# Proteus™ PurePass™ RF Digital Signal Processing Conditions the Spectrum Against Numerous Scenarios

*ISCO's Proteus: The simple solution for complex adjacent and co-channel interference problems.*

ISCO's Proteus RF Digital Signal Processor enables optimal performance even in the harshest RF environments, by adding intelligence to a previously neglected wireless transceiver component: the Rx feed from the RF preselector to the radio. By functioning as an intelligent front end to the radio receiver, the Proteus adapts the uplink channel to optimize Carrier to Interference ratio (C/I) in the presence of complex time-varying co-channel interference – regardless of the interference source. In addition, the DSP-based filtering of the Proteus allows rejection of near-adjacent channel RF transmissions that are not addressable using conventional physical filter technologies.

The aggregate effect of interference, regardless of the source, is the reduction of the net spectral efficiency of a network, which manifests itself in underperforming or erratic data services, blocked or dropped voice traffic, and a generally degraded customer experience. Mitigation of these revenue-eroding effects provides immediate and dramatic performance benefits.

**Potential sources of interference are many and varied, and may include:**

1. **Co-channel transmissions** from wireless traffic occurring at international and market borders including unwanted co-channel GSM**.**
2. **Harmonics** emitted from poorly designed or failing broadcast RF amplifiers, or wireless amplifiers operating in a lower frequency band**.**
3. **Environmental Passive Intermodulation (PIM) generation** caused by non-linear effects in the physical environment in the near-field of the antennas, including steel architectural elements in indoor installations, corroded junctions in fences, and countless other examples.
4. **CATV booster amplifiers** poorly-designed that oscillate due to insufficient input/output isolation or missing output terminations.
5. **Wireless bi-directional amplifiers** poorly-designed that oscillate or emit harmonics.
6. **Repeaters** with insufficient isolation of internal frequency references, or poorly performing power amplifiers.
7. **Co-channel terrestrial television broadcast transmissions** (effectively wideband interference sources with narrow band characteristics due to the high power spectral density at the video and audio carrier frequencies) occurring across international borders
8. **Intermodulation** products due to **transmitter cross-coupling** resulting from insufficient isolation between the output of one power amplifier and the input of another.
9. **Near-adjacent channel uplink traffic** in a competitor's spectrum, often exacerbated by the use of smaller guard bands as demand for spectrum has increased, and by near-far effects that occur in situations where operators do not or cannot co-site their infrastructure.
10. **Near-adjacent channel digital terrestrial broadcasts** in the 700 MHz bands.
11. **Near-field of DAS systems** from electronic equipment such as ID card readers, routers or two-way wireless communication systems.
12. **PCS band selectivity** improves Adjacent Channel Selectivity (ACS) in the PCS band, by only passing the necessary band(s) being supported.
13. **Cellular A' band rejection** improves ACS for the B-Band by removing adjacent A' band energy.
14. **Cellular A' selectivity** improves ACS for existing UMTS carriers by reducing the impact of adjacent GSM.

Due to Proteus's unique ability to optimize C/I, based on proactive instantaneous RF channel conditioning from its powerful PurePass™ fast interference identification algorithm, performance benefits can be realized *independent* of the interference source.

## *Spectral Analysis Tool – SpectrumView PLUS*

In addition to *proactively removing* interference, Proteus works in harmony with current operations helping to improve activities to track down and eliminate the source of interferers. With Proteus installed, service providers have access to ISCO's SpectrumView PLUS spectrum analysis software tool. SpectrumView PLUS r*eports and logs spectral history capturing detailed information about interference events.* For sources that can potentially be tracked down and eliminated, Proteus with SpectrumView PLUS serves as an invaluable information source by capturing and logging transient, difficult to isolate interference events, while simultaneously isolating the network from the negative effects of the interference. Below in Figure 1 are typical reports created by SpectrumView PLUS giving valuable information pertaining to co-channel interference. The information includes such detail as frequencies, power levels, time of day, volume of occurrences and more.

