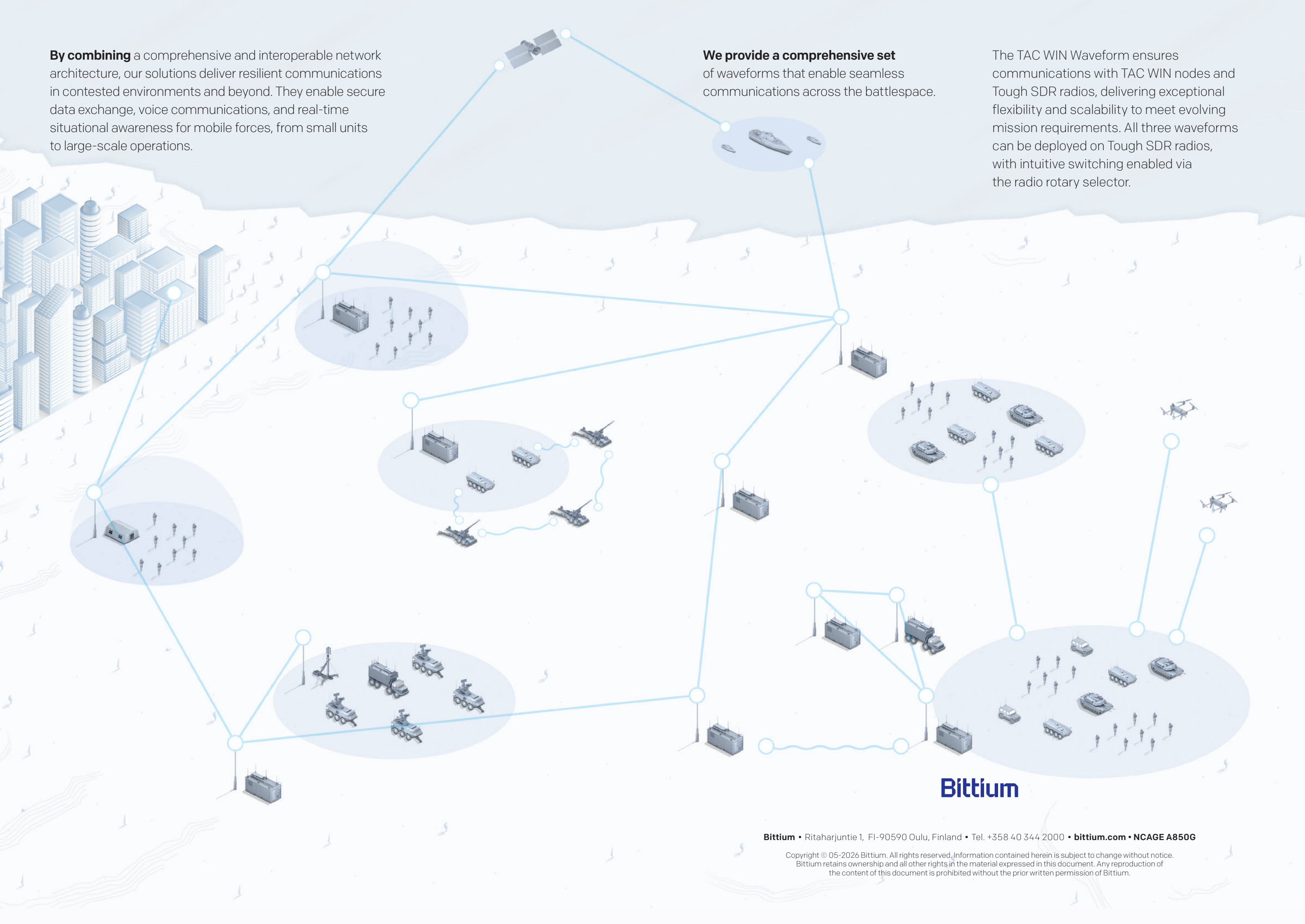


By combining a comprehensive and interoperable network architecture, our solutions deliver resilient communications in contested environments and beyond. They enable secure data exchange, voice communications, and real-time situational awareness for mobile forces, from small units to large-scale operations.

We provide a comprehensive set of waveforms that enable seamless communications across the battlespace.

