INTERFERENCE MITIGATION SOLUTIONS
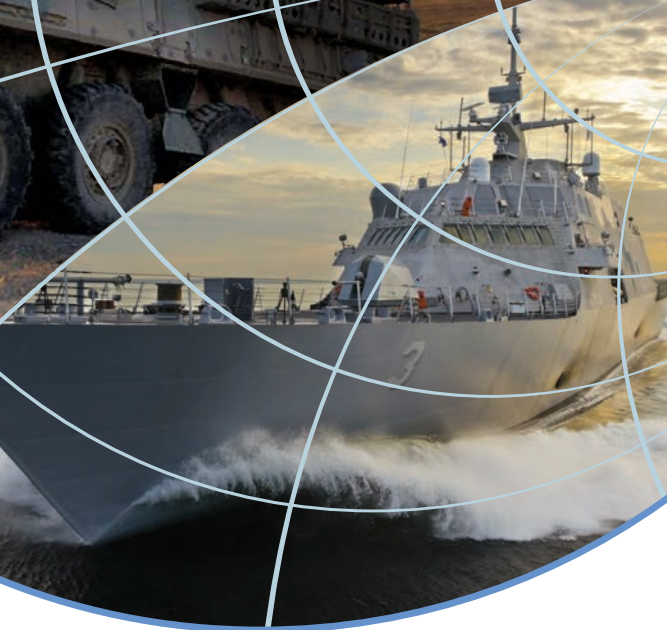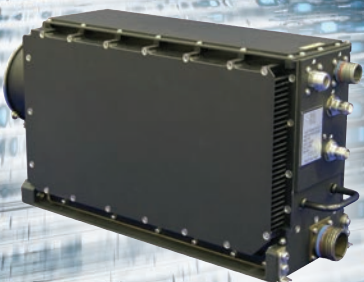
Protect your receiver and **Purify** your transmitter for **Increased Communication Range**

MPG **POLE ZERO**®
a DOVER company

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INTEGRATED COSITE EQUIPMENT (ICE)

Pole/Zero is the premier provider of solutions for communications challenges arising from RF interference. Our products enable military platforms to simultaneously operate multiple radios on the same platform without degradation in performance, range or compromises in CON-OPS. Our Integrated Cosite Equipment (ICE) line of products are incorporated between your radios and antennas to enable simultaneous operation of all your communications, radar, SIGINT/COMINT and other RF systems.

The Cosite Interference Challenge

Today's military transceivers operate over broad frequency bands with features such as embedded cryptography, frequency hopping, networking, and upgradeable waveforms. When transceivers are operated in close proximity to other RF emitters, these "other" RF emissions constitute interference to the receiver. Receive performance degrades rapidly due to a phenomenon termed "cosite interference". Vulnerability to cosite interference degrades the receiver's sensitivity to low-level, desired signals. Additionally, cosite RF emitters, although often operating at a frequency offset from the receiver, may degrade a receiver's range by creating spurious emissions (harmonics, intermodulation products, broadband noise, etc.). The challenge for the system designer is to resolve these various interference mechanisms to maintain performance and range.

Radio Range Reduction Due to Interference
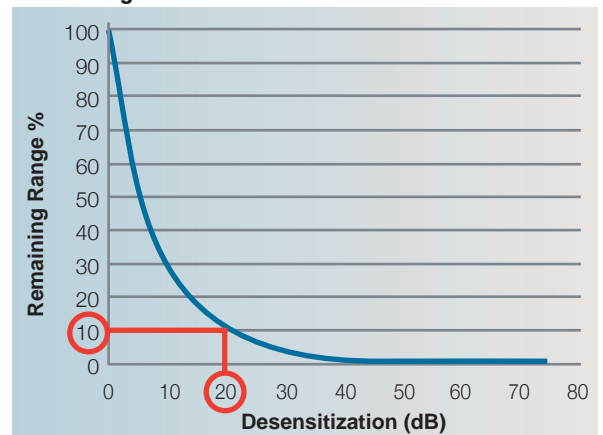
Note that a 20 dB desensitization of your receiver results in the loss of 90% of your range! Regain the operating range of your system by incorporating ICE on your platform.

Pole/Zero offers an ICE product for every Cosite situation.

