



Independent network for secure communication

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Cognitive Networked HF Service

Telenor Maritime secure communication

Any operation centre / command post with access to the MoD IP network can directly utilise the HF Radio network anywhere from the country.

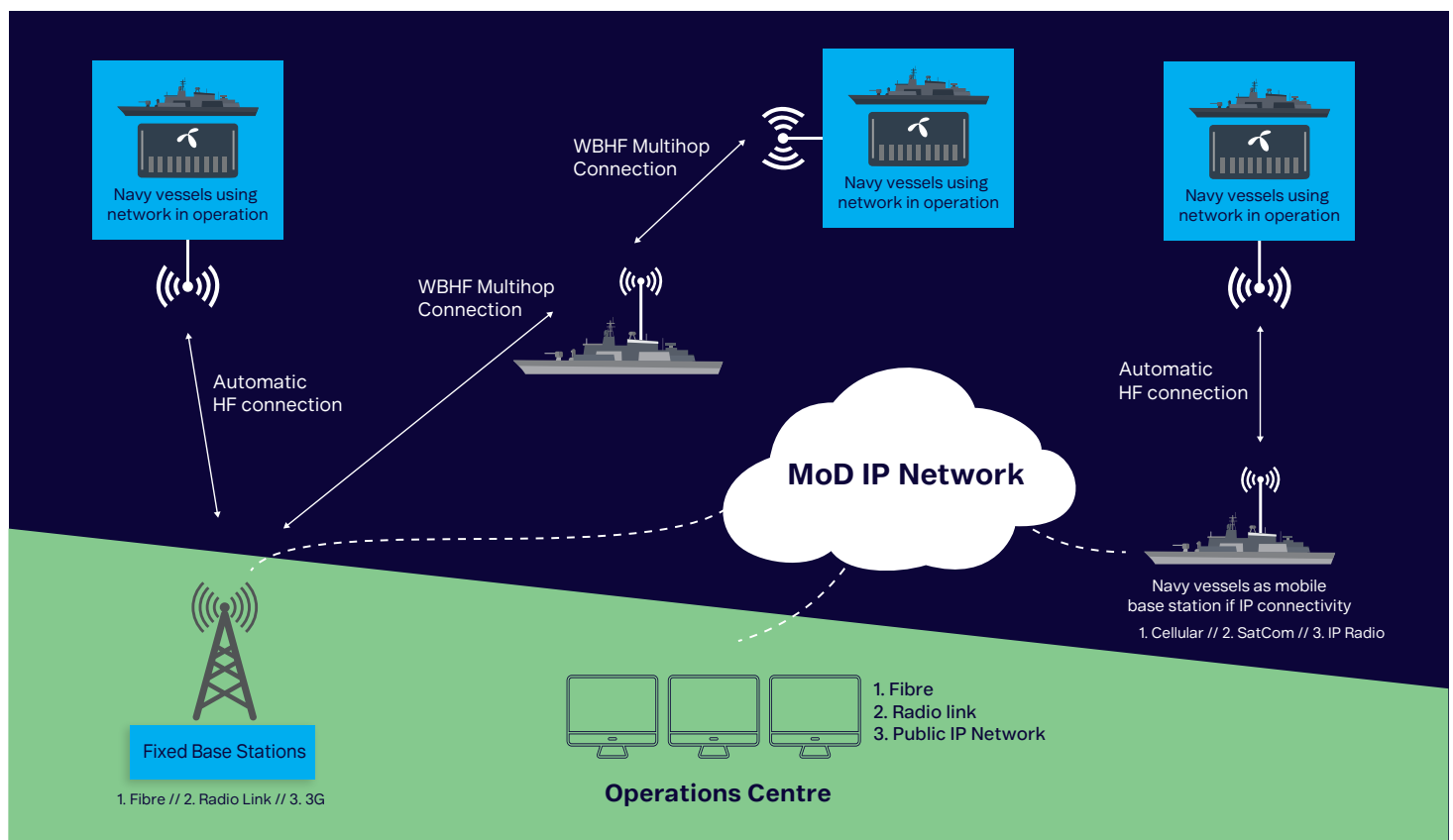
All the traffic is routed automatically, so HF is only used if needed. The HF network operates an integrated part of the MoD IT network.

