

LOW PHASE NOISE AMPLIFIERS

apitech

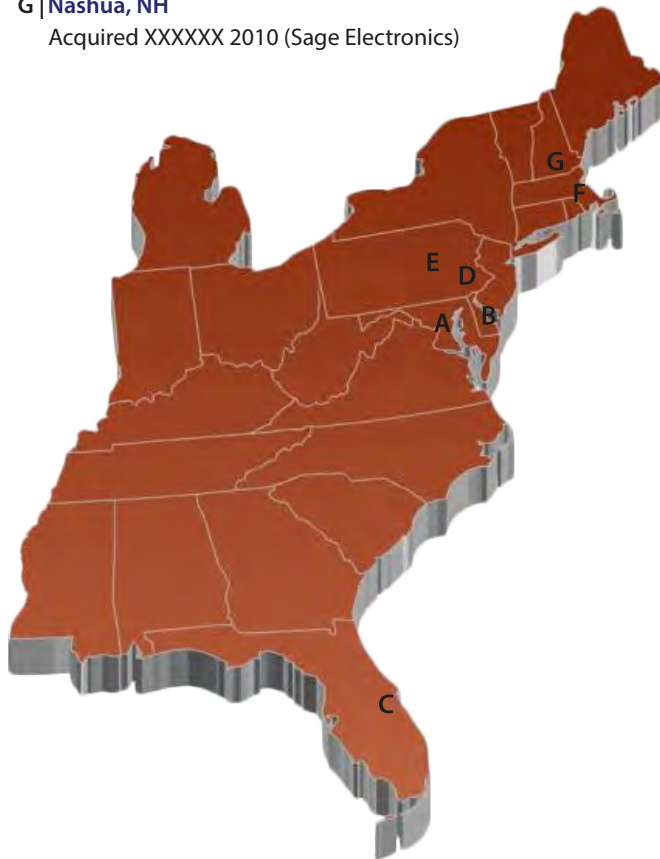


APITech provides guaranteed ultra low phase noise performance in a series PM Amplifiers that use a combination of design techniques, material selection, and in-house testing.



30 Years Of Design & Manufacturing Experience

- Over 600 Microwave employees
- Access to lower cost manufacturing (APITech RF facilities in Mexico and China)
- State College, PA facility - 275,000 sq. ft.
 - 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)
 - G | **Nashua, NH**
Acquired XXXXXX 2010 (Sage Electronics)



The APITech Family of Business

Microwave Components & Systems Business SpectrumMicrowave.com

When your amplifier requirements are for 100 units or more, we offer cost effective package options that combine savings and high performance in one product. APITech has a large selection of both standard and custom higher volume designs, offering both exceptional value and outstanding performance.

Guaranteed High Performance in a Lower Cost Package

- Custom frequencies to 4000 MHz
- Output Power to 2 watts
- Noise figures as low as 0.9 dB
- No external biasing or RF matching circuits needed
- Available in tape and reel
- Perfect drop-in gain solution for Integrated Assemblies

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
- 8 IMA engineers with 22 years of experience

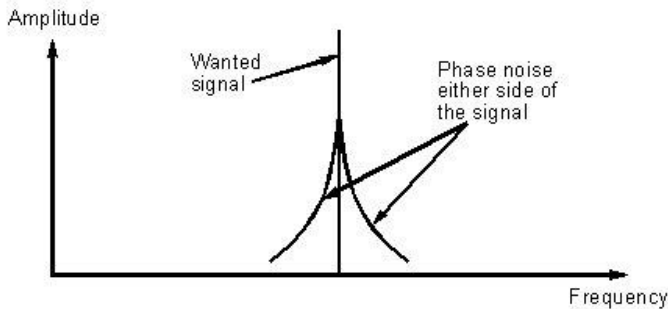
What Do All Of These Sophisticated Systems Have In Common?



