Absolute Analysis Investigator™
## CPRI Radio Access Network Tester

Investigator™ for CPRI Provides a Comprehensive Toolset for Validating Performance and Interoperability in 2G/3G/4G/LTE Radio Access Networks

Fully-Integrated Architecture

Investigator tests performance and interoperability of radio access network that use the CPRI link as its communication link. The trend towards centralized base stations and distributed small base station cells have put tremendous strain on the bandwidth requirements of these networks. Investigator will ensure proper operation so you meet your quality of service and bandwidth requirements.

General Specifications:

- Performance application measures **latency, service disruption delay, and BER** for radio access networks
- Protocol analysis, traffic generation, and performance statistics
- **Full extraction of IQ data** across all antenna containers to assist in optimization of modulation algorithms
- **Fast C&M decode** to Ethernet frame commands for debugging RRH to BBU communications
- Stress testing with **error injection** and **delay line** functions
- Link monitoring for **real-time alarm** error conditions
- Monitor up to 16 CPRI links concurrently
- Lossless 100% line rate data capture
- Link Speeds: 0.614, 1.228, 2.46, 3.072, 4.91, and 6.144Gbps
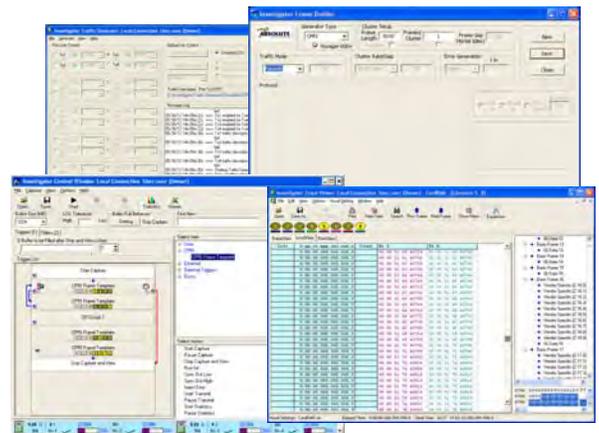
Investigator™ Software above shown with Mini-Portable Platform Option

Investigator Applications

The Investigator platform is ideal for testing radio access networks that use CPRI high speed serial links to transport digital R/F data and RRH to BBU command data. In debugging these complex networks, visibility is key. Investigator provides bit level trace capture, so engineers have no doubt as to what in happening on the link. Both control & management data, as well as IQ data can be extracted for further analysis.

Investigator for CPRI helps engineers in both the lab and the field who are doing mobile communications that use the CPRI link. This includes radio access network integrators, mobile telecom service providers, BBU and RRH equipment manufacturers, and passive optical network equipment manufacturers.

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Investigator™ for CPRI Solution Overview

Investigator offer full testing capabilities to validate your Radio Access Network performance via the CPRI link.

