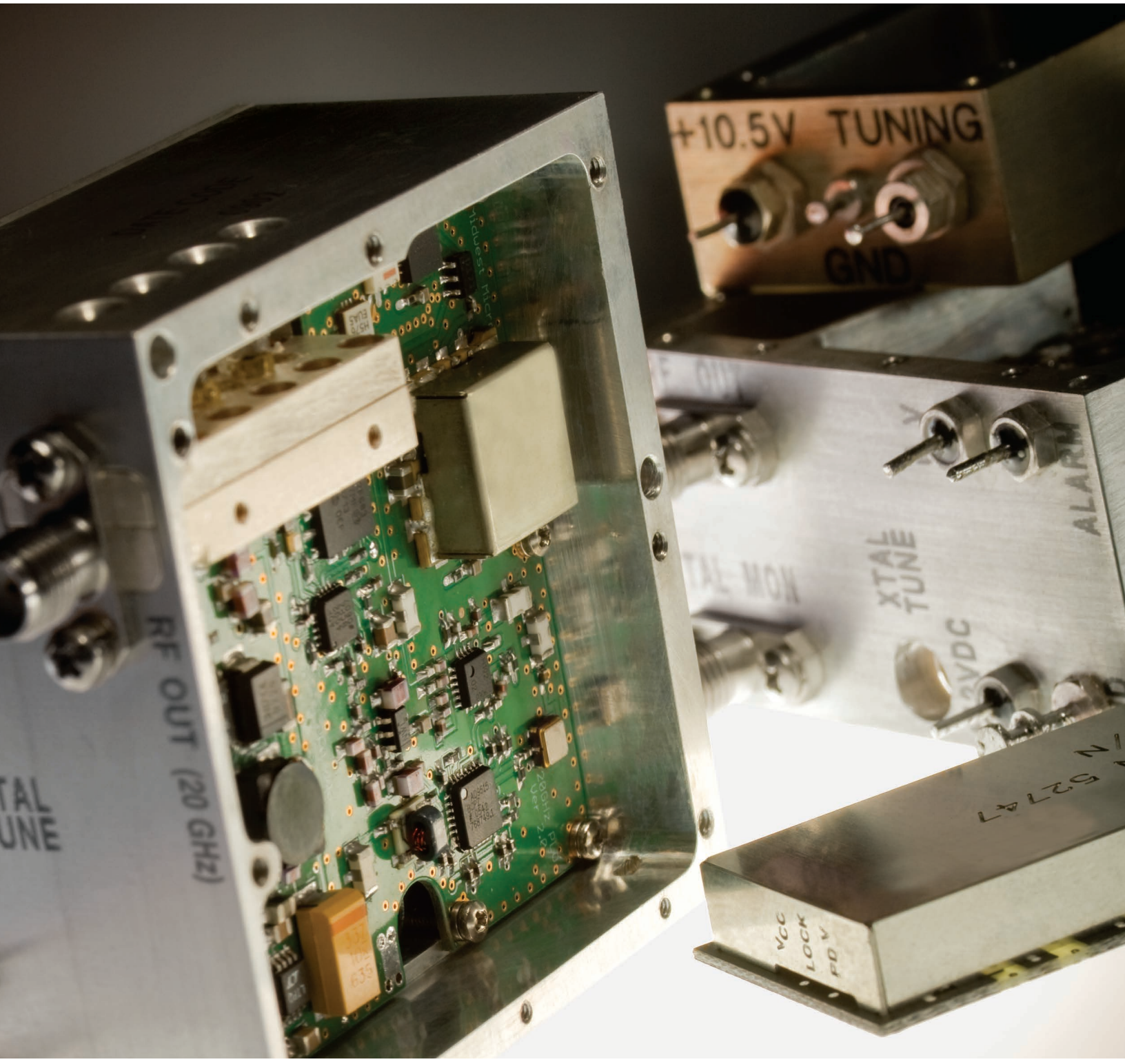
Low Phase Noise Frequency Sources



api technologies corp.

Frequency Source Solutions

API Technologies offers an extensive design library of low phase noise sources from both our talented staff of RF Engineers and the rich heritage of Radian Technologies, Magnum Microwave and EMF Systems. API combines these engineers with other team members, specialists in their own right who design high performance amplifiers, mixers, filters, and switches... optimizing your overall design for superior performance and value.



API engineers offer a broad selection of Frequency Sources to meet today's demanding applications. At the core of our standard product line are five key solutions including:

- Phase Locked Oscillators
- Dielectric Resonator Oscillators
- Coaxial Resonator Oscillators
- Comb Generators
- Synthesizers

10GHz
MMS_PLO_20G_L
REF IN
+12V

More Features. Better Value.

The API Technologies Difference

At the core of API's designs is our ceramic based resonator circuitry exhibiting very low loss and dependable stability even during extreme temperature changes. To reduce modulation sidebands and microphonics during high vibration and shock, their designs insure that the resonator is securely and firmly attached to either the housing or an acceleration dampening platform. All these features added together give you, the customer, the API Technologies Advantage.



- Laser sealed enclosures to ensure Robust Hermetic Sealing
- We design our own filters in-house allowing fine tuning for optimum performance with the adjacent circuitry
- Our custom designed and tuned filters and mixers significantly outperform off-the-shelf components and contribute to our optimized full system performance
- With resident thin film hybrid, oscillator, and amplifier design and fabrication support API designs complete solutions for demanding requirements.

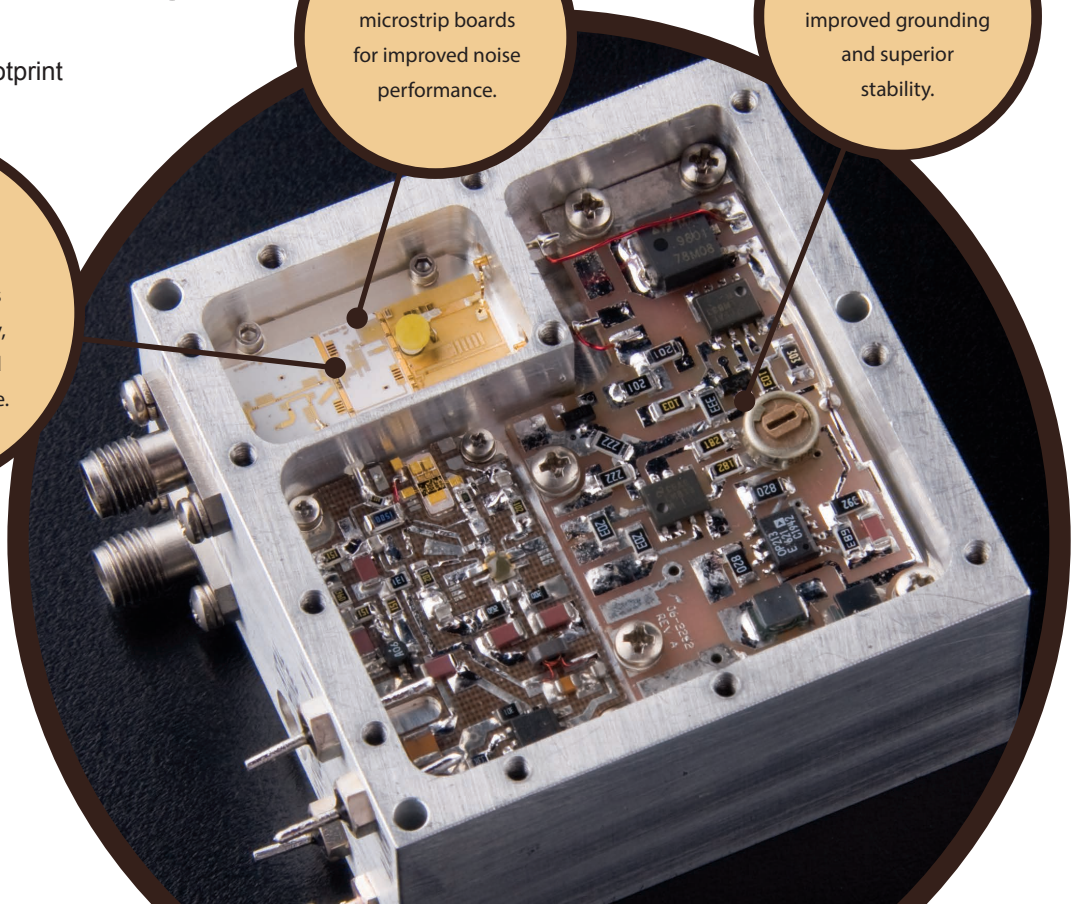
Small Surface Mount Packages available for many DRO designs