The TAC WIN Waveform ensures communications with TAC WIN nodes and Tough SDR radios, delivering exceptional flexibility and scalability to meet evolving mission requirements. All three waveforms can be deployed on Tough SDR radios, with intuitive switching enabled via the radio rotary selector.



WAVEFORMS FOR TACTICAL COMMUNICATIONS



Waveforms at the heart of high-performance networking in national and coalition use cases

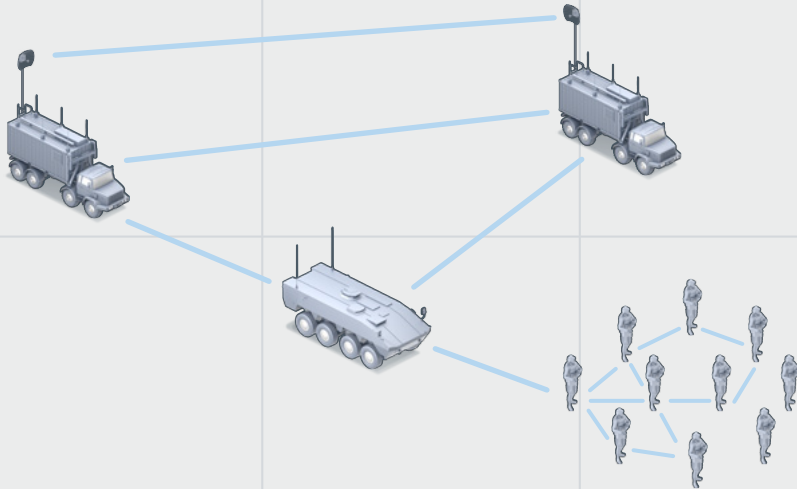
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BITTIUM TAC WIN WAVEFORM™

Bittium TAC WIN Waveform is a wideband waveform that provides the foundation for a high performance tactical network. The waveform supports several services, such as Multicasting and QoS, and provides a reliable development platform for upcoming applications.

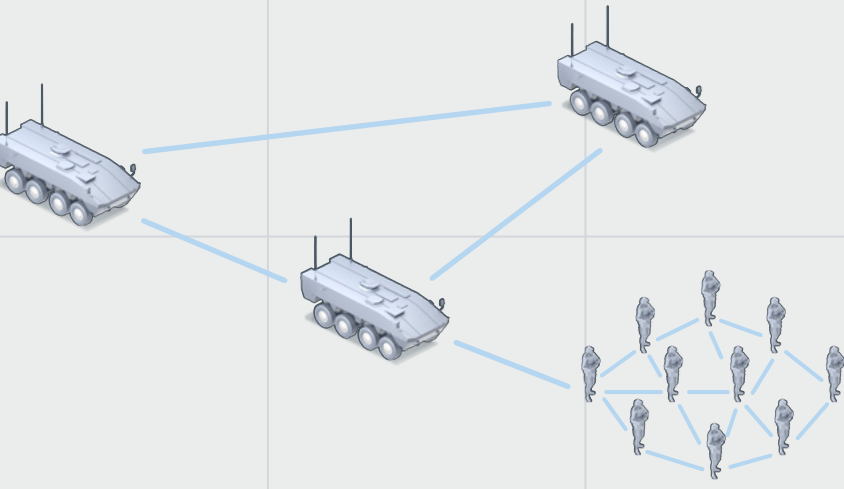
The waveform is made for mobile ad-hoc networking (MANET). It utilizes multicarrier technology, OFDM (Orthogonal Frequency-Division Multiplexing) on its physical layer. The OFDM combined with the highest quality radio hardware offers superior performance for tactical use. The TAC WIN network can be used in mesh or link mode.



ESSOR HDR WF (NATO STANAG 5651)

ESSOR High Data Rate Waveform (HDR WF), NATO STANAG 5651, provides an innovative, interoperable, new generation, secure, mobile ad-hoc networking (MANET) radio transmission network. It is a combat net radio (CNR) waveform that offers simultaneous voice (dual PTT) and data (IPv4) service for end users. ESSOR HDR WF enhances the operational capabilities on the battlefield by providing coalition troops high data rate services when compared to existing data modes of legacy CNR radios.