Data Carried by CPRI

- Protocol specific data
- Control & Management Data
- Vendor specific data
- IQ data of RF signal
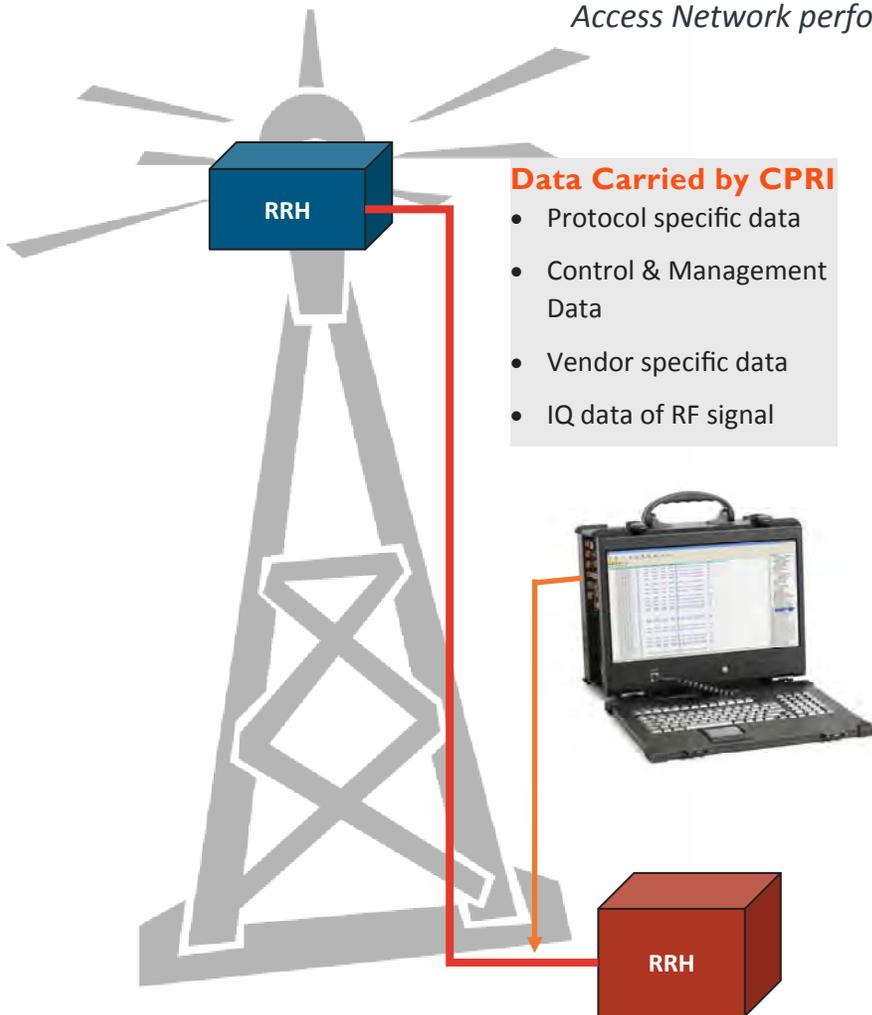
Interoperability Testing

Interoperability testing starts with decoding and validating the CPRI specific data such as control characters, HFN and BFN numbers, and all L1 Inband protocol parameters. Parameter is captured and decoded for quick link validation.

## BBU/RRH Communications Testing Across Fast C&M Channel

Full visibility into the commands and messaging sent between the BBU and the RRH via the **Fast C&M channel**. The messages can be read into Ethernet viewer like Wireshark via the PCAP format.

Custom Messaging Testing

Any vendor specific bytes transmitted are captured with the rest of the data. The can be decoded and processed according to the user specifications.

IQ Data Modulation Validation

All IQ data is captured and can be post – processed to extract the raw IQ pairs. This data can then be imported into an IQ analysis program for further modulation analysis. Correlation between RF and digital RF can be done via the external triggering function.

Radio Access Network Performance Testing with Investigator
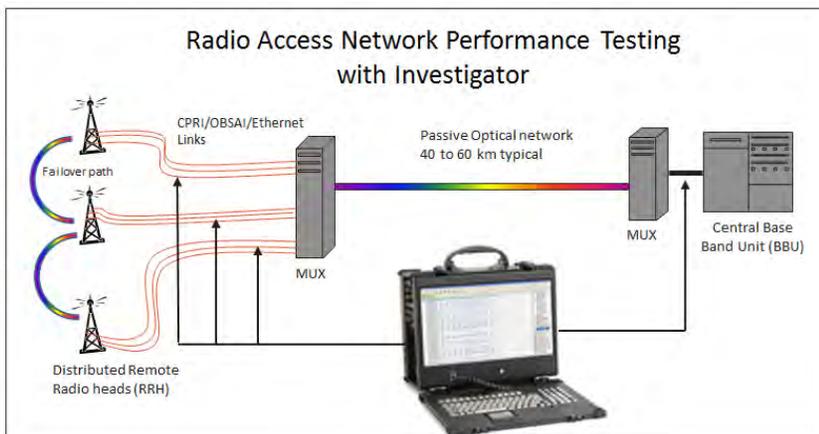
Long Haul PON Testing

In the case where you have long haul fibre connecting your RRH to BBU, you will need passive optical network equipment such as muxes and repeaters to extend the signal.