Our .500" Square Surface Mount DRO designs offer low cost and a smaller footprint

Custom thin film microstrip boards for improved noise performance.

Metallized PC backplanes for improved grounding and superior stability.

Screened High Performance Voltage Tuned Varactor Diodes for tuning repeatability, long term stability and predictable phase noise.



We incorporate a Standard Integral Voltage Regulator

- Supply Voltage Flexibility
- Improved Phase Noise
- Reduced Spurious Signals

Dielectric Resonator Oscillators and Coaxial Resonator Oscillators

API's line of Dielectric Resonator Oscillators (DROs) and Coaxial Resonator Oscillators (CROs) are designed and built with both Small size and Low Phase Noise in mind. Packed full of standard features, our complete line of free running DRO designs operate from 500 MHz to 21.5 GHz, with "modified standard" units available in all frequencies from HF to Ku band.

DROs / CROs

Series	Frequency	Output Power (dBm)	Phase Noise @ 100 kHz Offset (dBc/Hz)	Harmonics (dBc)	Spurious (dBc)	Supply (Volts/mA)
511 Series CRO	500-700 MHz	10	-143	-25	-80	15V / 70 mA
511 Series CRO	700-900 MHz	10	-142	-25	-80	15V / 70 mA
511 Series CRO	900-1100 MHz	10	-140	-25	-80	15V / 70 mA
511 Series CRO	1100 MHz-1200 MHz	10	-138	-25	-80	15V / 70 mA
511 Series CRO	1200 MHz-1400 MHz	10	-137	-25	-80	15V / 70 mA
511 Series CRO	1400 MHz-1600 MHz	10	-136	-25	-80	15V / 70 mA
511 Series CRO	1600 MHz-1800 MHz	10	-134	-25	-80	15V / 70 mA
511 Series CRO	1800 MHz-2000 MHz	10	-133	-25	-80	15V / 70 mA
MDR2100-2500 DRO	2500-3500 MHz	10	-130	-20	-80	15V / 90 mA
512 Series DRO	2000-3000 MHz	10	-132	-20	-80	15V / 90 mA
MDR2100-3500 DRO	3500-4500 MHz	10	-130	-20	-80	15V / 90 mA
512 Series DRO	3000-4000 MHz	10	-131	-20	-80	15V / 90 mA
MDR2100-4500 DRO	4500-5500 MHz	10	-130	-20	-80	15V / 90 mA
513 Series DRO	4000-5000 MHz	10	-130	-20	-80	15V / 90 mA
MDR2100-5500 DRO	5500-6500 MHz	10	-128	-20	-80	15V / 90 mA
513 Series DRO	5000-6000 MHz	10	-128	-20	-80	15V / 90 mA
MDR2100-6500 DRO	6500-7500 MHz	10	-128	-20	-80	15V / 90 mA
514 Series DRO	6000-7000 MHz	10	-127	-20	-80	15V / 90 mA
MDR2100-7500 DRO	7500-8500 MHz	10	-125	-20	-80	15V / 90 mA
514 Series DRO	7000-8000 MHz	10	-126	-20	-80	15V / 90 mA
MDR2100-8500 DRO	8500-9500 MHz	10	-125	-20	-80	15V / 90 mA
515 Series DRO	8000-9000 MHz	10	-125	-20	-80	15V / 90 mA
MDR2100-9500 DRO	9.5-10.5 GHz	10	-125	-20	-80	15V / 90 mA
515 Series DRO	9-10 GHz	10	-124	-20	-80	15V / 90 mA
MDR2100-10500 DRO	10.5-11.5 GHz	10	-125	-20	-80	15V / 90 mA
516 Series DRO	10-11 GHz	10	-122	-20	-80	15V / 90 mA
MDR2100-11500 DRO	11.5-12.5 GHz	10	-120	-20	-80	15V / 90 mA
516 Series DRO	11-12 GHz	10	-121	-20	-80	15V / 90 mA
MDR2100-12500 DRO	12.5-13.5 GHz	10	-118	-20	-80	15V / 90 mA
517 Series DRO	12-13 GHz	10	-120	-20	-80	15V / 90 mA
MDR2100-13500 DRO	13.5-14.5 GHz	10	-118	-20	-80	15V / 90 mA
517 Series DRO	13-14 GHz	10	-119	-20	-80	15V / 90 mA
MDR2100-14500 DRO	14.5-15.5 GHz	10	-115	-20	-80	15V / 90 mA
518 Series DRO	14-15 GHz	10	-118	-20	-80	15V / 90 mA
MDR2100-15500 DRO	15.5-16.5 GHz	10	-115	-20	-80	15V / 90 mA
518 Series DRO	15-16 GHz	10	-116	-20	-80	15V / 90 mA
MDR2100-16500 DRO	16.5-17.5 GHz	10	-115	-20	-80	15V / 90 mA
MDR2100-17500 DRO	17.5-18.5 GHz	10	-115	-20	-80	15V / 90 mA
MDR2100-18500 DRO	18.5-19.5 GHz	10	-113	-20	-80	15V / 90 mA
MDR2100-19500 DRO	19.5-20.5 GHz	10	-113	-20	-80	15V / 90 mA
MDR2100-20500 DRO	20.5-21.5 GHz	10	-113	-20	-80	15V / 90 mA

For all part numbers, Output Power is 10 dBm and Spurious is -80 dBc.

All performance data listed is defined as typical measured at 25°C.

For Superior Phase Noise Performance, API engineers integrate both a doubler and a x4 multiplier, optimizing the 100 MHz reference signal.

Integral low loss band pass filter for Superior Harmonic Suppression.