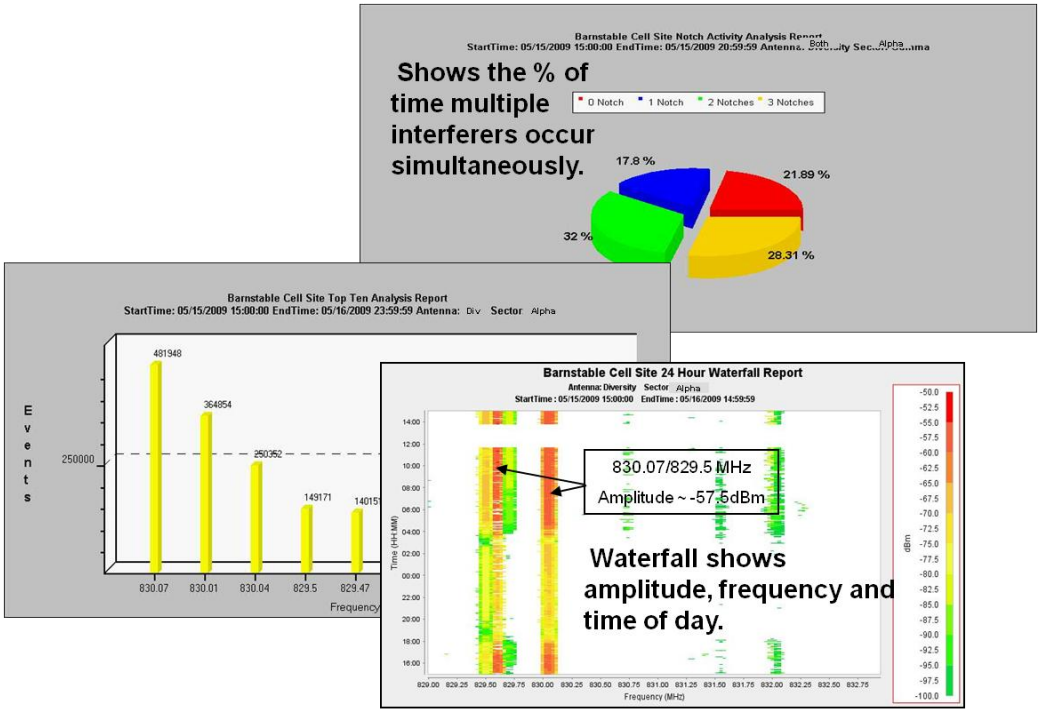


**Figure 1**

*Typical SpectrumView PLUS Reports*

## *Proteus is an Intelligent Frontend for the BTS Receiver*

Proteus is installed on the receive uplink and breaks the path between the antenna and the receive side of the base station or remote radio head (Diagram 1.) Once installed, Proteus will automatically condition the receive path maintaining an RF layer free of physical layer impairments (PLIs) using the capabilities described in this paper.

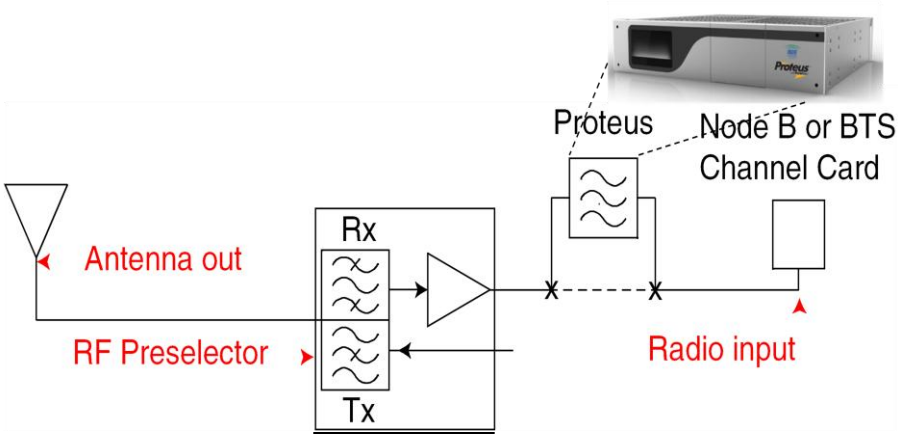


**Diagram 1. Proteus installs on the receive, uplink path**

*The exact configuration of an installation will vary depending on the base station and other site specific details.*

**About ISCO International:**

ISCO International operates on the "front lines" of 3G – and soon – 4G communications by enhancing the integrity of a mobile operator's "physical layer" assets – the cell site and acquired spectrum. ISCO understands that wireless communications depend heavily on the user's RF connection to the base station and the company's "spectrum conditioning" product line ensures that this connection performs as expected even in the most hostile and unpredictable environments. ISCO's new Proteus™ product, based on the latest PurePass™ digital signal processing technology, adaptively identifies and corrects the physical layer impairments (PLI) that decrease a cell site's coverage, capacity, data throughput and KPI performance. In sum, ISCO allows wireless carriers to get the most out of their existing base stations and spectrum (possibly eliminating the need to build additional ones in certain situations), reduce operating expense and deliver a consistently high quality of service. Please visit www.iscointl.com for more information.

More information about all ISCO wireless solutions can be obtained from the ISCO website at www.iscointl.com.

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