Investigator includes applications to test the PON for BER, latency, and failover delay time to ensure peak operation.

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Software Functions - Displaying and Finding Trace Data

Find and Debug Errors Fast

Investigator software provides exceptional functionality to find and debug errors fast. The software can constantly monitor data on the line, and only capture events necessary for your debug. This both saves time as well as precious capture data, insuring you will capture only the required conditions that caused the problem.

To achieve this, the software utilizes a number of advanced functionality, including:

- **Alarms**: Build and save custom trigger, filter and capture configurations to server for later use, or use as part of a formal test procedure

- **Advanced triggering**: Start capturing data only when specific conditions are met

- **Powerful filtering**: Sift through trace data fast, and filter out all conditions except the ones you are looking for

- **Search facilities**: Find any data pattern within any packet or control symbol, and maintain a library of predefined search patterns

- **Bookmarks**: Set bookmarks for reference in later debugging
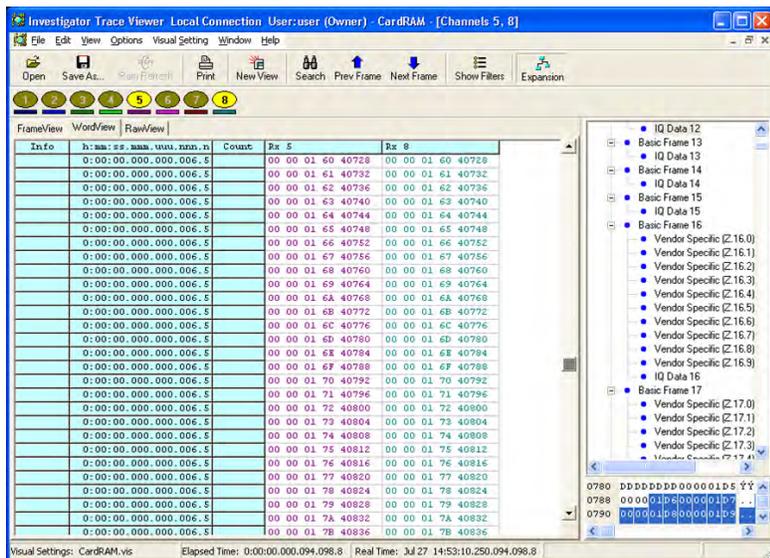
Investigator Trace Viewer in Word View

Performance Statistics

Performance statistics monitors the health of the CPRI link. Users can view in real-time a number of different parameters, including:

- Loss of Signal
- Loss of frame
- Service port access defect
- Remote Alarm Indicators
- HFN/BFN sequence errors
- HFN out of range errors
- Invalid BFN numbers
- Bit Error Rate
- Transmitted/Received frames

Full Decode of CPRI Frames

- Decode all control words

- Decode all IQ data

- Visibility into both all Vendor Specific bytes and control word bytes.
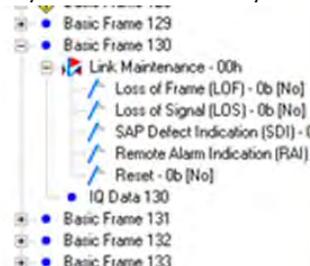
Data Display Formats

- **Frame View**: Show frames at the basic frame level

- **Word View**: Show words in hexadecimal for each frame

- **Raw View**: Show each word down to the bit level

- Save/print/export trace segments or entire capture with comments.

Collaboration and Offline Viewing

The Investigator Viewer is available for free download, enabling design team collaboration with captured trace data. All traces can be captured and stored on any standard PC.