The system operates as a hybrid system, where one station can both transmit, receive, and use multiple connections at the same time, for example for built-in cellular and HF Radio. Base stations (both fixed and mobile) automatically connect via the MoD IP network.

The connectivity can utilise all connections simultaneously or prioritise these as defined (fibre, radio links and 3G). With Telenor Maritime no separate TX and RX sites are required and multiple simultaneous transceivers can transmit from the same site.

There is no need for radio operators or any personnel to operate the radio station. Major financial savings on sites, equipment, maintenance and personnel costs.

Greatly improved operational efficiency and security.



Cognitive Network Explained

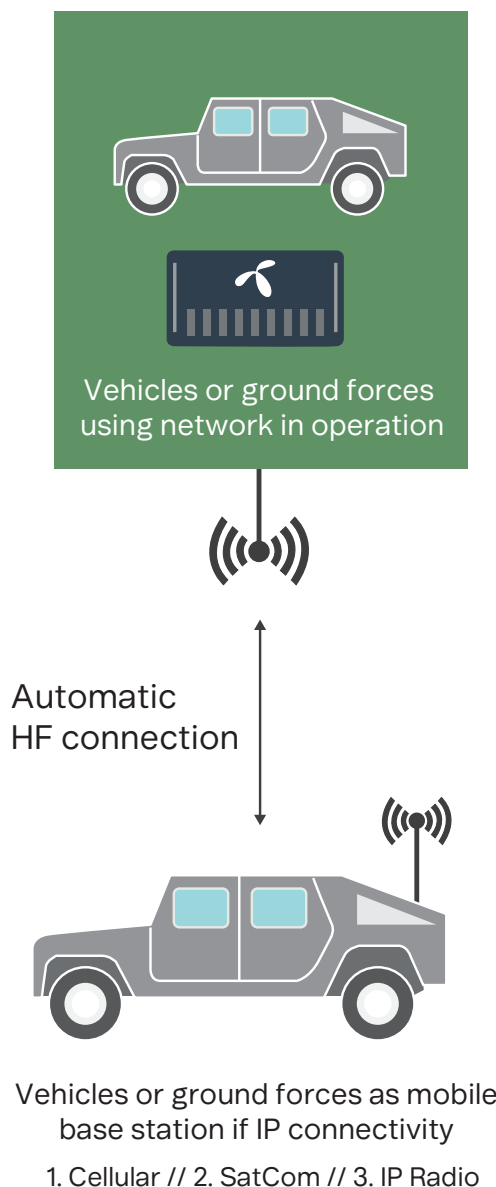
Telenor Maritime CNHF Radio

Radio spectrum, especially in the HF area, is an extremely challenging operating environment because of multiple parameters affecting communications, like radio propagation, interference from other users thousands of kilometres away. This creates a reputation that HF systems are unreliable and difficult to use – something that we, at Telenor Maritime, have proven to be incorrect.

The Cognitive Networked HF Radio (CNHF) senses its operating environment without the intervention of the user and can adapt to the user's communications needs. A CNHF Radio can intelligently detect whether any portion of the spectrum is in use and can temporarily use it without interfering with the transmissions of other users. At Telenor Maritime we have built the ultimate CNHF Radio with the capability to optimise every parameter in the system – automatically and in real time.

Every radio at Telenor Maritime builds its own understanding of spectrum, propagation and other users in the network. This information is updated every second with a data flow of more than 500 million samples of data per second. This information is combined with information from user needs to communicate things like requested applications and QoS. The amount of data for the network is optimised based on that information. Something that no human can manage.

When managing the propagation in the HF spectrum, we do not rely on prediction and probabilities, as every radio at Telenor Maritime measures the propagation in real time. This allows Telenor Maritime to provide the best reliability and performance and use HF frequencies in completely new ways.

