Mobile Monitoring Receiver and Direction Finder

DATA SHEET | HUGIN 304DF

NOVATOR SOLUTIONS

Mobile, Turnkey Monitoring Receiver and Direction Finder

INTRODUCTION

HUGIN 304DF is Novator Solutions' mobile monitoring receiver and direction finder. It provides 64 channels enabling simultaneous monitoring, listening, and recording of analogue clear voice push-to-talk (PTT) communication using FM, AM or SSB modulation. HUGIN 304DF provides spectrum monitoring alongside lines of bearing in one view.

Highlights

- Simultaneous monitoring and recording of 64 channels
- Automatic direction finder
- Intuitive user interface and control software
- 4 individual tuners with 80 MHz instantaneous bandwidth each
- Monitoring & DF frequency coverage: 20 - 520 MHz
- Optional 150 MHz – 6 GHz coverage for monitoring
- Compact and rugged design for mobile applications

HUGIN 304DF in brief

The mobile monitoring receiver and direction finder is an out-of-the-box solution for on-the-move operation. HUGIN 304DF is optimized for quick deployment in any vehicle platform without preparation. It comes with temporary mountable antennas, a main processing unit which can be placed in the hatchback of any vehicle, and an intuitive user interface and control software installed on a rugged laptop.
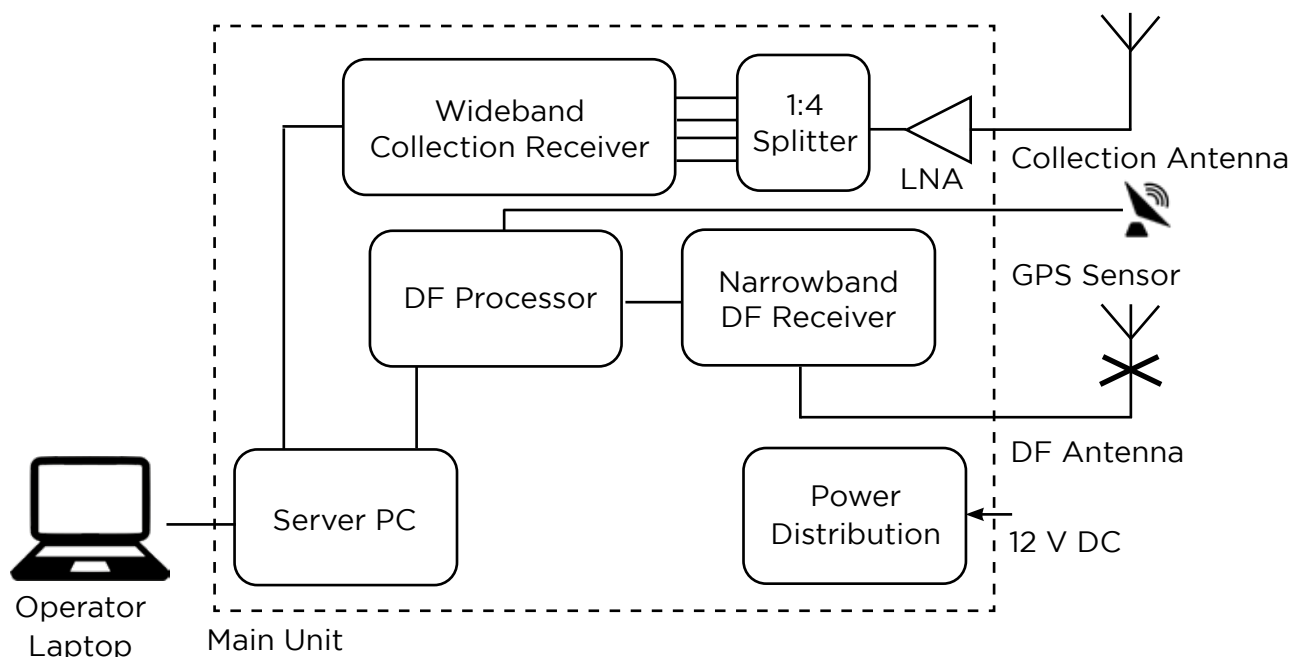
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Applications

HUGIN 304DF 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, HUGIN 304 DF 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.

