Mobile Monitoring Receiver and Direction Finder

DATA SHEET | RXDF3104

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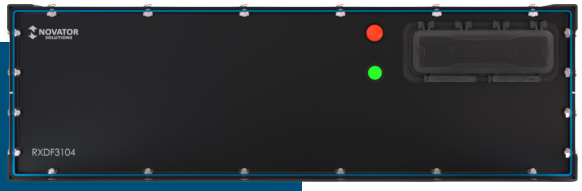
NOVATOR SOLUTIONS

Turnkey Systems for Direction Finding and Spectrum Monitoring

INTRODUCTION

RXDF3104 is Novator Solutions' next-generation mobile C-ESM (communications electronic support measures) system. It introduces a new direction-finding subsystem, enhanced positioning accuracy and expanded signal interception capabilities. Designed for mobile and deployable operations, the system enables detection, direction finding, monitoring and analysis of RF signals across a wide frequency range. RXDF3104 supports both rapid tactical response and detailed communications intelligence missions within a compact and ruggedised platform.

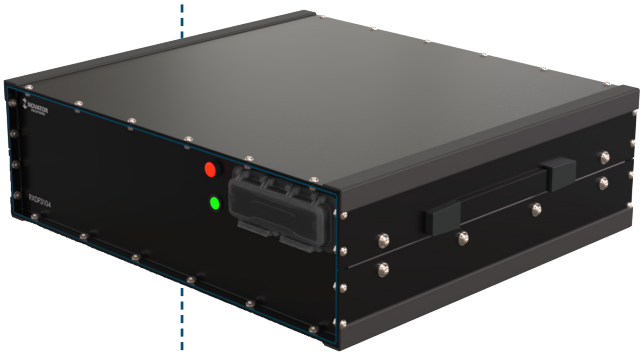


Highlights

- Wideband DF coverage from 20 MHz to 6 GHz
- High-speed spectrum scanning with the new Stitch Search function
- Simultaneous DF, scanning, monitoring and recording
- Up to 64 simultaneous narrowband channels
- Integrated high-accuracy GNSS/INS positioning and heading
- Compact, ruggedised design with IP43 protection

RXDF3104 in brief

RXDF3104 is an out-of-the-box solution for on-the-move operations. The system is optimised for quick deployment in any manned or unmanned vehicle with minimal preparation. It comes with temporary mountable antennas, a main processing unit that can be placed in the hatchback of a vehicle, and an intuitive user interface and control software installed on a rugged laptop.



RXDF3104

Applications

RXDF3104 is designed for on-the-move operation in applications including communications electronic support measures (C-ESM), communications intelligence (COMINT), border security, and search and rescue. For EW and signals intelligence, RXDF3104 can monitor many channels in parallel, allowing signals of interest to be identified within a congested electromagnetic environment. This is equally valuable to border guards, since push-to-talk radios are often utilised in illegal activities such as smuggling contraband or unauthorised crossings. And for search and rescue, commonly used communications channels may be monitored alongside distress frequencies, beacons and sonobuoys. In each of these scenarios, it is important to be able to calculate the angle of arrival of signals, in order to locate emitters.

Operational Capabilities

Direction Finding

RXDF3104 incorporates a new direction-finding subsystem based on a compact multi-band Adcock antenna with integrated band switching. The new system extends the frequency coverage to 20 MHz – 6 GHz. It utilises the three-channel Watson-Watt DF method with rapid bearing calculation, and can detect multiple emitters within the instantaneous bandwidth. The DF antenna can be used for both DF and monitoring, or a dedicated monitoring antenna may be optionally added.

Spectrum Scanning & Stitch Search

RXDF3104 introduces a new feature known as Stitch Search. Stitch Search performs high-speed scanning at > 3 GHz/s across configurable or full frequency ranges, enabling rapid detection of new signal activity.