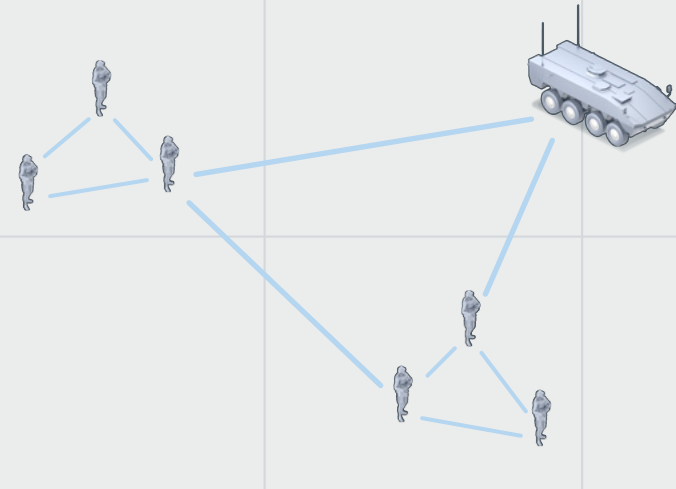
The ESSOR HDR WF network is deployed on the tactical level, it is secure, self-organizing and self-healing, and it works on-the-move forming a multihop mobile ad-hoc network, and therefore increases the connectivity of mobile warfighters. Using ESSOR HDR WF in the radios, broadband data transfer, cooperation and direct communications also between different national troops in coalition operations, starting already from the patrol level, are made possible.



BITTIUM NARROWBAND WAVEFORM™

Bittium Narrowband Waveform is a CNR waveform for voice and data communications, operating in VHF and UHF bands from 30 MHz to 512 MHz with 50 kHz channel bandwidth. With its frequency hopping and other EPM capabilities, it supports simultaneous secure voice and data communications also in hostile, jammed environments.

Bittium Narrowband Waveform can be used to provide voice and data capable command networks from brigade level down to squad level or for example as a system radio for GBAD or other systems. In the tactical environment, it complements and works alongside other waveforms such as the Bittium TAC WIN Waveform and ESSOR High Data Rate Waveform.



Specifications

- Adaptive waveform optimized for different network and link conditions
- Automatic data transfer capacity adjustment between nodes and node link directions according to current data transfer capacity need ensures best available data throughput at network level
- Adaptive modulation and channel coding according to current link condition ensures best available data throughput in data link level
- Supports a large number of network subscribers. Up to 100 simultaneous nodes in the same 2-hop wireless MANET network. Up to 1000 active nodes in the wired and wireless IP network.
- Supports simultaneously three different adaptive wireless network topologies
- High-capacity Line-Of-Sight (LOS) Point-to-Point (P2P) links
- Broadband Point-to-Multipoint (P2MP) connection
- High data rate unstructured network topology (MANET) with late-entry capability
- ECCM Capabilities
- Frequency hopping, adaptive modulation and MANET routing ensure connectivity also during electronic warfare conditions
- Independent from GNSS using Bittium Air Interface Synchronization (AIS)
- Security
- Bittium TAC WIN Waveform has TRANSEC that encrypts all data using AES-256
- Bandwidth of network: 20 MHz, 10 MHz, or 5 MHz
- Node maximum throughput (20 MHz bandwidth): up to 72 Mbps
- Node maximum throughput (10 MHz bandwidth): up to 36 Mbps
- Node maximum throughput (5 MHz bandwidth): up to 12 Mbps
- Duplexing: TDD
- Channel access method: TDMA
- Channel coding: CTC
- Modulations: QPSK, 16QAM, 64QAM
- 5 QoS classes
- Communication range up to 100+ km
- IPv4

