CRFS

SenS Remote

High performance, uncompromising
signals intelligence - 24/7 recording,
monitoring, geolocation & analysis

40GHz
RF SPECTRUM
INTELLIGENCE

RF**eye** SenS

The power of an RFeye Node combined with the best of the RFeye SenS Portable using fiber-optical links - Raw **Big Data** Intelligence

Intelligent Receiver with Remote I/Q Recorder

The RFeye SenS Remote combines the RF and edge processing capabilities of the RFeye Node together with the high-fidelity I/Q recording and signal extraction of the RFeye SenS family

- **Remote Radio Head**
- **Full-rate I/Q Streaming**
- **Long term storage**

The RFeye SenS Remote enables recording to take place in fixed, unmanned locations such as on a mast or tower. The weatherproof remote receiver head is located as close to the antenna as possible to minimize cable losses. High resolution 100MHz Instantaneous Bandwidth I/Q data is streamed from the receiver via fiber-optic cables to COTS rack-mounted processors and storage media housed in a building or environmental enclosure.

The SenS Remote can operate alone, or as part of a normal RFeye Node network and performs all the functions of a RFeye Node (scans, sweeps, geolocations etc.). It can also act as a long-term RF recording system. As disks can be hot-swapped, SenS Remote can record spectrum data indefinitely.

Once the data has been recorded it can be instantly analyzed in DeepView, the forensic signal analysis software. Multi-terabyte datasets can be quickly loaded, and signals of interest extracted. The data can be used to capture deep pattern-of-life information or generate libraries of high-value signals for intelligence purposes.

When combined with the geolocation information from the RFeye Node network, complete awareness within a contested spectrum environment is possible.

Features and Benefits

- Wide-area spectrum monitoring up to 40GHz
- 100MHz IBW fiber optic streaming and recording
- Rugged IP67 remote receiver for mast or building deployment (maintains no operational process intelligence if captured)
- COTS system processors and recording media in secure equipment hut
- RFeye DeepView forensic analysis software included
- Fiber advantages:
    - Supports longer-duration recording of full-rate I/Q at 100 MHz IBW
    - No Ethernet protocols – intercepted data reveals no operational intelligence
- Designed for VITA-49

Multi-**user** . Multi-**mission** . Multi-**domain** . Multi-**site**

Border Security

Accurate build a pattern-of-life of spectrum activity in contested border areas

RFeye SenS Remote is a valuable tool where operators need to understand, record, and analyze what is happening across international borders or at the border itself. Often, activity at borders is carried out using devices that emit an RF signal, such as push-to-talk radios, radars, tactical data links, jammers etc.

When looking for signal of interest, the operator won't always know when it will be transmitted. By using the SenS Remote to record RF data over a long period, they can go back over the timeline and find signals that may only have been broadcast for an extremely short period of time or hidden within the noise floor. The signal can then be extracted and analyzed to gain vital intelligence.

By passively capturing signals from across borders using SenS Remote, you can detect, record and importantly geolocate emissions; delivering a vast amounts of additional intelligence on intent, equipment, capabilities and improving general situational awareness. And because SenS Remote is passive, an operator can build up a solid pattern of life without overtly highlighting their own intent.

- Passively track activity at a contested border
- Record full rate spectrum data over a sustained period
- Find signals hidden within the noise
- Quickly isolate and extract signals of interest
- Constantly track and geolocate target signals
- Covertly build up a pattern of life

National Security

The RFeye SenS Remote can be used as a 24/7 strategic monitoring tool to capture wideband RF spectrum intelligence

RFeye SenS Remote, is the ideal platform to capture long duration wide bandwidth spectrum intelligence. Gathering intelligence and evidence is often difficult to achieve before the fact. RFeye SenS Remote delivers the capability to interrogate spectrum data with the benefit of hindsight. This ability to travel back through RF spectrum data over time and frequency means maximizing your chances of identifying critical evidence or intelligence. Whether you're monitoring and geolocating radio traffic, analyzing trigger device transmissions or finding jamming equipment, the SenS Remote delivers essential intelligence when it matters.

Due to the sensors small physical size, a number of tactics, techniques and procedures can be adopted to deploy the system in a covert form. In addition, the system's multi-user, multi-mission approach lends itself to multiple agency, or multi agent use.

