

Frequency Sources

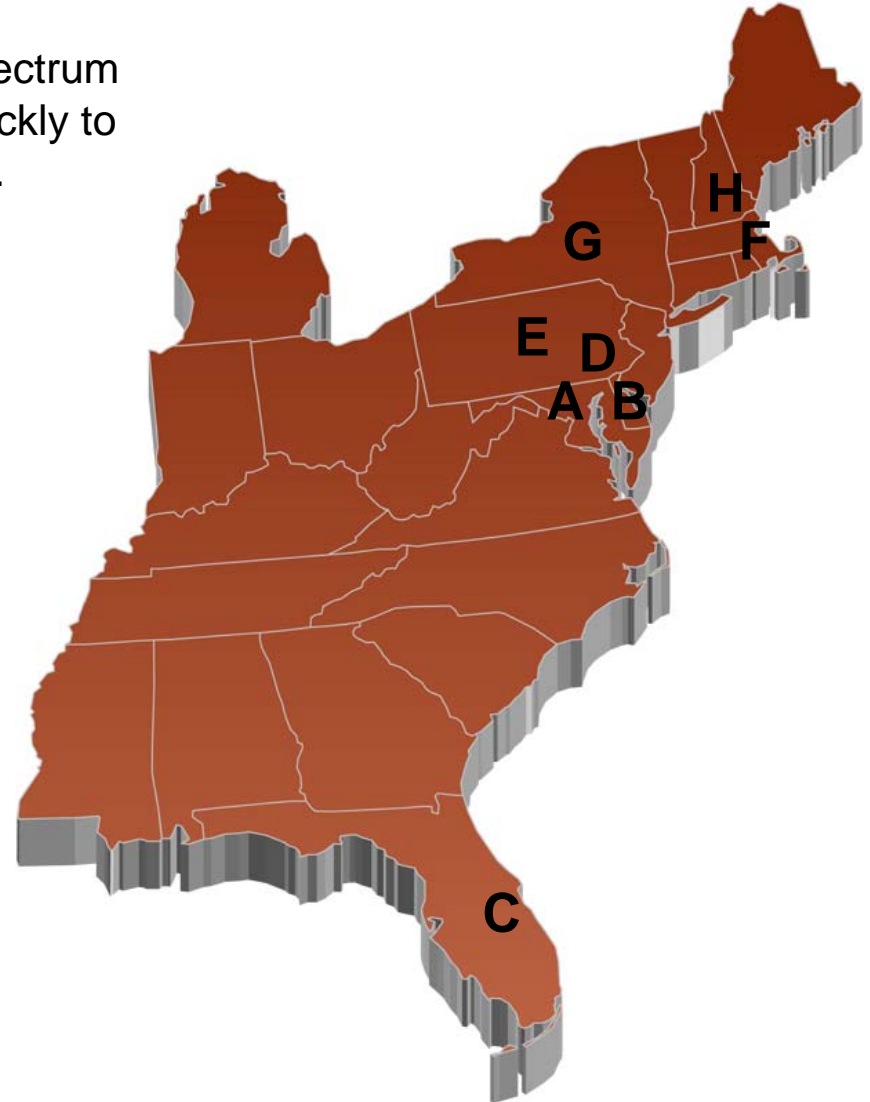


30 Years of Design & Manufacturing Experience

With over 600 employees and 65 engineers, Spectrum Microwave is uniquely positioned to respond quickly to demanding design and production requirements.

- **Over 600 Microwave employees**

- A | Columbia, MD**
Acquired July 2002 (FSY)
- B | Delmar, DE**
Acquired February 2004 (Salisbury Engineering)
- C | Palm Bay, FL**
Acquired October 2004 (Q-bit)
- D | Philadelphia, PA**
Acquired February 2005 (Amplifonix)
- E | State College, PA**
Acquired January 2007 (EMF Systems)
- F | Marlborough, MA**
*Acquired September 2008 (Satcon-Film MicroElectronics)
Acquired December 2009 (IDT-MicroNetworks)*
- G | Auburn, NY**
Acquired December 2009 (IDT-Creative Electric)
- H | Nashua, NH**
Acquired June 2010 (Sage Labs)





The Spectrum Family of Businesses

Microwave Components & Systems Business | SpectrumMicrowave.com

- *Amplifiers, Mixers, Switches, Oscillators & Sources*
- *RF/Microwave Filters, Diplexers & Multiplexers, Integrated Multifunction Modules*
- *Thin Film Substrates, Hybrid Assembly Services*

EMI Filter & Components Business | specemc.com

- *EMI Surge Suppression Components & Modules*
- *Power Line Filters & Power Entry Modules*
- *Interconnect Devices*
- *Terminal Blocks & Passive Components*

Power Management Systems | specpower.com

- *Power Management & Distribution Systems*
- *AC & DC Power Strips*
- *Power Monitoring Equipment: Environmental, Electrical, Security, Mechanical*

