RFEYE ARRAY

20 MHz – 40 GHz

Ultra-wide frequency, high-speed, highly accurate radio direction finding and geolocation for fixed, tactical, and mobile deployments

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CRFS

EXTRAORDINARY
RF TECHNOLOGY

CR-005309-MD

RFEYE ARRAY
AT A GLANCE

Spectrum monitoring and communication intelligence systems all rely on CRFS's intelligent RF sensors, radio direction finders and innovative DF antennas.

With a frequency range of 9 kHz to 40 GHz and a DF frequency range of 20 MHz to 40 GHz, RFeye Arrays can detect even the shortest frequency agile signals as well as high-frequency signals to support EMSO.

RFeye Arrays are perfect for both tactical and strategic applications, including COMINT, SIGINT, ISR missions, radio interference sourcing, radio monitoring, border security monitoring, protecting friendly forces, localization, and geolocation of enemy emitters—operators can also combine spectrum monitoring, geolocation, and I/Q recording in parallel.

BENEFITS

Unique multi-layer approach
More sophisticated and versatile than traditional DF for maximum accuracy, maximum sensitivity, and reliable detection of signals invisible to other DF systems.

DF antennas
Unique directional and omnidirectional antennas layout is optimized for different frequency bands and arranged in multiple orientations.

All linear signal polarizations
RFeye Arrays are sensitive to most incoming signal polarizations (including all linear), allowing more reliable signal detection.

Combined geolocation methodologies
Sophisticated timing and synchronization technology enables combined PoA, AoA, TDoA (2D and 3D), and hybrid DF that maps all signal types (power, bandwidth, and frequency).

9KHz | 40GHz

100 MHz IBW wideband frequency monitoring
Quickly sweep from 9 kHz to 40 GHz and a DF frequency range of 20 MHz to 40 GHz with a high probability of intercept.

Intelligent RF sensor
High-performance, intelligent RF sensor with in-built edge processing, reducing backhaul data bandwidth.

RF recording (I/Q capture)
Record and capture in high fidelity. Stream wider signals high-definition I/Q for SIGINT.

Networked for multiple users & missions
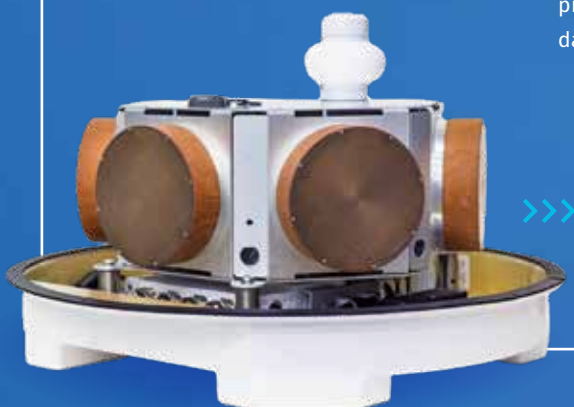Multiple users have multi-mission capabilities and can fully manage EMSO and user interaction.

Ruggedized protection from water or dust (IP55)
Designed for outdoor deployment, RFeye Nodes operate in -30ºC – +55ºC environments.

Easy installation, setup, & operation
COTS-optimized, RFeye technology is easy to connect and install and does not require recalibration.

RFEYE ARRAY
COMPARISON

RFEYE ARRAY 100 SERIES

RFEYE ARRAY 125

Single RF sensor Array with a frequency range of 9 kHz – 8 GHz and DF range of 500 MHz – 8 GHz.

PLATFORMS

Mobile (vehicle / trailer), CRFS' V-Track solution, or fixed (tower / mast / building) .

RFEYE ARRAY 150

Single RF sensor Array with a frequency range of 9 kHz – 18 GHz and a DF range of 500 MHz – 18 GHz.

PLATFORMS

Mobile (vehicle / trailer), CRFS' V-Track solution, or fixed (tower / mast / building) .