ICE1000   **ICE2000**   **ICE3000**   **ICE4000**   **ICE5000**
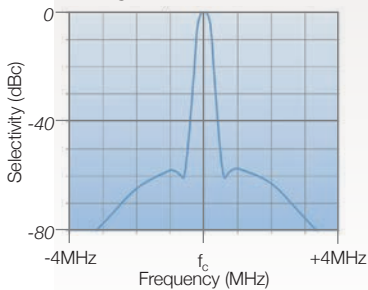
INTEGRATED COSITE EQUIPMENT (ICE)

- Today's crowded communication bands and closely located transceivers are often needed for simultaneous operations (SIMOP) and require RF systems designers/integrators to pay increasing attention to managing their equipment's generation and rejection of undesired signals and noise. Receiver desensitization greatly diminishes communications range.

- For the challenge of enhancing a modern transceiver's performance in a cosite environment, Pole/Zero offers our Integrated Cosite Equipment (ICE). ICE integrates high dynamic range amplification and frequency agile filtering to provide the transceiver the required cosite interference mitigation.

- ICE systems are designed to MIL-STD-810 and MIL-STD-461, interfacing directly with each transceiver to support modern single channel SATCOM and fast frequency hopping waveforms (e.g. SATURN).

- Key Features of ICE:
  - Reduced transmit broadband noise levels
  - Suppressed harmonics, intermodulation and spurious emissions
  - Significantly enhanced receiver dynamic range
    - Improved noise figure, and high signal handling and intermodulation
    - Reduced reciprocal mixing and cross-modulation
  - Mitigation of receiver desensitization at close frequency spacing

ICE3009

ICE5000 Applications

- Frequency Coverage: 30 to 406 MHz
- ARC-210/ARC-231 Interfaces
- Tune Time 50 µs typical
- TX RF Output Power Over 100 W
- Highly Selective

Radio   30-406 MHz   Comms Antenna

Selectivity (dBc) vs **Frequency (MHz)**
0, -40, -80
-4MHz f_c +4MHz

225-400 MHz

Diplexer/Cosite LNA

Typical Command & Control Platform (Multi radio systems)

ICE1000 Applications

- Frequency Coverage: 30 to 512 MHz
- Tune Time: 25 µs typical
- In-Band RF Power: 1 W (input) typical
- 1.0 x 3.8 x 2.8 (in.)

ICE1006   Bi-Directional Amplifiers

Comms Radio Relay (Retrans)

An Example of Receiver Performance Improvement with ICE

Receiver Performance without ICE	ICE Enhancement	Cosite Enhanced Performance with ICE
Noise figure = 12 dB	8 dB	Noise figure = 4 dB
Receiver IF BW = 38 kHz		Receiver IF BW = 38 kHz
Sensitivity = -106 dBm	8 dB	Sensitivity = -114 dBm
Interference Susceptibility		*Interference Susceptibility*
(5% removed) = -23 dBm	32 dB	(5% removed) = 9 dBm
(10% removed) = -23 dBm	56 dB	(10% removed) = 33 dBm

Transceiver   Integrated Cosite Equipment   Transceiver

ICE3009 Configuration Selection Guide

The ICE3009 design provides a flexible ICE platform that can be configured for your specific application. Your requirements can be achieved by tailoring the design through choices such as multiple frequency bands, multiple interface options, output power levels and various additional features such as Guard monitoring.

Tailor your ICE3009 to meet platform needs:

1 Choose one to three:
- VHFL: 30 to 88 MHz
- VHFH: 108 to 174 MHz
- UHF: 225 to 400 MHz

2 Choose a radio/tuning interface:
- ARC-210
- PRC-117
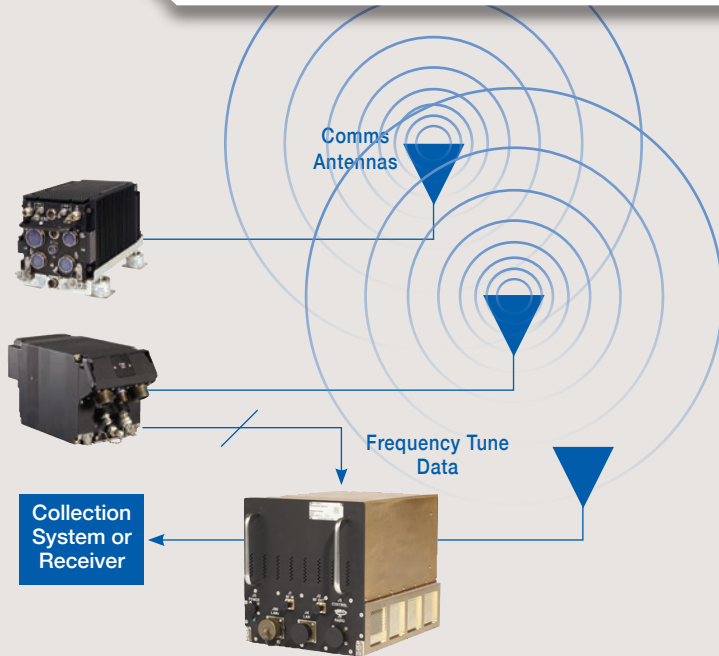- ARC-231
- TRA 2030

3 Select RF output:
- 20 W (AM), 50 W (FM) for Tri-Band (VHFL, VHFH, and UHF)
- 25 W (AM), 50 W (FM) for Dual Band VHFH and UHF
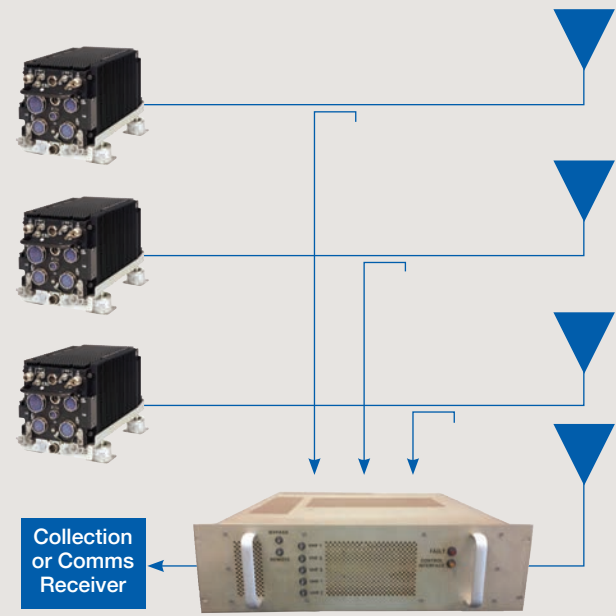- 40 W (AM), 100 W (FM) for Single Band UHF

4 Identify other requirements:
- Input RF power (0 to +43 dBm)
- Incorporation of a Guard channel
- Modified frequency range

MULTICHANNEL INTERFERENCE CANCELERS

Broadband Surveillance Application

Comms Antennas

Frequency Tune Data

Collection System or Receiver

Near-channel Mitigation Application

Collection or Comms Receiver

Multichannel Referenceless Canceler

The ICE2004 is an 8-channel, 30-512 MHz RF interference canceler system that achieves 40 dB of strong signal attenuation without the need for reference signals from local transmitters. The ICE2004 enables the reception of low-level RF signals in the presence of up to 8 strong interferers as a result of its inherent low loss path for all non-canceled signals. The ICE2004 provides fast canceler acquisition and is compatible with SINCGARS and HAVE QUICK hopping waveforms. The ICE2004 can auto-tune to on-board or off-board signals and also supports direct radio tuning.