Sensors & Controls Business | specsensors.com

- *Potentiometers, Temp Sensing Probes, Surge Current Limiters*

Product Line Overview

- **Hybrid Components, Mixers & Advanced Technologies**

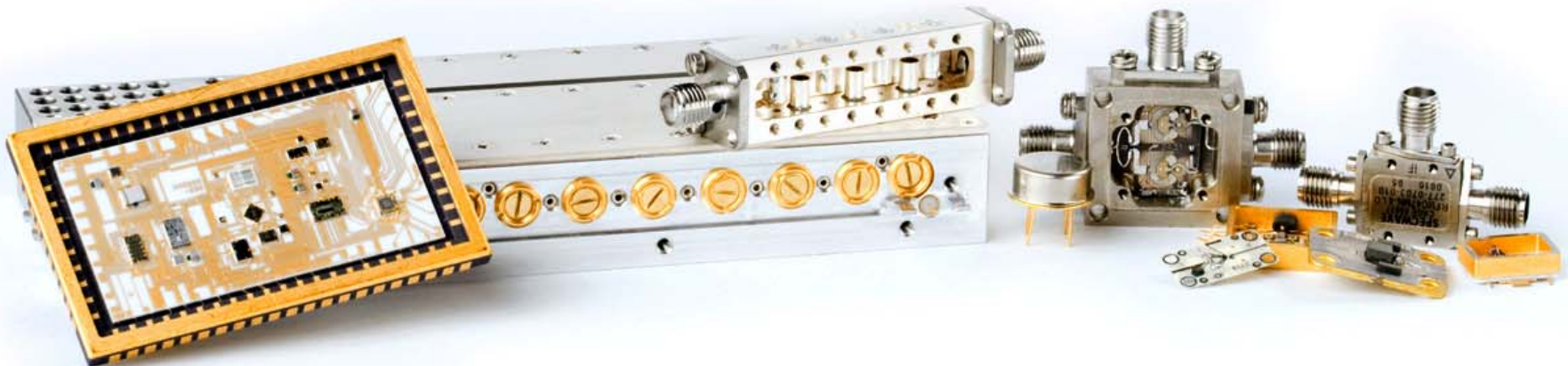
- In-house thin & thick film capability
- 30 year heritage design database
- Quick turn prototypes (2-4 days)
- Complete testing & ESS capability
- Rapid military to low cost conversion
- Modular assemblies

- **Filter Components & Integrated Filter Assemblies**

- Complete filter solutions
- In-house machining
- Complete testing & ESS capability
- 20 year heritage design database
- Focused design centers for quick turn prototypes (2-4 weeks)

- **Frequency Sources & Integrated Microwave Assemblies**

- 80% critical component content
- In-house development of ATE
- 10 IMA engineers with 22 years average experience



Frequency Sources

Spectrum Microwave 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



Frequency Sources

**Small Surface Mount Packages
available for many DRO designs.**

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

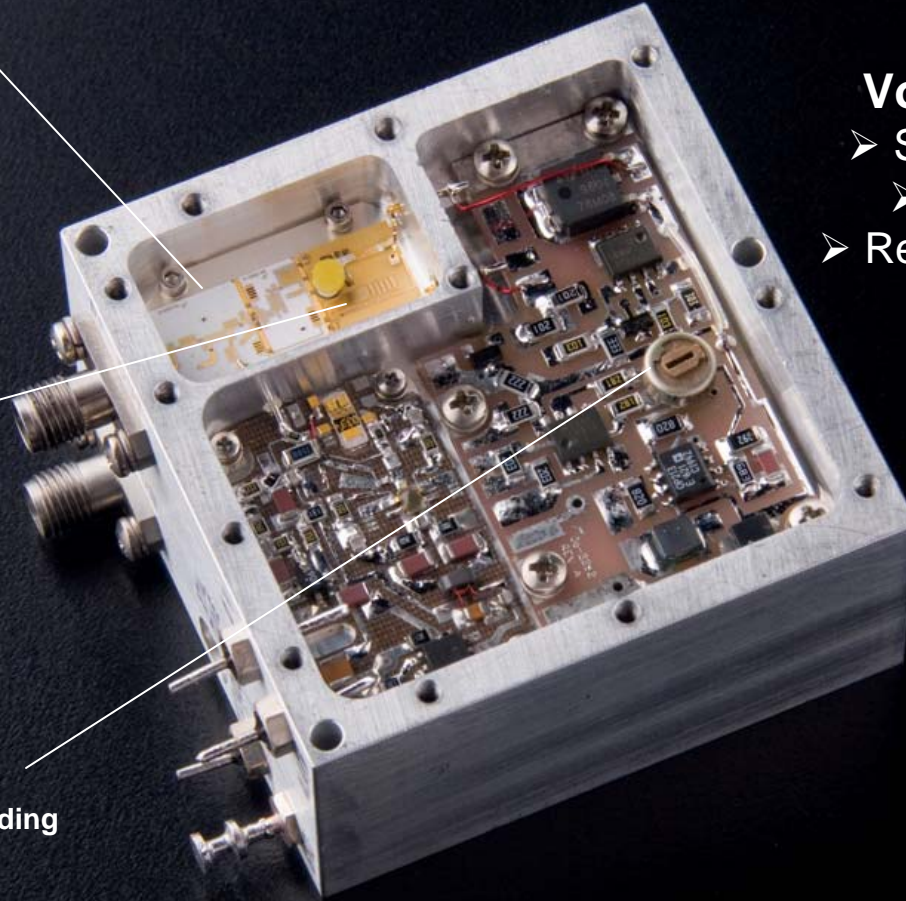


Frequency Sources

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

Custom thin film microstrip boards for improved noise performance.

Metalized PC backplanes for improved grounding and superior stability.



We incorporate a Standard Integral Voltage Regulator for:

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

Frequency Sources

TESTING

Testing our designs using modern equipment like this 4 port Agilent Network Analyzer allows Spectrum Microwave 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.

Frequency Sources

Spectrum Microwave's 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.

