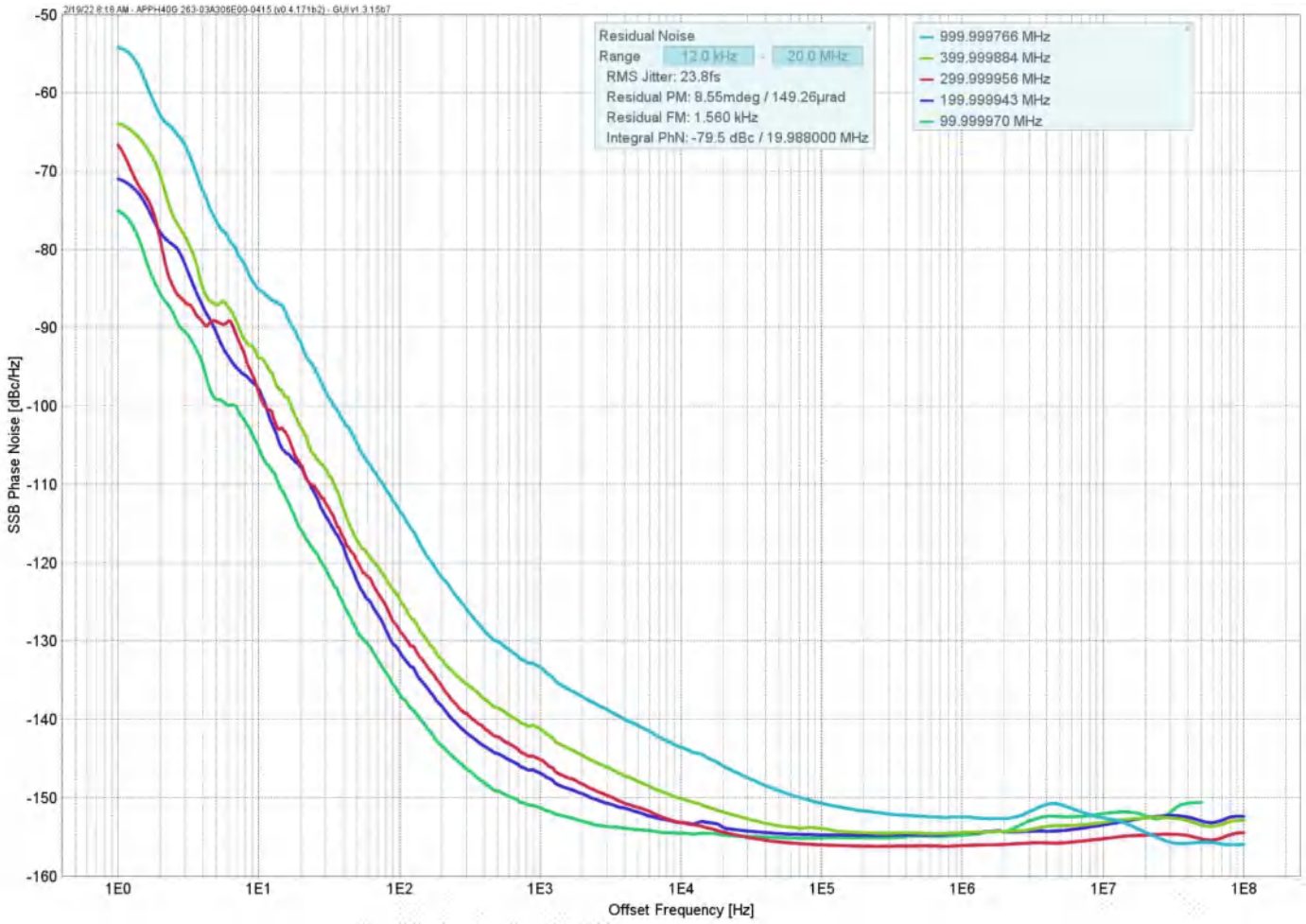


Figure 3: SSB Phase Noise Performance, APVSGXX, low frequency CW without option LN, Pout = 10 dBm



Offset → RF ↓	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	floor
100 MHz		-119	-135	-148	-155	-156	-158	-159
1 GHz		-100	-114	-129	-140	-150	-152	-160
4 GHz		-87	-102	-118	-129	-139	-140	-151
40 GHz		-62	-89	-103	-113	-117	-117	-139