RFEYE ARRAY 300 SERIES

RFEYE ARRAY 300-8

Dual RF sensor Array with a frequency range of 9 kHz – 8 GHz, DF from 300 MHz – 8 GHz, and a VHF DF extender option (20 MHz >).

PLATFORMS

Fixed (tower / mast / building) in a permanent or temporary deployment.

RFEYE ARRAY 300-18

Dual RF sensor Array with a frequency range of 9 kHz – 18 GHz, DF from 300 MHz – 18 GHz, and a VHF DF extender option (20 MHz >).

PLATFORMS

Fixed (tower / mast / building) in a permanent or temporary deployment.

RFEYE ARRAY 300-40

Dual RF sensor, highly-sensitive Array with a frequency range of 9 kHz – 40 GHz, DF from 300 MHz – 40 GHz, and a VHF DF extender option (20 MHz >).

PLATFORMS

Fixed (tower / mast / building) in a permanent or temporary deployment.

A MORE SOPHISTICATED & VERSATILE APPROACH TO DF

Spiral directional antennas

The RFeye Array uses a unique multi-layer approach that is more sophisticated and versatile than traditional direction-finding techniques. High-performance spiral directional antennas are optimized for different frequency bands and arranged in multiple orientations. The spiral antennas support a high-speed commutating approach, whereby an RF receiver scans from 300 MHz to up to 40 GHz. This allows swift and accurate direction finding or signal characterization as the receiver calculates bearing probabilities based on received power at each antenna face.

Signal polarizations

The RFeye Array is sensitive to most incoming signal polarizations, including all linear polarizations, allowing reliable detection of signals, including those invisible to other DF systems. Also, timing and synchronization features enable combined AoA, TDoA, and PoA techniques. Irrespective of signal power, bandwidth, or frequency, these techniques allow all signal types in the range to be overlaid onto a wide variety of maps, satellite images, and 2D/3D GIS datasets to give a unique positional display showing source geolocation probabilities.

Accuracy ensured

Each RFeye Array undergoes individual calibration in real-world settings to ensure its accuracy. It then retains a constant, unique calibration file, eliminating the need for frequent recalibrations. This design guarantees sustained accuracy, even in extreme environmental conditions, offering reliable performance without the maintenance hassle.

Networked for multiple users and missions

RFeye Arrays can be networked over large distances as part of a wide area monitoring and TDoA network with other RFeye Arrays or Nodes. Networks can be combined to provide wide-area monitoring over an entire country or integrated into other networks, including Command and Control systems. They also have multi-user and multi-mission capabilities.
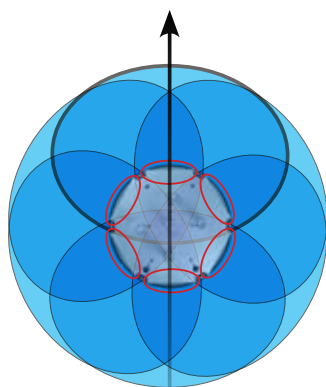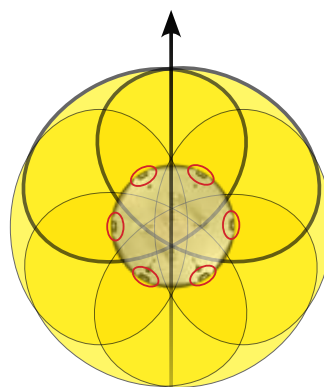
EXAMPLE RFEYE ARRAY 300
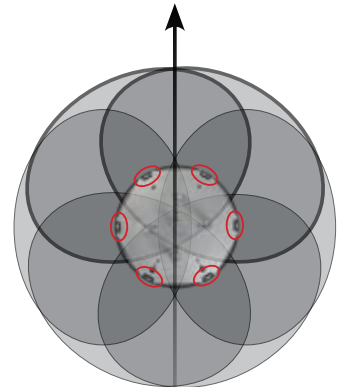## ANTENNA LAYOUT