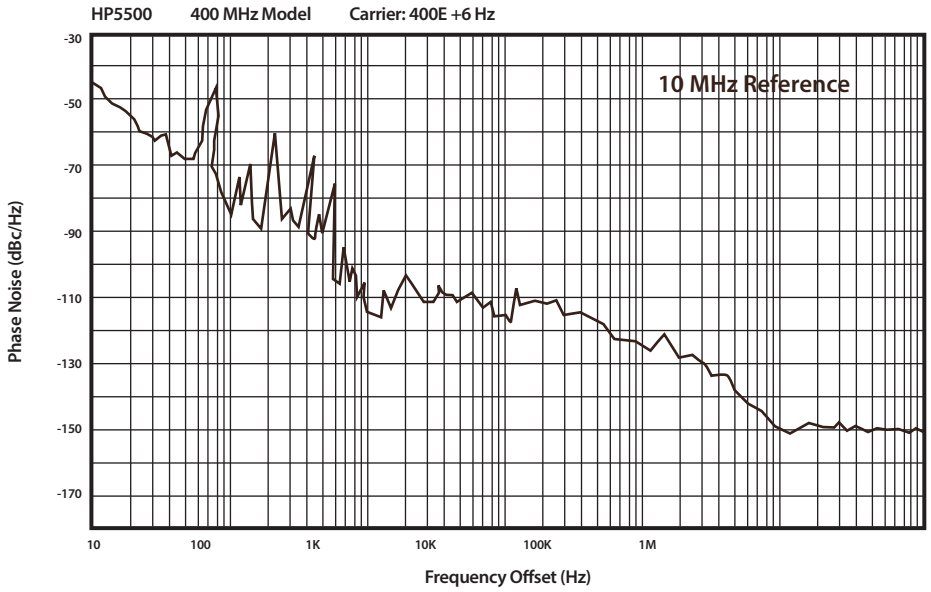
Another Standard feature is Internal Crystal Frequency Monitoring for precision tuning and ideal reference performance.

Phase Lock Indicator output for built-in test or error detection.

An integral voltage regulator is incorporated to ensure Superior Phase Noise Performance and Reduced Spurious Signals.

Loaded with Standard Features

Series 600 PLO



Our Exceptional Low Phase Noise Performance Offers You

- Better receiver sensitivity
- Improved sub-clutter visibility
- Enhanced system noise floor
- Lower bit error rate

Design Benefits

- The oscillator is isolated from the phase lock circuitry for improved spurious performance.
- Isolators are also incorporated for enhanced performance when needed.

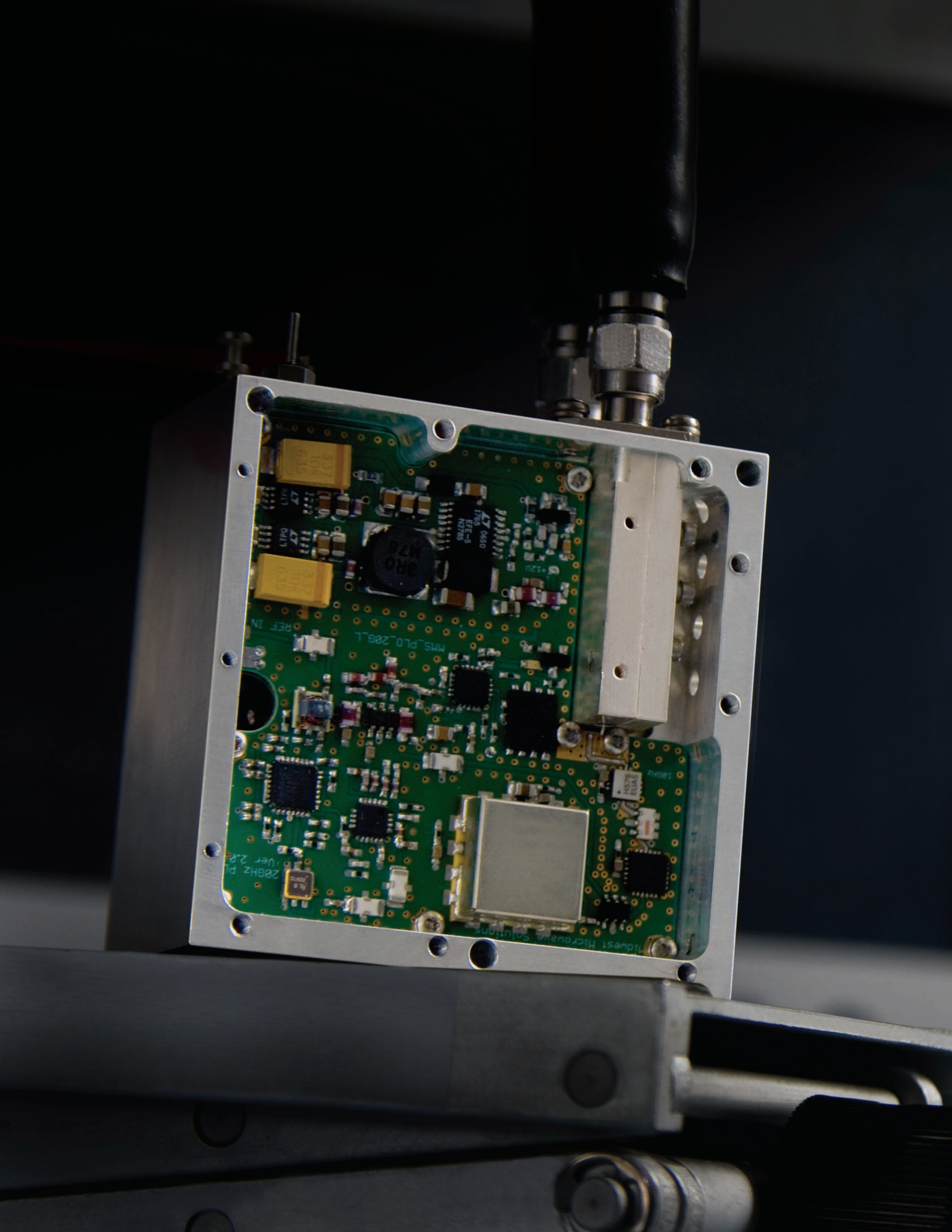
| Phase Locked Oscillators |

API Technologies' experience with Phase Locked Oscillators covers a period of 35 years and literally hundreds of proven designs. We've worked closely with systems engineers on some of the most technically sophisticated programs in the country. API Technologies' PLO designs have a rich history of not only Superior Low Phase Noise Performance, but are packed with Standard Features giving you…the API Advantage.