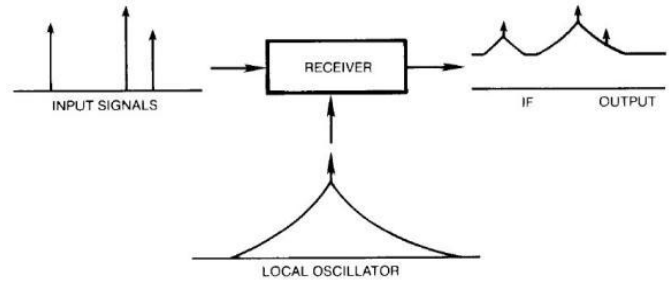
APITech supports all these systems due in part to the **expertise of their engineers** and **superior technology** that makes us the pinnacle of Low Phase Noise excellence. All these systems require exceptionally low phase noise performance amplifiers.



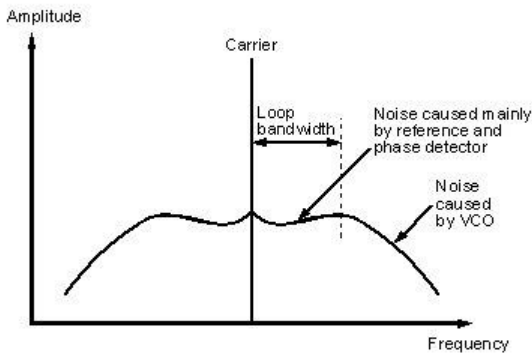
What Is Phase Noise And Why Is It So Important?



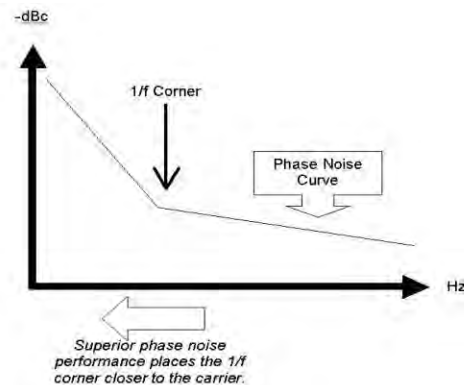
Every signal has Phase Noise to some degree, sometimes it is seen as jitter of some kind, but simply put...



Remember, all passive and active components contribute to phase noise to some degree, some more than others. Noise figure (dB) manifests itself as a reduction of the output S/N ration of the device.

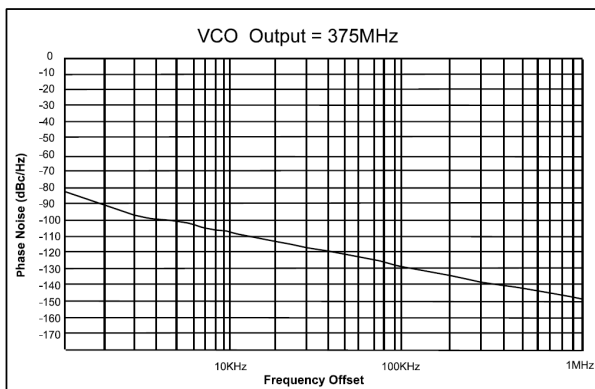


...it is unwanted noise on both sides of the carrier signal caused by random variations of the frequency and phase of the carrier.



Besides Noise Figure, there is an additional characteristic of noise, the 1/f corner.

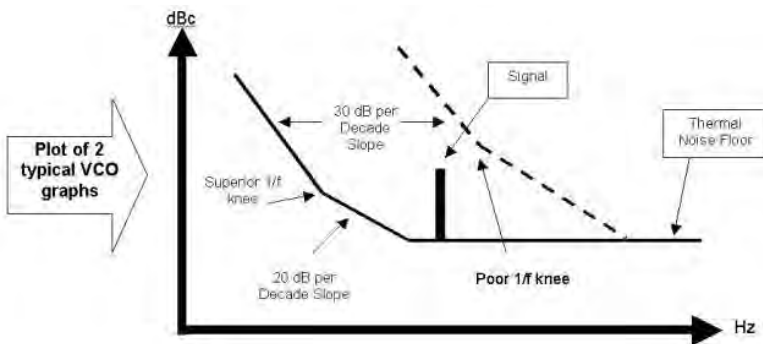
The 1/f corner, or sometimes referred to as the "knee" of the curve, is the point where the Phase Noise slope drops by 10dB per decade.