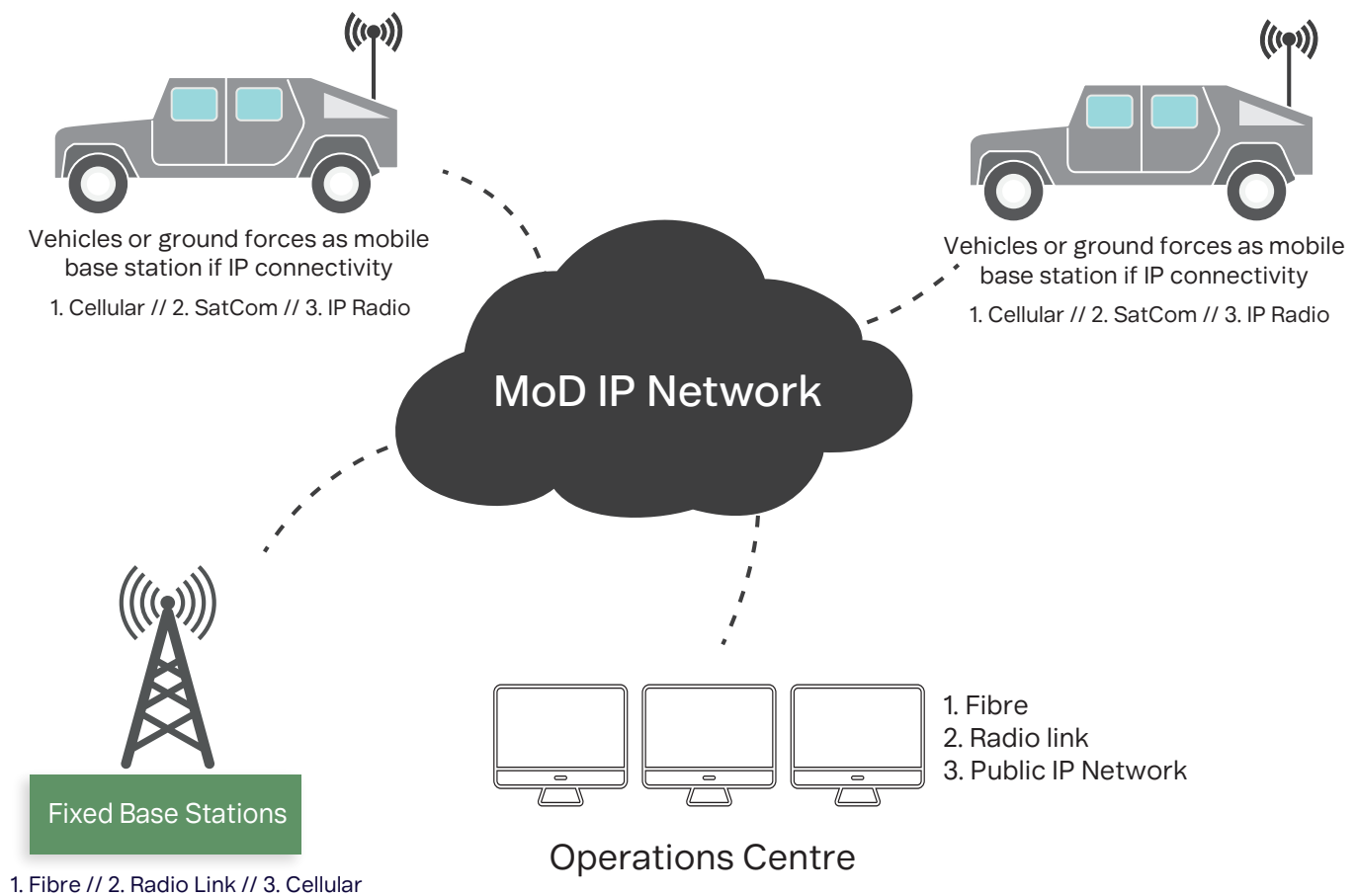


Networked functionality

To take maximal advantage of the CNHF Radio capabilities, the single-link behaviour is automated and optimised, and goes beyond that to network layer. Unlike legacy solutions in radio networks, where users are needed to define the path for communication and establish a link between sender and end receiver, Telenor Maritime's network defines the optimal route.

This allows Telenor Maritime to take full advantage of constantly changing environments in the HF spectrum to utilise the long-distance connectivity by providing unique network diversity to the user. With all the information provided by the state-of-the-art signal processing in the Telenor Maritime Cognitive Engine, the Telenor Maritime network defines the optimal network topology for any given transmission – automatically and in real time. If the conditions change during the transmission, the Telenor Maritime system utilises built-in automatic-link maintenance and either establishes a new link to the same node or reconfigures the network to guarantee the delivery of information without any actions needed from the user.