Figure 2: SSB Phase Noise Performance, CW with Option LN, 1 GHz, Pout = 10 dBm

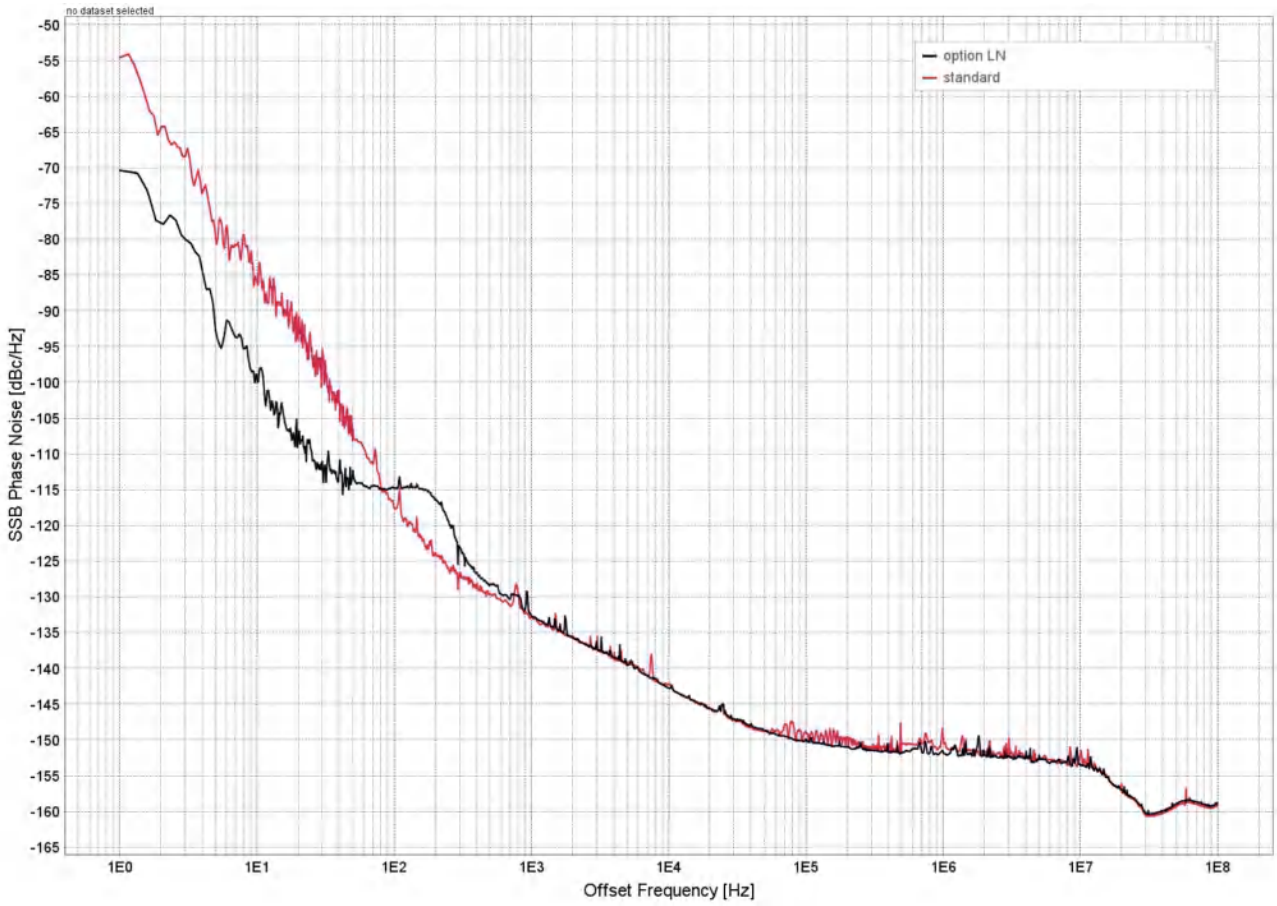


Figure 2a: Amplitude Noise, 2 GHz, Pout = 10 dBm

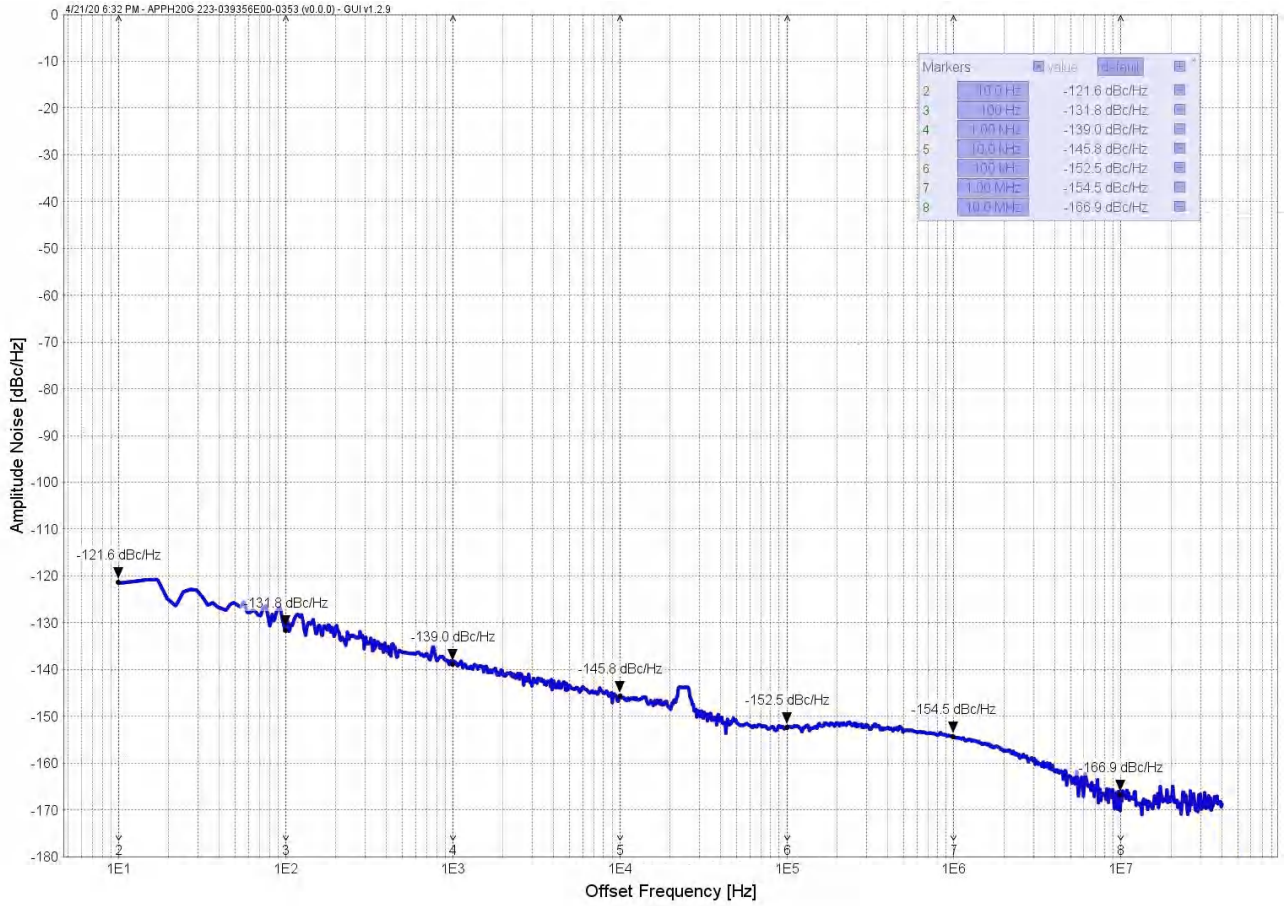
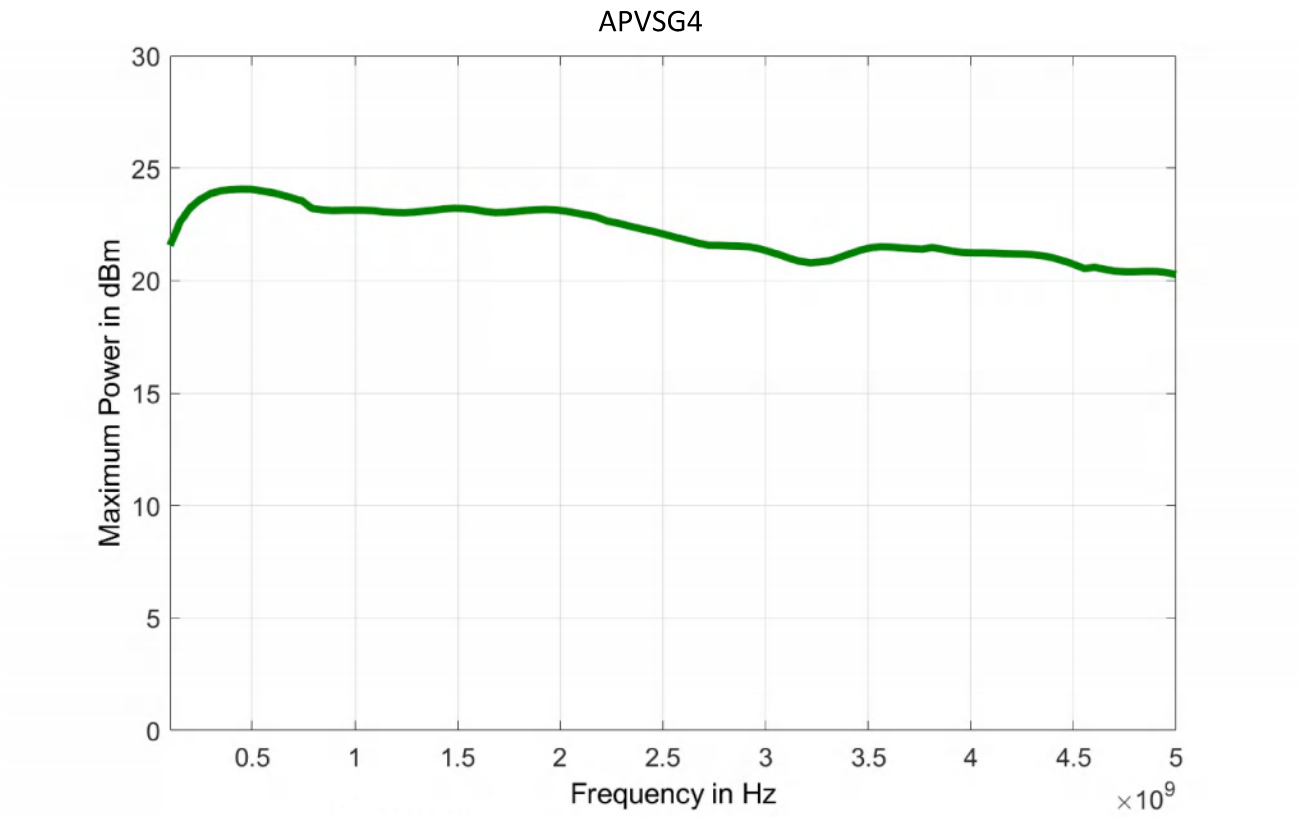
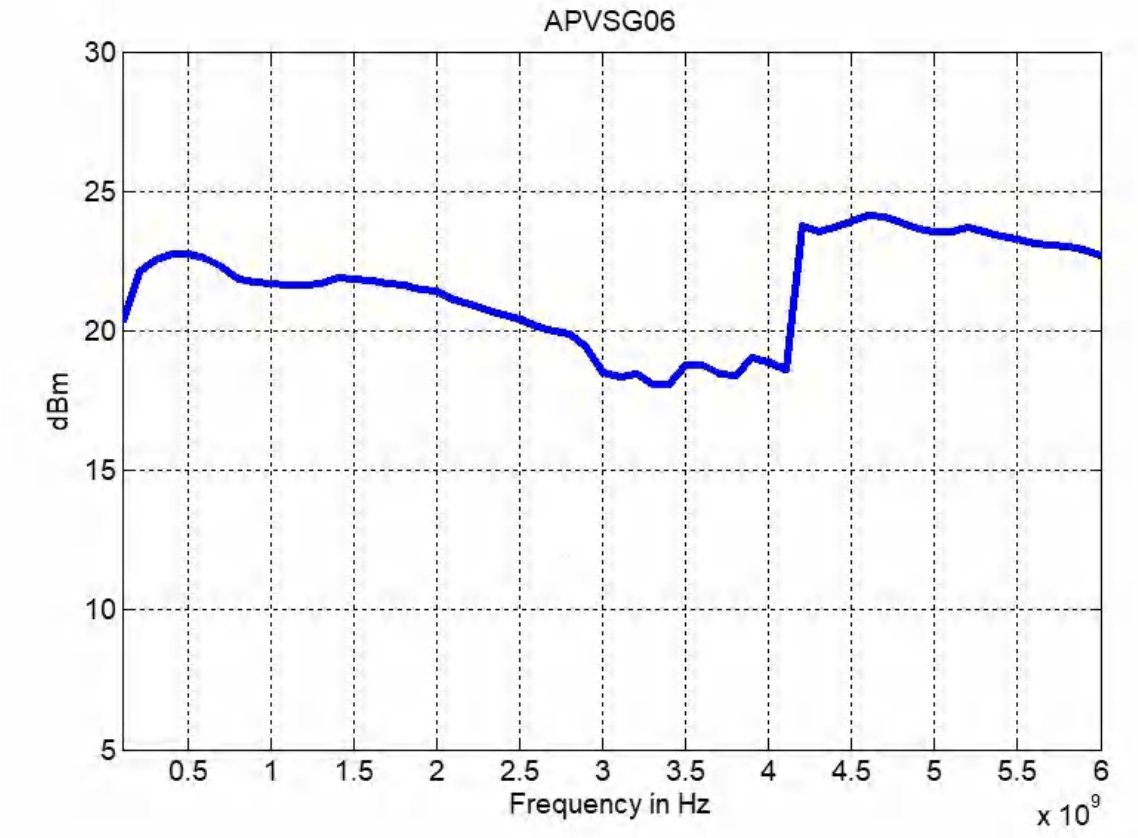


Figure 3: Maximum Output Power





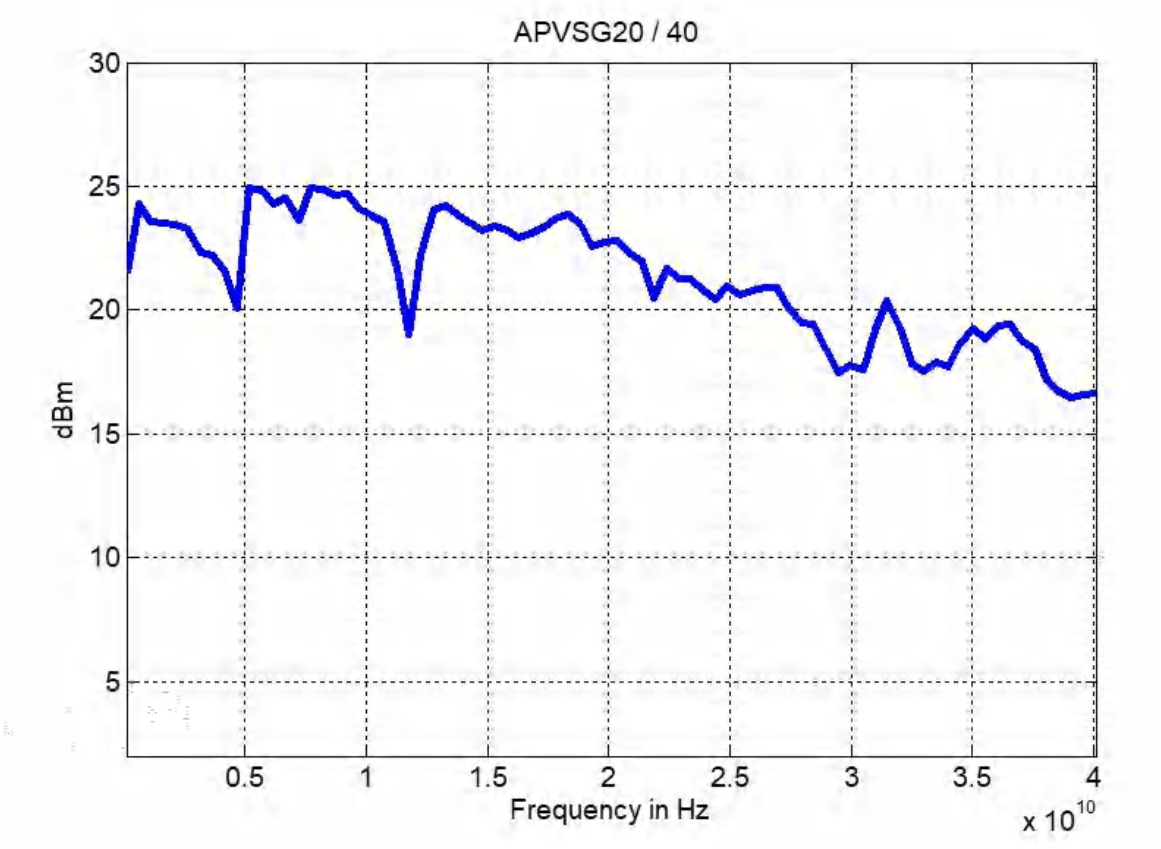
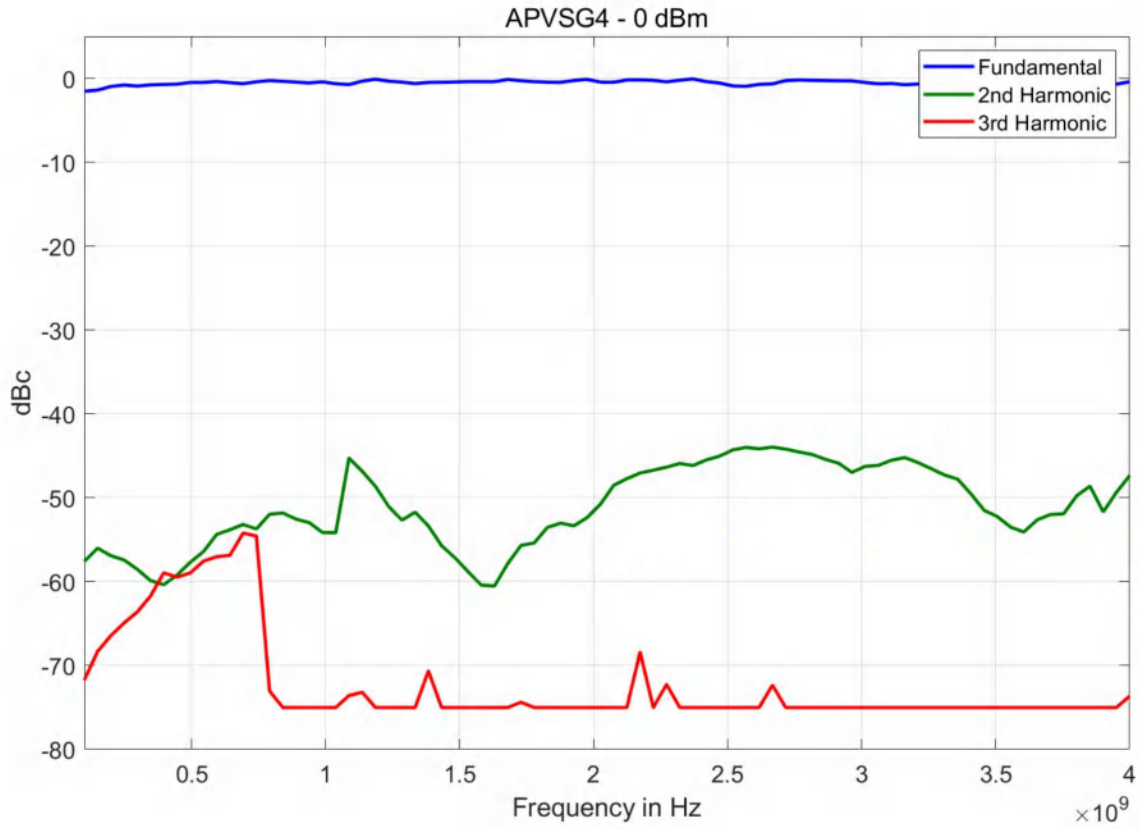

APVSG20 / 40
30
25
20
15
10
5
dBm
0.5
1
1.5
2
2.5
3
3.5
4
Frequency in Hz
x 10^10