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Software

The command and control (C2) software utilises a back-end server responsible for processing-heavy tasks. It manages all subsystems, audio and IQ recordings, and automatic DF processing. The C2 software includes a thin client application with an intuitive user interface. Via a single laptop screen, operators control all four 80 MHz band segments and can monitor live activities on the wideband power spectrum. All assigned digital drop receivers (DDRs) are highlighted in the waterfall and power spectrum display. DDRs can be managed graphically via the power spectrum display and via a list view. All settings including centre frequency, bandwidth and modulation are configured individually and independently from each other in real-time. Operators can load preconfigured frequency lists. The client software presents all lines of bearing (LOBs) including the position of the collection asset (vehicle) on a map. In addition, a polar display shows all LOBs in reference to the heading of the collection asset. A graphical view provides an overview of all recorded interceptions per channel/frequency versus time. Via this display, the operator gets easy access for replaying any audio channel in near real-time. Audio replay is synchronised with the map display.

Backend server

The backend server runs as a service on the industrial PC. All necessary services start automatically in the background. It integrates and controls all subsystems and manages all processing and data-intensive tasks.

Manages

- Collection receiver including DDRs
- Direction Finder subsystem
- Position from GPS sensor or manual overwrite
- Recorder plug-in

Audio

- All audio channels stream continuously to recorder plug-in
- 0.5 to 2 seconds pre-buffer for audio streams
- Recording format: 8 kHz, 16-bit samples
- Triggered recording based on squelch level
- Balance control (5 steps) when listening

IQ recording

- IQ data streams continuously to recorder plug-in
- Operator starts and stops IQ recording manually

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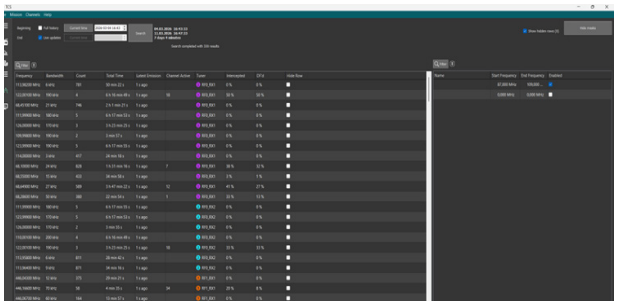
The control software for RXDF3104 allows operators to set channel parameters, configure interceptions and view lines of bearing on the move. Settings are configured via hotkeys and the display is clearly readable, even in direct sunlight. Five GUIs are used by the operators of the system.

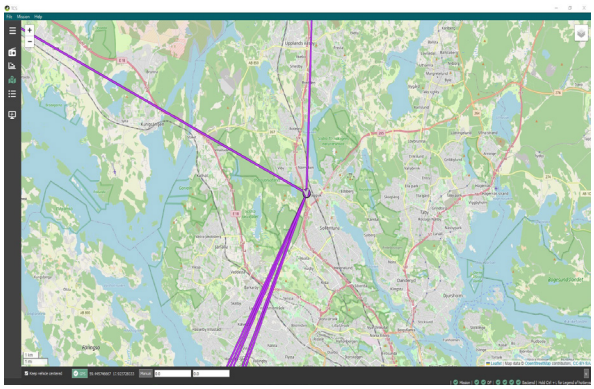
Situational Awareness View

RXDF3104 provides an enhanced visualisation of the RF environment through integrated situational awareness tools such as a histogram display that will display all detected transmissions across the bandwidth.



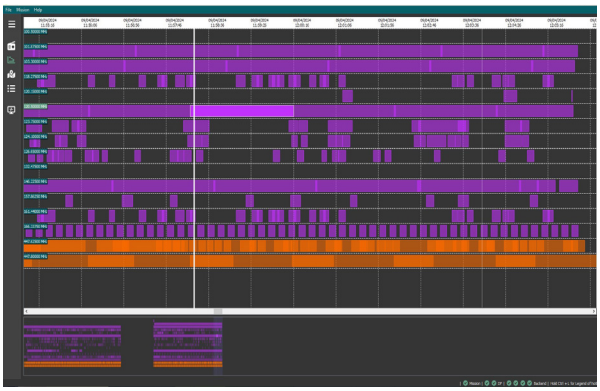
Map View

RXDF3104 plots the position of the system, plus lines of bearing to each intercepted emitter on a map. Real-time, recorded and played-back bearings are separated into discrete layers, allowing them to be view individually or together. By connecting multiple systems to an external network, cross-bearing triangulation of emitter positions may be performed. Maps may be customised and are pre-loaded from QGIS.



Tuner and Channel Configuration View

Operators determine the channels they wish to monitor and configure all characteristics of those channels. The operator may toggle between all four wideband tuners, viewing both an FFT of the spectrum and a waterfall plot. Enabled channels are plotted on a polar plot, and the demodulated audio may be listened to in near real-time.