This networked functionality provided by Telenor Maritime greatly improves reliability, security and performance and enables the use of HF in the most demanding operations, where failure is not an option.



Key Technology

The benefits in short



The CNHF Radio is fully automatic, optimising frequency usage.



The CNHF Radio receives the whole HF spectrum at once and has extremely fast link establishment (less than 500ms).



The Telenor Maritime network is capable of operating independently from other networks and infrastructure. Thus with built-in cellular and LAN network, advanced configurations can be established.



Physical layer adapts to existing conditions and provides data rates up to 300kbit/s over the HF radio link.



Finnish Navy

The Finnish Navy has purchased the cognitive wideband CNHF system from Telenor Maritime. The Telenor Maritime system enables more reliable, secure and capable long- distance communication for Finnish Navy use cases.

Customer Experiences:

"We haven't seen this superior HF system performance ever before."

"One of Telenor Maritime's advantages with its' system is that it's a complete solution in one box."

"As a true software-defined radio the Telenor Maritime platform offers a future-proof solution for continuous development work according to the customer needs."

"Telenor Maritime enables tactical use of HF in a completely new way."

CNHF Radio

The CNHF Radio, developed by Telenor Maritime in Finland, is a new era of HF radios. It is a fully-digital transceiver capable of spectrum estimation and optimising its own operation according to the signal environment and traffic at hand. The CNHF Radio is a software defined radio making it possible for remote configurations and updates.



Technical specifications	
HF RADIO: FREQUENCY RANGE	1.5 - 30 MHz
HF RADIO: BANDWIDTHS	1.9 – 48 kHz
HF RADIO: MODULATIONS	BPSK, QPSK, 8PSK, 16/32/64/128/256 QAM
HF BAND RADIO: SENSITIVITY	more than -125 dBm
HF BAND RADIO: DYNAMIC RANGE	140 dB
HF RADIO: TRANSMITTING POWER	250W PEP (Peak Envelope Power)
CELLULAR	UMTS/HSPA - 800/850/900/1700/1900/2100 MHz (Bands VI, V, VIII, IV, II, I) 3GPP Release 7 5.76 Mb/s uplink, 21.1 Mb/s downlink GSM - GSM 850/900/1800/1900 MHz 3GPP Release 7, PBCCH support GPRS - Class 12, CS1-CS4 - up to 86.5 kb/s; EDGE Class 12, MCS1-9 - up to 236.8 kb/s
GNSS (GLOBAL NAVIGATION SATELLITE SYSTEM)	GPS, GLONASS, GALILEO, QZSS and SBAS
ETHERNET	2 x 100 Mbps
SUPPLY VOLTAGE	AC: 100-240 VAC ±10%, 8.9A, 50-60Hz, 600W. DC: 12-30 VDC ±5%, 50A, 600W
DIMENSIONS	19" / 6U rack mountable Width: 483mm - Height: 266mm - Depth: 425mm Weight: 30 kg
OPERATING TEMPERATURE RANGE	-20 – 55 °C
INTERFACES	HF antenna, connector type: N (F) Cellular antenna, connector type: TNC (F) GNSS antenna, connector type: TNC (F), supply voltage for active antenna: 3.3VDC Ethernet connectors, 2 x RJ45
IP Class	IP 21

Type approvals	
<ul style="list-style-type: none"> • In conformity with R&TTE Directive (1999/5/EC) and RoHS directive 2011/65/EU • Radio Equipment Directive 2014/53/EU, RED-1158 • Certain HEALTH & SAFETY (Art. 3(1)(a)), EMC (Art. 3(1)(b)) and SPECTRUM (Art. 3(2)) • WEEE (Waste Electrical and Electronic Equipment) compatibility 	
HEALTH & SAFETY (ART. 3(1)(A))	HF: Compass safe distance test EN 60945:2002, EN 60950:2006 + A11:2009 + A12:2011 + A1:2010 + A2:2013 2G/3G: EN 60950-1:2006 + A11:2009 + A1:2010 + A12:2011, EN62311:2008
EMC (ART. 3(1)(B))	HF: EN 301 843-1 v.1.3.1, EN 301 843-5 v.1.1.1, EN 61000-6-2:2005 , EN 61000-6-3:2007, EN 61000-6-3/A1:2011, EN 301 489-1 v.1.9.2 Annex B 2G/3G: EN 30Spectrum (Art. 3(2)): 1 489-1 V1.8.1, EN 301 489-7 V1.3.1, EN 301 489-24 V1.5
SPECTRUM	HF: EN 300 373-1 V1.4.1, EN 300 373-2 V1.2.1, ITU M. 1798-1, ITU-R SM 329-12, EN 300 113-1 v1.7.1 2G/3G: EN 301 511 V9.0.2, EN 301 908-1 V4.2.1, EN 301 908-2 V4.2.1GNSS: EN 300 440-1 V1.6.1, EN 300 440-2 V1.4.1