Even the best oscillators and signal generators have some degree of phase noise, expressed in dBc/Hz.



So Why Is Phase Noise So Important For My Design?



As the graph illustrates, a poor 1/f knee places the signal into the thermal noise region. Moving the 1/f corner closer to the carrier results in removing the noise from the signal.

So How Does Phase Noise Effect Doppler Radar, Missile Illuminators and, Other Data Transmission Systems?

Low phase noise is a key element in a missile illuminator. For example, the objective of the system is to detect and amplify small reflected target signals. Simply put, degraded phase noise can result in the loss of the intended target signal.

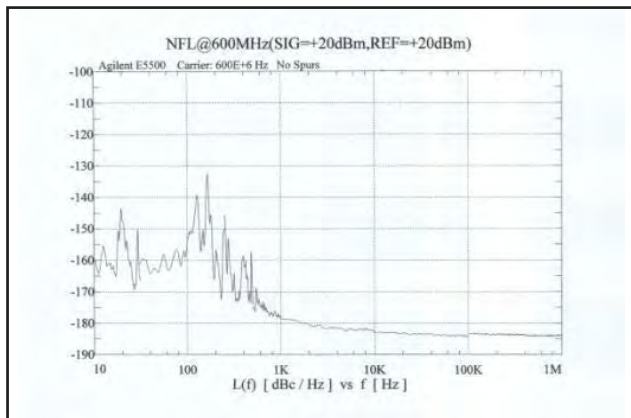
Degraded phase noise also impacts the bit error rate (BER) of all data transmission systems. Improving the Phase Noise results in substantial BER performance improvement by increasing the S/N ratio in the receiver.

For all doppler radar designs, improving the sub-clutter visibility (SCV) is the bottom line. This allows the radar to see small moving objects on its screen. Excessive Phase Noise will degrade the SCV of the system. Improving the Phase Noise however increases the cancelled S/N ratio thereby improving the SCV.

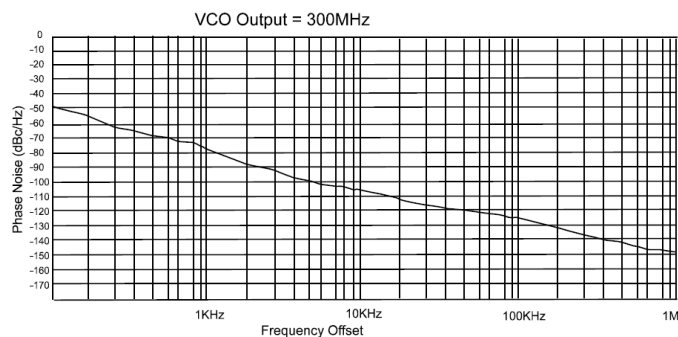




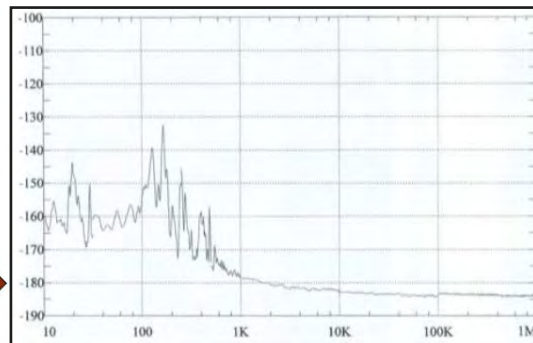
How Does APITech Measure Phase Noise?



Unlike measuring Phase Noise in a VCO, amplifiers require a much more sensitive measuring system with an extremely low noise floor.