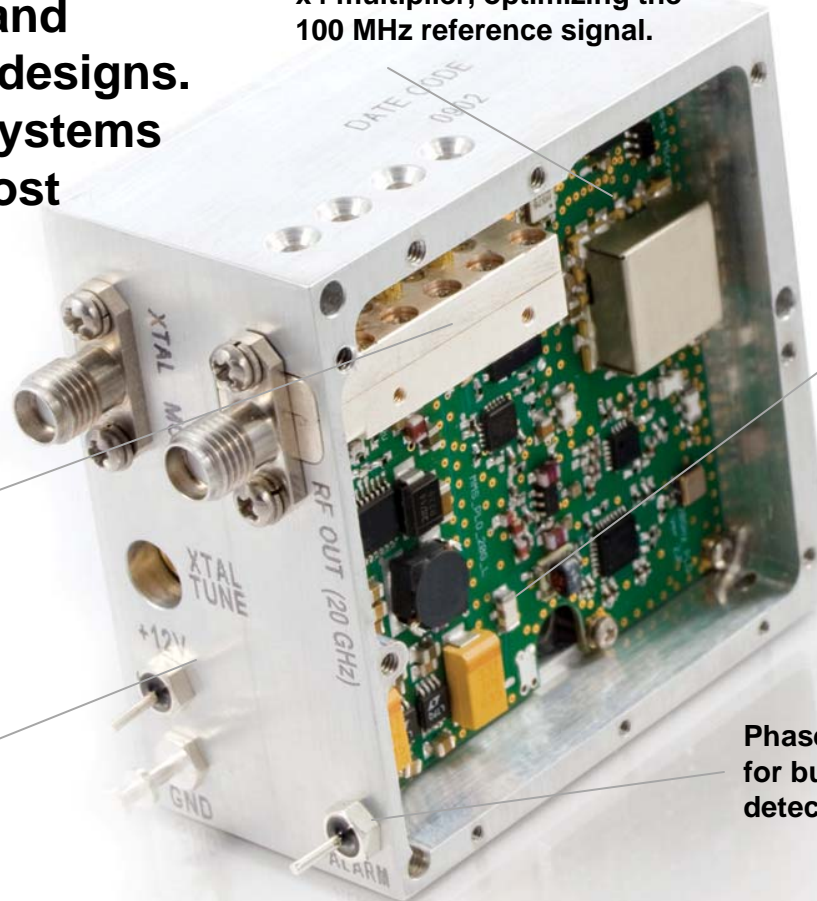
For Superior Phase Noise Performance, our engineers integrate both a doubler and a x4 multiplier, optimizing the 100 MHz reference signal.

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

Integral low loss band pass filter for Superior Harmonic Suppression.

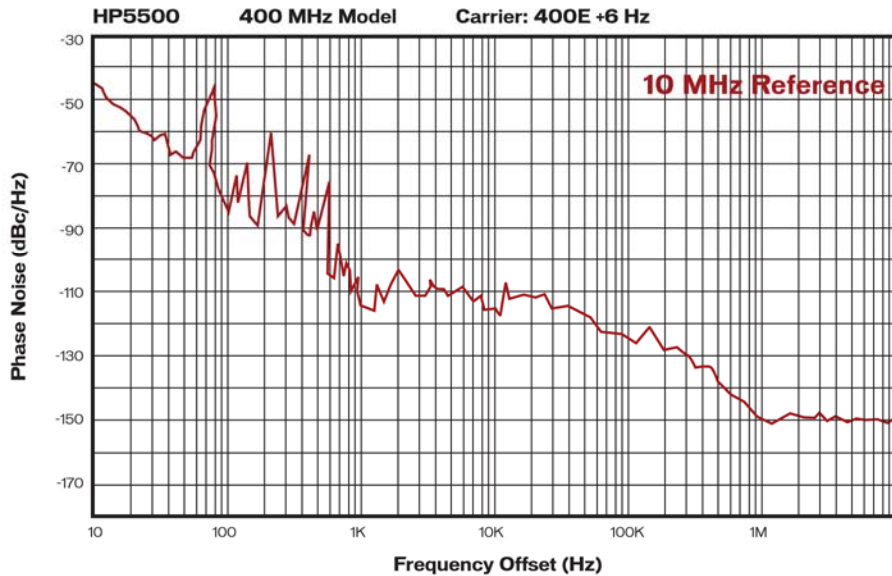
An integral voltage regulator is incorporated to ensure Superior Phase Noise Performance and Reduced Spurious Signals.

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



Frequency Sources

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.**

Frequency Sources

Optional output filtering is provided to insure a clean signal with optimum combs within the required band of interest.

Designing and producing our low loss filters in house allows Spectrum Microwave to offer improved spurious response and better selectivity.

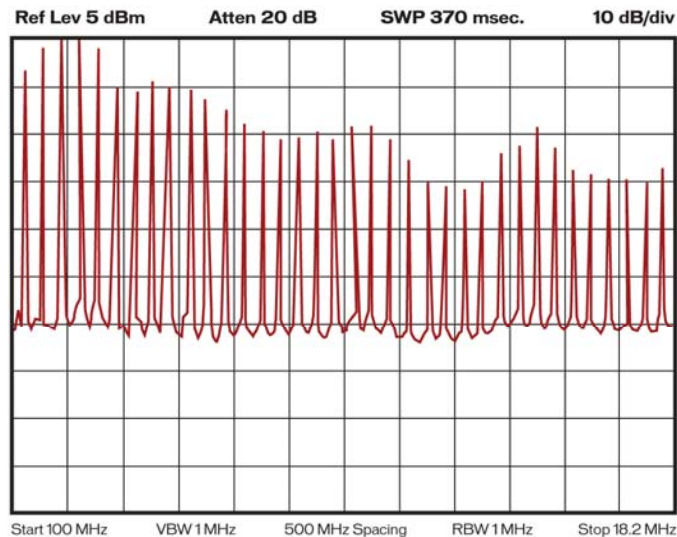
For improved phase noise and stability, an internal OCXO is an option.