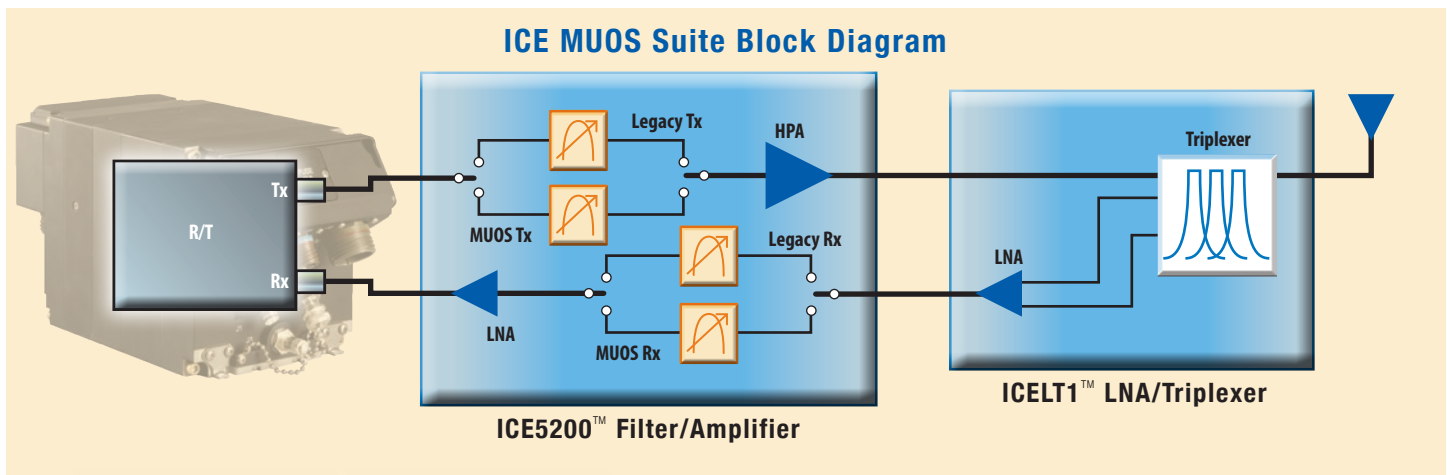## Multichannel Interference Canceler

Pole/Zero's MULTICHANNEL INTERFERENCE CANCELER (MIC) is a five channel VHF/UHF canceler system which significantly reduces the levels of strong interfering RF signals from co-located emitters to allow proper communications or collections receiver operation. The canceler detects frequency changes automatically – even with frequency hopping signals.

INTRODUCING THE ICE MUOS SUITE
NEW 2021 RELEASE

For decades, Pole/Zero has offered specialized Integrated Cosite Equipment (ICE) Filter/Amplifier Solutions to enable the concurrent use of Legacy UHF satellite communications (SATCOM) and Line of Sight (LOS) radios on air-, sea-, and ground-based Command and Control (C2) platforms. With the advent of the United States' Mobile User Objective System (MUOS) for enhanced UHF SATCOM, Pole/Zero is developing a new suite of solutions for **cosite interference mitigation.**

Introducing Pole/Zero's **ICE MUOS Suite**, a solution set that provides system integrators with the cosite interference mitigation tools necessary to support UHF SATCOM and LOS communications for decades to come. The ICE MUOS Suite not only supports MUOS but also continues support of Legacy UHF SATCOM (e.g., DAMA, IW). The ICE MUOS Suite includes two new assemblies: the ICELT1™ Low Noise Amplifier (LNA)/Triplexer and the ICE5200™ Filter/Amplifier. The ICE5200 is Pole/Zero's highest performance Filter/Amplifier product, specially configured for Legacy UHF SATCOM and MUOS operation.

ICE MUOS Suite Block Diagram

ICE5200™ Filter/Amplifier

ICELT1™ LNA/Triplexer

ICELT1™ LNA/Triplexer Features

- Support for Legacy UHF SATCOM and MUOS, including MUOS transmit scan functionality
- Separate Transmit and Receive ports
- Enhanced filter selectivity for maximum cosite interference performance
- High dynamic range low noise amplifier supporting MUOS' unique signal characteristics

ICE5200™ Filter/Amplifier Features

- UHF filter and amplifier supports Legacy SATCOM and MUOS
- High RF power output matches industry standards for MUOS
- Superior transmit and receive filter selectivity
- Low cost of ownership with modern system architecture