Activity Timeline

A historic view of all interceptions in a specific mission is displayed by frequency over time. This allows operators to revisit and listen to previous interceptions. Interceptions may be individually selected by clicking on them, cycled through using hotkeys, or played sequentially channel by channel.

Interception View

This provides a list display with metadata for each intercepted and recorded signal. This includes: line of bearing; quality of bearing; timestamps; frequency; bandwidth; and modulation scheme. The threshold for activity detection is based on a specified squelch level.

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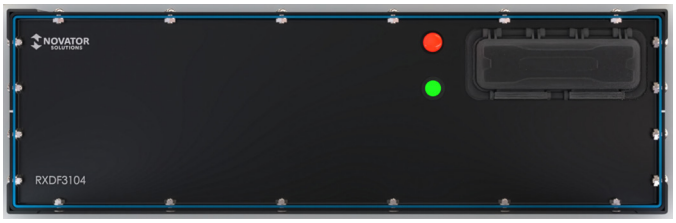
Hardware

RXDF3104 is designed for temporary use in any vehicle and powered from the vehicle's 12 or 24 V DC supply. The system is installed in a single 3U 19" main unit with a depth of 400 mm. The unit is ruggedised to withstand shock and vibration, and is IP43 rated. The unit is primarily designed to be placed in the hatchback of a car or unmanned ground vehicle, and may also be used with other moving platforms including vessels, helicopters or light aircraft. A 1200 Wh capacity battery case may be optionally added to cover droppages in the vehicle power supply or to power the system for 8+ hours continuously.



Direction Finder (DF)

The direction-finding subsystem is based on a compact Adcock DF antenna with integrated band switching. The implementation is based on the three-channel Watson-Watt DF method. The DF system covers 20 MHz to 6 GHz in three bands: 20 – 700 MHz; 500 – 2000 MHz; and 1500 – 6000 MHz. A heavy-duty magnetic mount is used for temporary antenna installations on a vehicle. Alternatively, the antenna may be mounted on a tripod, allowing the antenna to be deployed up to 15 metres from the vehicle.

Positioning and Heading

A VN-200 GNSS/INS sensor from VectorNav is used to provide higher accuracy positioning and heading information. The sensor is mounted to the DF antenna, to ensure correct positioning without the need to calibrate the heading relative to the antenna. An arbitrary passive GNSS controlled reception pattern antenna (CRPA) may be used with the VN-200 sensor, and operators may select which satellite constellations and signals to use.

Server and Client PCs

A Windows server PC is the main backend processing unit. It takes care of all processing-intensive tasks, such as the recording plug-in. All user data, system files and recorded mission data are stored on a single quick-release, removable solid-state disk (SSD). The RXDF3104 client application is optimised for use on a single laptop screen. As standard, the system includes a rugged laptop with a 14" screen and high brightness, enabling viewing in direct sunlight. The laptop may be connected via a LAN cable or Wi-Fi to the main processing unit.

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Product Specifications

Collection Receiver	
RF receiver channels (Rx)	4
Instantaneous bandwidth	4 x 80 MHz
Input impedance	50 Ohm
Max input power	+10 dBm
Frequency range	20 MHz – 6 GHz
Receiver architecture	Two-stage superheterodyne
ADC resolution	14 bit
Noise figure	< 5 dB
Linearity	IP3 +2 dBm
Frequency accuracy	2.5 ppm
Residual spurs	-95 dBm (non-input related)
SFDR	88 dB
Number of DDRs / DDCs)	64
Demodulation modes	AM, FM, SSB, IQ
Demodulation bandwidth AM	6/10/20 kHz
Demodulation bandwidth FM	10/20/50/200 kHz
Demodulation bandwidth SSB	3 kHz
Direction Finder (DF)	
Frequency range	20 MHz – 6 GHz
DF technique	Three-channel Adcock/Watson-Watt
Bearing accuracy	5 deg. RMS (typical)