Frequency Sources

Spectrum Microwave'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.

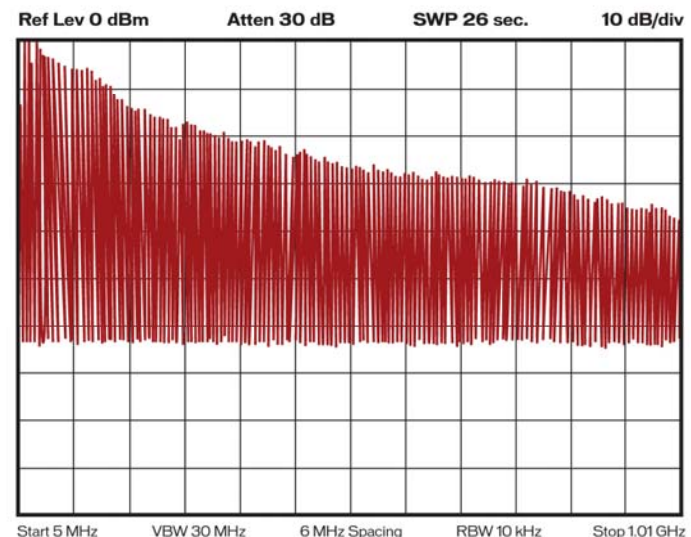
Series 95200

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



Series 95200

Spectrum Microwave designs its combs to maximize Output Power even over multiple octave bandwidths.



Frequency Sources

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

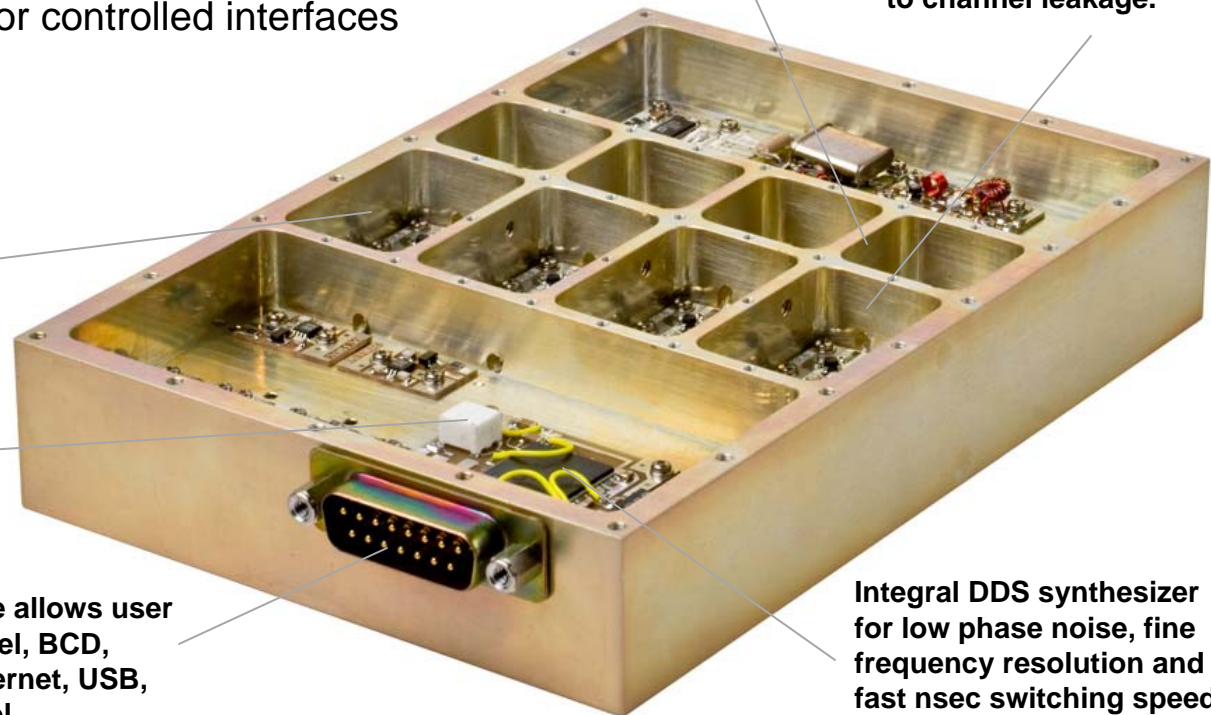
Our own line of low conversion loss mixers allow multiple conversions to the desired frequency with minimal Phase Noise degradation.

Internal Voltage Regulator for consistent phase noise performance and reduced spurious emissions.

Multiple controller interface allows user to select from Serial, Parallel, BCD, RS-232, RS-422, GPIO, Ethernet, USB, and microprocessor control.

Careful isolation of digital and analog circuitry ensures Low Spurious Performance.