Signal Library Collection

A powerful system to capture, identify and isolate signals ready for integration into signal libraries

With SenS Remote you can record spectrum over long periods, capturing a range of possible signals of interest. Using the built-in signal analysis and extraction software, RFeye DeepView, you can quickly sift through terabytes of data to find the exact signals you are interested in. These signals can then be extracted and collated within a signal library. Furthermore, the new signal hunter feature allows the system to identify emissions from background noise, and autonomously extract and archive. This powerful system also allows users to identify any given signal type, which may for example be from an existing library, then search the recorded data for signals that match the library signal parameters.

Feeding a signal of interest into DeepView also gives

you the ability to only record those types of signal or signals. Because the head is separated from the data and processor, these collection mediums can be removed to prevent capture. Similarly, the optical interconnect makes tapping the device very difficult.

Naval EMSO

For Electromagnetic Spectrum Operations, RFeye SenS Remote delivers rich intelligence, safe-guarding future operations

From EMCON and spectrum management to hostile transmitter geolocation and library building, SenS Remote provides critical intelligence during friendly naval deployment, in contested waters and the littorals.

- Monitor and investigate ship board emmissions
- Intercept and analyze opponent transmissions
- Fragile equipment (servers etc) can be housed deep inside the ship.
- Optical interconnect ensures electrical isolation from sensitive I.T. systems
- High sensitivity means you can receive signals from further away with fewer sensors

Military Test Range Signal Capture

Capture and analyze signals during military tests and exercise

During a test of new equipment on a military test range, SenS Remote can be used for long duration RF signal capture to assess the performance of the equipment. SenS Remote can record all RF transmissions emitted to see if they were as expected and to spec. Any anomalies could be analyzed and accessed and the source of any potential interference geolocated and investigated. The recordings could also be played back in the lab to aid further development.

During a military training exercise, the SenS Remote can be tasked with recording the spectrum within a certain bandwidth, e.g., AN/PRC or radar bands. The data can then be used for post mission debriefs, EMCON analysis and future exercise considerations.

Recording in Sensitive Environments

Ensure the integrity and security of recorded data

In certain sensitive or hostile environments, the security of recorded RF data is paramount. Having potentially sensitive data stored on a Node or transmitted over an ethernet cable could be a security risk. With the SenS Remote no data is stored on the Node and only raw RF data is being transmitted along the fiber cable. All sensitive data can be secured within a locked enclosure at the bottom of the tower or inside a secure building. It therefore makes it harder for anyone to intercept confidential/sensitive information.

RF**eye** SenS

SenS Remote

Example Specifications

8GHz/18GHz/40GHz options available

Remote radio head (RRH): 18GHz option

Frequency

Range	9 kHz to 18 GHz

Noise figures at maximum sensitivity

9 kHz to 83 MHz	11 dB
83 MHz to 1 GHz	9 dB
1 GHz to 2.9 GHz	8 dB
2.9 GHz to 5.9 GHz	7 dB
5.9 GHz to 10 GHz	9.5 dB
10 GHz to 15 GHz	12 dB
15 GHz to 16 GHz	13 dB
16 GHz to 17 GHz	18 dB
17 GHz to 18 GHz	21 dB

Sweep speed

Sweep speed at 2 MHz RBW	390 GHz/s typical

RF Signal inputs

Switchable full-bandwidth RF inputs	3 x SMA connectors
Instantaneous bandwidth	100 MHz
Tuning resolution	1 Hz

Sampling

Resolution	16 bits I&Q
Rate	125 MS/s I&Q

Internal frequency reference

Initial accuracy @ 20°C	±0.1ppm typical
Stability over temperature	±0.3 ppm typical
Ageing over 1 day	±0.04 ppm per year

Connectivity PCIe over Fiber

Equivalent lanes	4 x Gen 2.0 PCIe
Total throughput	Up to 4 Gbps

Size, Weight and Power

Dimensions (RRH) (w, h, d)	16.3 x 15.8 x 10.2 in
	415 x 400 x 260 mm
Weight (RRH)	62 lbs / 28 kg
Power consumption (RRH)	40 W typical

Environmental

Operating temperature range	0 to +50°C (32 to 122°F)
Storage temperature range	-40 to +71°C (-40 to 160°F)

Server rack

Node server (Node functionality)

|	
Operating system	Linux (Alpine)
Processor	Intel Xeon
Connectivity (to RRH)	Fiber optical cable to RRH
Connectivity (to DeepView server)	10GigE

DeepView server (Recording functionality)

Operating system	Windows 10
Processor	Intel Xeon
Connectivity (to Node server)	10GigE

Storage and record times (hours)

Disc capacity	25 MHz IBW	50 MHz IBW	100 MHz IBW
30 TB	60Hrs	30Hrs	15Hrs
60 TB	120Hrs	60Hrs	30Hrs