PLOs

Part Number		Frequency	Output Power (dBm)	Phase Noise @10 kHz Offset (dBc/Hz)		Harmonics (dBc)	Spurious (dB)	Supply (Volts/mA)	
Int. Ref.	Ext. Ref.			Int. Ref.	Ext. Ref.			Int. Ref.	Ext. Ref.
611208	621499	500 MHz	+10	-133	-138	-25	-70	15/150	15/120
611210	621501	600 MHz	+10	-132	-137	-25	-70	15/150	15/120
611212	621503	700 MHz	+10	-130	-135	-25	-70	15/150	15/120
611214	621505	800 MHz	+10	-129	-134	-25	-70	15/150	15/120
611216	621507	900 MHz	+10	-128	-133	-25	-70	15/150	15/120
611218	621509	1000 MHz	+10	-127	-132	-25	-70	15/150	15/120
611220	621511	1100 MHz	+10	-126	-131	-25	-70	15/150	15/120
611222	621513	1200 MHz	+10	-125	-130	-25	-70	15/150	15/120
611224	621515	1300 MHz	+10	-125	-130	-25	-70	15/150	15/120
611226	621517	1400 MHz	+10	-124	-129	-25	-70	15/150	15/120
611228	621519	1500 MHz	+10	-123	-128	-25	-70	15/150	15/120
611230	621521	1600 MHz	+10	-123	-128	-25	-70	15/150	15/120
611232	621523	1700 MHz	+10	-122	-127	-25	-70	15/150	15/120
611234	621525	1800 MHz	+10	-122	-127	-25	-70	15/150	15/120
611236	621527	1900 MHz	+10	-121	-126	-25	-70	15/150	15/120
611238	621529	2000 MHz	+10	-121	-126	-25	-70	15/150	15/120
MDR5100-2500	MDR6100-2500	2500 MHz	+10	-120	-120	-20	-80	15/275	15/150
612110	622177	3000 MHz	+10	-117	-122	-25	-70	15/150	15/120
MDR5100-4000	MDR6100-4000	4000 MHz	+10	-115	-115	-20	-80	15/275	15/150
613070	623115	5000 MHz	+10	-113	-118	-25	-70	15/150	15/120
MDR5100-6000	MDR6100-6000	6000 MHz	+10	-115	-115	-20	-80	15/275	15/150
614049	624107	7000 MHz	+10	-110	-115	-25	-70	15/150	15/120
MDR5100-8000	MDR6100-8000	8000 MHz	+10	-115	-115	-20	-80	15/275	15/150
615072	625133	9000 MHz	+10	-108	-113	-25	-70	15/150	15/120
MDR5100-10000	MDR6100-10000	10 GHz	+10	-110	-110	-20	-80	15/275	15/150
616058	626106	11 GHz	+10	-106	-111	-25	-70	15/150	15/120
MDR5100-12000	MDR6100-12000	12 GHz	+10	-110	-110	-20	-80	15/275	15/150
617050	627122	13 GHz	+10	-105	-110	-25	-70	15/150	15/120
MDR5100-14000	MDR6100-14000	14 GHz	+10	-105	-105	-20	-80	15/275	15/120
MDR5100-15000	MDR6100-15000	15 GHz	+10	-105	-105	-20	-80	15/275	15/120
MDR5100-16000	MDR6100-16000	16 GHz	+10	-105	-105	-20	-80	15/275	15/120
MDR5100-17000	MDR6100-17000	17 GHz	+10	-100	-100	-20	-80	15/275	15/120
MDR5100-18000	MDR6100-18000	18 GHz	+10	-100	-100	-20	-80	15/275	15/120
MDR5100-19000	MDR6100-19000	19 GHz	+10	-100	-100	-20	-80	15/275	15/120
MDR5100-20000	MDR5100-20000	20 GHz	+10	-100	-100	-20	-80	15/275	15/120
MDR5100-21000	MDR6100-21000	21 GHz	+10	-95	-95	-20	-80	15/275	15/120

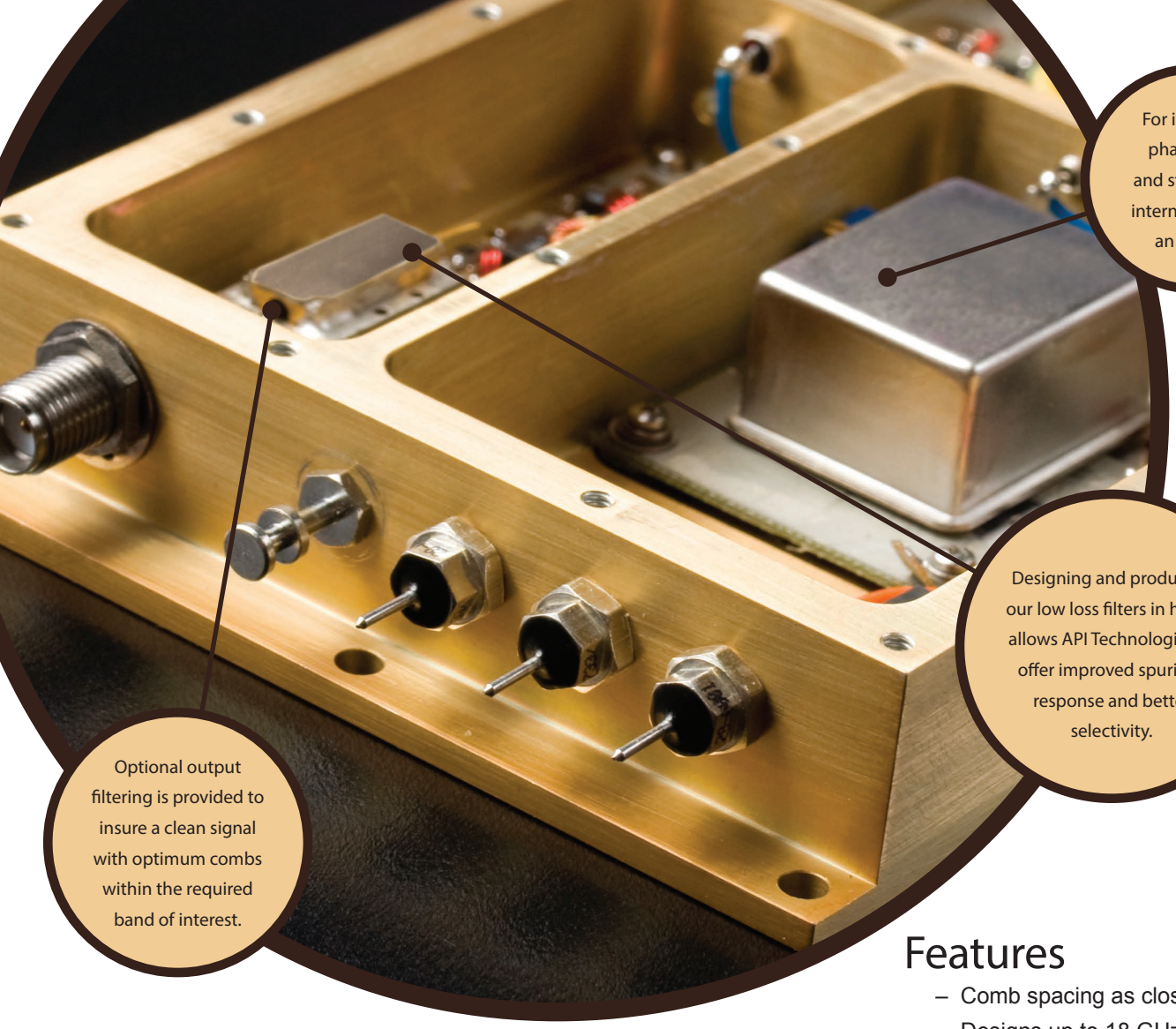
Phase noise measured using an API Technologies crystal oscillator at 25°C. External reference phase noise performance dependent on customer's supplied source. 100 MHz Reference. All performance data is defined as typical measured at 25°C.


MMS_PLO_206L
REF IN
+12V
180HZ



Testing

Testing our designs using modern equipment like this 4 port Agilent Network Analyzer allows API Engineers and Technicians to confirm performance of their designs at both ends of the spectrum, as well as deliver a complete and comprehensive data package to their customer.