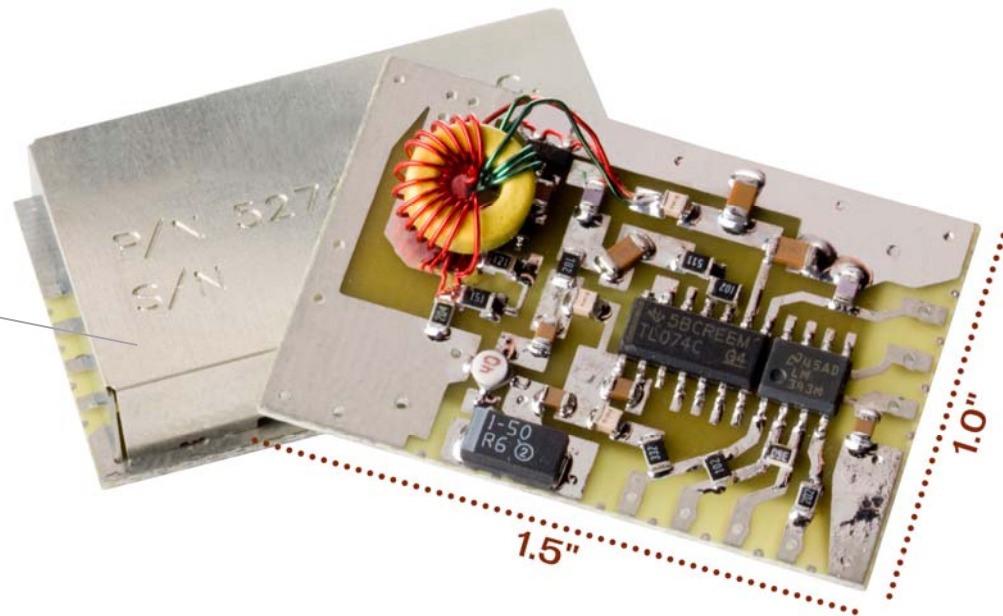
Spectrum engineers use cavities extensively to maximize isolation and minimize channel to channel leakage.



Frequency Sources

Spectrum Microwave's 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. Spectrum Microwave also offers several different options for locking to a specific source.

Small surface mount designs offer lower cost and a smaller footprint.

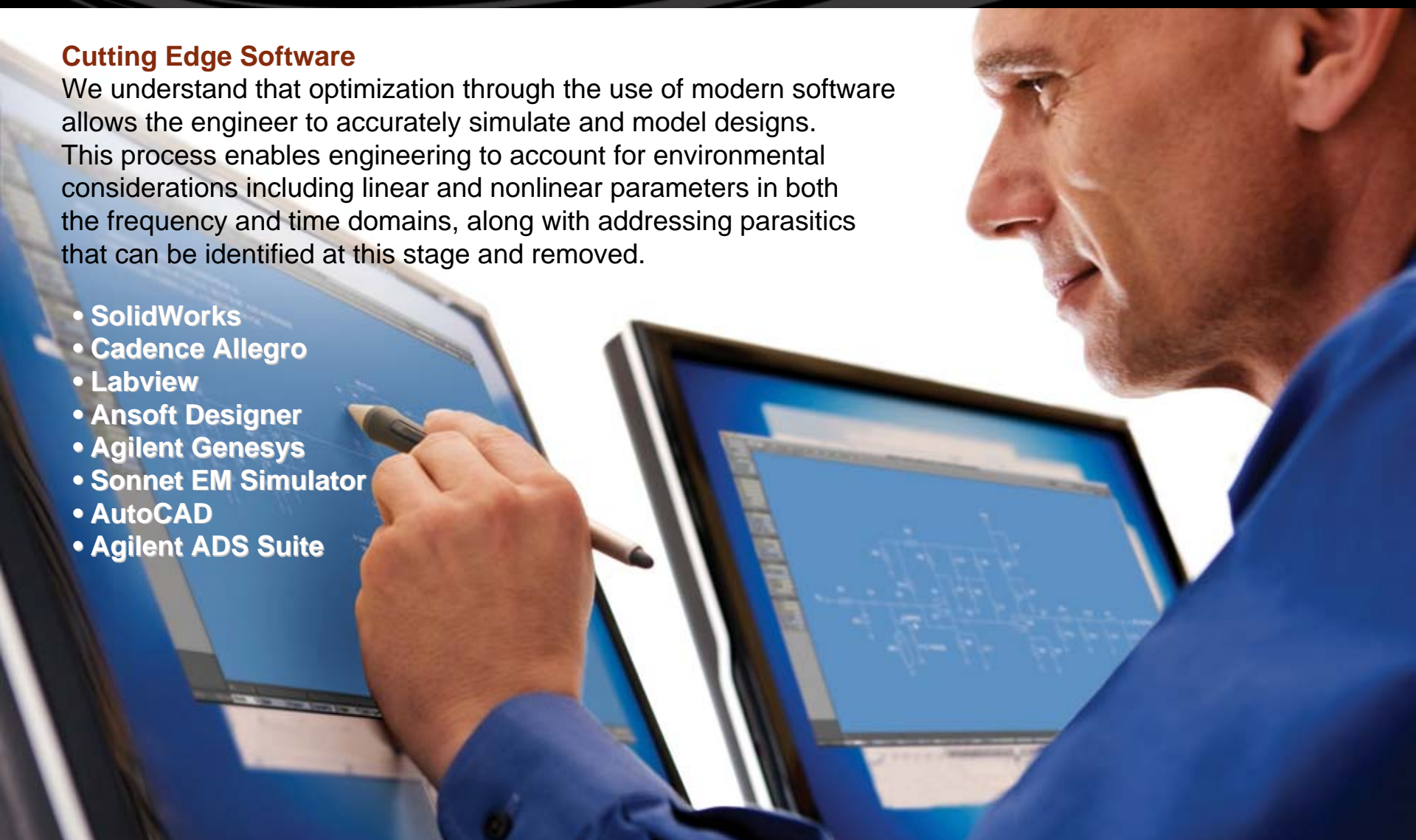


Frequency Sources

Cutting Edge Software

We understand 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.