Figure 4: Harmonic Performance at Pout = 0 dBm



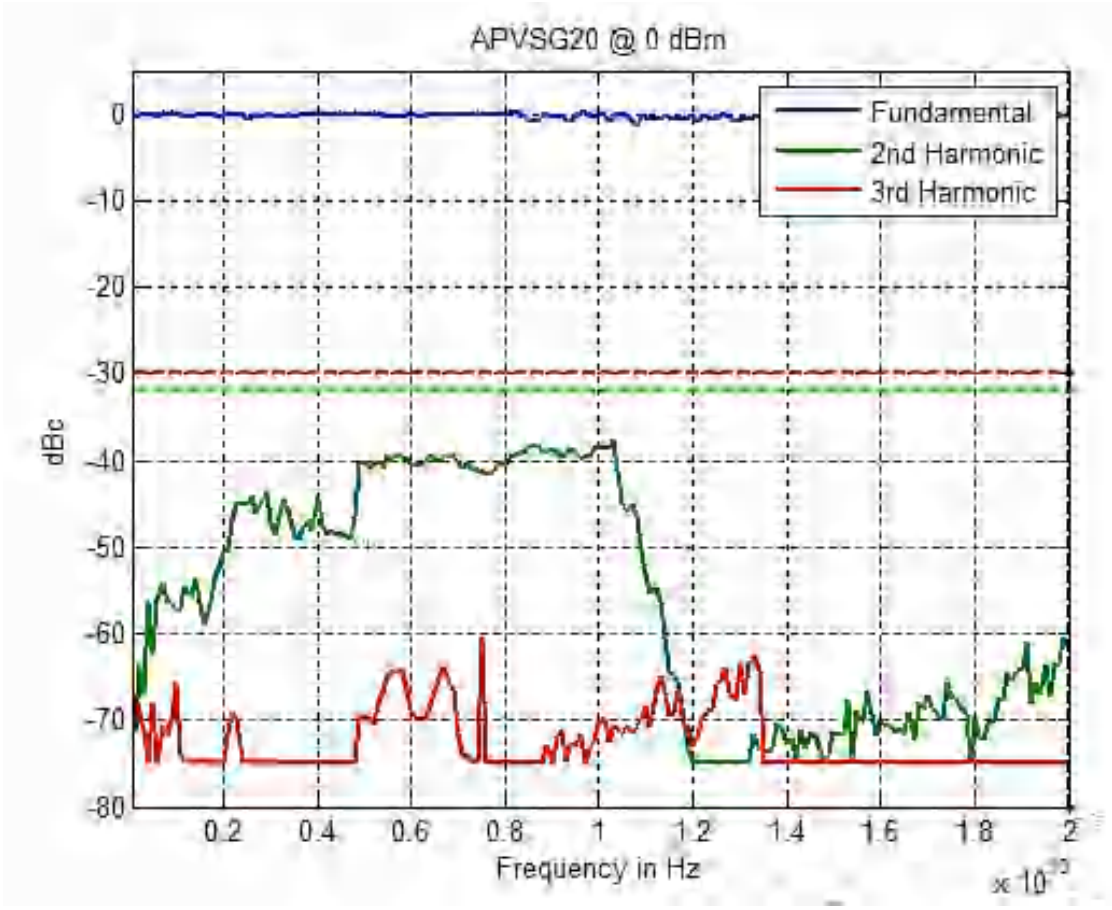
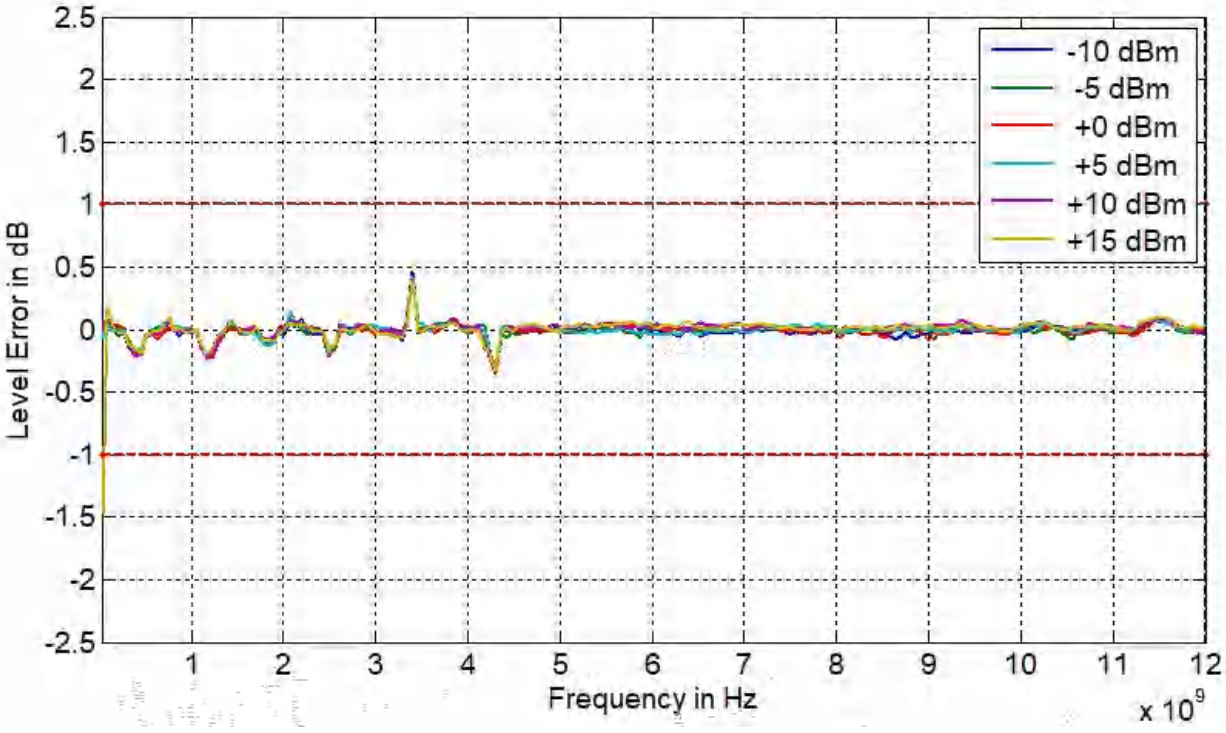
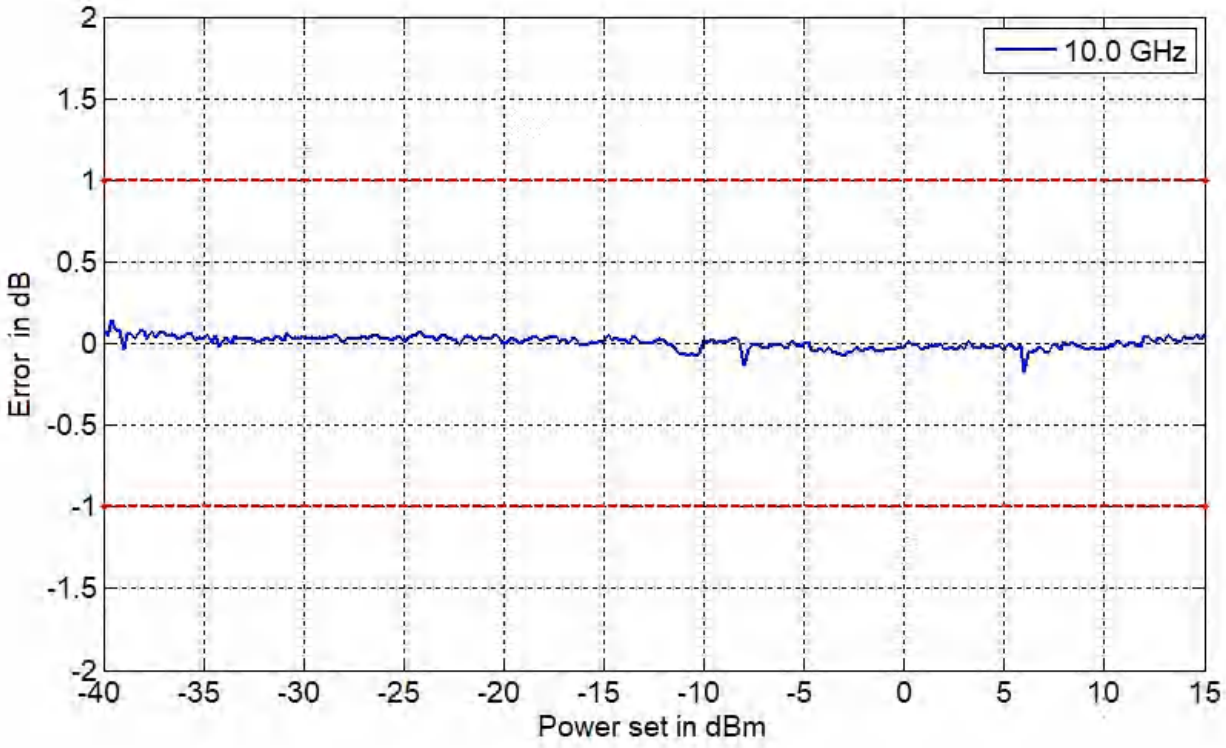
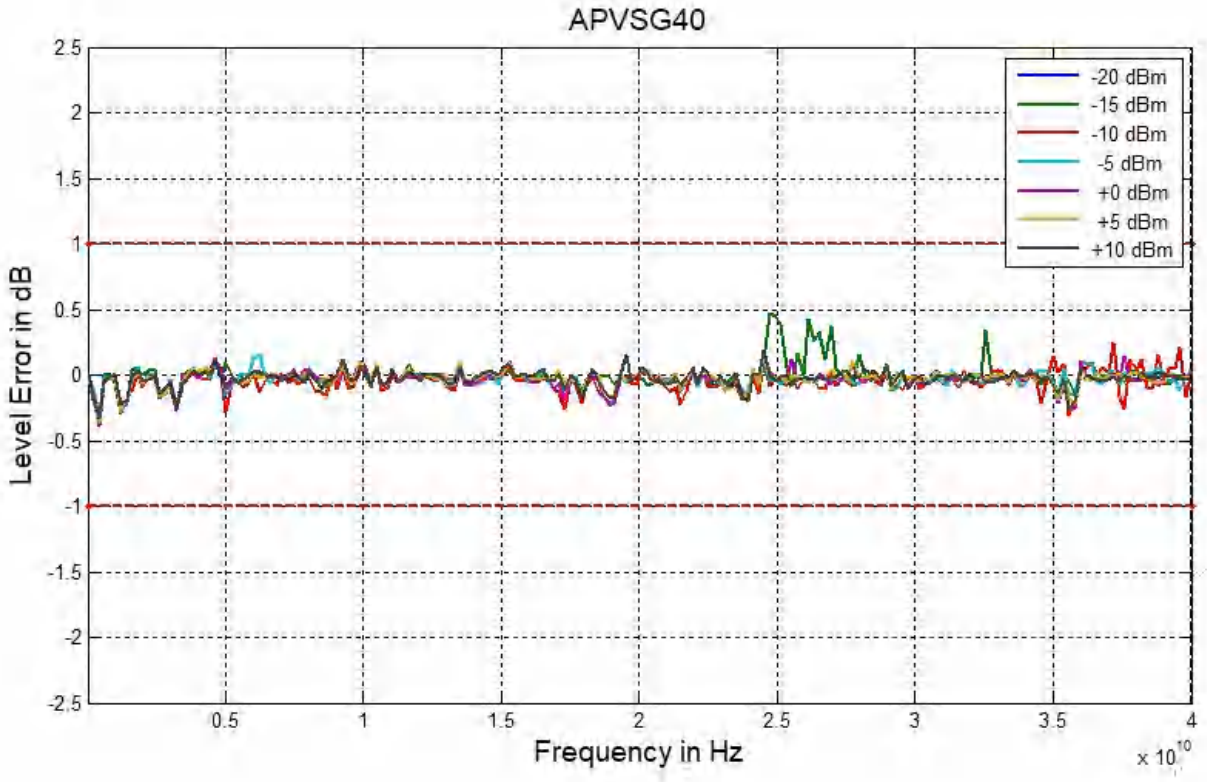


Figure 5: Level Accuracy

APVSG12






APVSG40
-20 dBm
-15 dBm
-10 dBm
-5 dBm
+0 dBm
+5 dBm
+10 dBm
Level Error in dB
Frequency in Hz
x 10^10