N
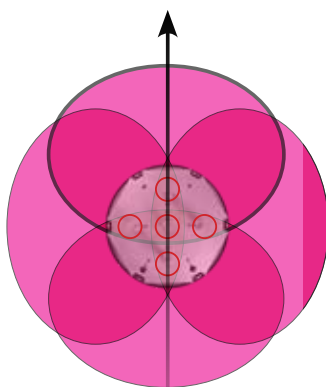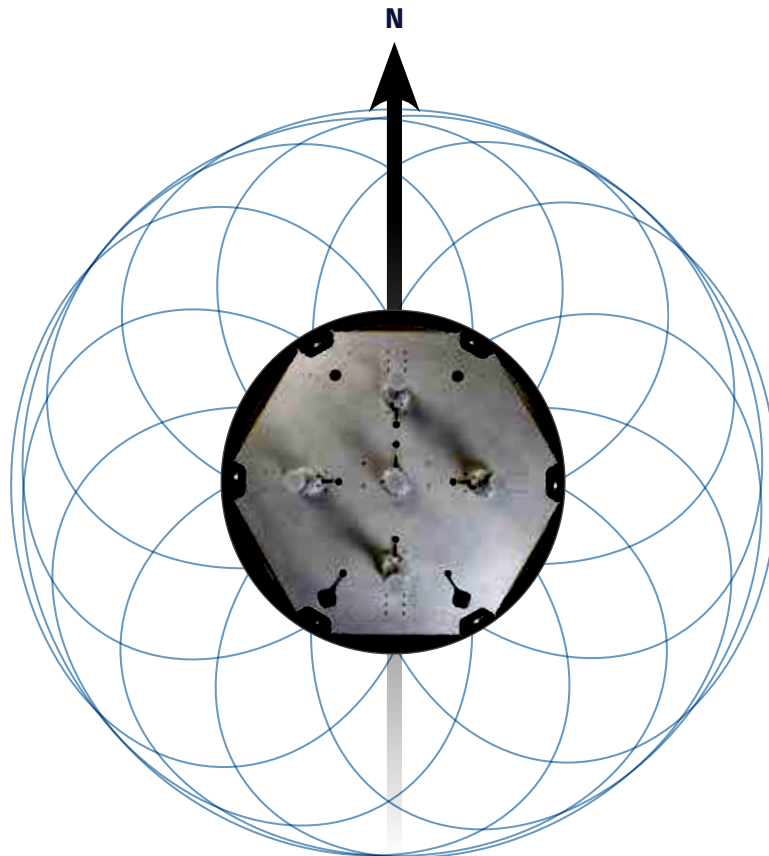
Watson-Watt:
High sensitivity low frequency monopole antennas

Directional Antennas:
High sensitivity mid frequency spiral antennas

Directional Antennas:
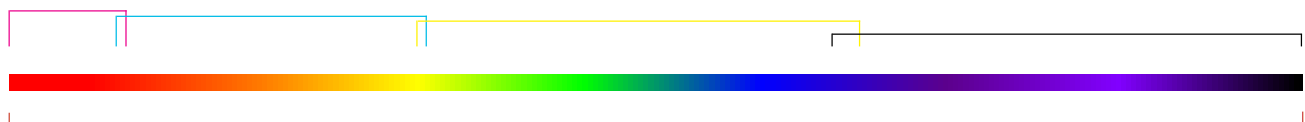High sensitivity high frequency spiral antennas

Directional Antennas:
High sensitivity ultra high frequency spiral antennas*

Watson-Watt
Coverage

Large Spiral
Coverage

Medium Spiral
Coverage

Small Spiral
Coverage

ANTENNA Coverage

20 MHz   20 GHz   40 GHz

*Array 300-40 (incorporates additional directional spiral antennas)

RFEYE ARRAY 100
IN DETAIL

Six directional spiral antennas arranged in multiple orientations:

- ✔ Reject interference and multipath
- ✔ Support a high-speed commutating approach
- ✔ Receive all linear polarizations