Configuration Options for the ICE MUOS Suite

- MUOS Rx filtering location moved to the ICELT1 LNA/Triplexer
- Two antenna ports, supporting high/low antenna switching, in ICELT1 LNA/Triplexer
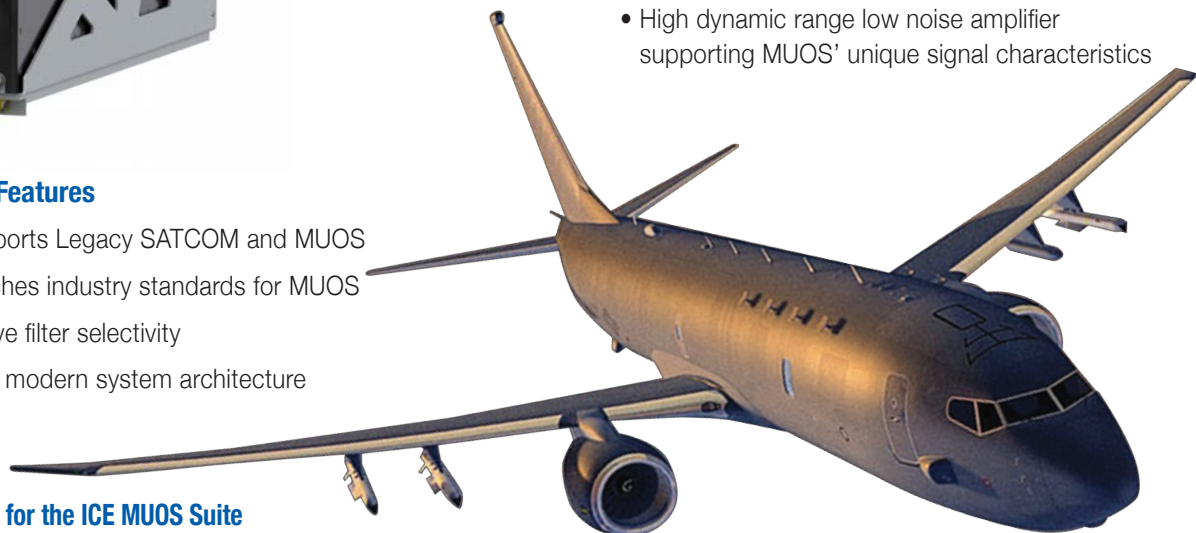
Contact Pole/Zero Business Development for a Quote!

HIGH POWER FILTERS AND RF DISTRIBUTION

MEGA-POLE®

- Frequency Coverage: 30 to 400 MHz (separate bands)
- Tuning Time: < 25 μs typical
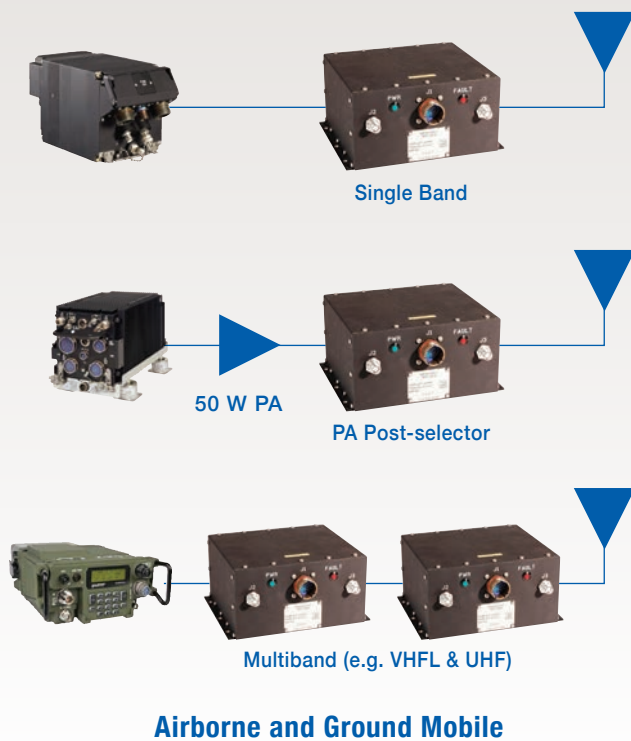- In-Band RF Input Power: 50 W average, 100 W peak
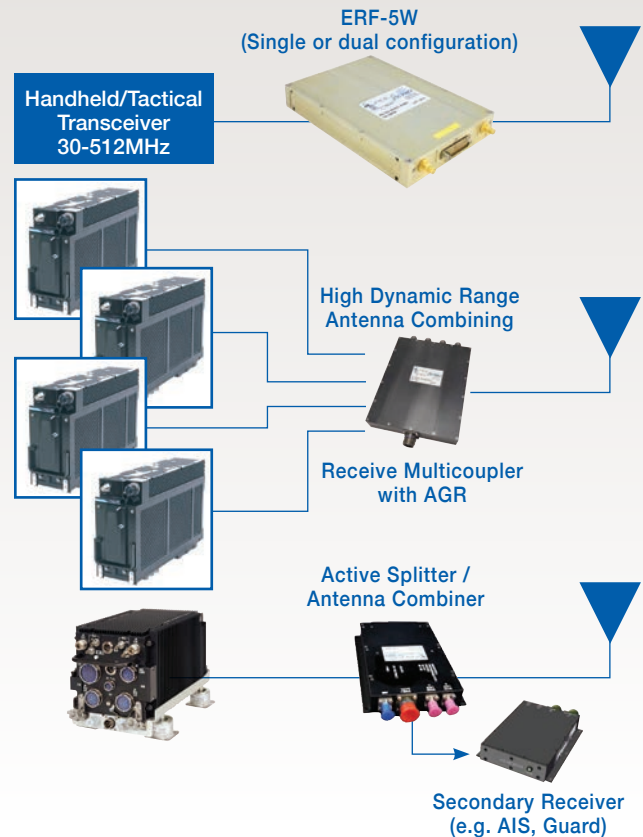- 6.0 x 7.6 x 3.6 (in.)