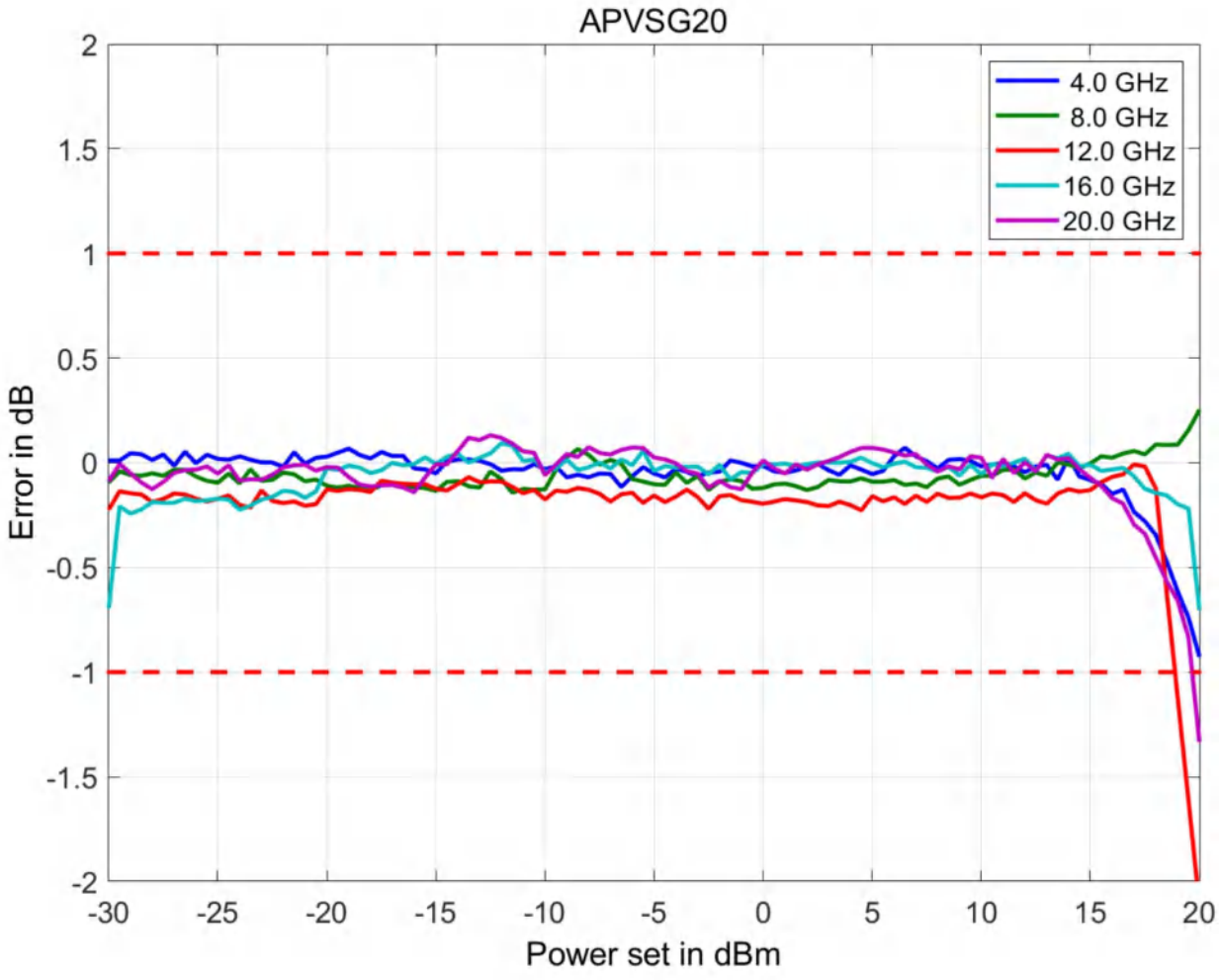
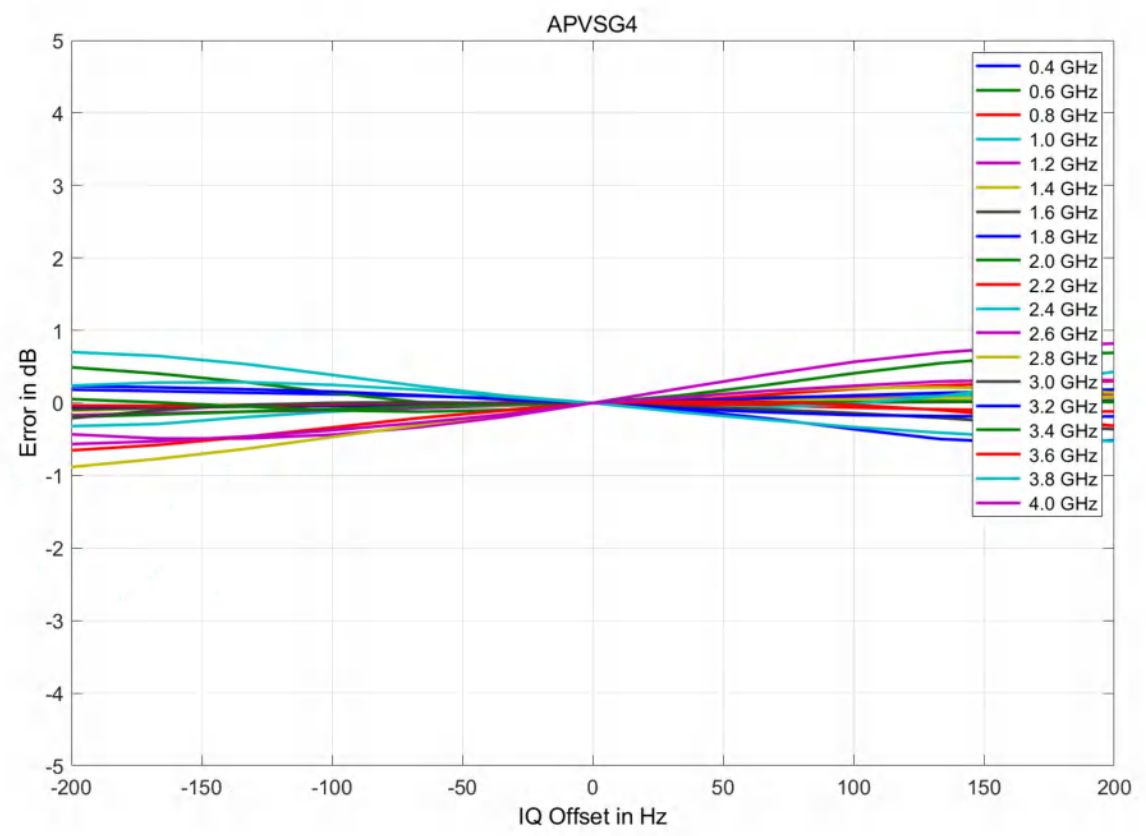

APVSG20
4.0 GHz
8.0 GHz
12.0 GHz
16.0 GHz
20.0 GHz
Error in dB
Power set in dBm

Figure 6: I/Q Relative Response (measured)