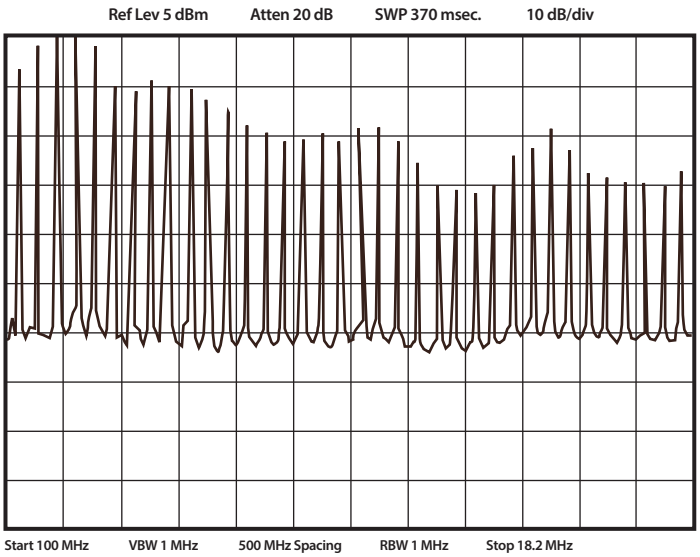


Features

- Comb spacing as close as 1 MHz
- Designs up to 18 GHz output
- Power Flatness to -5 dBc
- For improved noise and stability we can phase lock to an external frequency source

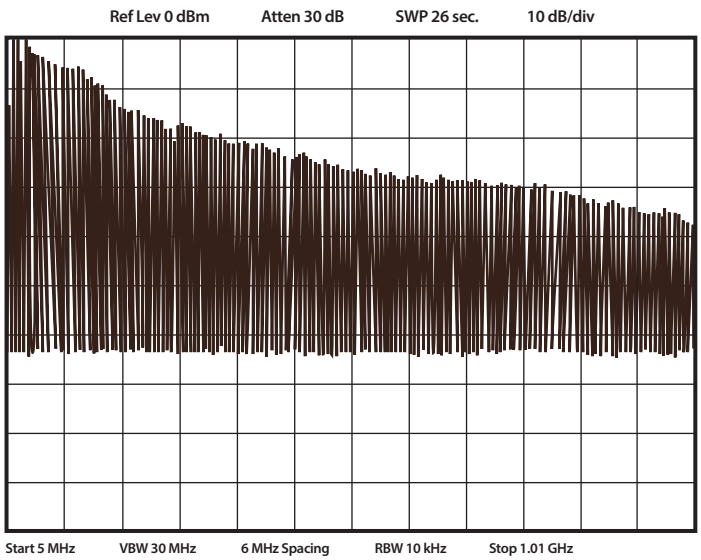
Series 95200

API's designs offer high output power levels to meet today's demanding requirements.



Series 95200

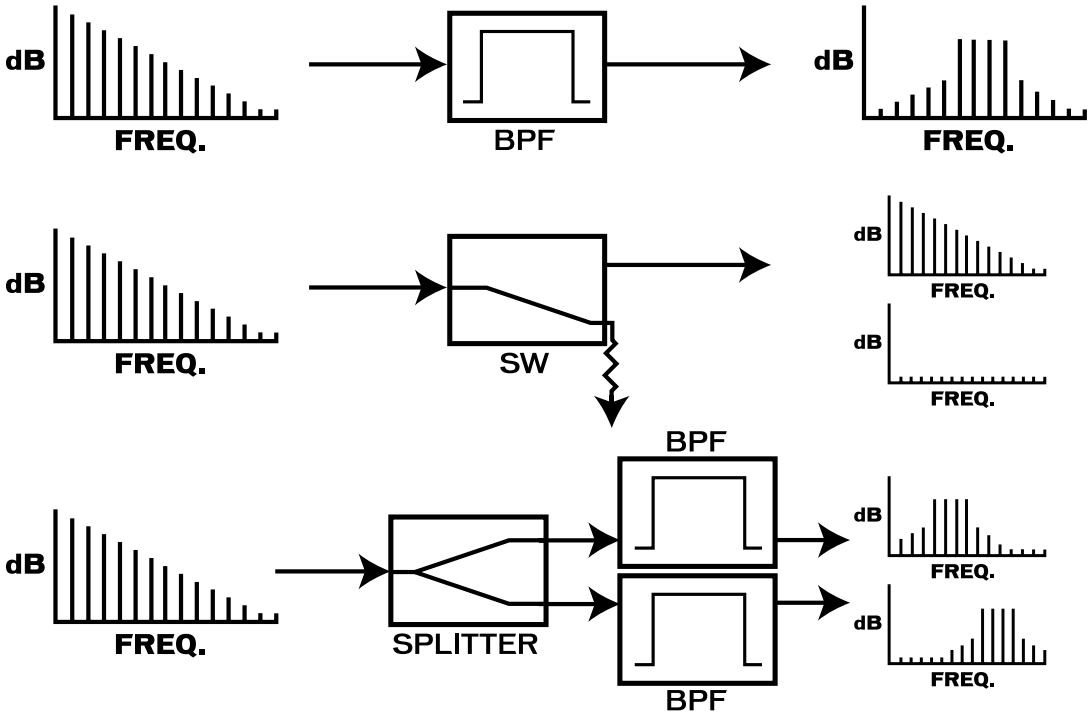
API Technologies designs its combs to maximize Output Power even over multiple octave bandwidths.



Comb Generators

API's Series 95 Comb Generators use a Step Recovery Diode (SRD) to generate very narrow voltage spikes. These in turn produce an output frequency spectrum rich in harmonics. The spacing between the signals is equal to the source that drives the SRD which in most cases is a stable crystal oscillator. The crystal oscillator is normally internal, however an external signal can be used to drive the SRD. These features combined with proven reliability and value, is why API Technologies is your #1 choice for Comb Generators.

Adding modifications to their standard line of Comb Generators is a service API Technologies promotes with each and every model. Modifications may include:



OPTION 1

Optional output bandpass filters target a specific band of interest.

OPTION 2

Fast GaAs or High Isolation PIN Diode switches can be added.

OPTION 3

Splitters and multiple filter topologies can be integrated to further customize the Comb to meet your specific requirements.