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



Frequency Sources

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

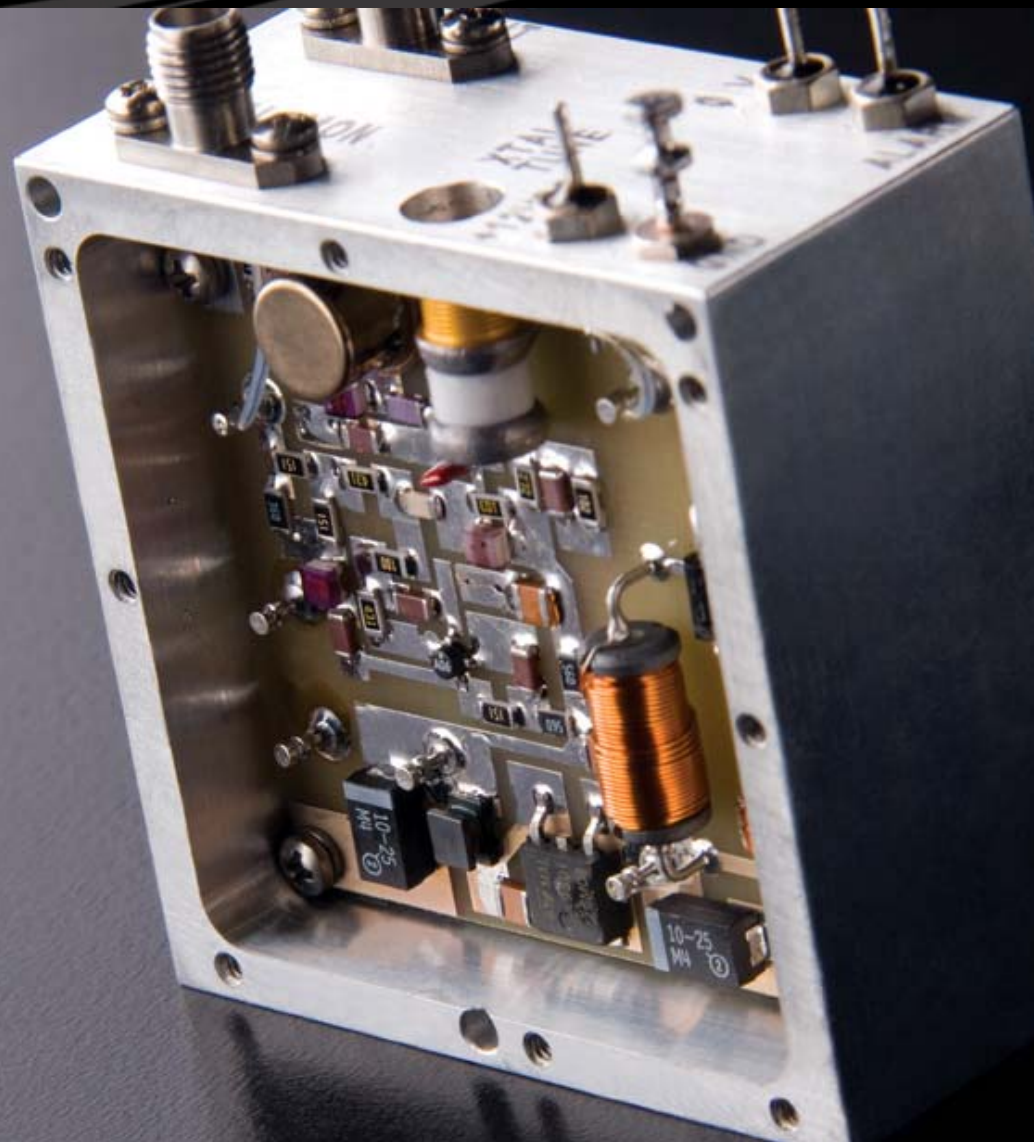
A customer needed to retain access to their external 120 MHz reference in order to maintain a consistent signal throughout the system. Our engineers designed in place a splitter so that the external reference could be sampled without distortion.