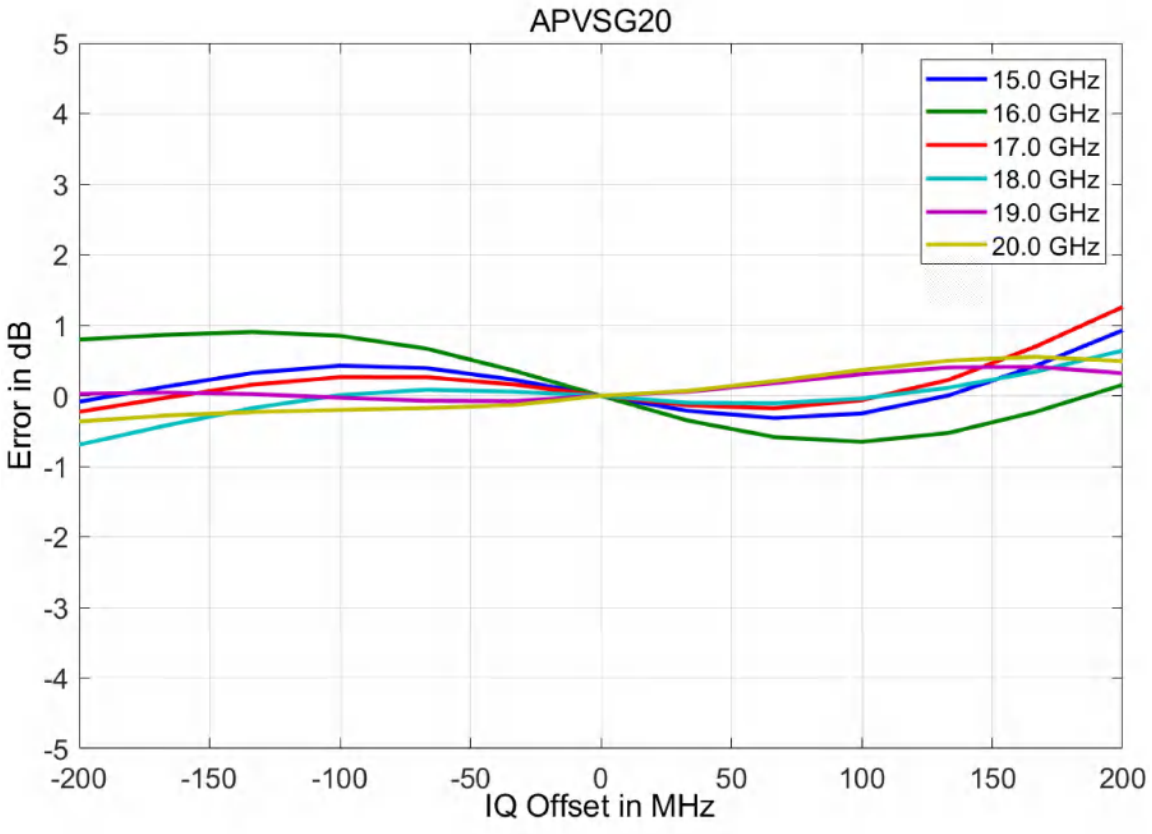


Figure 7: 64-tone 400 MHz Bandwidth Signal

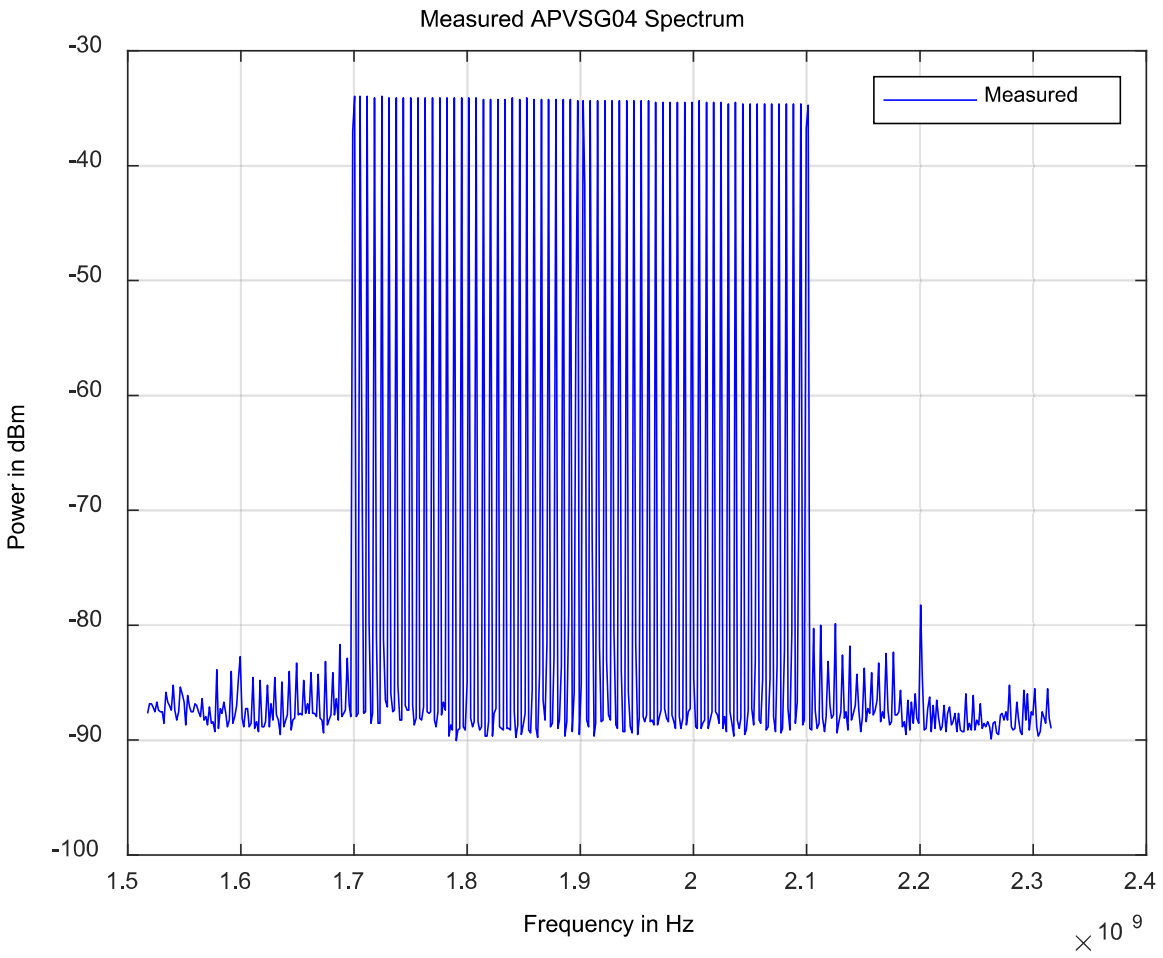


Figure 8: Two-tone Sideband Rejection

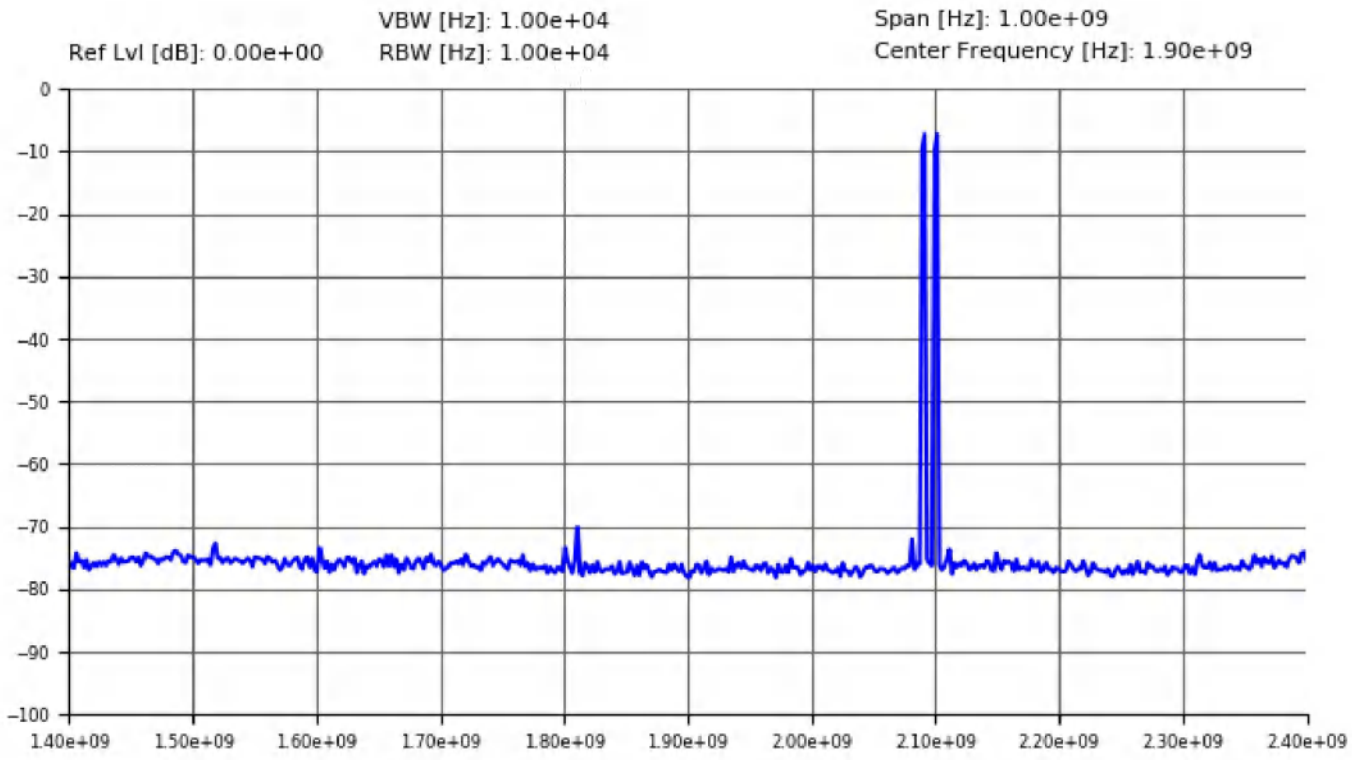


Figure 9: Wideband FM (1MHz Rate, 200 MHz Deviation)

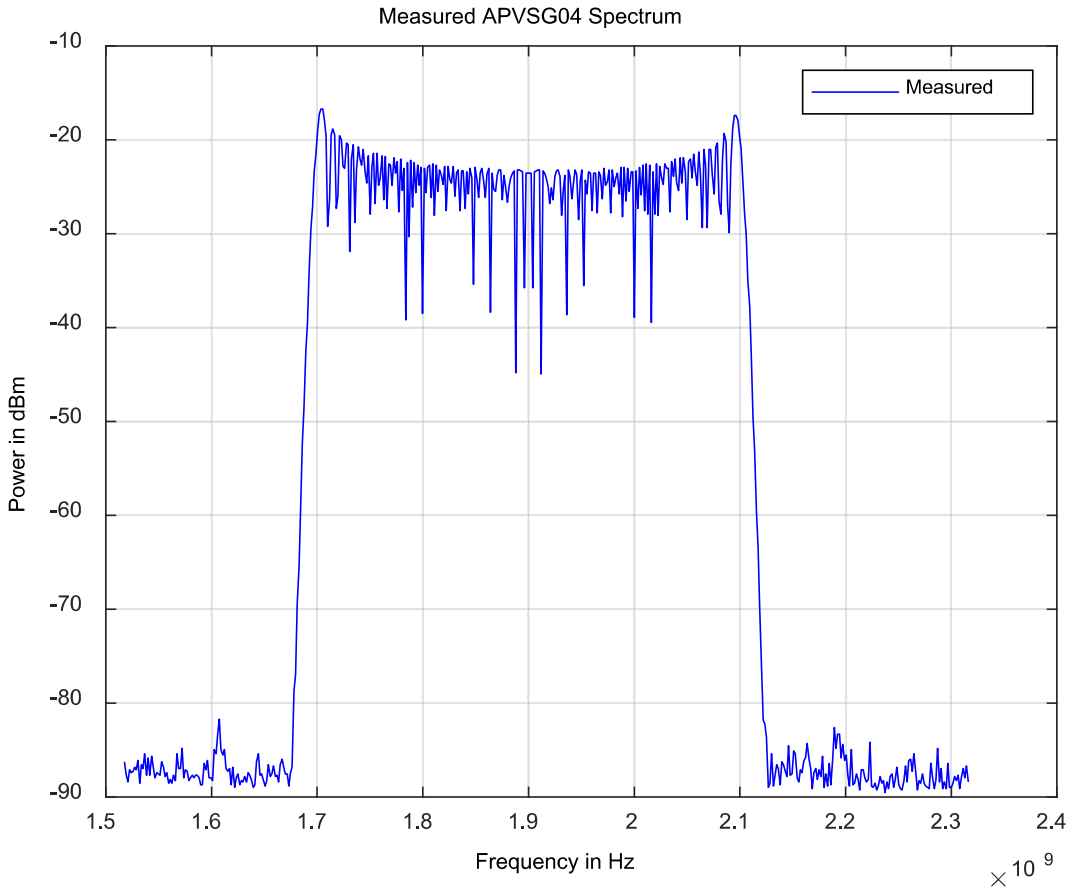


Figure 10: Pulsed Chirp (10 µs, 400 MHz Bandwidth)

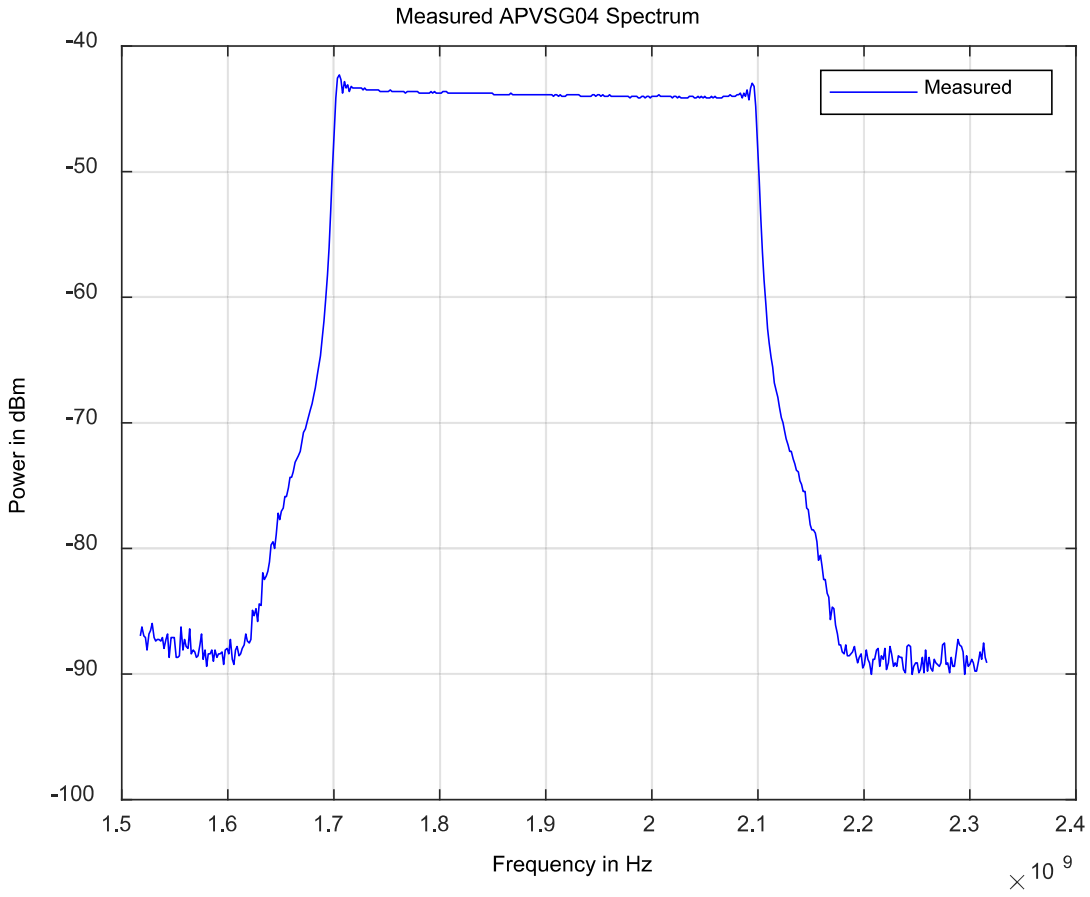


Figure 11: Amplitude Modulation (1 kHz Rate, 80% Depth)

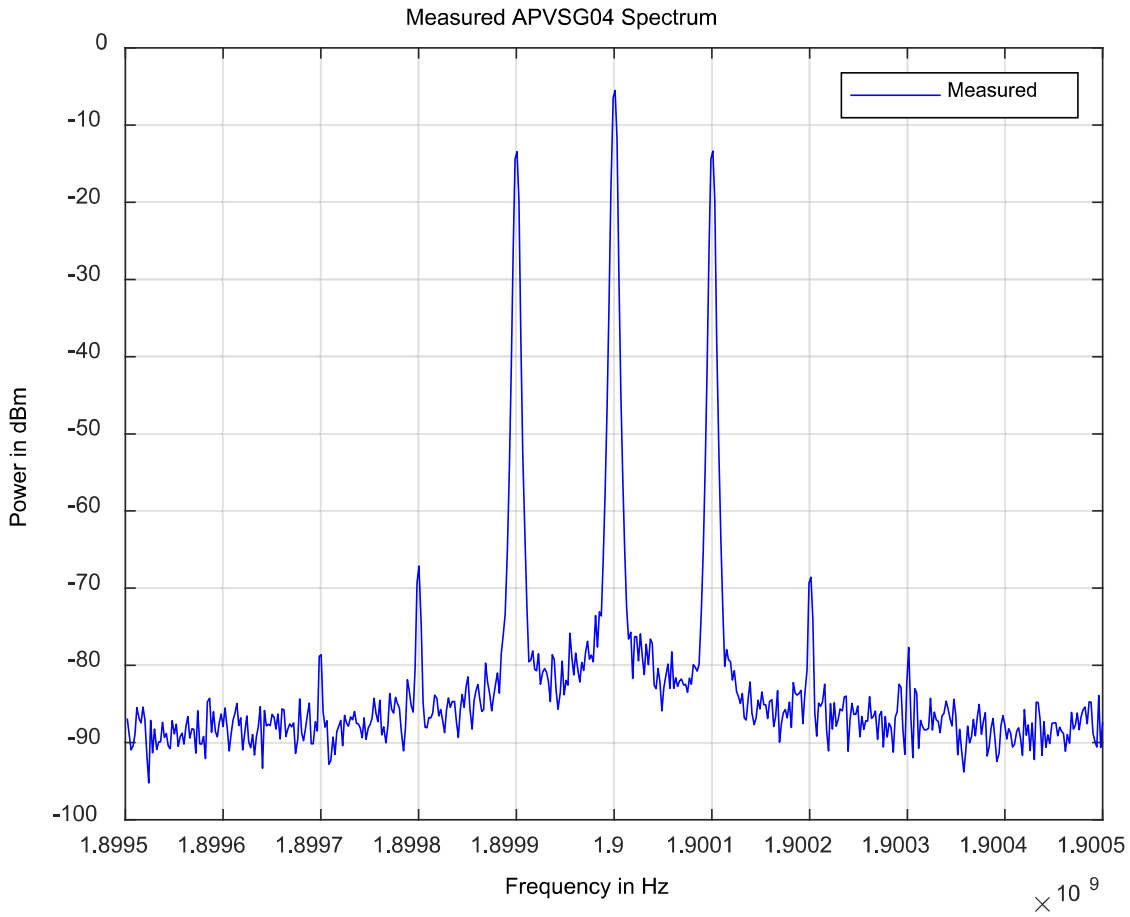


Figure 12: DME Spectrum (X Channel, Raised Cosine Filter)