High-frequency omni-directional antenna (optional)
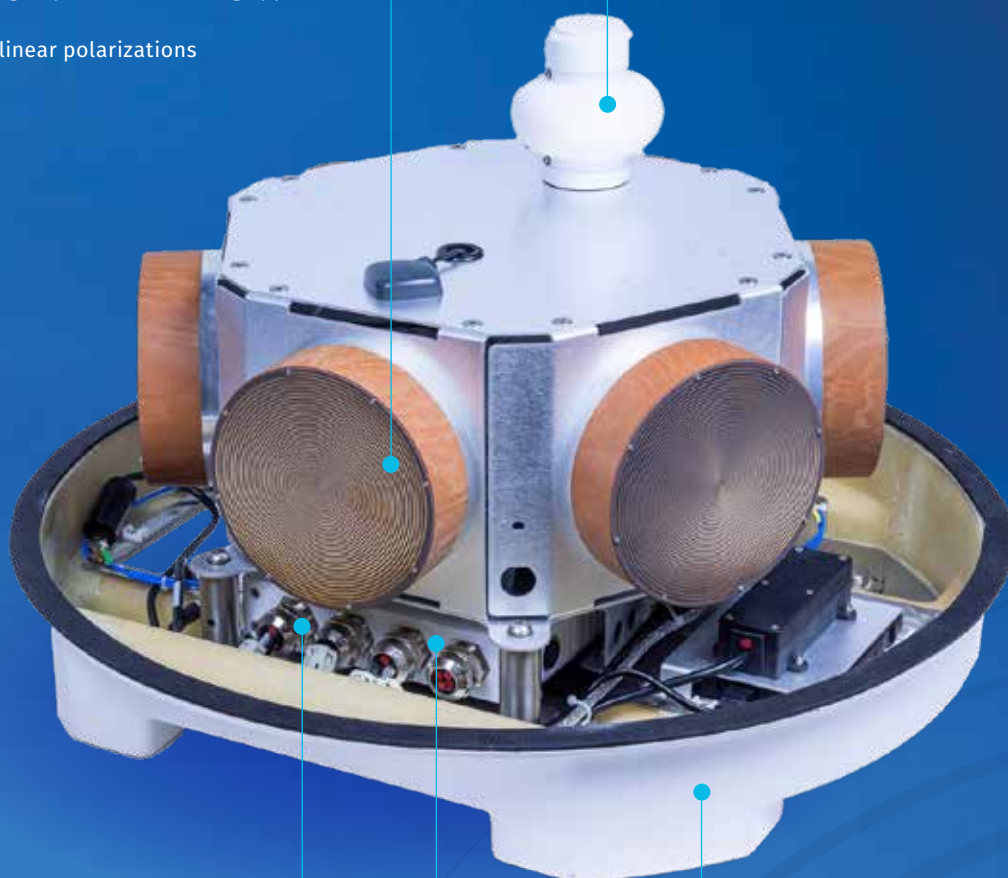
RF sensor is closely connected to antennas for maximum sensitivity

Highly sensitive RF sensor up to 18 GHz

Radome provides weatherproof shelter for rugged deployment

RFEYE ARRAY 300
IN DETAIL

Watson-Watt methodology for VHF signals between 20 MHz and 300 MHz

RF sensors are closely connected to antennas for maximum sensitivity

Radome provides weatherproof shelter for rugged deployment

Two RF sensors up to 40 GHz to provide multi-mission capability

Directional spiral antennas arranged in multiple orientations:

- ✓ Reject interference and multipath
- ✓ Optimized for different frequency bands
- ✓ Support a high-speed commutating approach
- ✓ Receive all linear polarizations

MAXIMUM PERFORMANCE
& FLEXIBILITY

RFeye Nodes can be deployed in the following ways:

Outdoors

Fixed masts / towers | Buildings

Tactical & mobile

V-Track | Vans | Trailers

RFEYE ARRAY
UNIQUE FEATURES

Wide IBW

RFeye Arrays are available with 100 MHz instantaneous bandwidth (IBW). A wide IBW allows RFeye Arrays to quickly sweep through the frequency range with less time to retune, translating to faster sweep speeds and a higher probability of intercept.