Functionality

The operator controls all aspects of the collection receiver and assigns the digital drop receivers (DDRs) to any active emitters of interest. The voice traffic channels can be played back in near real-time via the built-in audio device or attached headphones. Four additional DDRs can be assigned for recording digital signals. The recordings are stored in a non-destructive IQ-file format that can be used for post-mission signal analysis. The DF processor automatically calculates the lines of bearing (LOBs) of active interceptions. By moving the collection asset, it is possible to get multiple LOBs to geolocate the target emitters. The mission database stores all interceptions including frequency, line of bearing, time of intercept (TOI), and the GPS position of the collection asset. All functions are accessible via the intuitive client application on a single screen, providing good situational awareness.

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Software

The software utilises a back-end server responsible for processing heavy tasks. It manages all subsystems, audio & IQ recordings and automatic direction finding 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 analogue 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 situational awareness display 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 synchronized 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 & 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

- One IQ channel per tuner, configurable BW
- IQ data streams continuously to recorder plug-in
- Operator starts and stops IQ recording manually

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The control software for HUGIN 304DF 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. Four GUIs are used by the operators of the system.

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 View

A historic view of all interceptions in a specific mission is available. 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.

Map View

HUGIN 304DF plots the position of the system, plus lines of bearing to each intercepted emitter on a map. By comparing LOBs from multiple collection asset locations (ie. as the vehicle is moving), emitter positions may be triangulated. Maps are pre-loaded with static images from QGIS.

Interception View

The Interception View provides a list display with metadata for each intercepted 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.
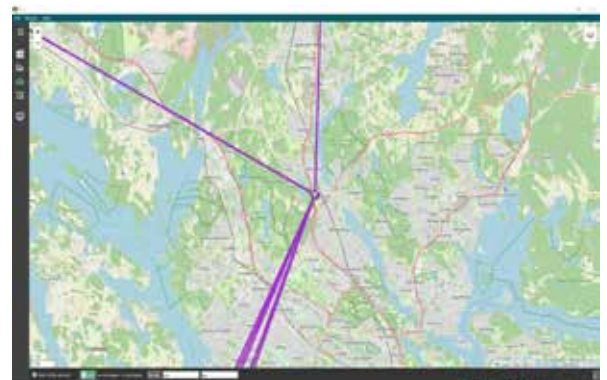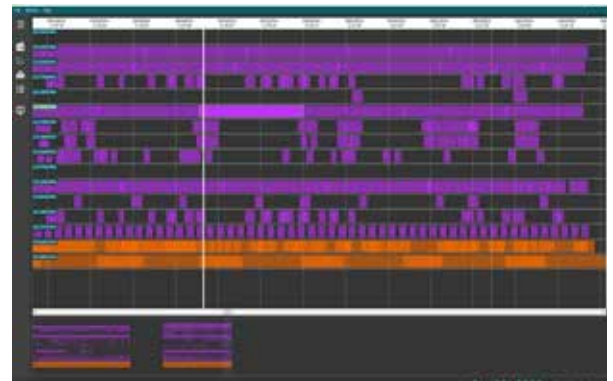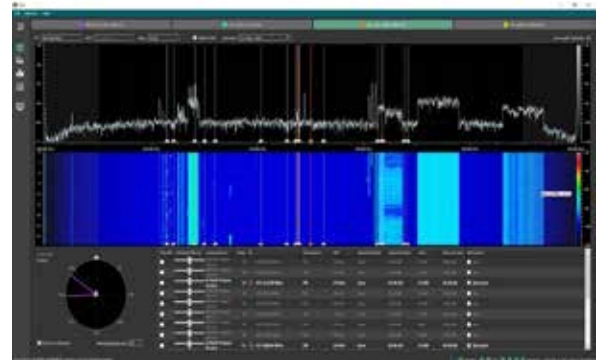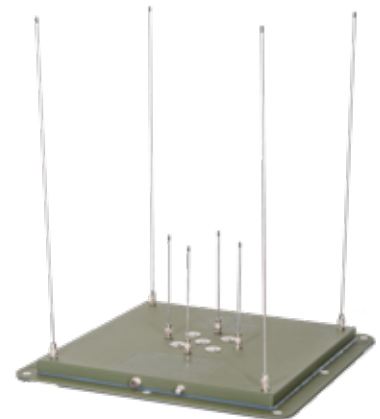
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Hardware

HUGIN 304DF includes antennas is designed for temporary use with any vehicle. It has three subsystems and a client PC which are described in more detail below. The subsystems are a collection receiver with four tuners, a narrowband direction finder and a server PC. All subsystems are installed in a single 6U 19" main unit that operates from a 12 V DC supply. The main unit comes in a protective case for easy and safe transportation. The case is primarily designed to be placed in the hatchback of a car, and may also be used with other moving platforms including vessels, helicopters or light aircraft.