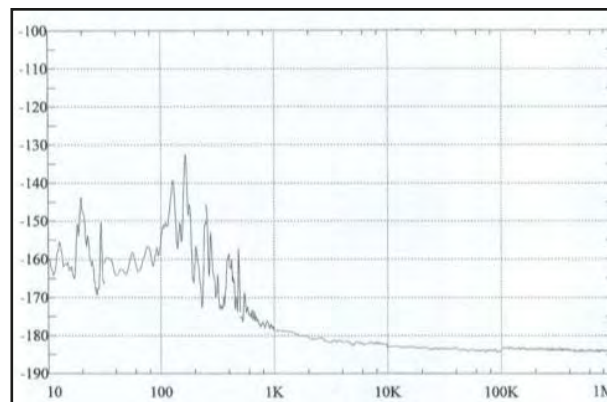


A typical noise floor for measuring VCO's may only be on the order of -145 to -150 dBc/Hz.



For Low Phase Noise Amplifiers, a noise floor of at least -180 @ 100kHz (offset from the carrier) is required in order to minimize the noise floor contribution to the amplifier's additive phase noise.

APITech accomplishes this feat using an "enhanced" Agilent ES5500 system coupled with a modified IFR low noise synthesizer.



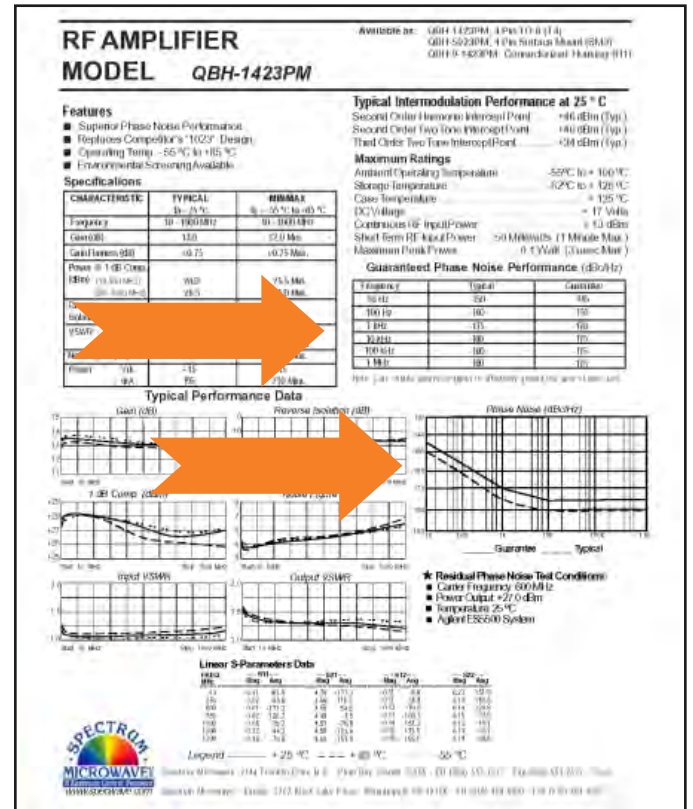
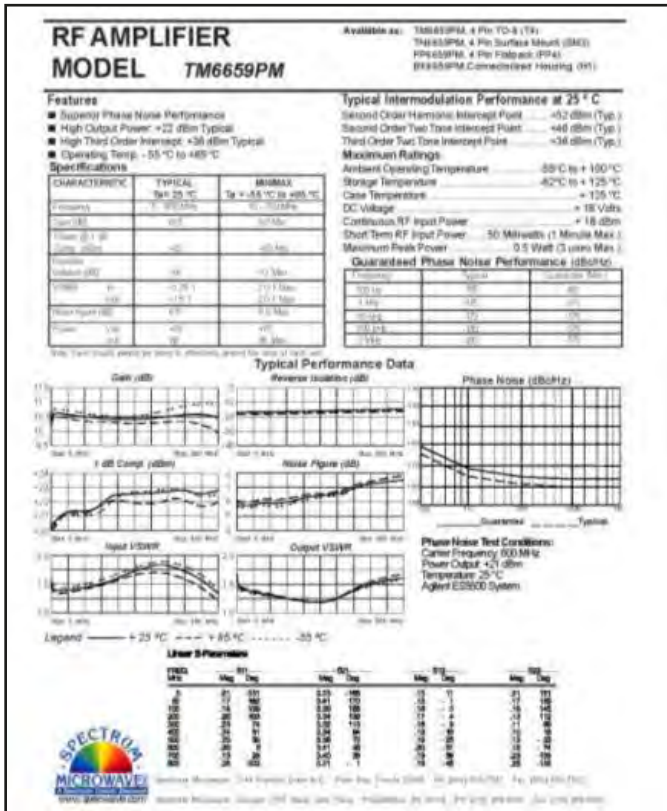
This enables us to meet the required Low Noise Floor criteria for measuring Low Phase Noise Amplifiers.