Security

All CNHF traffic, including addresses and headers, is encrypted using AES256 encryption. The CNHF Radios acting in base station mode connect to the Administrative Server (AS) by using the Virtual Private Network (VPN) tunnel. Third-party or national security applications can be integrated.

HF for data communications

Our R&D has greatly improved the speed and reliability of HF for data communications, giving each radio a two-way connection range of up to 10,000 kilometres.

Mesh network capable

Each radio can act both as a base station (when in cellular range), and as an endpoint (when out at sea). The result is unmatched reliability and global access.

CNHF Manpack

We have built our CNHF Manpack to serve a number of use cases, all while being simple, secure and reliable to operate. The CNHF Manpack is a portable version of the CNHF1 rack mountable radio. It utilises the same revolutionary, cognitive, adaptive CNHF waveform to provide superior performance and ease of use equivalent to the CNHF1 rack mountable version.

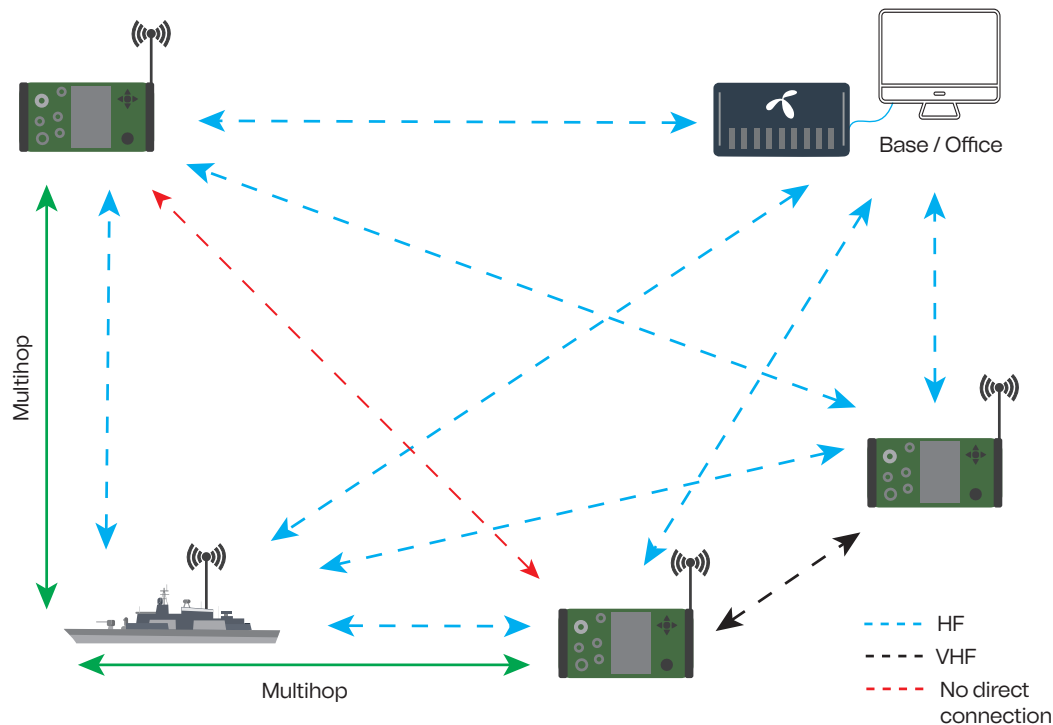


Advanced SDR Platform

The CNHF Manpack has a number of built-in features making easy to integrate with customers' existing systems. With built-in Ethernet, WLAN and an LTE modem, a variety of use cases can be fulfilled with maximum efficiency. Built using the latest SDR technology, the Manpack has very low power consumption which in turn maximises battery life. The built-in battery charging capability eases strain on support. Being a true SDR platform, we assure our customers that new features and capabilities can be added as a software to their radio fleet.