Comb Generators

Model	Comb Spacing (MHz)	Output Power Level (dBm @ Frequency)	Output Power Level (dBm @ Frequency)	In-band Spurious (dBc)	Frequency Stability (ppm/°C)	Supply (Volts/mA)
95220	1	0 dBm @ 1 MHz	-50 dBm @ 2 GHz	-80	5	15V / 150 mA
95221	10	0 dBm @ 10 MHz	-50 dBm @ 5 GHz	-80	5	15V / 150 mA
95222	25	0 dBm @ 25 MHz	-50 dBm @ 7 GHz	-80	5	15V / 150 mA
95223	50	0 dBm @ 50 MHz	-50 dBm @ 15 GHz	-80	5	15V / 150 mA
95224	75	0 dBm @ 75 MHz	-50 dBm @ 18 GHz	-80	5	15V / 150 mA
95225	100	0 dBm @ 100 MHz	-45 dBm @ 18 GHz	-80	5	15V / 150 mA
95226	200	0 dBm @ 200 MHz	-40 dBm @ 18 GHz	-80	15	15V / 150 mA
95227	250	0 dBm @ 250 MHz	-40 dBm @ 18 GHz	-80	15	15V / 150 mA
95228	500	0 dBm @ 500 MHz	-35 dBm @ 18 GHz	-80	15	15V / 150 mA
95229	1000	0 dBm @ 1000 MHz	-30 dBm @ 18 GHz	-80	15	15V / 150 mA

Performance data listed using a Low Noise Internal Reference. All performance data listed is defined as typical measured at 25°C

Synthesizers

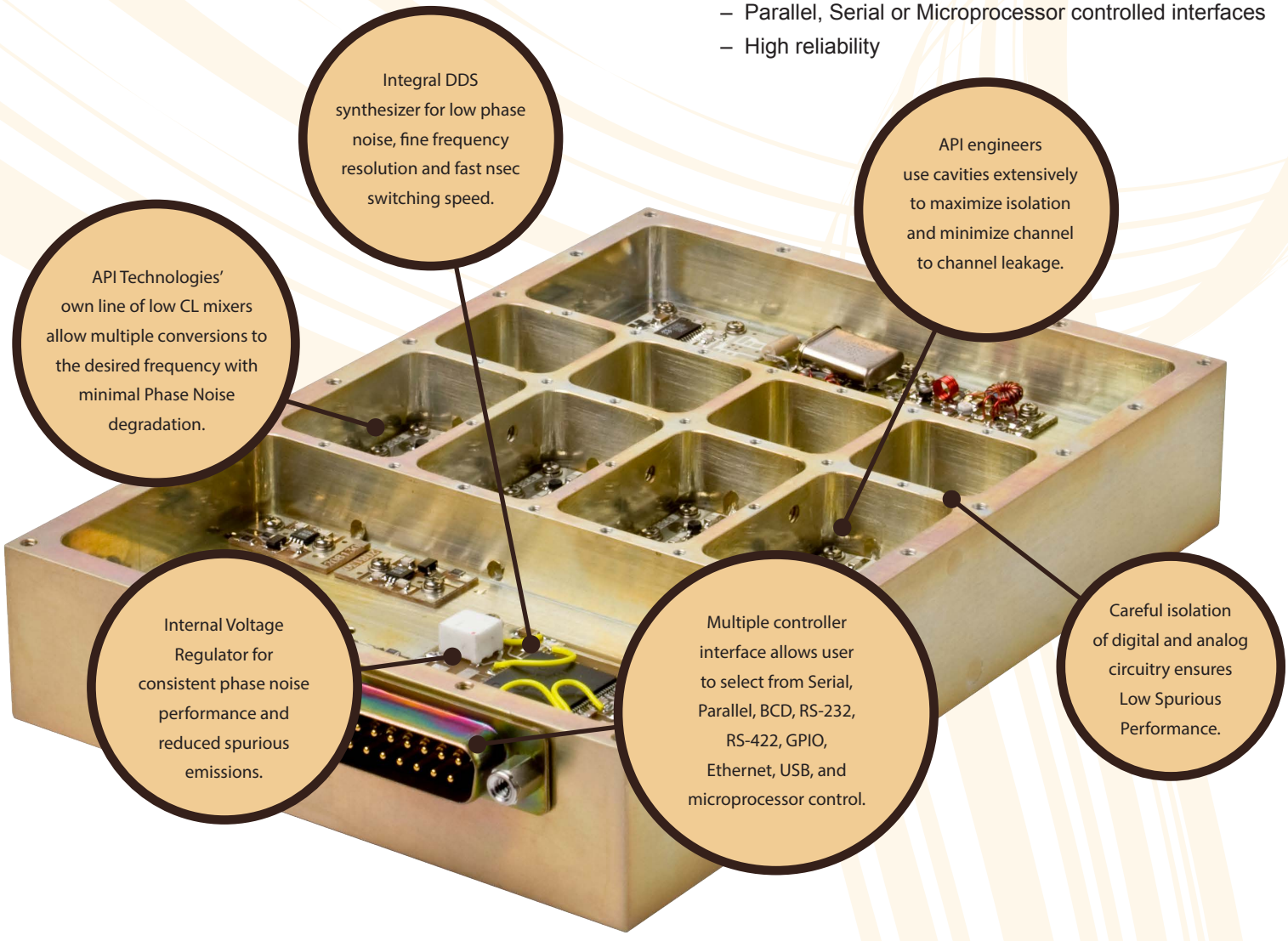
API Technologies' Series 400 Synthesizers offer Wide Bandwidth, Multiple Step Size Options, Fast Switching Speed, and Low Phase Noise combined with Exceptional Value and Reliability. Frequency control options on these designs include Serial/Parallel inputs, BCD/Binary format, or traditional thumb-wheel switches. API Technologies also offers several different options for locking to a specific source. The customer may choose internally referenced crystal oscillators or low ppm (high stability) OCXOs. Externally referenced frequencies can range from 10 MHz to 100 MHz.

Exceptional Low Phase Noise and High Reliability

These synthesizers feature rugged construction and the latest circuit techniques which makes them suitable for either military or commercial applications. APIs feature rich designs, coupled with Exceptional Low Phase Noise and High Reliability…ensures you, the customer, experience the API Advantage.

Features

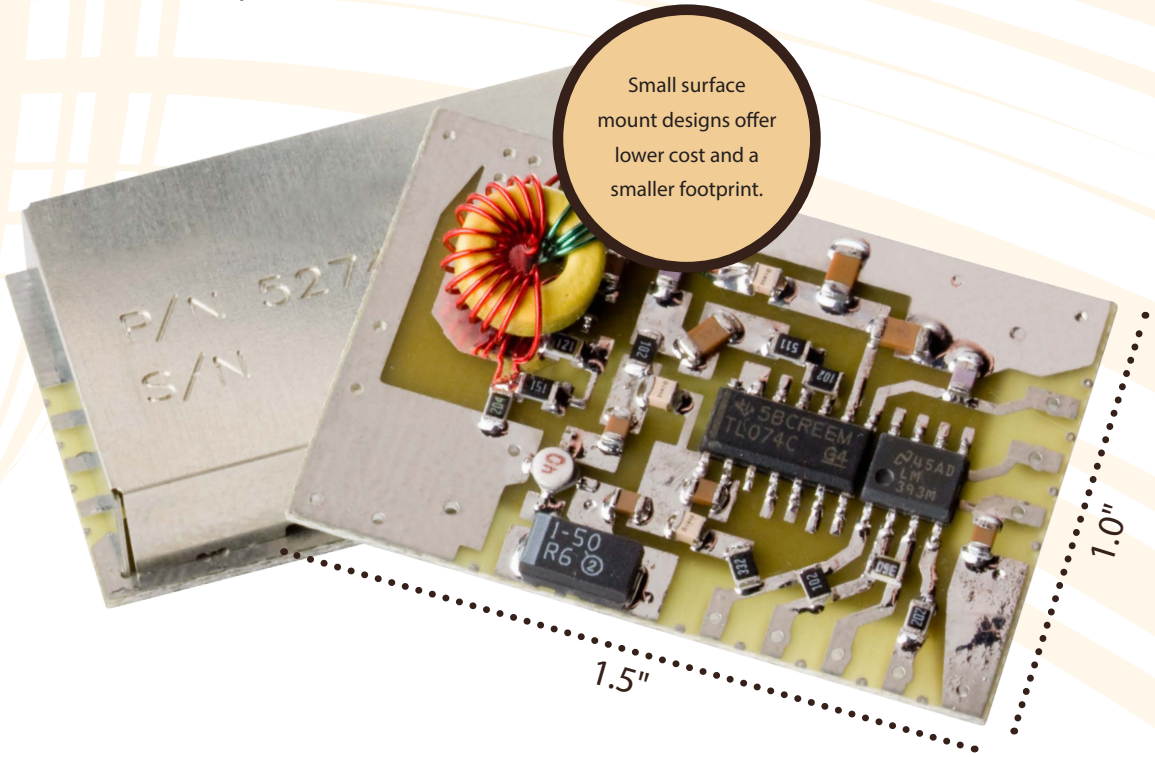
- 10 MHz to 14 GHz output
- Exceptional Low Phase Noise Performance
- Low Spurious outputs
- Internally and Externally referenced models
- Step Size typically 1 kHz to 10 MHz
- Parallel, Serial or Microprocessor controlled interfaces
- High reliability