Frequency Sources

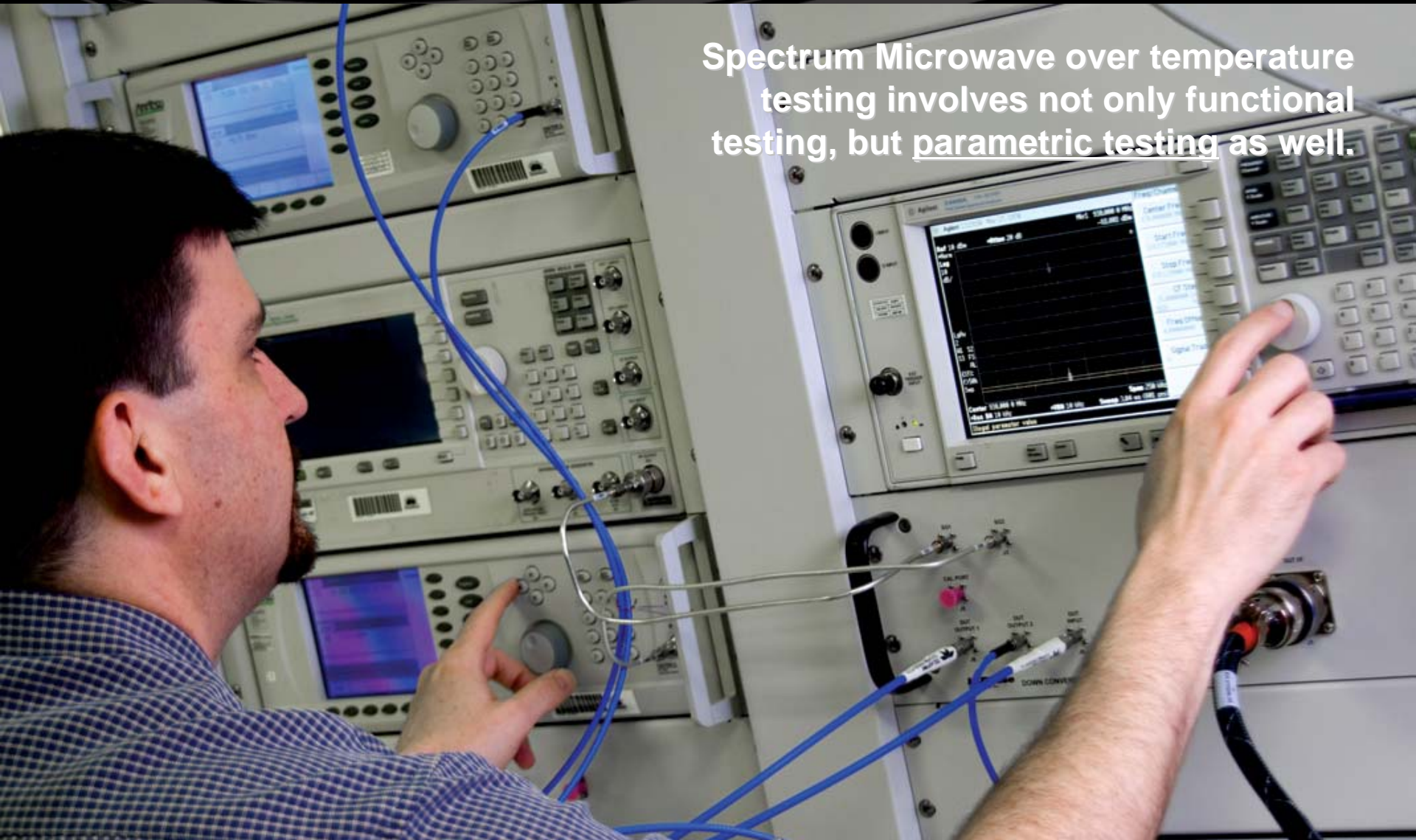
Problem solving to meet your needs

A customer came to Spectrum Microwave 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.