At APITech We Optimize Our Designs For Low Phase Noise And...

...Provide Both Typical And Guaranteed Phase Noise Data On Our Amplifiers.





So If You Want The Maximum Performance Out Of Your Design...

RF AMPLIFIER MODEL TM3072PM

Available in: TM3072PM, 4 Pin TO-8 (TA), TM3072PM, 4 Pin Surface Mount (SM), FP3072PM, 4 Pin Flipback (FM), BE3072PM, Connectorized Housing (CH)

Features

- Superior Phase Noise Performance
- High Output Power: +27.5 dBm Typical
- Operating Temp: -55 °C to +85 °C
- Environmental Screening Available

Typical Intermodulation Performance at 25 °C

- Second Order Harmonic Intercept Point: +48 dBm (Typ.)
- Second Order Two Tone Intercept Point: +48 dBm (Typ.)
- Third Order Two Tone Intercept Point: +44 dBm (Typ.)

Maximum Ratings

- Ambient Operating Temperature: -55°C to +105°C
- Storage Temperature: -62°C to +125°C
- Case Temperature: +125°C
- DC Voltage: +17 Volts
- Continuous RF Input Power: +15 dBm
- Short Term RF Input Power: 100 mW (1 Minute Max.)
- Maximum Peak Power: 0.2 WAVE (3 uses Max.)

Specifications

CHARACTERISTIC	TYPICAL	MIN/MAX
Frequency (MHz)	10 - 20 MHz	10 - 20 MHz
Gain (dB)	23.5	23 - 24
Phase @ 1 MHz (dBc/Hz)	-177.0	-180 Min.
Phase @ 10 MHz (dBc/Hz)	-179.0	-180 Min.
Phase @ 100 MHz (dBc/Hz)	-180.0	-180 Min.
Phase @ 1 MHz (dBc/Hz)	-177.0	-180 Min.
Phase @ 10 MHz (dBc/Hz)	-179.0	-180 Min.
Phase @ 100 MHz (dBc/Hz)	-180.0	-180 Min.

Guaranteed Phase Noise Performance (dBc/Hz)

Frequency	Typical	Guarantee
100 Hz	-165	-161
1 kHz	-175	-171
10 kHz	-179	-175
100 kHz	-180	-176
1 MHz	-180	-176

Typical Performance Data

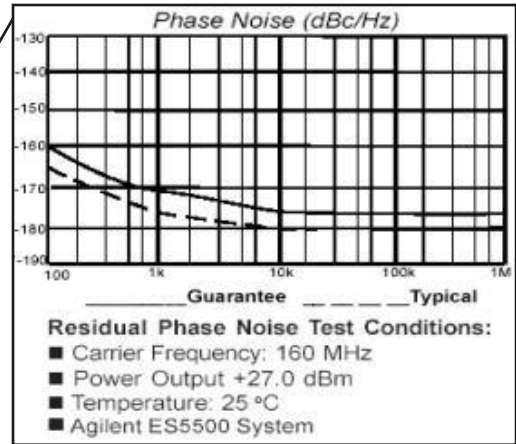
Gain (dB), Reverse Isolation (dB), Phase Noise (dBc/Hz), 1 dB Comp. (dBm), Noise Floor (dBm), Input VSWR, Output VSWR