For more information please call us at
888.553.7531

High Quality. Cost Effective.

These lower cost surface-mount synthesizers are ideal for commercial applications where cost is the leading performance driver. They are also designed for low current consumption (25 mA) and employ a 3-wire serial interface for microprocessor compatible frequency control. To reduce the housing dimensions, Spectrum Microwave uses integrated phase locked loop circuit, yielding a small 1" x 1.5" x .25" footprint, fine frequency resolution and flexibility in reference selection.



Externally Referenced

Series	Frequency	Output Power (dBm)	Phase Noise @ 10 kHz Offset (dBc/Hz)	Harmonics (dBc)	Spurious (dBc)	Supply (Volts/mA)
441	10 MHz to 1000 MHz	13	-130	-25	-70	15/150
442	1-2 GHz	13	-125	-25	-70	15/150
443	2-4 GHz	13	-120	-25	-70	15/200
444	4-8 GHz	13	-115	-25	-70	15/200
445	8-14 GHz	13	-105	-25	-70	15/200

Internally Referenced

Series	Frequency	Output Power (dBm)	Phase Noise @ 10 kHz Offset (dBc/Hz)	Harmonics (dBc)	Spurious (dBc)	Supply (Volts/mA)
451	10-100 MHz	13	-135	-25	-70	15/150
452	100-500 MHz	13	-135	-25	-70	15/150
453	500-1000 MHz	13	-130	-25	-70	15/150
454	1-2 GHz	13	-130	-25	-70	15/150
455	2-4 GHz	13	-125	-25	-70	15/200
456	4-8 GHz	13	-120	-25	-70	15/200
457	8-14 GHz	13	-110	-25	-70	15/200

Externally Referenced Phase Noise performance dependent on customer's supplied source.

Cutting Edge Software

API Technologies understands that optimization through the use of modern software allows the engineer to accurately simulate and model designs. This process enables engineering to account for environmental considerations including linear and nonlinear parameters in both the frequency and time domains, along with addressing parasitics that can be identified at this stage and removed. Software that API engineers use on a daily basis include:

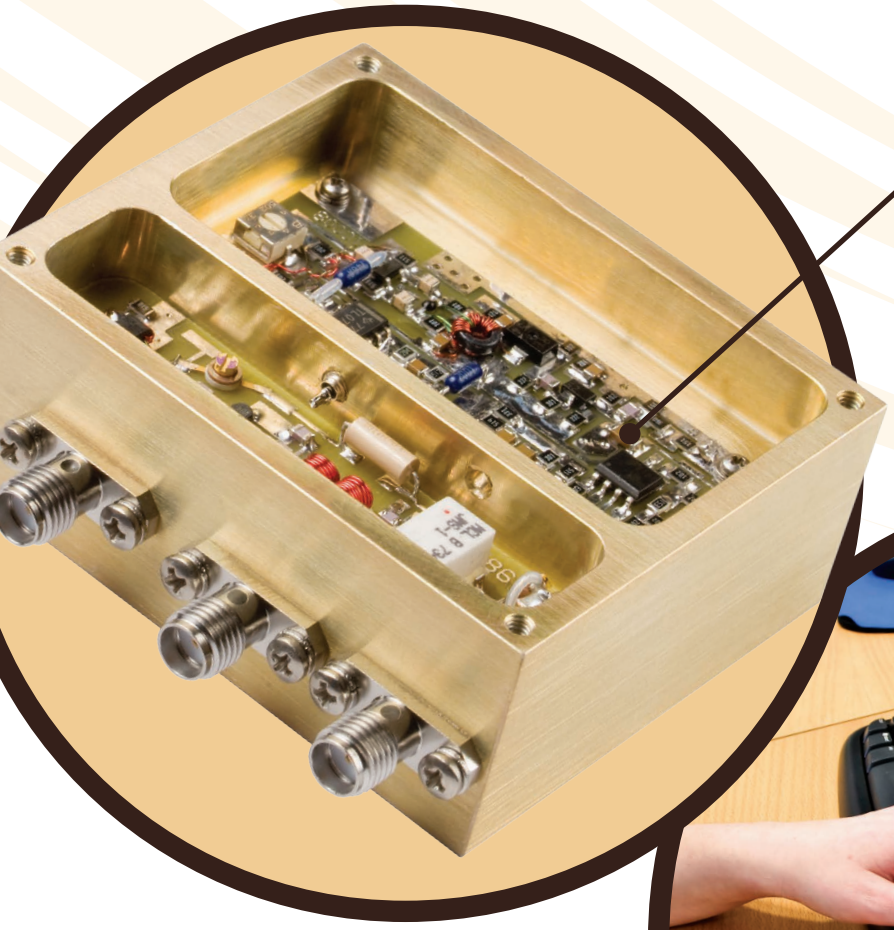
- **SolidWorks**
- **Labview**
- **Agilent Genesys**
- **AutoCAD**
- **Cadence Allegro**
- **Ansoft Designer**
- **Sonnet EM Simulator**
- **Agilent ADS Suite**





Adding Value to Our Standard Designs

At API, adding custom features to a standard stock unit is simple and affordable. Our modified standard designs enable the customer to modify or integrate custom features into a Commercial Off The Shelf (COTS) product, without the added costs commonly incurred with other frequency source vendors.



Adding value is a hallmark of our renowned reputation in the industry...

A customer needed to retain access to their external 120 MHz reference in order to maintain a consistent signal throughout the system. API engineers designed in place a splitter so that the external reference could be sampled without distortion.



Up To The Challenge

Improving upon a previous vendor's performance is a challenge API engineers undertake with pride, as in the case of a synthesizer involved in an all-weather radar system. The customer's radars were in the -47 dBc range for clutter rejection and they were looking for a synthesizer to get them to -54 dBc. The previous vendor delivered a synthesizer which peaked out at only -52 dBc. When they called API Technologies, our engineers took on the challenge and delivered a unit which improved overall performance to -64 dBc.