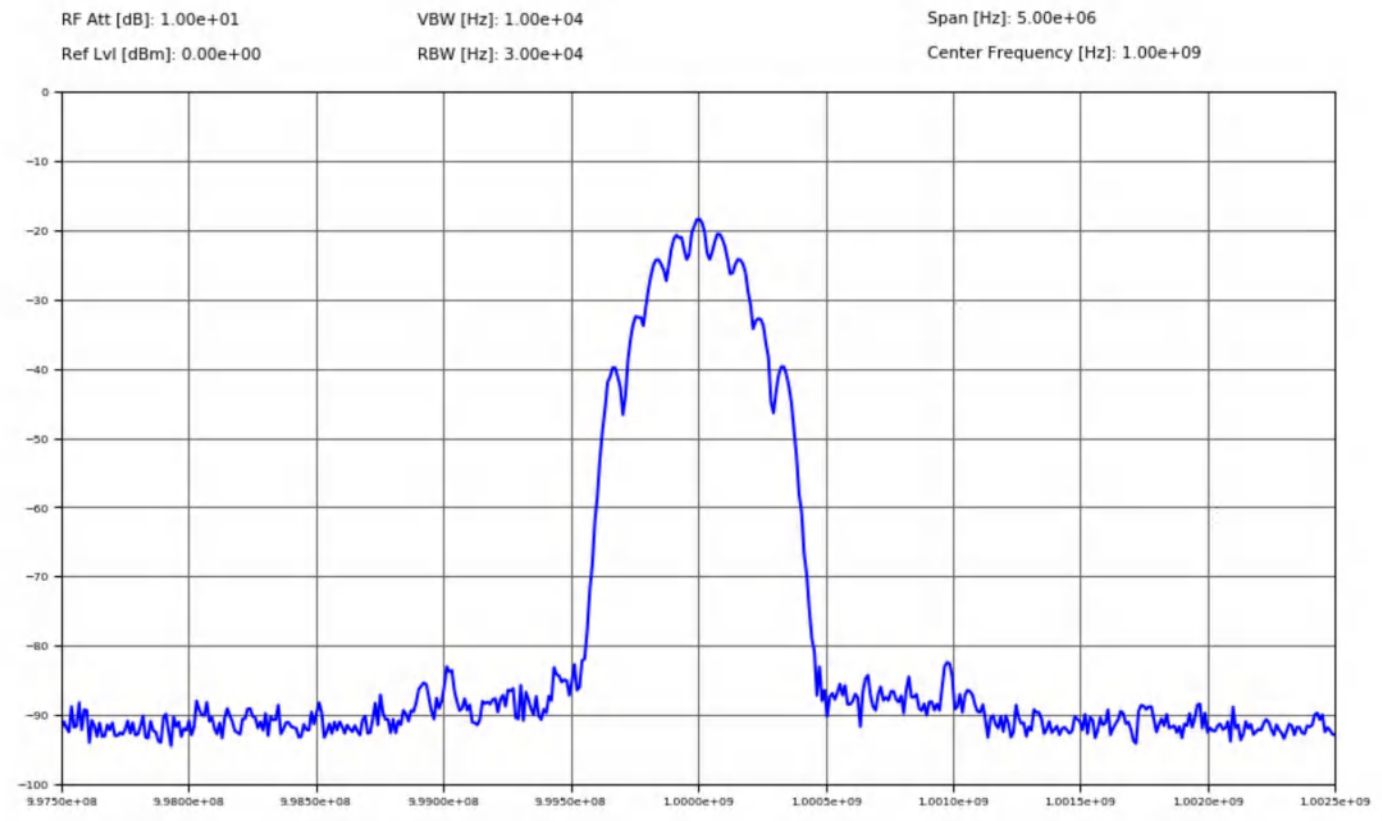


Figure 13: Pulse Modulation (10 MHz Rate, 10 ns Pulse Width)