Direction Finder (DF)

The direction finder subsystem is based on the single-channel 2-phase Adcock/Watson-Watt method. It provides wide coverage from 20-520 MHz in four bands. The rugged, compact, lightweight, and weather-sealed DF antenna unit is designed for mobile applications. The antenna array is easily installed on vehicles or helicopters which have a sizeable metallic ground plane. Nylon mounting straps and rain gutter hooks are supplied for temporary mounting to vehicle roof-tops. A small magnetic mount GPS antenna is directly connected to the direction finder processor.

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 removable solid state disk (SSD). The HUGIN 304DF client application is optimized 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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Collection Receiver

The collection receiver has four wideband tuners with 80 MHz instantaneous bandwidth each, providing a total of 320 MHz monitoring bandwidth. The default frequency range is 20 to 520 MHz. A magnetic mount collection antenna feeds the RF signal to all four tuners. One tuner can optionally be used as a collection receiver (without DF), supporting 150 MHz - 6 GHz frequency range. This option provides additional insight into activities in the upper frequency band.

Main Unit and Protective Case

The 6U 19" main unit operates from a 12 VDC supply (optionally with 24 VDC). It comes readily installed in an IP44-rated protective case for easy transportation. The case has shock absorbers, protecting all electronics from shock and vibration during transport and operation. Operators get easy access to connect all antennas and power by removing the front and back lids of the case. Removal of the lids also ensures cooling of the main unit during operation. The SSD is mounted via strong velcro to the main unit. Operators can remove the SSD within seconds to secure the data.

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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 - 520 MHz Optional: 150 MHz – 6 GHz on Tuner 4
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; 60 audio channels & 4 IQ channels
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
IQ recording	1 channel per tuner
Direction Finder (DF)	
Frequency range	20-520 MHz (Ground plane required)
DF technique	Single-channel 2-phase Adcock/Watson-Watt (derived sense)
Bearing accuracy	3 deg. RMS (Max) 1.5 deg. RMS typical (VHF); 2.5 deg. RMS typical (UHF)

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DF bands	20-60/60-200/200-300/300-520 MHz
Bearing resolution	0.1 deg
Bearing integration time	45 – 400 ms Typical 200 ms
DF bandwidth	6/15/30/200 kHz
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

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Environmental Specification	
HUGIN 304DF main unit with environmental case	
Main unit	6U 19-inch rack mount enclosure 266 x 482 x 465 mm (HxWxD)
Environmental case	Shock mount 19-inch rack case 410 x 490 x 710 mm (HxWxD)
Compliant to	IP44
Total weight	45 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 size	550 x 550 mm
DF antenna height	680 mm
DF antenna weight	6 kg (excluding cables)
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)

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Alternative DF Antenna Options

Alternative DF antennas are available, offering the benefits such as increased frequency coverage or reduced size, for a trade off of slightly reduced bearing accuracy. Options include:

- Frequency coverage extension to 20 MHz - 1 GHz
- Low-profile antenna for covert operations
- Dipole antenna for transportable or semi-permanent installations. This may be provided with a telescopic mechanical belt and winch-operated mast

Additional Options

- 24 V DC operation
- Monitoring (without DF): 150 MHz - 6 GHz via a separate antenna connected to tuner 4
- Environmental case colour: Olive green
- Rugged backpack for laptop

Customization

HUGIN 304DF can be customized to meet your project or mission requirements. The versatile platform, combined with our agility as an SME, helps you to get the best possible tactical EW/SIGINT system fulfilling your requirements while being cost effective.

About Novator Solutions

Novator Solutions AB, part of Novator Consulting 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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