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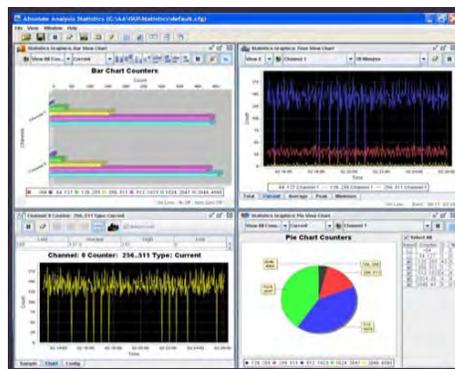
Advanced Triggering Capabilities

Expert Control: Find and Trigger on Any Control Word Byte

Part of the exercise of validating and debugging involves finding the problem quickly, without having to sift through gigabytes of data. With Investigator, the advanced triggering will allow you to trigger on any event or character within the protocol specification, and then setup automated multi-step tests.
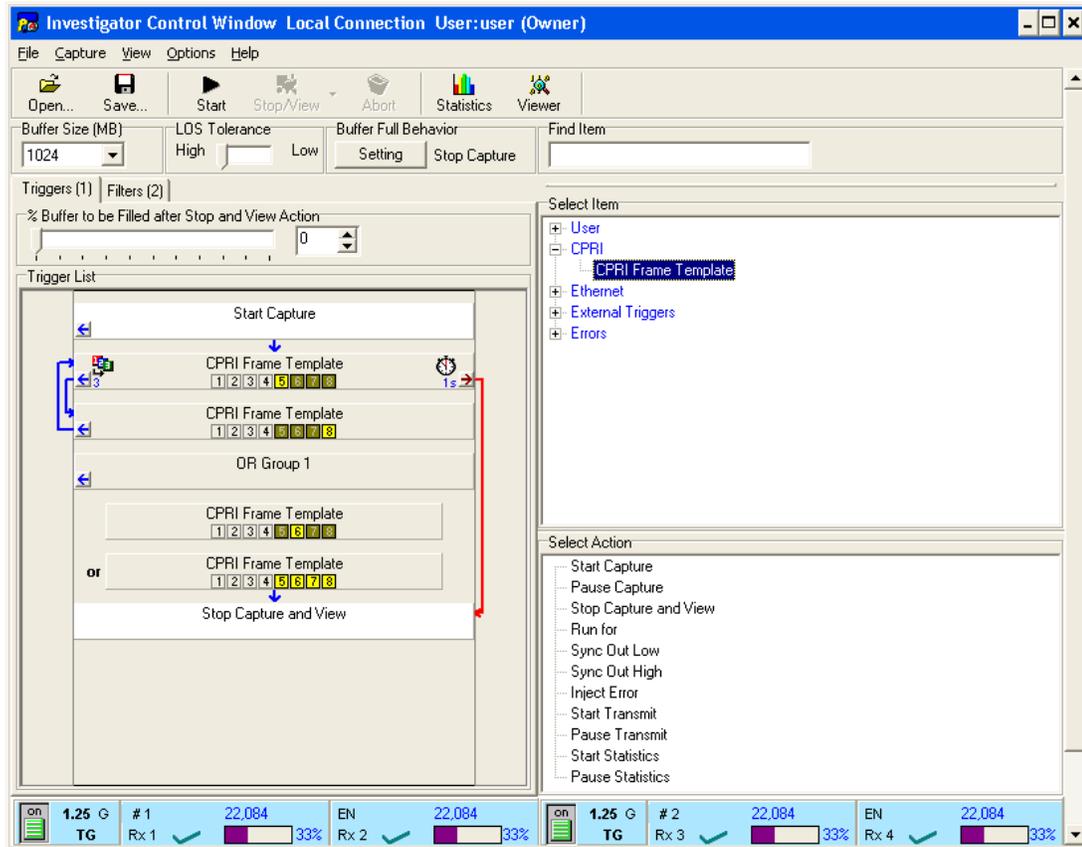
A Multi-Condition Trigger Example