Residual Phase Noise Test Conditions:

- Carrier Frequency: 160 MHz
- Power Output: +27.0 dBm
- Temperature: 25 °C
- Agilent E2550 System

Legend: +25 °C, +85 °C, -55 °C

SPECTRUM MICROWAVE



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RF AMPLIFIER MODEL TM3072PM

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Typical Intermodulation Performance at 25 °C

- Second Order Harmonic Intercept Point: +48 dBm (Typ.)
- Second Order Two Tone Intercept Point: +48 dBm (Typ.)
- Third Order Two Tone Intercept Point: +44 dBm (Typ.)

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- Temperature: 25 °C
- Agilent E2550 System

Legend: +25 °C, +85 °C, -55 °C

SPECTRUM MICROWAVE

...call us to learn more about APITech's Low Phase Noise Amplifiers.

855-294-3800



Latest Technology & Software

Design Tools

- Ansoft Designer
- Agilent Eagleware Genesys
- Orcad
- Cadence Allegro
- SolidWorks
- AutoCAD
- P-Spice
- Sonnet Pro EM Simulator

Quality & Reliability

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

- 1 Specification Development
- 2 Simulation & Design
- 3 Prototyping
- 4 Testing
- 5 Manufacturing
- 6 Logistics

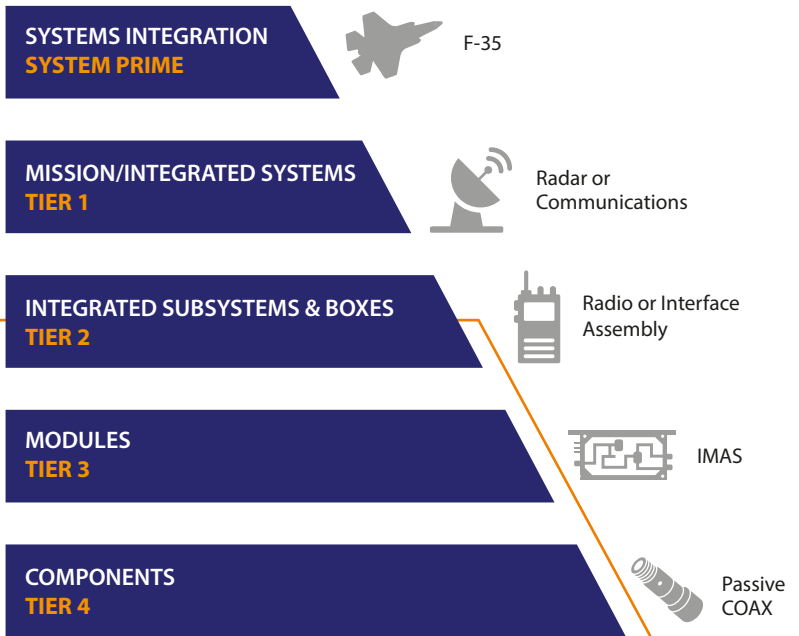




Who We Are

Value-added Integration from Components to Subsystem Solutions

APITech provides rugged, reliable, and efficient subsystems, assemblies, and components for use in the most mission critical defense and military applications, supporting government programs throughout the world. With diverse program experience and preferred supplier status with some of the industry's top premier contractors, our precision-engineered MIL-grade products are ideal for applications where uncompromised reliability and uninterrupted performance is required. APITech is the Electromagnetic Spectrum Innovator at Tier 2.5-4 in the supply chain.



The Electromagnetic Spectrum Innovator

APITech is an innovative designer and manufacturer of high performance systems, subsystems, assemblies and components for technically demanding RF, microwave, millimeterwave, electromagnetic, power, and security applications.

A high reliability technology pioneer with over 70 years of heritage, APITech's products are used by global defense, industrial, and commercial customers in applications spanning radar, electronic warfare, unmanned systems, missile defense, harsh environments, space, communications, medical, test and instrumentation, and more.



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