Signal analysis software

|	
RFeye DeepView software (included)	Windows 10 based
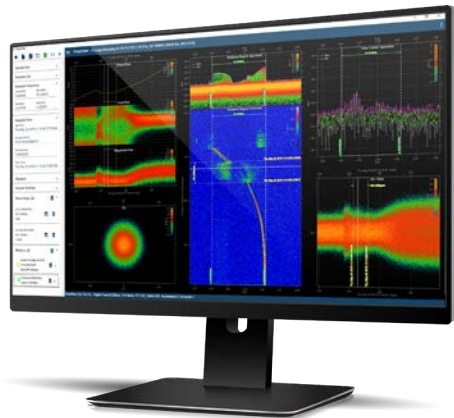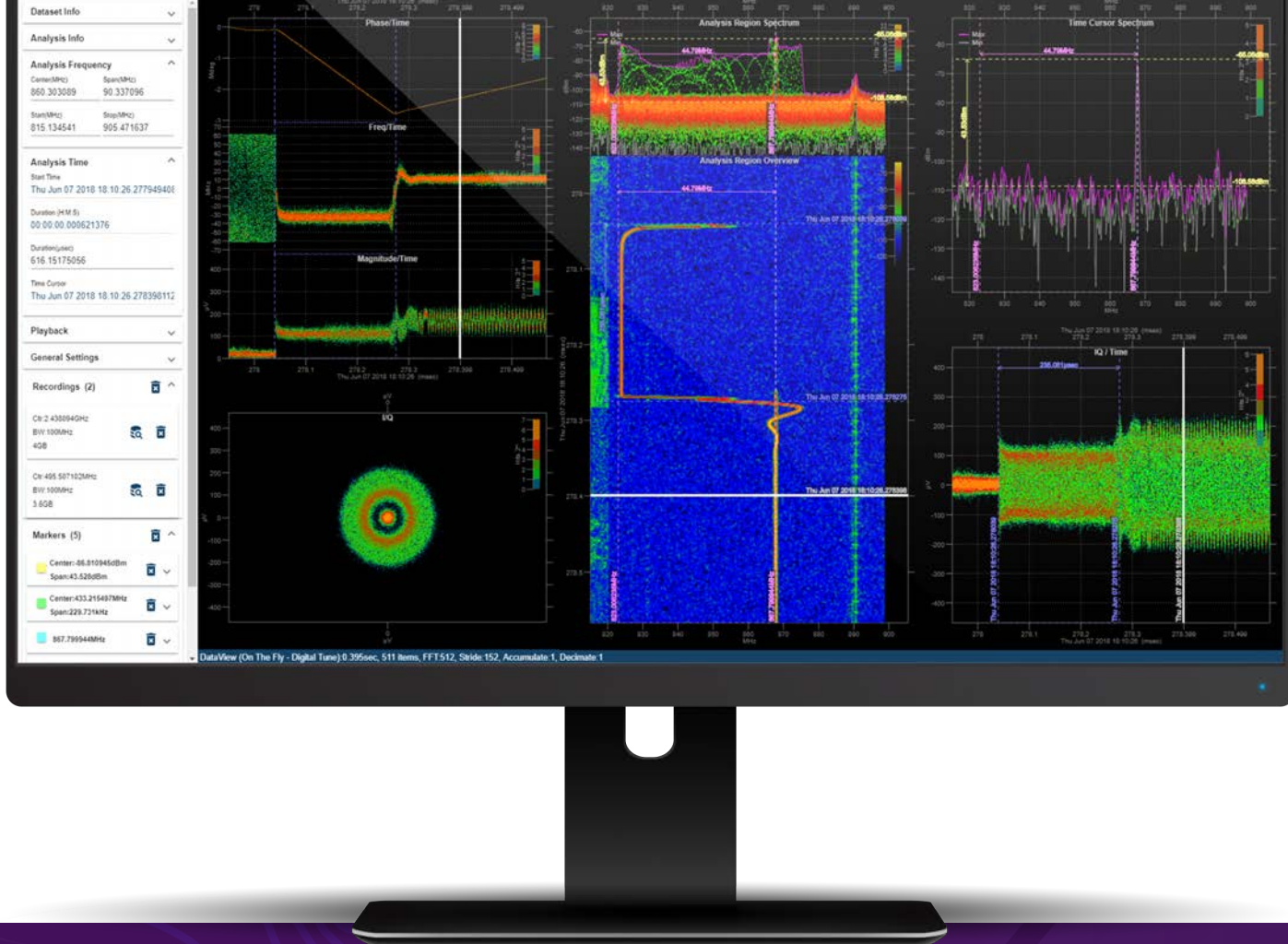
Big Data Analysis - **RFeye DeepView**

Deep-dive forensic RF analysis tool for searching massive multi-terabyte data sets for signals of interest. Designed for use with RFeye SenS recorders and RFeye Nodes.