* All specifications are subject to change

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Product Specifications

DF bands	20 – 700 MHz; 500 – 2000 MHz; 1500 – 6000 MHz
Bearing resolution	0.1 deg
Bearing integration time	45 – 400 ms Typical 200 ms
DF bandwidth	6 / 15 / 30 / 200 kHz (configurable)
Polarization	Vertical
Server PC	
Operating system	MS Windows 10 professional, 64-bit
CPU	Intel Core i7-12700TE
DRAM	32 GB DDR5
Hard drive	500 GB SSD, quick removable
Network interface	1x2.5 Gigabit Ethernet by I225 (RJ-45) Wi-Fi: 802.11a/b/g/n
Client/Operator Laptop	
Operating system	MS Windows 10 professional, 64-bit
CPU	Intel Core i5-1135G7
DRAM	16 GB DDR4
Hard drive	256 GB M.2 SSD
LCD	14” touch 1100 nits WBA FHD (1920x1080) sRGB Anti-Glare, Outdoor Viewable
Network interface	1x Gigabit Ethernet by I219LM (RJ-45) Wi-Fi: 802.11ax
Keyboard	English US RGB backlit sealed internal keyboard
Internal loudspeakers	2, high definition audio, 2 W
External audio interface	3.5 mm headset port
Battery	3 cell, 53.5 Wh

* All specifications are subject to change

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Product Specifications

Environmental Specification	
RXDF3104 Main Unit	
Dimensions	133 x 482 x 480 mm (h x w x d)
Compliant to	IP43 or better
Total weight	Approximately 15 kg
Operating temperature	0 C to +55 C
Storage temperature	-20 C to +55 C
Power draw	< 120 W
Maximum altitude	2000 m (6500 ft.)
Direction Finding Antenna	
DF antenna base diameter	320 mm
DF antenna height	800 mm
DF Antenna Weight	10 kg
DF antenna water proofing	IP65 rain proof
Client/Operator Laptop	
Compliant to	IP53 and MIL-STD-810G&H
Operating temperature	-29 C to +63 C
Weight	2.3 kg
Size	336 x 340 x 220 mm (HxWxD)

* All specifications are subject to change

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Operational Modes

RXDF3104 is optimised for fast detection and direction finding of signals of interest. It has three modes of operation:

1. Scan the spectrum and DF a single frequency as quickly as possible. The operator decides which frequency to DF.
2. Scan the spectrum and continuously DF multiple frequencies whenever they become active.
3. DF multiple frequencies, while using the fourth available RF input for monitoring, listening and recording.

In all use cases, three of the four RF channels are dedicated to DF processing to ensure high-speed operation. For use cases 2 and 3, it is possible to select multiple frequencies in the spectrum view and to DF those frequencies whenever they become active.

Future Capability Enhancements

Digital Demodulation

Demodulation for digital protocols including DMR and dPMR will be added, allowing operators to intercept and listen to digital communications signals.

COMINT Mode

A new operating mode is planned, to allow one of the four RF receiver inputs to be reserved for scanning the spectrum, while the other three receiver inputs are used for monitoring, listening and recording. In this operating mode, more simultaneous digital drop receivers will be available. When using the DF antenna as a monitoring antenna, the three 80 MHz bands will need to reside within the same DF antenna band.

Networked Operation

Multiple systems may be connected to an external network of the operating organisation's choice. An operator can assign the system for cross-bearing triangulation in network of active systems. Any of the assigned systems can initiate bearing request for one frequency at a time. Other participating systems return their own system location and emitter bearing information. This is saved in the interception list and plotted on the map on a separate layer for cross-bearings.

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Optional Antennas

Alternative antennas can be made available on request. Options include a higher performance antenna that comes with a trade-off of being larger and heavier than the antenna offered as standard. Alternatively, a smaller, lighter (~ 1.2 kg) antenna can be provided for space or weight-constrained deployments. Contact Novator Solutions for more information or to express interest in custom options.

Customisation

RXDF3104 can be customised to meet specific project or mission requirements. Its versatile architecture, together with Novator Solutions' agility as an SME, enables rapid adaptation to customer needs, and delivery of cost-effective tactical ESM systems optimised for operational performance.

About Novator Solutions

Novator Solutions AB, part of Defensor Group, is at the forefront of SIGINT and EW technology. Our highly skilled R&D team combines expertise in high-speed data processing and software defined radio (SDR) technology to develop cutting-edge monitoring receivers and RF signal recorders. Our software proficiency, combined with modular hardware designs, allows us to create customised solutions that meet specific project and mission needs.

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