Inbuilt processing for low backhaul

RFeye Arrays have their own inbuilt processor, so they process the RF data in situ. Results are sent securely anywhere in the world without needing high data-rate backhaul. Data can also be stored locally on a USB drive or optional internal SSD or be transmitted via an external wireless network.

Multi-user, multi-mission capability

The RFeye Arrays' unique architecture supports multiple simultaneous tasks and missions, as well as queries from multiple users. TDoA geolocations can be performed at the same time as spectrum occupancy measurements. Also, remote programming allows tasks to be assigned relative priorities.

Remain highly accurate without recalibration

Each RFeye Array is individually calibrated to test potential accuracy as well as accuracy in the presence of other signals. Each RFeye Array carries a unique calibration file, which remains constant, unlike other systems on the market, meaning there is no need for repeated, scheduled recalibration.

Example tasks include:

- Spectrum sweeps
- Emitter localization
- Signal processing
- I/Q captures
- I/Q streaming (VITA-49)
- Signal classification
- Automated multi-sensor geolocation
- Portable wideband monitoring & DF system
- Spectrum occupancy measurements
- Alerting on mask breaks and triggering alarms
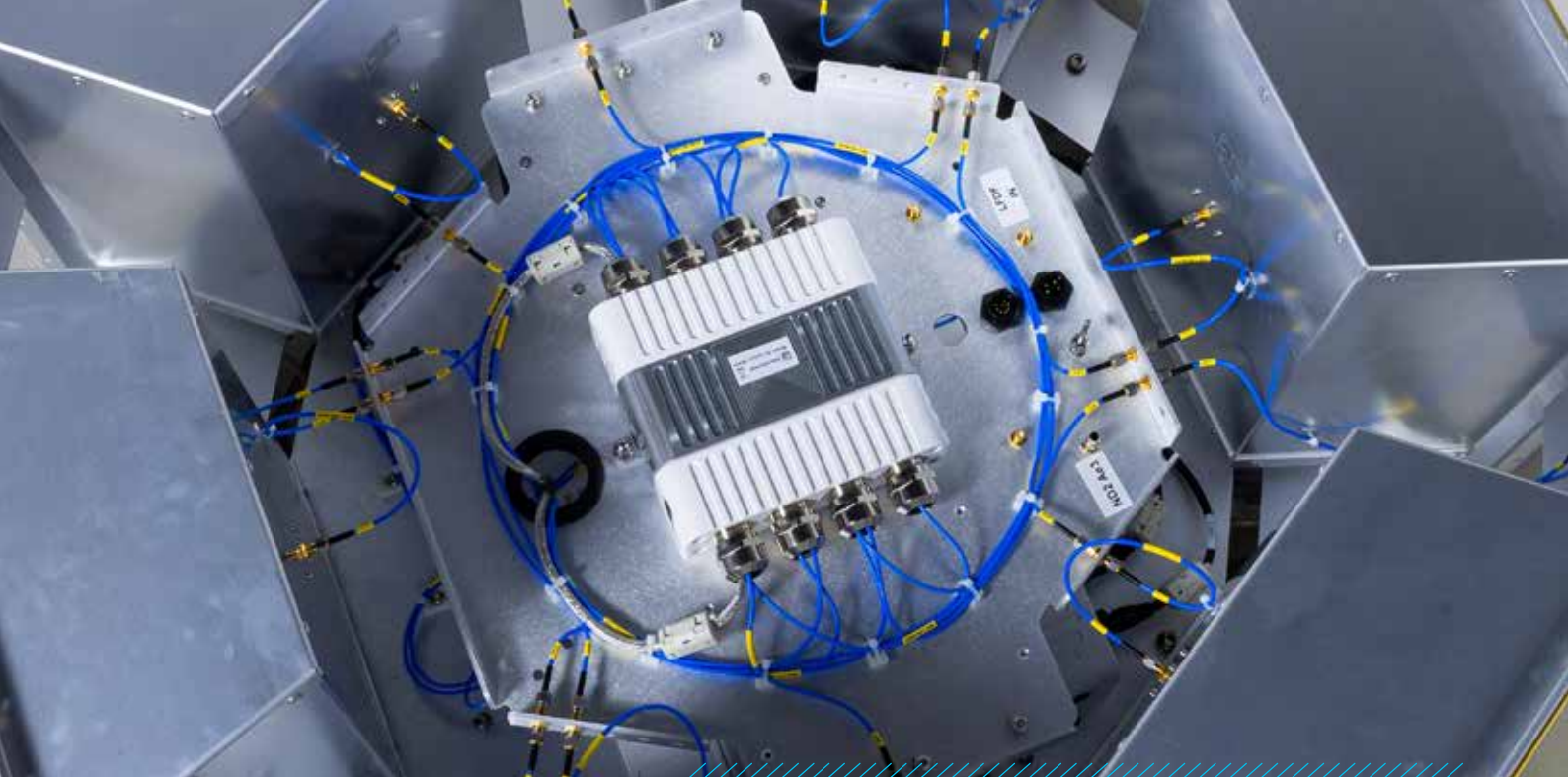
RFEYE ARRAY
INTEGRATION & APIs