RFeye DeepView offers an unmatched user experience. With signal capture presets, JSON exports, and FFT automation for time versus frequency optimization, DeepView's intuitive UI enables novices to record, analyze and export RF files in a matter of minutes.

RFeye DeepView allows signals of interest (SOIs) to be extracted with surgical precision and pristine clarity. Interoperability support means DeepView fits into your existing architecture to save you time and money. It can run as a PC application in a local web browser or in a remote browser-based operation and supports multiple receiver recording and data analyses to create a seamless display. There are five key signal views available in the spectrum overview:

- Dataset Overview (D.O.): Displays an overview of all the IQ data currently loaded for analysis, plotting time against frequency

- Analysis Region Overview (A.R.O.): Displays the spectrogram of the dataset currently selected in the D.O.

- Analysis Region Spectrum: Displays a heat-map of the analysis region selected in the Dataset Overview, plotting power against frequency

- Time Cursor Spectrum: Displays the snapshot spectrum that is currently selected by the time cursor in the A.R.O. and the Power/Time Charts. Plots power against frequency.

- Power/Time Chart: This displays the region selected in the D.O. in time-domain. It also shows a time cursor that can be dragged to a desired location using the mouse pointer

- NEW - Powerful Automated signal hunting. Identifies signals from noise then collates all instances from the recorded data set. Collect, export and analyze specific signal types across wide frequency ranges automatically.

- Designed for VITA-49
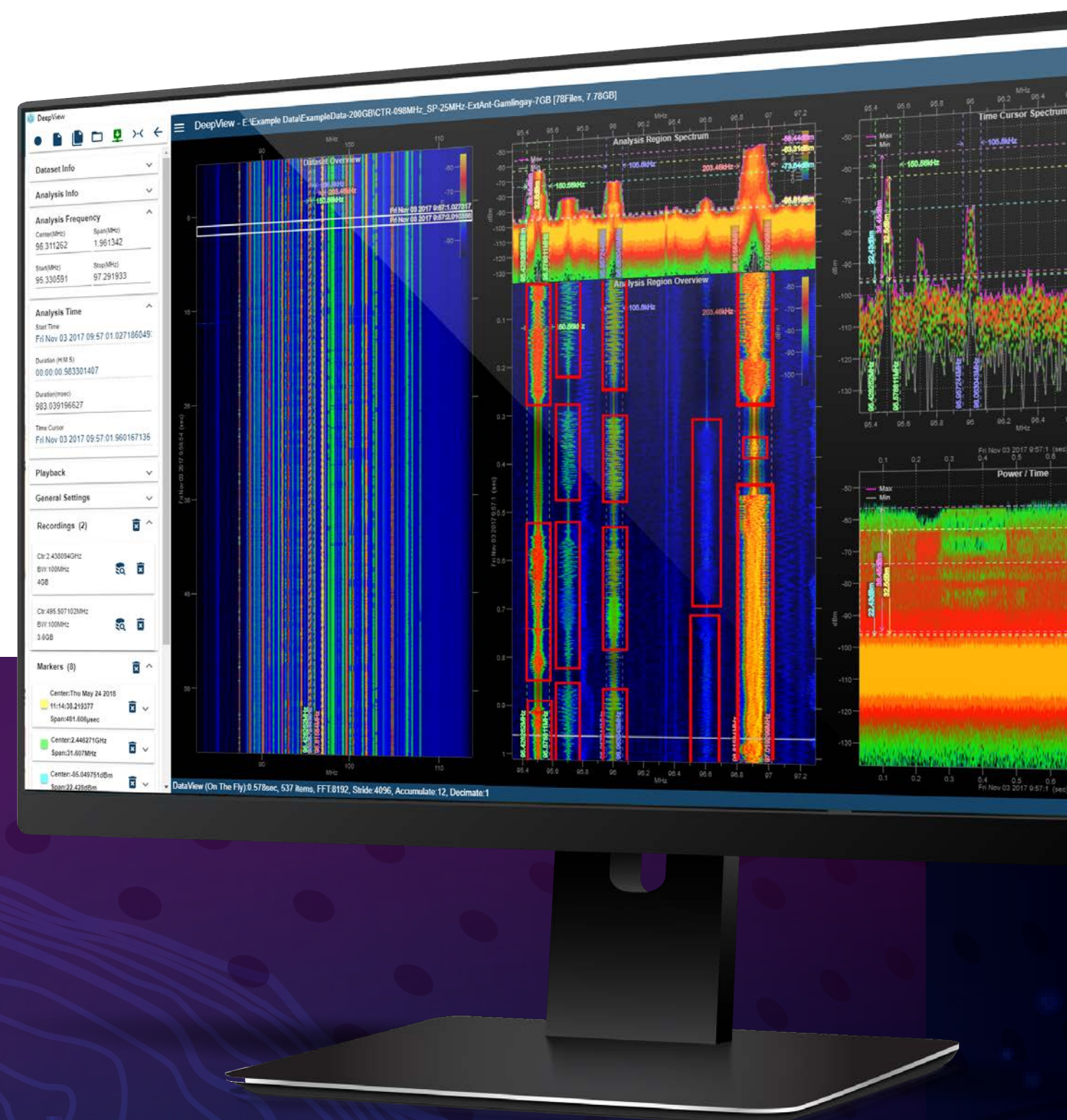
Features and Benefits:

- Record and Analyze signals of interest
- Multi TB big-data analysis tools
- Individual or batch datasets
- Comprehensive correlative analysis
- Adjustable spectrum thresholding
- Multiple file types supported

- Seamless workflow with RFeye SenS Portable/Remote
- No wait, multi-terabyte file analysis
- Signal resolution down to 1Hz
- Zoom & scroll UI with fluid motion reduces fatigue & increases user accuracy

The CRFS difference

Leading the way in Spectrum Monitoring & Management

CRFS is at the forefront of new technology for distributed monitoring and geolocation, featuring wideband receivers with lightning-fast sweep speeds and best-in-class noise figures and phase noise. These high-sensitivity receivers are known as RFeye Nodes.

For our military customers, fast sweep speeds and instantaneous bandwidth mean higher probability of intercept (POI). This translates to confidence that potential threats can be detected for real-time tracking, recording and further analysis.

Low noise means that operators can detect and locate lower-power, more distant signals that might otherwise have been missed entirely, providing earlier threat warning indicators (TWIs) and better situational awareness of an area of operations (AO).

RFeye's high-performance hardware and state-of-the-art software enable extremely fast processing to give much faster geolocation updates than other systems. Our TDOA geolocation algorithms typically update 10 times per second compared to similar systems that may only update once every 30 seconds. Fast geolocation updates are crucial in situations where hostile targets may be moving at speeds of over 1,000 mph.

Best in class RFeye wideband receiver technology
- Rugged, SWaP optimized, outstanding RF performance
- Highest probability of intercept
- Deployment options for fixed, mobile & tactical
- TRL9 - Trusted, proven, deployed

Comprehensive RFeye software & visualization tools
- Real-time expert mode
- Automated reports & alerts
- Forensic analytics
- Task automation (e.g. scheduling)

Best price / performance
- Solutions at different price points
- Unmatched system performance

One system, multiple purposes
- Multi-user/multi-mission architecture
- Deploy, redeploy, reconfigure

Best customer experience
- Agile development team
- Customizable solutions
- Outstanding support & training
- "Try before you buy" on-site trials & demos

1: RFeye Array 100/150
2: RFeye Stormcase
3: RFeye Array 300
4: RFeye Node + ODK
5: RFeye Node 100-18
6: RFeye SenS Portable Recorder