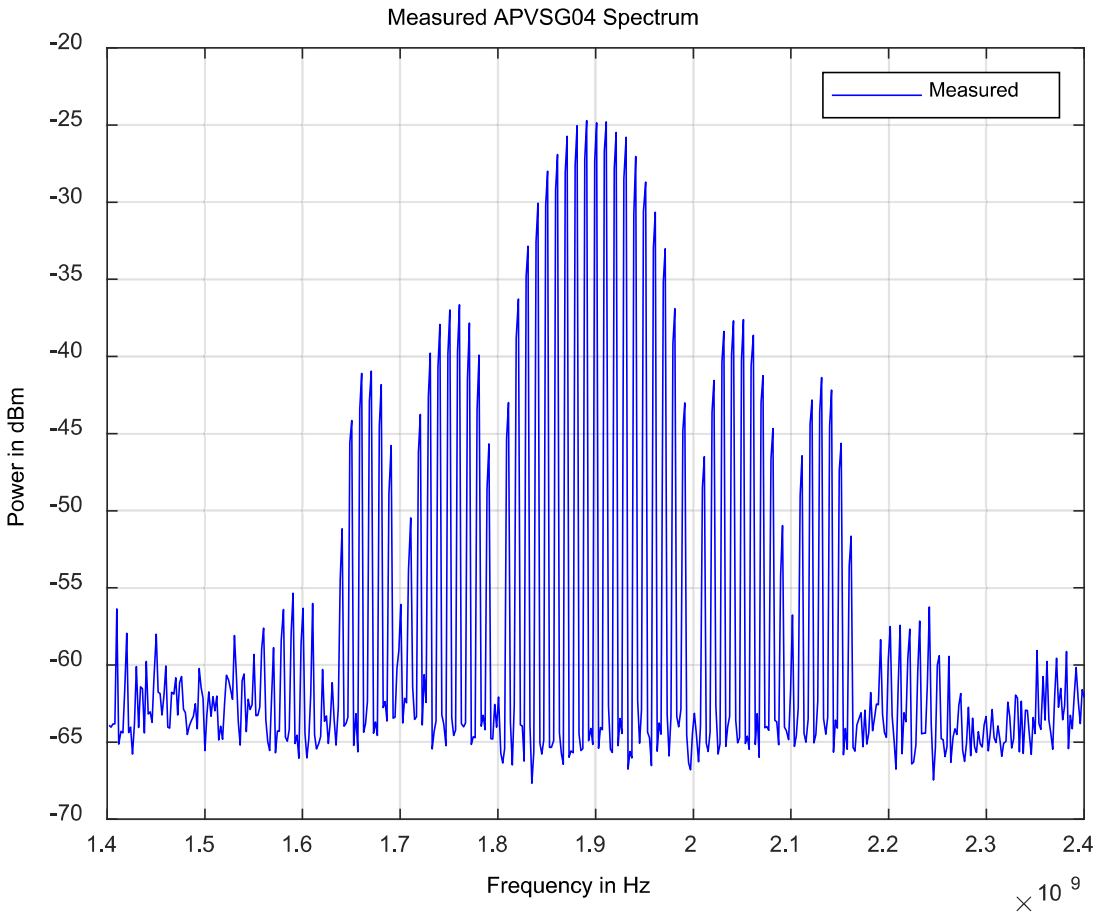


Figure 14: 256QAM 10 MS/s

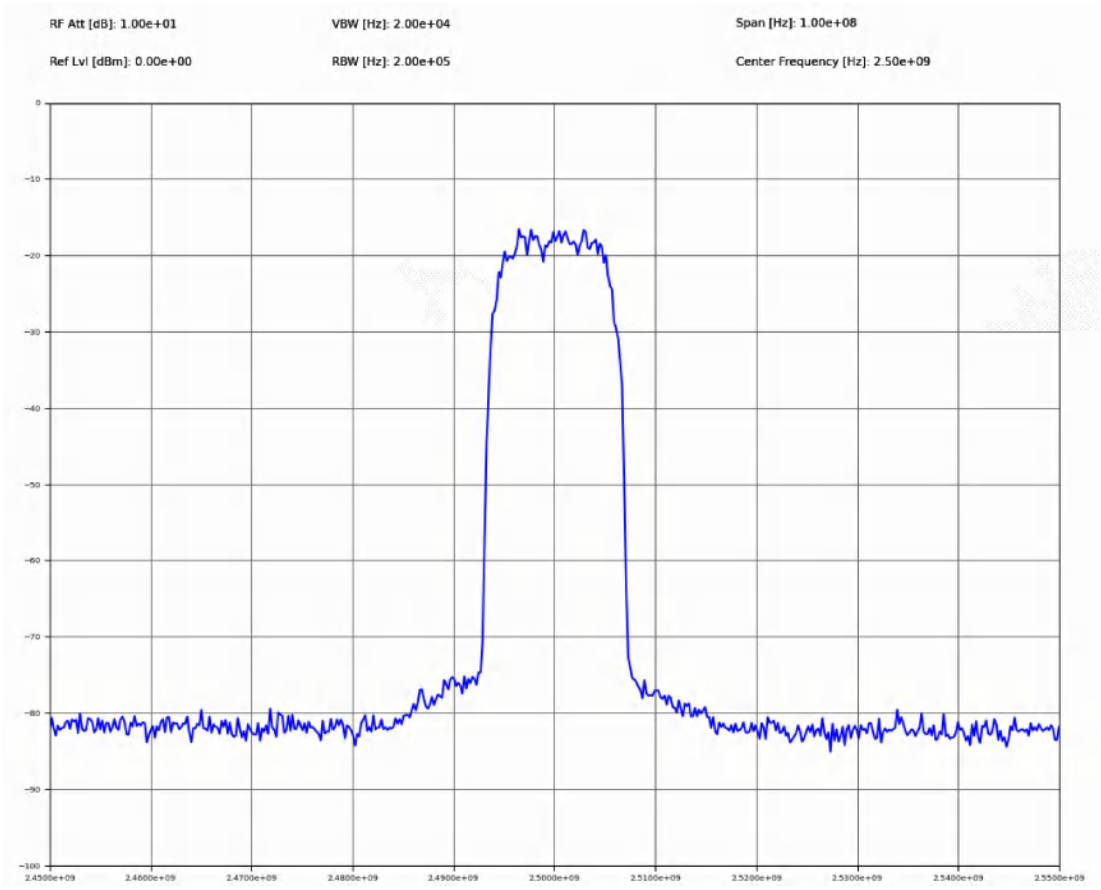


Figure 15: 16QAM 250 MS/s

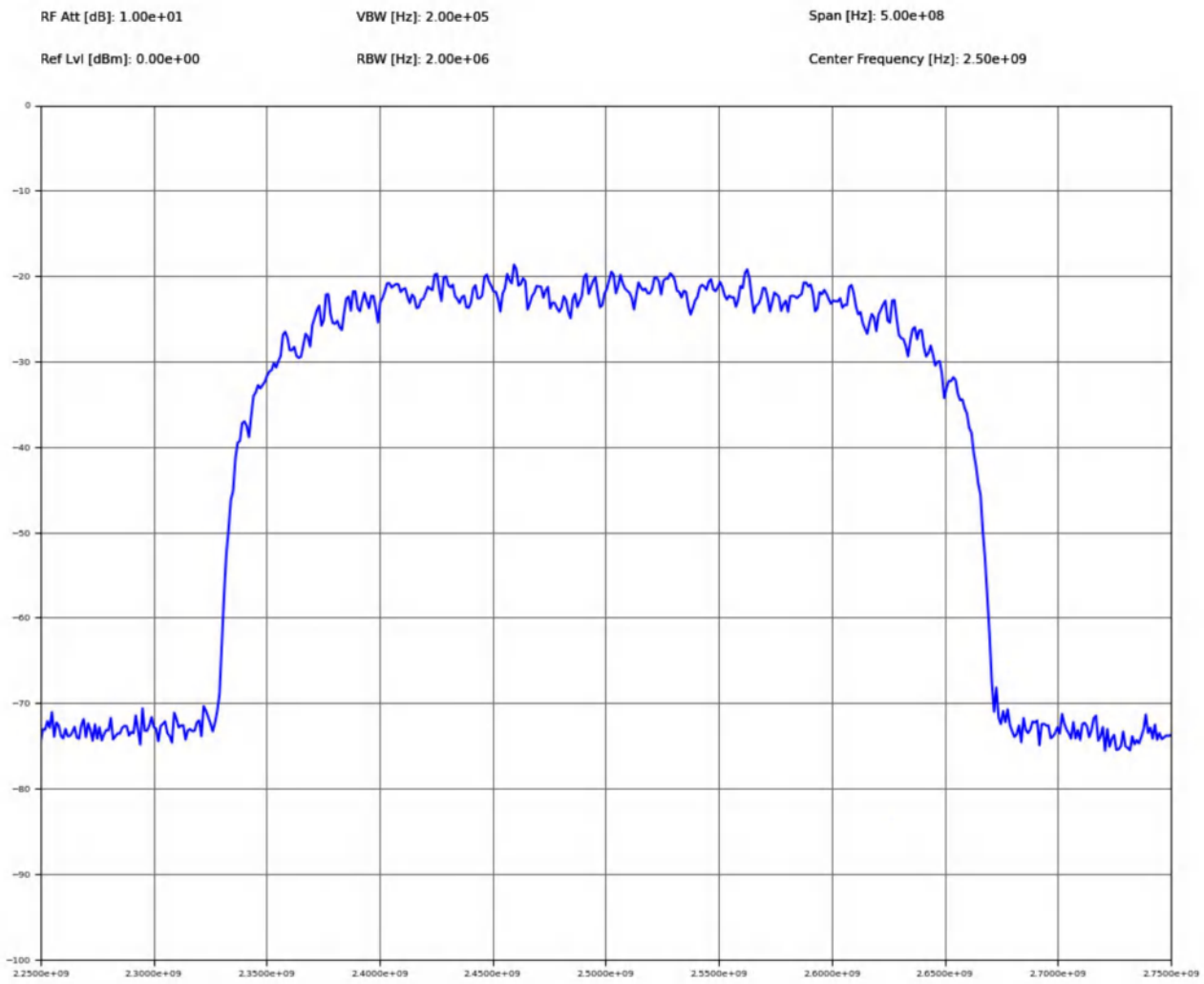


Figure 16: EMV vs Output Power, 16QAM, 10 MS/s, 2.5 GHz

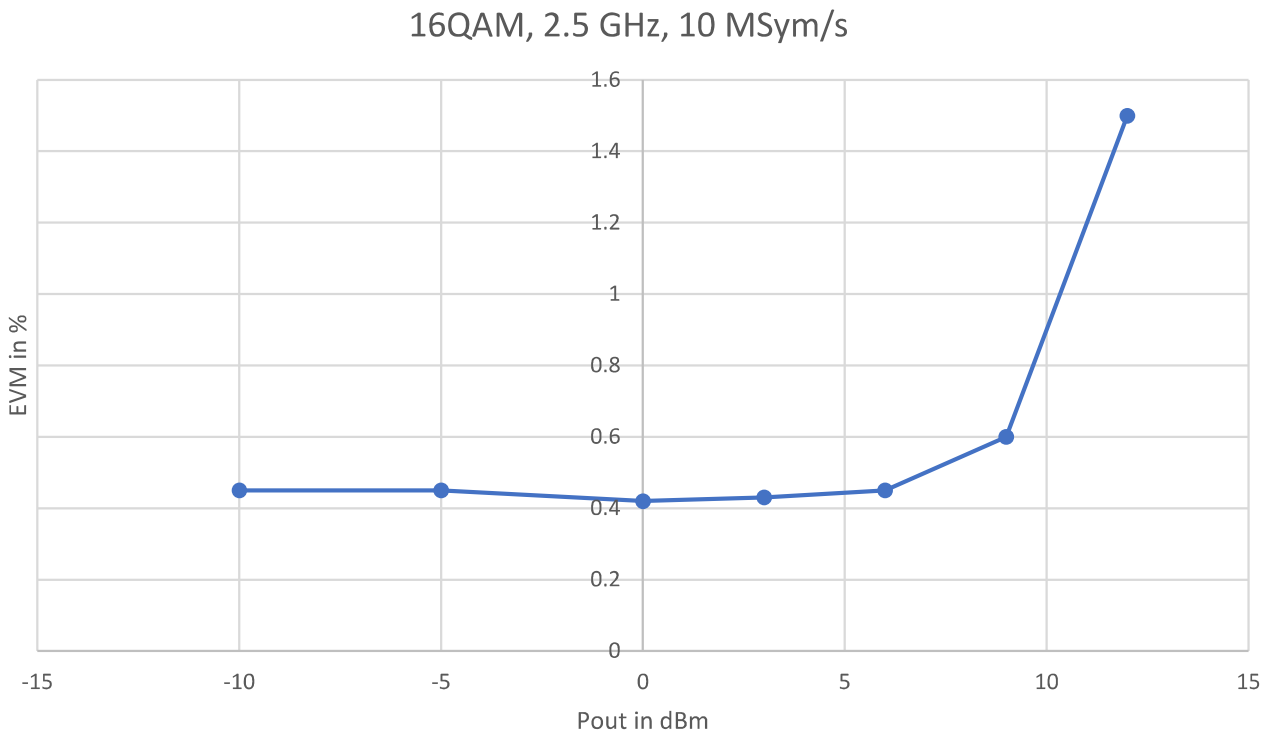


Figure 17: EMV vs Symbol Rate, 16QAM

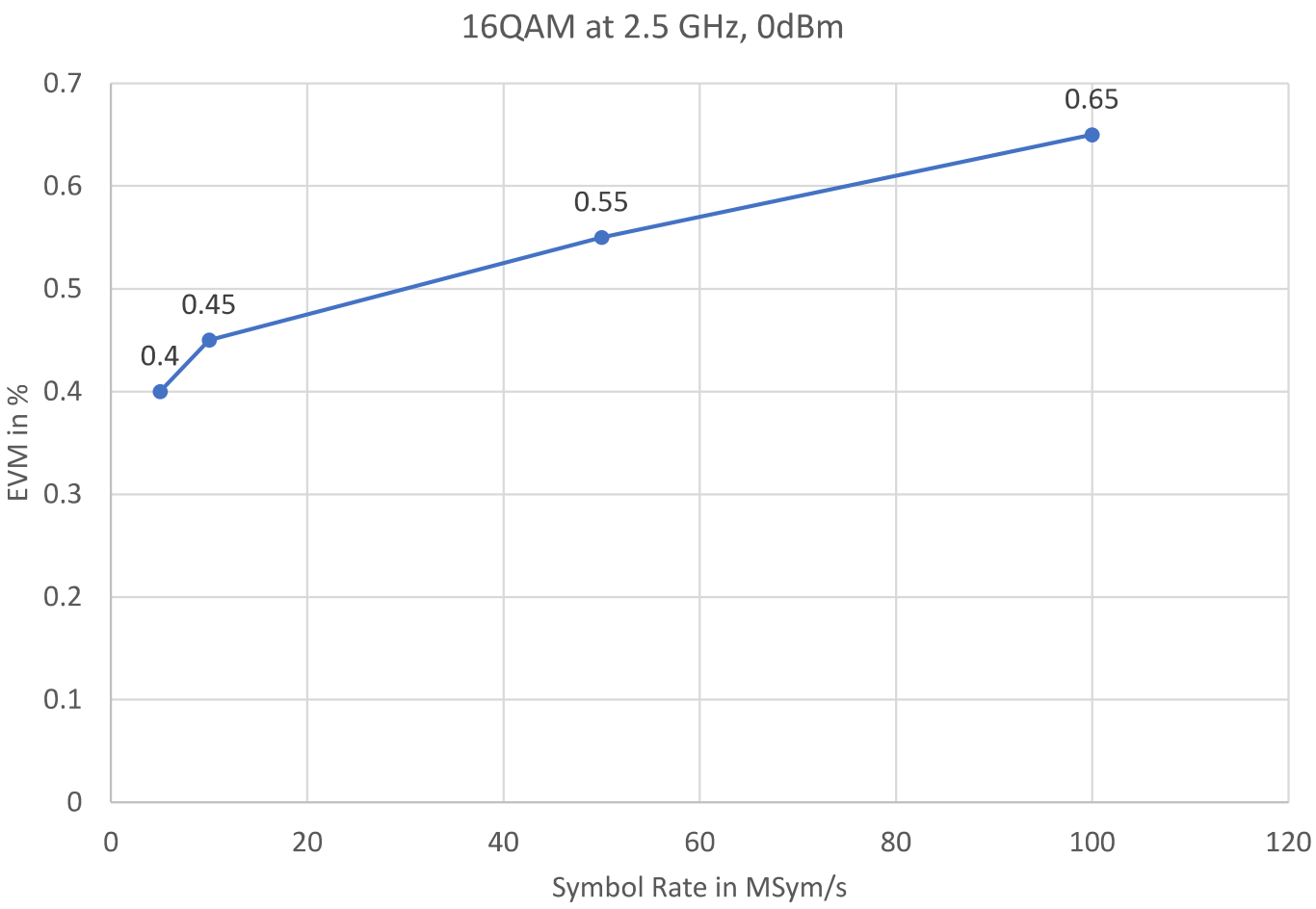


Figure 18: EMV vs RF Frequency, 16QAM, 10 Msymbols/s

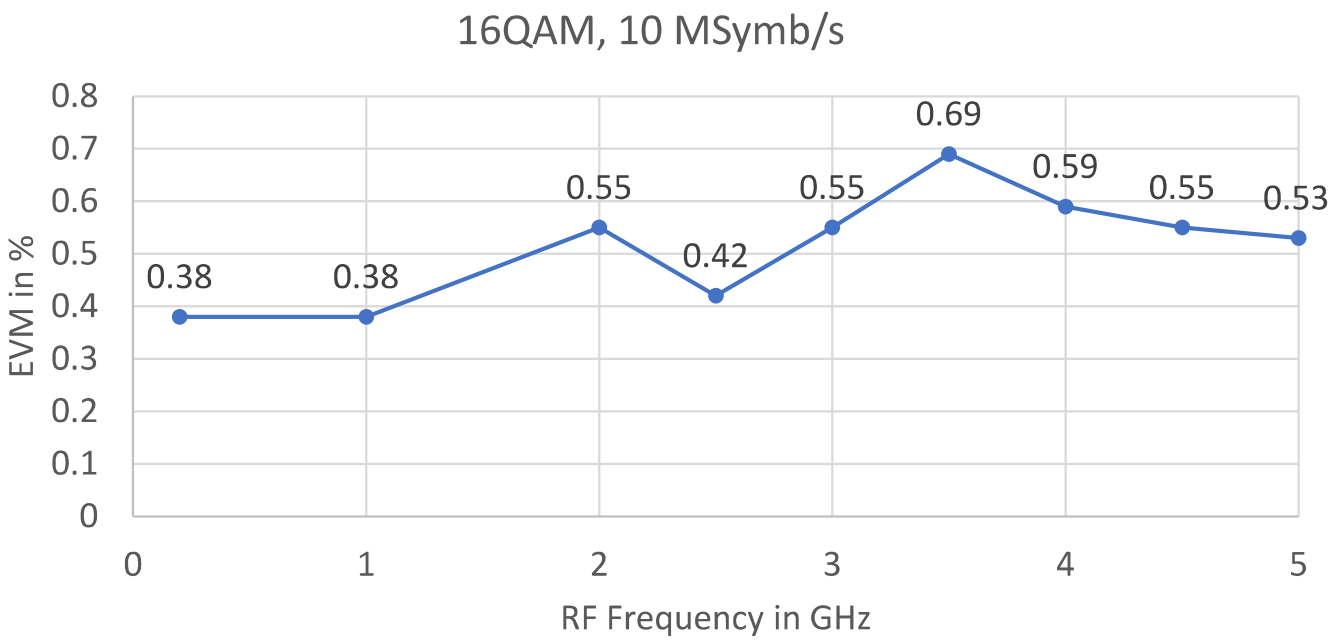


Figure 19: Typical VSWR (APVSG04)