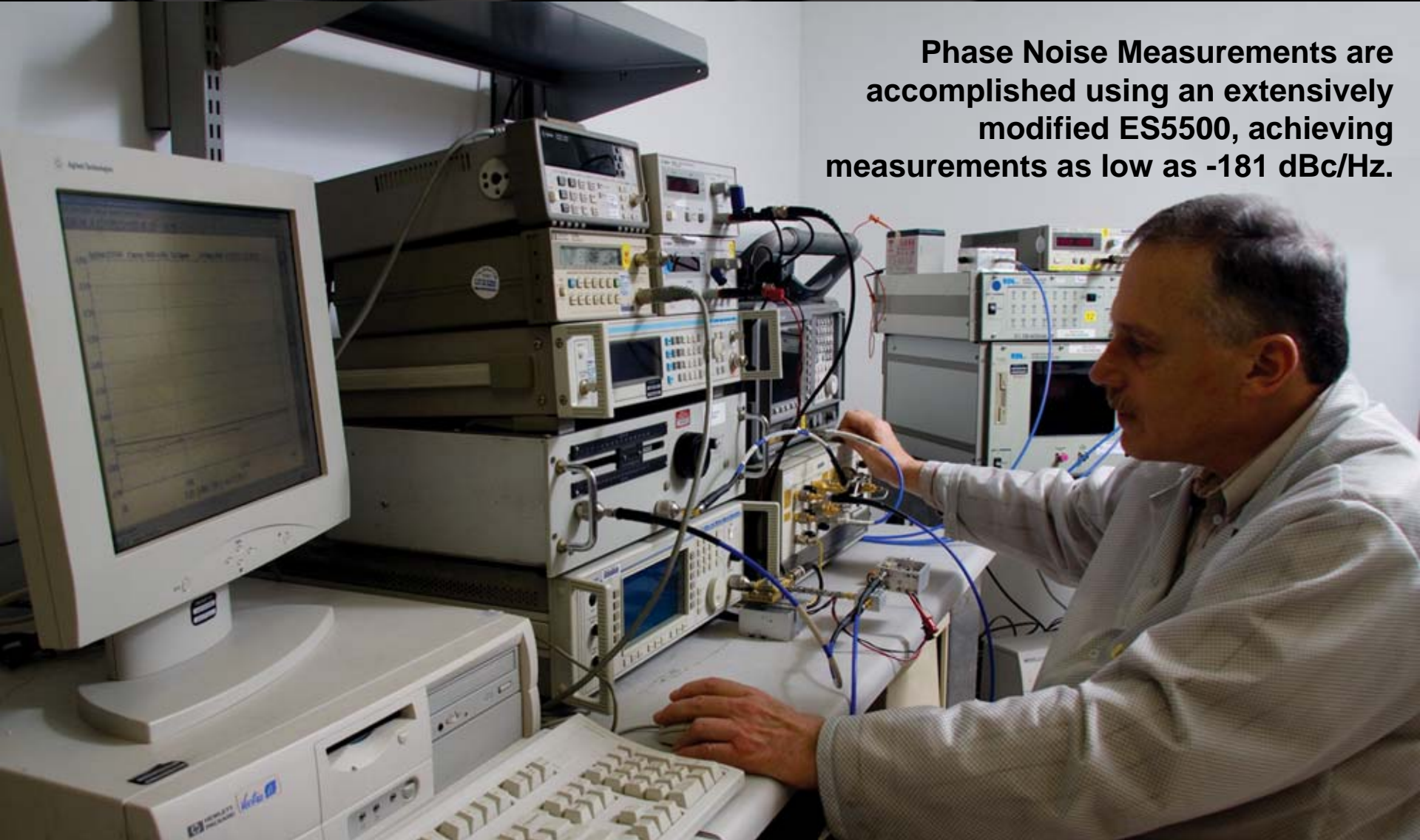
Frequency Sources

Spectrum Microwave over temperature testing involves not only functional testing, but parametric testing as well.



Frequency Sources

Phase Noise Measurements are accomplished using an extensively modified ES5500, achieving measurements as low as -181 dBc/Hz.



Frequency Sources

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



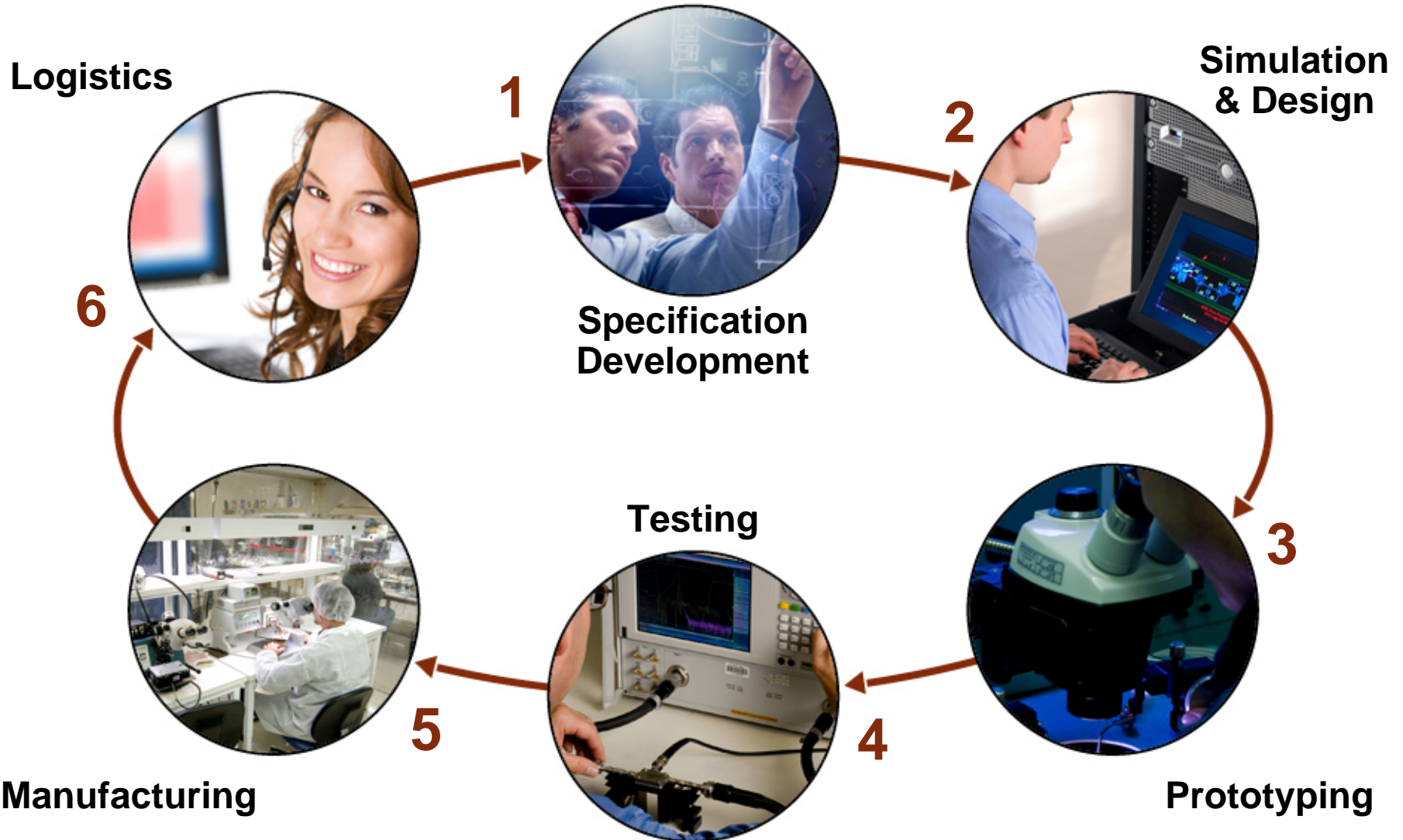
Quality & Reliability

ISO 9001:2008 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)
 - Environment 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



Design & Development Process





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SpectrumMicrowave.com