Analyzer Control

- Capture and decode data before & after the trigger
- Send out an external sync out signal to any oscilloscope or logic analyzer
- Loop back to begin after capturing data
- Use Boolean logic for up to 32 trigger conditions
- Re-arm trigger if condition is not met
- Independent channel triggers

Triggering Options

- Multi-level triggering
- Trigger on multiple consecutive events, or across every channel
- Select from a list of predefined trigger events
- State machine "loop sequence" triggering
- Re-arm trigger if condition is not met
- Independent channel triggers
- Trigger from an external source

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Investigator Stress Testing

Drive traffic, Inject Errors and Introduce Delay Into Your Network

Absolute Analysis Investigator's Traffic Generator allows you to generate compliant traffic into a Device Under Test (DUT) with complete control over the timing and content of the data.

Valid and invalid traffic streams can be defined to test network device error recovery. The traffic generator's ability to maintain full-line rate traffic, even across multiple links, allows device performance to be measured and operation under stress to be characterized.

The Investigator Impairment application can introduce virtual cable delay onto the line, allowing the user to simulate long cabling or other impairments.
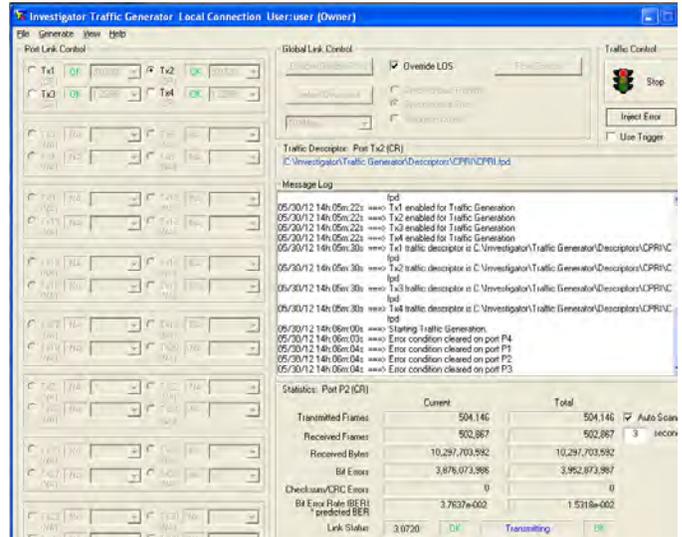
Use the Investigator Traffic Generator to generate traffic and stress test your network

Investigator CPRI Data Extractor for C&M and IQ Data
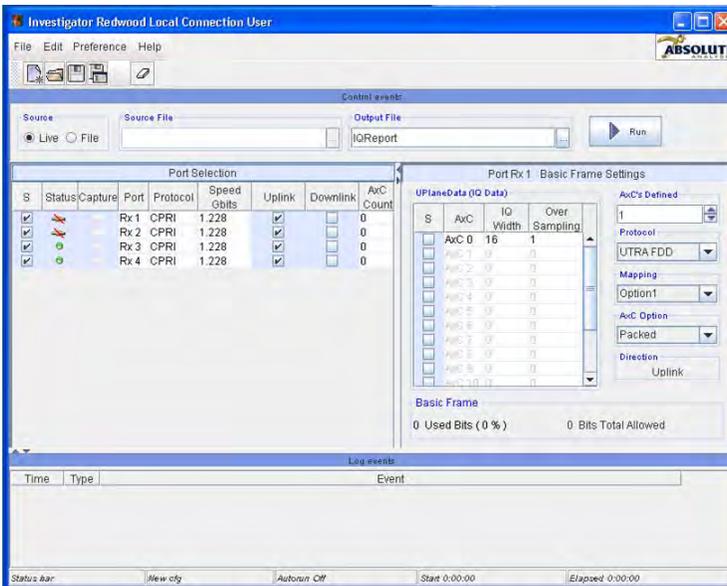
Use the CPRI Data Extractor to output IQ data and Fast C&M (Ethernet) data captured on the trace.