Specifications

- High data rate: ~1 Mbps, ~512 kbps, ~256 kbps at radio link, automatically selected. Maximum user throughput up to ~700 kbps with 1 Mbps radio link data rate.
- UHF: 225–400 MHz (extensible in Tough SDR)
- 1.25 MHz bandwidth, frequency hopping, frequency diversity (automatic establishment of parallel communications on different frequency channels)
- Designed to support up to 200 nodes per network, scalable routing algorithm
- Cohabitation of ESSOR networks deployed in the same area while sharing a common pool of frequencies
- Multi-hop MANET: Mobility management of the nodes and communication on the move. Self-forming & self-healing, splitting and merging procedure support
- Dynamic adaptation to the environment (propagation, node density, traffic, high altitude nodes, ...)
- Node mobility: up to 130 km/h
- Synchronization: distributed
- Synchronization capability with or without GNSS. In mixed configuration, taking advantage of the GNSS when available
- Radio silence capability
- Secure: Red / Black - embedded COMSEC / NETSEC / TRANSEC. Support for Over-The-Air rekeying/ distribution/zeroization OTAR/D/Z. External COMSEC (IPsec) compatibility
- Compatible with standard IP applications including VoIP: QoS traffic classification based on IP header information – unicast / optimized multicast / broadcast traffic

- IP Internet working between HDR WF network and legacy/future networks (e.g. Bittium TAC WIN) through open interfaces such as OLSR or OSPF. Static and dynamic external network announcements
- CNR PTT voice: half-duplex Push-To-Talk (PTT) voice service with several PTT groups in the network. Dual PTT capable. Relaying over a configurable number of radio hops (from 2 to 4) with floor pre-emption and selective call capability.
- Supports local and remote management and supervision
- Provides interoperability between coalition partners even with different radio platforms from different vendors
- Bittium SDR Waveform VoIP Gateway is available as a RoIP application to connect VoIP and PTT networks

Specifications

- VHF/UHF: 30–512 MHz
- 50 kHz bandwidth, frequency hopping, supports also orthogonal frequency hopping
- Independent from GNSS using Bittium Air Interference Synchronization (AIS)
- No practical limit for number of nodes in the network. The probability of PTT voice and data collisions gets higher as network and radio neighborhood gets bigger
- Node mobility: up to 130 km/h
- Secure: COMSEC (AES256) for voice and data. TRANSEC to protect all radio transmissions including signaling
- Voice service: Several voice channels (voice groups) allowing dual PTT functionality. Broadcast, half-duplex PTT voice with MELPe 2400 vocoder.
- Data service: Configurable number of broadcast data channels for data applications (such as battle management systems) with maximum user throughput up to 12.4 kbps
- For data applications data service is available as a proprietary, non-IP, socket interface. Data applications can reside in end user devices (EUD) or be integrated into Tough SDR radios' application sandbox
- Bittium SDR Waveform VoIP Gateway is available as a RoIP application to connect VoIP and PTT networks

Configuration of waveforms

Bittium Tactical Configuration Tool™ for easy and intuitive creation of configurations.

See separate datasheet for details.

Compatible with

Bittium TAC WIN network nodes and Bittium Tough SDR radios

A photograph showing two pieces of military communication equipment. On the left is a Bittium Tough SDR radio, a ruggedized handheld device with a screen and various buttons. On the right is a Bittium TAC WIN network node, a larger, more complex piece of equipment with multiple ports and a screen.

Compatible with

Bittium Tough SDR radios

A photograph showing two Bittium Tough SDR radios. They are ruggedized handheld devices with screens and buttons, designed for military use.

 ESSOR High Data Rate Waveform has been developed in the ESSOR (European Secure Software Defined Radio) programme. The aim of the ESSOR programme is to develop pan-European Software Defined Radio (SDR) technology in order to improve the ability of Armed Forces to cooperate in coalition operations. The programme was initiated in 2009 under the umbrella of the European Defence Agency (EDA) and is

currently sponsored by the governments of Finland, France, Germany, Italy, Poland, and Spain. The ESSOR programme has been awarded by the Organisation Conjointe de Coopération en matière d'Armement (OCCAR) to the dedicated joint venture Alliance for ESSOR (a4ESSOR S.A.S.). a4ESSOR is in charge of managing the industrial consortium composed of Bittium, Indra, Leonardo, Radmor, Rohde & Schwarz, and Thales.

Compatible with

Bittium Tough SDR radios

A photograph showing two Bittium Tough SDR radios. They are ruggedized handheld devices with screens and buttons, designed for military use.

All the waveforms you need for connectivity across the battlefield.

For more information, please contact: **defence@bittium.com**