Cognitive Networked HF Waveform

The CNHF Waveform has multiple game-changing features not currently found elsewhere: cognitive spectrum usage and extremely fast GNSS independent ALE supporting over 2500 calling channels listened to simultaneously. In addition, wideband HF data up to 300 kbit/s and extremely robust modes are able to operate with less than -10 dB SNR. The innovative multihop functionality ensures that a route from source to destination is always found. Lastly, as the CNHF Manpack also covers VHF up to 56 MHz, interoperability with legacy VHF FM radios can be achieved when required.



CNHF Multihop functionality. Both HF and VHF can be used for multihop to establish advanced network topologies and to overcome connectivity challenges.

Technical specifications

GENERAL	
Platform	SDR platform
Frequency range	HF: 1.5 - 30 MHz, VHF 30 - 56 MHz
Bandwidth	Up to 96 kHz
TX Power	HF: 25 W, VHF: 25 W
RX Sensitivity	HF: better than -125 dBm @ 1.875 kHz
Size	115 mm (H), 210 mm (W), 275 mm (L)
Weight	Under 4 kg without battery
Battery type	BB-2590/U
Battery charger	Built-in
DC input	9-32 V DC
WAVEFORMS	
HF	CNHF Normal & Robust Mode - Bandwidth: up to 96 kHz - Modulations: BPSK - 256QAM - FEC - Data rates: up to 300 kbit/s - ALE: GNSS independent cognitive ALE with more than 2500 calling channels listened simultaneously - ARQ & Non-ARQ modes - Unicast, multicast, broadcast - Multihop Analog SSB (J3E), CW. Possible to implement legacy & future MIL-STD and STANAG HF and WBHF waveforms if required.
VHF	CNHF Normal Mode (see HF Waveforms for details) Analog FM (F3E) Possible to implement other narrow band waveforms if required.
Services	
	Digital encrypted voice (unicast, multicast, broadcast), email w/attachments, instant and voice messaging, blue force tracking, file transfer, data transfer, broadcast and multicast messaging etc. Built-in web based email and instant messaging clients SMTP and IMAP interfaces for external email client and server XMPP interface for external XMPP client and server Analog SSB voice

Technical specifications	
INTERFACES	
Audio	Analogue handset
Ethernet	Built-in, 100 Mbit/s
Serial	RS-485
USB	USB-C, power and data
GNSS	Commercial. GPS, GALILEO, GLONASS, BEIDOU. Simultaneous tracking of multiple GNSS systems. Spoofing and jamming detection and reporting.
LTE	Built-in
WLAN	Built-in. AP & client modes. 2.4 GHz, IEEE 802.11b/g/n. Up to 8 clients in AP mode.
User Interface	320 x 480 color display, arrow keys.
	Browser based user interface with access control.
OTHER	
Tuner	Built-in antenna tuner
Environmental	MIL-STD-810H ground mobile, operational temperature -40 - +55 °C
Security	CNHF Normal & Robust Mode: AES256 encryption, static & changing keys Radio platform: Secure boot, signed software, tampering detection, zeroize function



Use Case – Reliable communication solutions for Navy



Situation

Navy operations of today require situational awareness and reliable communications to be able to communicate with other vessels, fleets and on-shore installations – furthermore, modern Command, Control, Communications, Computers, & Intelligence (C4I) systems or even advanced counter command, control, communications, computers, cyber, intelligence, surveillance, reconnaissance and targeting (C5ISR&T) capabilities requires a reliable and secure communication link to handle the exchange of data between systems and other units and operators.

Electronic Warfare (EW) threats, including cybersecurity incidents, are increasing and constantly threatening ongoing operations.

Solution

Telenor Maritime (former KNL Networks) has developed a Cognitive Networked HF Radio which accommodates the needs and requirement of modern military and security operations and warfare.