Analyze and Decode Captured Trace Data with the CPRI Data Extractor Utility

The CPRI Data Extractor provides an easy to use GUI to extract both the IQ data and the Fast C&M (Ethernet) data from a captured trace.

To extract the data, the user simply enters the parameters of the network configuration, including the IQ sample width and number of AxC containers. The CPRI Data Extractor then uses this data to de-multiplex the data into usable format.

The IQ data can be output in either CSV or Matlab V5 format. The Fast C&M data can be output as a PCAP file, which can be read by Wireshark or other PCAP enabled trace viewer.

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Investigator™ Library Application Programming Interface (API)

Automated Testing

All of the functions used by the various Investigator applications are made available to the user through the Investigator Library API. The 'C' compatible interface allows 3rd party applications to be created on top of the investigator platform that can be used for Test Automation, Production Testing or Conformance Testing.

The API can also be accessed from a UNIX platform using remote procedure calls enabling the integration of Unix-based platforms into the Investigator Solution. As the support of Java-based applications increases within the Investigator platform, parts of the solution can run natively under UNIX.
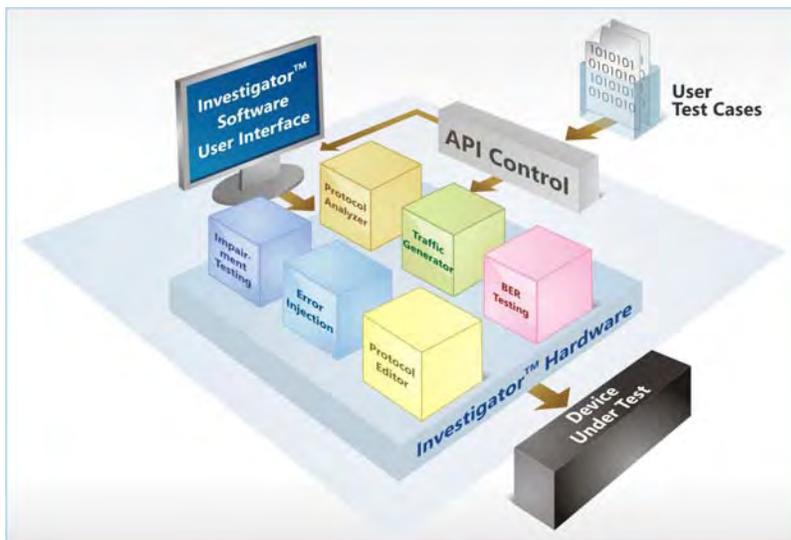
Investigator™ Protocol Editor

Support for Custom & Proprietary Protocols

The Protocol Editor is easy to use, powerful means of adding implementation defined packets and control symbols, per the respective protocol specification.

The Protocol Editor uses a GUI to correctly display the translated data from the link. Once it is saved into the protocol database the new or revised protocol is available for decoding and searching within the Trace Viewer, in the Protocol Analyzer as trigger and filter definitions, also in the Frame Builder as a communications event.

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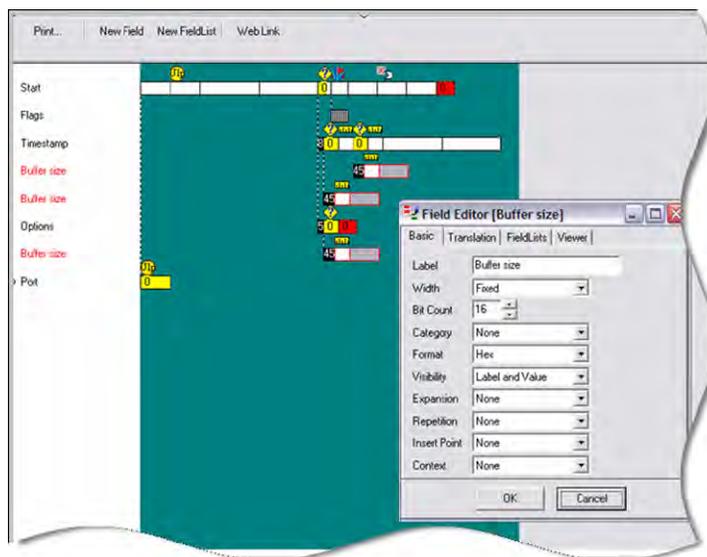
Investigator™ Connectivity