By leveraging CRFS' Application Programming Interface (APIs), customers can seamlessly integrate the capabilities of CRFS software into their proprietary systems, thereby automating tasks, which would otherwise have to be performed manually.

- EMP APIs allow users to manage non-synchronous tasks control on the Node, such as spectrum sweeps.
- GMP APIs allow users to manage synchronous tasks across multiple Nodes, such as geolocation.

CRFS APIs are designed with four key features that collectively enhance the usability, efficiency, and effectiveness of APIs in terms of system integration and communication.

- RESTful APIs use standard HTTP methods
- The JSON open data format allows interoperability between different systems and platforms
- Event streams allow for real-time data processing and notifications
- Clear schemas allow APIs to be easily integrated into larger systems

VISIT OUR DEPLOYMENT LIBRARY

Our online deployment stories library showcases CRFS' expertise across multiple domains and sectors.

Si **RFEYE SITE**

UNLOCK RFEYE ARRAYS WITH
ADVANCED SPECTRUM MONITORING
& GEOLOCATION SOFTWARE

RFeye Site software is designed by RF experts, for RF experts. It provides users with a comprehensive toolkit for real-time spectrum monitoring and geolocation.

Highly versatile, easily configurable, and providing a broad array of advanced functionalities, RFeye Site includes all essential functionality for spectrum monitoring and management tasks: from basic RF sweeps, simulations, and I/Q capture to detailed spectrum power/occupancy/ bandwidth measurements and comprehensive 3D TDoA visualizations.

The software has a multi-mission capability that enables multiple spectrum monitoring and geolocation tasks to run simultaneously on the same RFeye Nodes.

RFeye Site's key capabilities:

- Indoor and outdoor real-time geolocation using AoA, TDoA, PoA, and hybrid measurements
- Real-time EW and SIGINT data input and output
- Multiple data and map overlays of node networks and geolocation results
- Alarms and triggered missions (e.g., sweep, I/Q capture, geolocation) in response to frequency mask breaks
- Signal classification
- Real-time control of Nodes and data analysis
- Post-analysis of recorded signals (including geolocation)
- Simulation and propagation modeling to optimize receiver networks for required coverage
- Terrain analysis and site planning for receiver coverage and geolocation coverage by type
- Simulation capabilities for monitoring and geolocation scenarios testing

Features:

- Spectrum sweeps & signal capture
- Mapping: 2D, 3D (TDoA), satellite images
- Automation: alarms, masks & triggers
- Record & playback: manual & automated
- Simulation & modeling: emitters, receivers, structures & geo-data
- Terrain analysis and site planning
- Simulation modes to model system performance
- I/Q streaming (VITA-49) to third party software

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INNOVATIVE VISUALIZATION SOLUTIONS
DELIVER FAST AoA OPERATIONAL WORKFLOWS

RFeye Site features many capabilities for AoA geolocation missions, including traditional capabilities and innovative tools that shorten user workflows and give operators target assurance. For example, key workflow considerations such as frequency selection for a mission's signal of interest can be rapidly defined by dragging your cursor across frequency ranges. Also, users can easily apply power masks to avoid background noise.