ERF-5W™

- Frequency Coverage: 30 to 520 MHz
- Tuning Time: 25 μs typical, 50 μs max.
- In-Band RF Input Power: 5 W average
- Single: 4.7 x 6.8 x 1.0 (in.)
- Dual: 4.7 x 6.8 x 1.9 (in.)

MEGA-POLE® Applications

Single Band

50 W PA

PA Post-selector

Multiband (e.g. VHFL & UHF)

Airborne and Ground Mobile

ERF-5W™ & RF Distribution Applications

**ERF-5W
(Single or dual configuration)**

**Handheld/Tactical
Transceiver
30-512MHz**

**High Dynamic Range
Antenna Combining**

**Receive Multicoupler
with AGR**

**Active Splitter /
Antenna Combiner**

**Secondary Receiver
(e.g. AIS, Guard)**

COSITE ANALYSIS

Pole/Zero offers a Cosite Analysis and Integration service to assist in determining the level of cosite mitigation required for a specific communication application. The goal of the analysis is to work closely with the integrator to ensure maximum communications range and channel availability given the size, weight, power, and cost (SWaP-C) constraints.

Use Pole/Zero Integrated Cosite Equipment (ICE) to resolve interference in your communication/data links. Protect your receivers and purify your transmitters in order to recover the range required for your missions. Determining the right ICE model for your application is easy and straightforward with the additional Pole/Zero capability to conduct a cosite analysis to achieve an optimal communication system.

Pole/Zero is an industry leader in high dynamic range RF communications solutions with over 30 years of experience.

Microwave Products Group
a DOVER company

Enabling Communication and Signal Control

For focused attention to your solutions, contact:

Ryan Canning	Bill Enigk	Kevin Pennycuff
Business Development Engineer	Business Development Engineer	Business Development Engineer
513.870.4072	**513.870.4073**	**513.870.4076**
rcanning@polezero.com	**benigk@polezero.com**	**kpennycuff@polezero.com**

513.870.9060 • support@polezero.com • www.polezero.com

BSC Filters
Dover House, 10-11 Stirling Park,
Bleriot Way, Clifton Moor,
York, YO30 4WU UK

Phone: +44 (0) 1904 694250
Fax: +44 (0) 1904 694260
Email: sales@bscfilters.com
Web: www.bscfilters.com

K&L Microwave
2250 Northwood Drive
Salisbury, MD 21801
USA

Phone: +1 410 749 2424
Fax: +1 443 260 2268
Email: sales@klmicrowave.com
Web: www.klmicrowave.com

Dow-Key Microwave
4822 McGrath Street
Ventura, CA 93003
USA

Phone: +1 805 650 0260
Fax: +1 805 650 1734
Email: askDK@dowkey.com
Web: www.dowkey.com

Pole/Zero Corporation
5558 Union Centre Drive
West Chester, OH 45069
USA

Phone: +1 513 870 9060
Fax: +1 513 870 9064
Email: support@polezero.com
Web: www.polezero.com

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