A variety of connector types available

The ports on every Investigator System have been standardized to accommodate the widest range of connections using the SFP (small form factor pluggable) transceiver specification.

We support the most common connection methods for radio access networks, which include:

- Copper SFPs
- Optical SFPs

  SFPs can be single mode or multi-mode

Please contact us for your specific connector and cabling needs.

Example Optical SFP Connection to Investigator

Investigator™ Platforms

Portables

Three Screen

Rack Mount
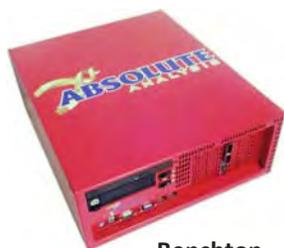
Benchtop

Select the chassis to suit your needs

Investigator Platforms have been designed to meet a number of different customer requirements from **high port count** to **extreme portability** and **ruggedization**.

Investigator makes use of industry standards within its design to protect customer investments in our technology. **This means future upgrade paths are flexible and cost effective**. Often, additional protocols and capabilities can be self-installed into existing hardware, without having to send the unit back to the factory.

Investigator platforms use industry standard PC-based platforms, Windows-based operating systems and Java -based applications.

Absolute Analysis invests time and effort in ensuring the enclosure technology provides appropriate power and cooling for the Investigator Interface Cards. Each platform provides exactly the same high level of functionality as the others with the only difference being the number of Interface Cards, and consequently the number of communications ports, supported.

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Investigator™ for CPRI Radio Access Networks Summary

A complete solution on a single piece of hardware

Functions	Protocol Analyzer, Traffic Generator and Performance Tester for Radio Access Networking using the CPRI protocol
Special Applications	Error injection, delay line (impairment) tester, performance statistics, bit error rate tester, CPRI data extractor for C&M and IQ data decoding, and protocol editor for custom CPRI decodes
Protocol Support	Supports up to version 5.0 of the CPRI specification.
Maximum Port count	Supports a maximum 16 CPRI links simultaneously
Speed Support	0.614, 1.228, 2.46, 3.072, 4.91, and 6.144Gbps
Capture Memory Capacity	Maximum 4 GB per card, or 1 GB per port. This will capture approximately 13 radio frames at 2.5 Gbps
Triggering Functions	Trigger on real-time traffic, using any control symbol, packet or port. Advanced Boolean functions for setting trigger conditions, including external trigger in and out capabilities.
Filtering	Filter trace data on any symbol or packet. Save filter conditions post-capture analysis. Add note and bookmarks to help facilitate debugging.
API Support	Use the API to control the analyzer and traffic generator with an external C program. Automate test cases, and reproduce specific traffic pattern to facilitate a repeatable test plan.
Network Connections	The Investigator™ platform supports a variety of connectors and cables, including optical and copper SFPs.
Maximum Port Count	Up to 16 full duplex or 32 half duplex ports on a single chassis.
Platforms and Configurations	Absolute Analysis Investigator™ Systems are available in several platforms ranging from portable to high port count rack mounts to ruggedized chassis.

Service and Support

Absolute Analysis provides unsurpassed service to all Investigator™ users including remote diagnostics, extended warranties, and upgrade paths to current offerings from any Investigator™ system.

Training

Absolute Analysis offers comprehensive training courses for products and protocols. Training can be provided at your location or remotely, and can be customized to your requirements.

For More Information

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