Bearing waterfall

The bearing waterfall divides compass bearings into a color spectrum to extract visual patterns for the user. Even faint signal sources become a clear pattern using this tool. Frequency resolution can also be dynamically adjusted to differentiate multiple signal sources.

Quality segments

Enabling bearing confidence uses segments that continually adjust in width and color depending on the signal's quality. A central line of bearing is displayed in the middle of this segment.

Polar chart

Polar bearing shows what the RFeye Array sees; it is conceptually a top-down view of the RFeye Array showing bearing against signal power.

Hybrid geolocation

With an omnidirectional antenna fitted to an RFeye Array, RFeye Site combines AoA and TDoA to deliver positional confirmation against a target transmitter.

Cumulative AoA

When mounted on a moving vehicle, the RFeye Array operates cumulatively. As the vehicle moves, the line of bearing pivots on the signal source to create a lat/long geolocation and home in on the signal.

Pulsed & sweeping signals

Bearing averaging allows users to identify pulsed and sweeping signals by continuously combining measurements to create an average position for the signal source. This allows a sweeping target to be pin-pointed over a few rotations.

A GATEWAY TO POWERFUL SOFTWARE

All CRFS customers have access to software to monitor, capture, analyze, geolocate, and report signals of interest. Our complimentary software suite provides teams with the tools to achieve complete spectrum visibility.
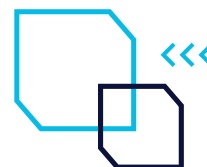
Mm **RFEYE MISSION MANAGER**
Automated spectrum monitoring and mission management

Dv **RFEYE DEEPVIEW**
Forensic signal analysis software with 100% probability of intercept

RFEYE ARRAY
SPECIFICATIONS

	RFEYE ARRAY 125	RFEYE ARRAY 150	RFEYE ARRAY 300-8	RFEYE ARRAY 300-18	RFEYE ARRAY 300-40
Channels	Single RF sensor (Node)	Single RF sensor (Node)	Dual RF sensors (Nodes)	Dual RF sensors (Nodes)	Dual RF sensors (Nodes)
Frequency range	9 kHz - 8 GHz	9 kHz - 18 GHz	9 kHz - 8 GHz	9 kHz - 18 GHz	9 kHz - 40 GHz
Direction finding frequency range	500 MHz - 8 GHz	500 MHz - 18 GHz	20 MHz - 8 GHz	20 MHz - 18 GHz	20 MHz - 40 GHz
VHF DF extender option (20 MHz - 300 MHz)	N/A	N/A	Yes	Yes	Yes
Noise figures at maximum sensitivity	6-10 dB typical	7-18 dB typical	6-10 dB typical	7-18 dB typical	8.5-16 dB typical
Instantaneous bandwidth (IBW)	100 MHz	100 MHz	100 MHz	100 MHz	100 MHz
Sweep speed (typical)	280 GHz/s @ 2 MHz RBW	390 GHz/s @ 2 MHz RBW	280 GHz/s @ 2 MHz RBW	390 GHz/s @ 2 MHz RBW	232 GHz/s @ 2 MHz RBW
Supports PoA, AoA, TDoA, hybrid DF methods	Yes*	Yes*	Yes	Yes	Yes
Deployment	Fixed & mobile	Fixed & mobile	Fixed (recommended)	Fixed (recommended)	Fixed (only)

* Optional omni-antenna to support PoA and TDoA.

RESOURCES

Discover educational white papers, webinars, videos, product brochures, and data sheets.

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Receive tailored content directly to your inbox.

TALK WITH AN EXPERT

Discuss your RFeye Node deployment requirements.

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CRFS is an RF technology specialist for defense, national security agencies and systems integration partners. We provide advanced capabilities for real-time spectrum monitoring, situational awareness and electronic warfare support to help our customers understand and exploit the electromagnetic environment.