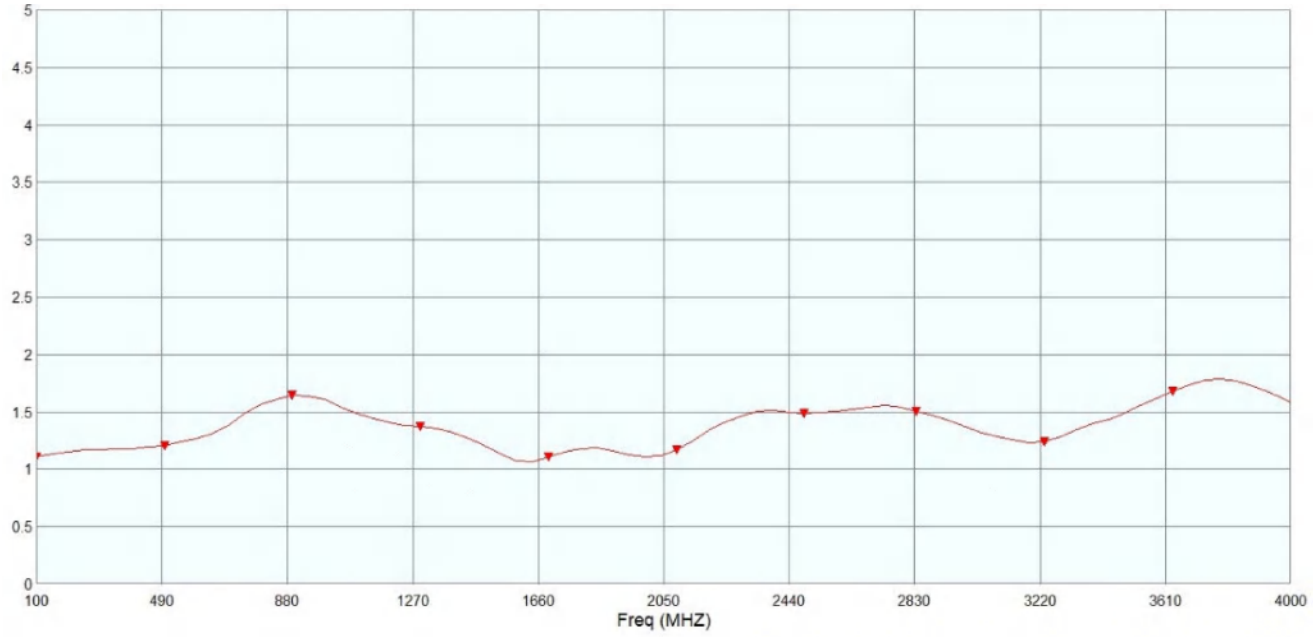
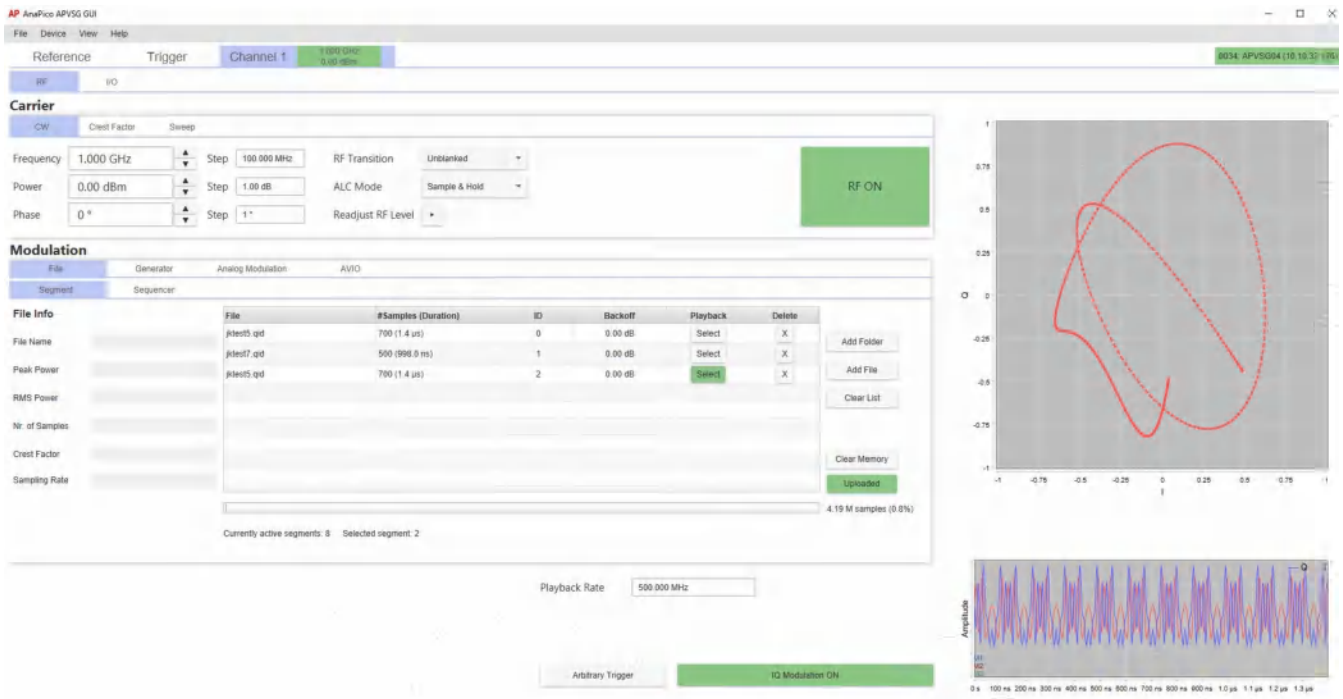


Figure 20: Typical VSWR (APVSG12 & APVSG20)

tba

Figure 21: User Interface



I/O CONNECTOR

Front Panel (Single Channel Model):

LABEL	TYPE	DESCRIPTION	OPTION
RF 50 Ω	N female (APVSG04/APVSG06/APVSG12) SMA female (APVSG20) K (2.92mm) female (APVSG40)	RF output	



Rear Panel (Single Channel Model):

LABEL	TYPE	DESCRIPTION	OPTION
DC24V	DC power plug female	Power of instrument	
⏚	M4	Ground reference screw	
USB	USB type B	Remote programming interface	
LAN	RJ-45	Remote programming interface	
GPIB	24-pin female	Remote programming interface	GPIB
SD	MicroSD	Card slot for non-volatile storage of I/Q data	
REF IN	BNC female	Reference frequency input	
REF OUT	BNC female	Reference frequency output	
MF1 IN, MF2 IN	BNC female	Multi-function inputs: User-configurable (e.g. trigger, external pulse)	
MF1 OUT, MF2 OUT	BNC female	Multi-function outputs: User-configurable (e.g. trigger, marker)	
I IN, Q IN	BNC female	Analog inputs: User-configurable (e.g. I/Q modulation, external analog modulations)	AIQ
FCP	36-pin mini-D female 3M MDR 102 Series	Fast control port, external digital I/Q data streaming (per channel)	FCP



Front Panel (2U Multi-Channel Model):

LABEL	TYPE	DESCRIPTION	OPTION
RF OUT (for each channel)	SMA female / K (2.92mm) female (APVSG40-X)	RF output	



Rear Panel (2U Multi-Channel Model):

LABEL	TYPE	DESCRIPTION	OPTION
-	C13	Power of instrument	
⏚	M4	Ground reference screw (earth)	
USB	USB type B	Remote programming interface	
LAN	RJ-45	Remote programming interface	
GPIB	24-pin female	Remote programming interface	GPIB
SD	MicroSD	Card slot for non-volatile storage of I/Q data	
REF IN	BNC female	Reference frequency input	
REF OUT	BNC female	Reference frequency output	
CLK IN	SMA female	High-stability reference input	
CLK OUT	SMA female	High-stability reference output	
FCP (for each channel)	36-pin mini-D female 3M MDR 102 Series	Fast control port	FCP
MF1 IN, MF2 IN (for each channel)	SMB female	Multi-function inputs: User-configurable (e.g. trigger, external pulse)	
MF1 OUT, MF2 OUT (for each channel)	SMB female	Multi-function outputs: User-configurable (e.g. trigger, marker signals)	
I IN, Q IN (for each channel)	SMB female	Analog inputs: User-configurable (e.g. I/Q modulation, external analog modulations)	AIQ



ORDERING INFORMATION

HOST MODEL	PRODUCT	DESCRIPTION	
APVSG	APVSG04	4 GHz model	
APVSG	APVSG06	6 GHz model	
APVSG	APVSG12	12 GHz model	
APVSG	APVSG20	20 GHz model	
APVSG	APVSG40	40 GHz model	
APVSG-X	APVSG04-X	4 GHz model (X channels)	2 to 4 channels
APVSG-X	APVSG06-X	6 GHz model (X channels)	
APVSG-X	APVSG12-X	12 GHz model (X channels)	
APVSG-X	APVSG20-X	20 GHz model (X channels)	
APVSG-X	APVSG40-X	40 GHz model (X channels)	

HARDWARE OPTIONS	PRODUCT	DESCRIPTION
APVSG(-X)	Option LN	Enhanced close-in phase noise & frequency stability
APVSG(-X)	Option LN+	Enhanced close in phase noise & further enhanced long term frequency stability
APVSG(-X)	Option FCP*	Fast control port, external digital I/Q data streaming (per channel)
APVSG(-X)	Option AIQ	External analog I/Q inputs (per channel)
APVSG(-X)	Option GPIB*	GPIB interface
APVSG04(-X) APVSG06(-X) APVSG12(-X)	Option PE4	Electrical step attenuator
APVSG(-X)	Option PE	Mechanical step attenuator (down to -90 dBm)
APVSG(-X)	Option PE2	Mechanical step attenuator (down to -120 dBm)
APVSG(-X)	Option 100K	Frequency range extension to 100 kHz

* Option combination FCP / GPIB is not supported on single channel models.

SOFTWARE LICENSES	PRODUCT	DESCRIPTION
APVSG(-X)	Option MOD	Internal analog modulations
APVSG(-X)	Option UFS	Ultra-fast switching speed
APVSG(-X)	Option IVM	Internal digital modulation schemes
APVSG(-X)	Option AVIO	Avionic modulations (DME, VOR, ILS, Marker Beacon)
APVSG(-X)	Option VREF	Variable external reference
APVSG(-X)	Option AWGN	Additive white gaussian noise generation, bandwidth selective
APVSG(-X)	Option SD	MicroSD card support for non-volatile storage of I/Q data

ACCESSORIES	PRODUCT	DESCRIPTION
APVSG	Option EB	External power bank adapter cable
APVSG	Option BAG	Portable bag

SERVICE	PRODUCT	DESCRIPTION
APVSG(-X)	Option WE	One year warranty extension
APVSG(-X)	Option ReCal	Recalibration with certificate (recommended: 2 years interval)

GENERAL CHARACTERISTICS

Remote Programming Interfaces

- Ethernet 100BaseT LAN Interface,
- USB 2.0 Device Interface
- GPIB (IEEE-488.2,1987) with listen and talk (Option GPIB)
- Control Language: SCPI Version 1999.0

Power Requirements

Single Channel Model

Input Voltage Range	24 VDC ± 3.0 V	
Power Consumption (typ) (without Options)	45W 55W 65W	APVSG04 APVSG06, APVSG12 APVSG20, APVSG40
Main Adapter supplied (without Options)	100 - 240 VAC 50/60Hz; 24 VDC and 65W max	APVSG04, APVSG06, APVSG12
	100 - 240 VAC 50/60Hz; 24 VDC and 160 W max	APVSG20, APVSG40
Multi-Channel Model		
Input Voltage Range	100 - 240 VAC 50/60Hz	
Fuse Rating	5x20mm, 250 V, 6.3 AT	2-poles, each
Power Consumption (max)	200 W 400 W	APVSG4-x, APVSG6-2, APVSG12-2, APVSG20-2, APVSG40-2 APVSG6-4, APVSG12-4, APVSG20-4, APVSG40-4

Environmental (Levels similar to MIL-PRF-28800F Class 3/4)
Environmental stress Samples of this product have been type tested to be robust against the environmental stresses of storage, transportation, and end-use; those stresses to temperature, humidity, shock, vibration, altitude, and power line conditions.

Operating temperature range: 0 to 45 °C
Storage temperature range: –40 to 70 °C
Operating and storage altitude up to 15,000 feet (4600 m)

CE notice
EMC complies to EMC regulations and directives for emission and immunity to interference (EN 61326-1 Industrial, EN/IEC 61326-2-1).
Safety complies to applicable safety regulation IEC/EN 61010-1.
This product complies with directive 2011/65/EU.

Single-channel (portable / benchtop)
Weight:
2.7 kg (6 lbs) to 4.0 kg (8.8 lbs) net without main adapter
Dimensions:
incl. rubber: 124 mm H x 183 mm W x 305 mm L [4.88 in H x 7.20 in W x 12.01 in L]
with RF output connector type N: 124 mm H x 183 mm W x 310 mm L [4.88 in H x 7.20 in W x 12.20 in L]

Multi-channel (rack-mountable) 19'' 2HU enclosure
Weight:
18 kg (37 lbs) net, ≤ 25 kg (8 lbs) shipping
Dimensions:
Body: 88 mm H x 444 mm W x 567mm L [3.5 in H x 17.5 in W x 22.3 in L]
Front panel: 88 mm H x 486.2mm W [3.46 in H x 19.14 in W]

Recommended calibration cycle: 24 months

Document History

Version/Status	Date	Author	Notes
V110	2019-10-28	jk	Update
V111	2020-02-20	yg/jk	Update
V113	2020-03-31	jk	Analog modulations revised, option EI/Q added, measurement plots added
V114	2020-04-31	jk	New plots added
V120	2020-11-10	jk	Extended to multi-channel, 12 GHz model
V121	2021-1-10	jk	Power specs refined, data plots added
V122	2021-05-03	rp	Pulse modulation, marker, multi-function in/outputs specs refined
V123	2021-06-01	ee	Updated product images
V124	2021-06-25	jk	Refined power ranges
V125	2021-07-20	rp	Updated FCP/baseband generator
V126	2022-02-04	jk	Plot update
V127	2022-03-21	jk/rp	Update
V128	2022-03-29	Jk ee	Option PE2 for APVSG6/12 , Option PE4, Option LN+, Reference bypass info Updated product images

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