Arrange a Demo

Don't take our word for it

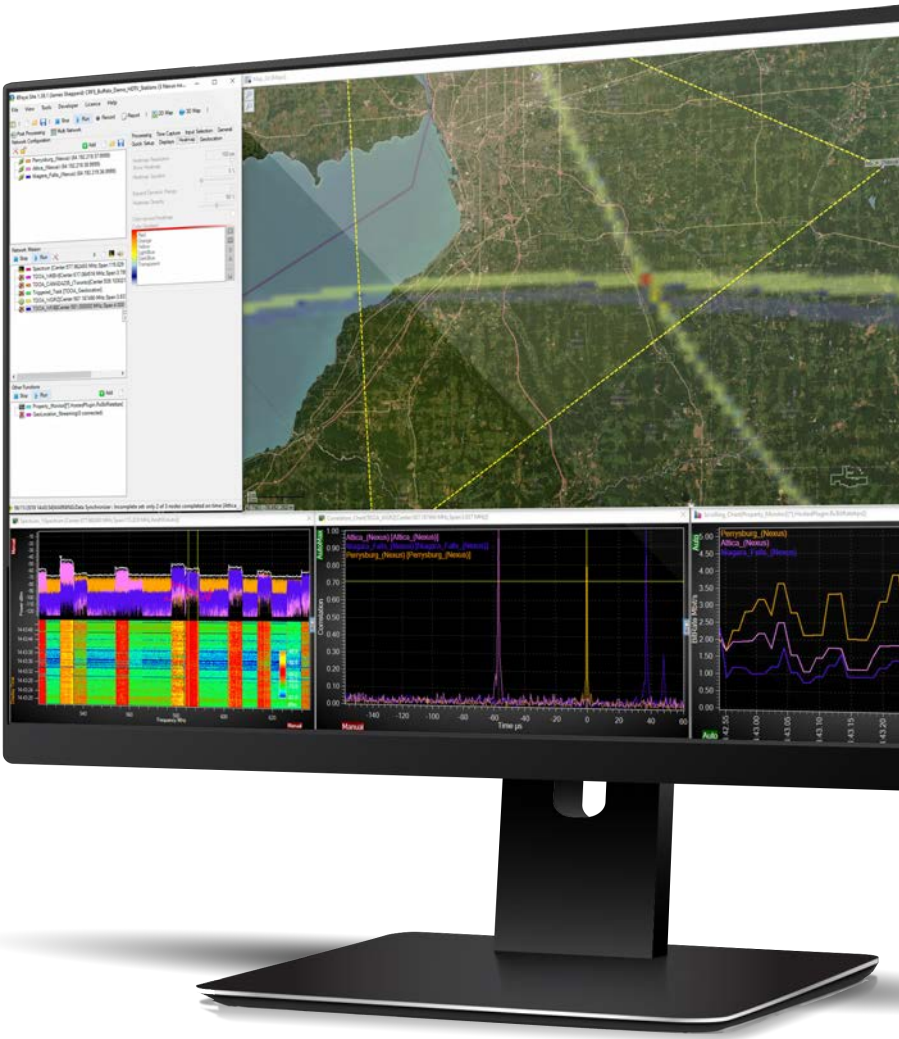Contact us for a live remote or on-site demo.

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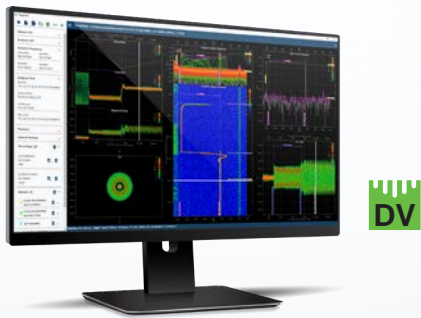Tel: +44 (0)1223 859 500

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Software Solutions

Site

RFeye Site is our state-of-the-art desktop application for real-time monitoring and geolocation requirements.

Monitoring, Geolocation, Indoor Geolocation, 3DTDOA MLAT, Signal Classification, Propagation, Map, Signal Verification

DeepView

RFeye DeepView software is the ultimate forensic tool for searching through multi-terabyte datasets for signals of interest.

Big data view: time/spectrogram & heatmap, Live mode: Real-time Spectrum Analyzer, Fast zoom/scroll through IQ data, Select export: filtered IQ data, Full dataset or selection playback, Marker: Delta function with live recording, Unlimited file duration, Screens: Dataset, Analysis region overview, Analysis region Spectrum, Time cursor Spectrum, Power/Time

RFeye Mission

RFeye Mission is CRFS's flagship solution for automated spectrum operations.

It enables spectrum stakeholders to derive useful and actionable intelligence from their deployed RFeye receivers without the need for teams of RF experts. It has been designed for use with RFeye assets deployed over wide areas such as ranges, test sites, borders and cities, as well as small networks such as indoor technical surveillance countermeasures (TSCM).

About CRFS

CRFS creates deployable systems to detect, identify and geolocate signals in complex RF environments.

We provide end-to-end automated solutions for spectrum management and deconfliction, interference hunting and threat detection, using our intelligent receiver technology, software and advanced analytics.

Our RFeye systems are widely deployed by military, intelligence, law enforcement and regulatory agencies around the world.

RFeye SenS

For further information or to schedule a demonstration visit:

crfs.com

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bsi. ISO 9001:2015 Quality Management

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