Problem solving to meet your needs

A customer came to API Technologies requesting additional bit error protection. They needed to guard against losing the reference signal and possibly compromising the accuracy of the PLO's output. Our engineers added a unique bit error output signal which provided the customer's engineers protection against a disabled reference signal.

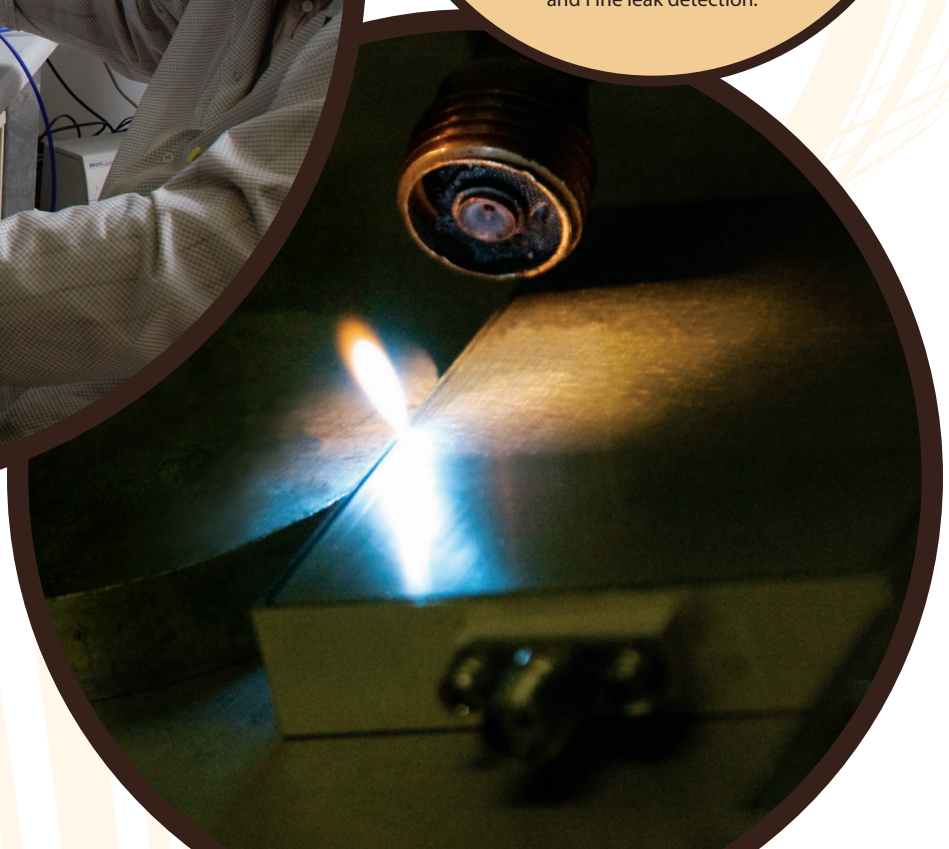
Testing and Verification

Integral to finding solutions to frequency control problems is the ability to test for compliance. In order to successfully test these complex designs, we have invested heavily in high-performance test equipment, including Agilent PNA network analyzers with calibrated performance to 50 GHz, Low Phase Noise Signal Generators, and Agilent ES5500 Phase Noise Measurement Systems, just to name a few. Using this equipment, API Technologies has measured the vibration-induced phase noise modulation performance of systems and components employing narrow-band filtering. Our ability to conduct such a wide range of tests in-house allows for a faster turnaround of complete design solutions.



Phase Noise Measurements are accomplished using a modified ES5500, achieving measurements as low as -180 dBc/Hz.

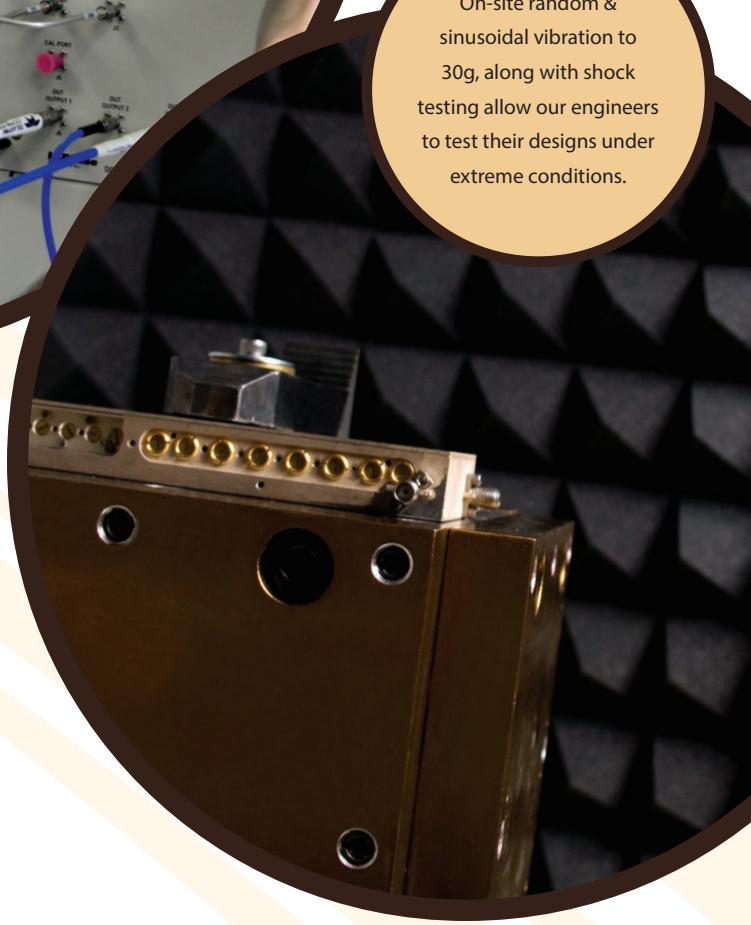
API Technologies' inventory of sealing alternatives include Seam Sealing, Projection Welding and Laser Welding which provide a very reliable hermetic seal, all while maintaining a cool, stable environment for the package and its temperature sensitive contents. Hermetic seam sealing also maintains environmental integrity to pass the rigors of MIL-PRF-38534 Methods 1014 Conditions A & C for both Gross and Fine leak detection.





API Technologies over temperature testing involves not only functional testing, but parametric testing as well.

On-site random & sinusoidal vibration to 30g, along with shock testing allow our engineers to test their designs under extreme conditions.



World Class Quality

API Technologies delivers the world class quality and consistency that our customers demand. The efficiencies gained from our manufacturing procedures enable us to cost effectively produce small volume custom products and high run standard products. We monitor critical phases of the production process with data logging technology.

ISO 9001:2000 Quality Operating System

- **MIL-PRF-38534 product screening and qualification capability**
  - Device screening and groups A, B, C, and D qualification (when required by order)
  - Environmental testing per MIL-STD-883 test methods
- **Other specifications guidelines**
  - J-STD-001 Class 3 and IPC-A-610, for eutectic attach and general soldering processes
  - IPC-7711 and IPC-7721, for rework and authorized repair operations
- **Quality assurance programs**
  - Calibration recall program for test and measurement equipment
  - Facility ESD program
  - Failure analysis and corrective action system
  - Internal ISO audit program
  - Operator training program

For more information please call us at
888.553.7531

| Design Resources |



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