The radio, either as a Base Station or Manpack unit, is a cognitive radio which operates automatically and agile on the full HF spectrum and VHF for the Manpack.

It has built-in hardware encryption and can achieve data transmissions of up to 300 kbps.

The system can operate as an independent IP network, mesh network or multi-hopping, with or without access and Ip connection to a core network.

Challenges

The limited access to and high costs of dedicated satellite capacity sometimes force commanders to choose commercial satellite connectivity, which relies on 3rd party operators and infrastructure. Also, it has been proved that satellites can be jammed, shot down or targeted by cyber-attacks.

Legacy HF systems can be jammed (artificial noise) and can also experience propagation which can be challenging to plan for and accommodate, especially for non-experienced operators. Furthermore, the data-transmission capabilities of legacy HF systems are minimal and cannot accommodate the need of current operations.



CNHF radio



CNHF Manpack



Use Case – Reliable communication solutions for Navy



Situation

Assuming that customer wants to set up a new system with ten base stations, commanding headquarter base is set up in the headquarter centre, which is designed to manage and control the entire system. 100 mobile stations will be set up in vessels sailing around for surveillance, patrolling, and supporting purposes, customer's needs as follows:

- Ensure stable communication 24/7 through voice and data, able to send a report without high latency
- Transmit point-point, group recipients, and broadcast
- Track location and historical moving of vessels
- Send captured pictures every 5 mins to headquarter for report purpose
- Send attachment file
- Track level of energy consumption
- Able to communicate in long-range

Solution

Based on customer's challenges and needs, Telenor Maritime proposes complete CNHF solution:

- Set up 10 CNHF base-station radio versions for the base stations
- Install 40 CNHF manpack radios in the vessels
- To optimal the transmission, we use multi-hopping for the system and ensure transmitting 24/7
- Adding a sensor to track energy consumption level; data will be collected by collecting box to be sent to headquarters
- Short text and voice messages can be sent through the instant messaging function on the user interface

Challenges

- No connection from 2-5 AM
- Cannot track the locations of vessels
- Unstable communication between bases
- For big files, it requires a lot of time to send, high latency of transmission
- A vulnerable system, the high potentiality of being hacked
- High satellite cost
- Being or potentially jammed by enemies
- Current cumbersome system
- Only a highly technical personnel can manage the system
- Not being able to control the consumption of energy from vessels or vehicles

Antenna types

Base stations: Wideband, folded dipole, antennas are recommended.

Mobile Stations (vessels etc.): Whip antennas are recommended.

Antenna specification information and requirements are available in our manuals.

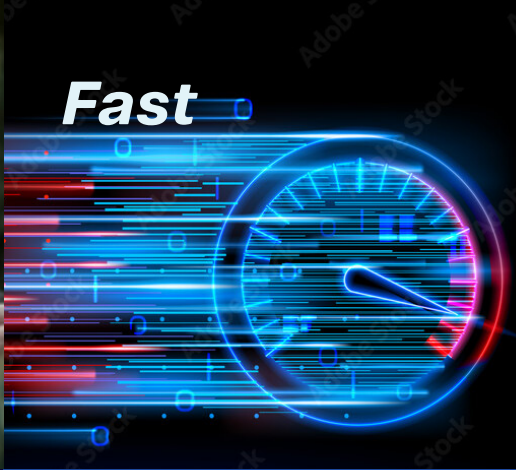
- Voice can be sent through analog, digital (push-to-talk) or audio in messaging menu
- Tracking vessel location is available in tracking menu
- The communication range possibility is up to 10,000km
- Pictures and files can be sent through instant messaging or attached and sent as emails
- Transmit point-point, group recipients, and broadcast functions are available
- AES256 encryption standard, be able to add additional encryption



Easy

Instant messages

Short messages, pictures and files can be sent easily.



Fast

Fast connections everywhere

Extremely fast-link establishment - less than 500 ms.

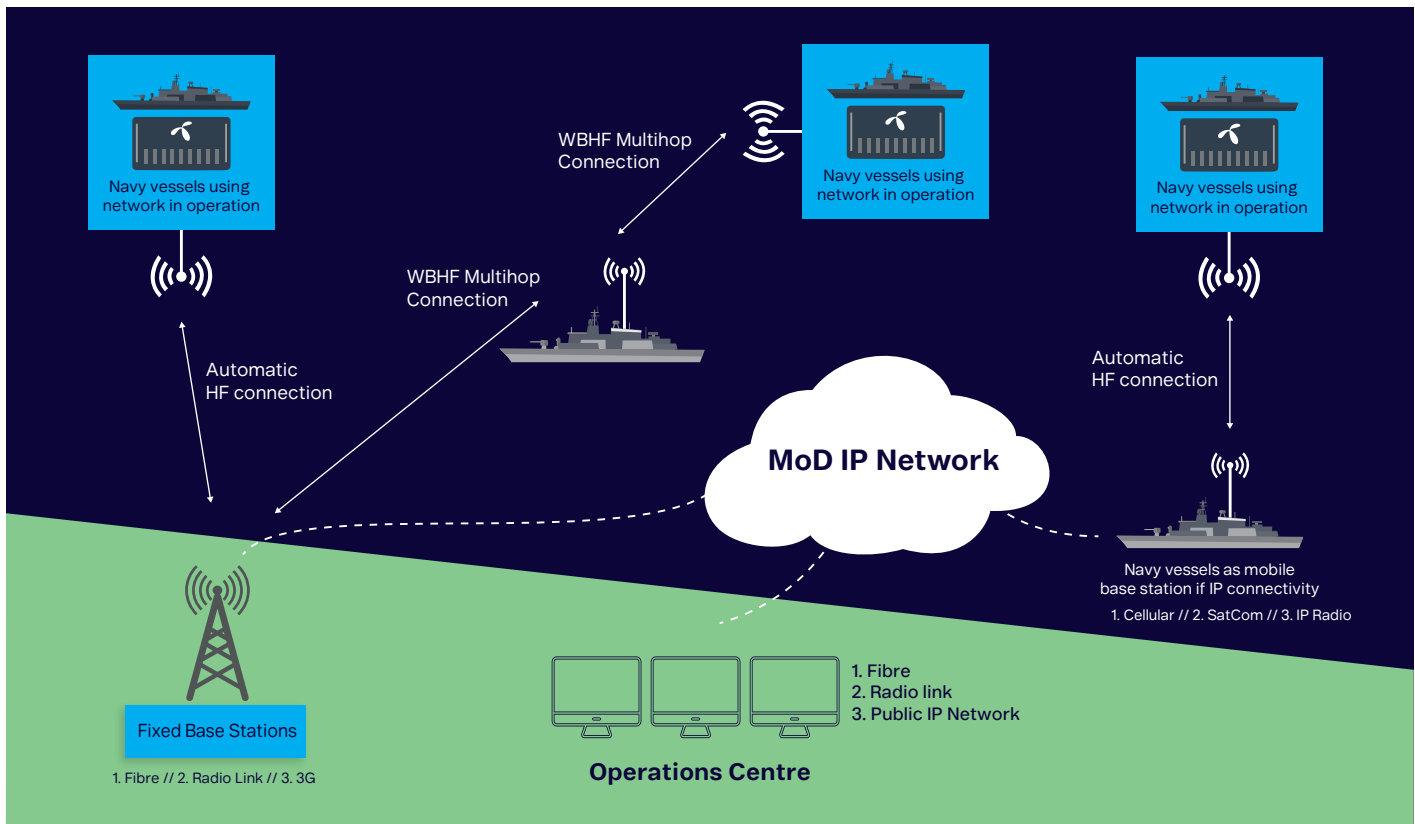


Safe

Safe encryption

Our solutions have AES256 encryption standard.

Multihop and peer-to-peer network



Contact us



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About Company

Telenor Maritime is the leading global communications partner, developing solutions for mission-critical operations for the maritime and terrestrial industries alike. We are trusted by the defense and military, maritime industry and disaster-relief organisations who need reliable worldwide communications. We provide simple, secure and reliable connectivity.

Our engineers have backgrounds from the military and defence sector, and they are security checked to ensure the highest level of confidentiality. In addition to security clearance, we hold the standard and approvals for the DefSec industry.

Wholly owned by Telenor ASA, we have headquarters in Arendal, Norway and we are present in local offices in Europe, North America and Asia.

For more information contact defence@telenormaritime.com



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