DECODIO SPECTRUM MONITORING SOFTWARE

DIGITAL PMR ANALYSIS | MARITIME & AERO PROTOCOL DECODING |
DIRECTION FINDING | EMITTER LOCALIZATION | ALARMING |
TASKING | SIGNAL CLASSIFICATION | VISUALIZATION |
ITU MEASUREMENTS | OPEN PROCESSING INTERFACES |

Decodio

www.decodio.com

DETECT | DECODE | VISUALIZE

DECODIO SOFTWARE OVERVIEW

Flexible, Agile, and Innovative.

We place these tenets at the forefront of our software design, ensuring our clients stay ahead of the fast-pace changes within contested electro-magnetic spectrums.

We make certain Decodio software simply runs on PCs and seamlessly integrates an ever increasing list of Radio and Direction Finding Receivers from top industry names. Link together our software through multiple pathways, making it easy to add our products to your networks and establish monitoring sites. Interested in using Decodio as a backend, doesn't get any simpler via our JSON API network interface.

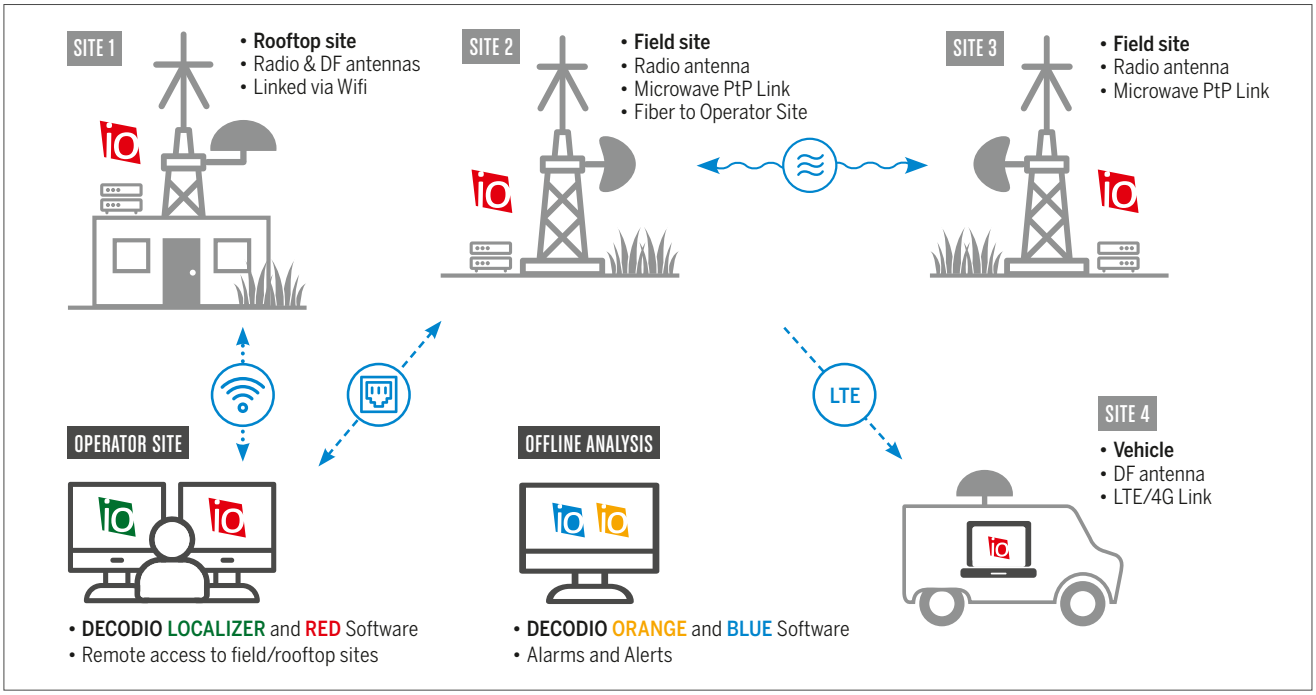
RED	SIGNAL ANALYSIS DECODING	ORANGE	PROTOCOL ANALYSIS + DATA VISUALIZATION	PINK	RULE-BASED ALARMING
LOCALIZER	EMITTER GEO-LOCATION	BLUE	BIG DATA ANALYTICS + WEB- BASED VISUALIZATION	GREEN	API INTERFACE

Custom Software Pairings and Configurations

Easily match Decodio software to your needs.

- FULL SITE SPECTRUM MONITORING SYSTEM
- DIRECTION FINDING
- PMR/LMR DECODING AND ANALYSIS
- SIGINT/EW
- NETWORK MONITORING AND OPTIMIZATION
- API FOR CUSTOM ALGORITHM IMPLEMENTATIONS
- DRIVE TESTS
- TDOA/AOA/HYBRID SIGNAL LOCALIZATION (GEO-LOCATION)

Endless Deployment and Remote Configuration Options



Link together deployed sensors using multiple network pathways and a VPN/intranet. Upgrade your established spectrum monitoring sites, or place additional expeditionary field, vehicles, or man pack sensors in hard to reach places.

Decodio software enables a single user to remotely access distributed sites across vast distances. Signal acquisition and processing are performed in the same location with only decoded data and control commands being exchanged with other sites. This means reliable operations even with poorer network capability.

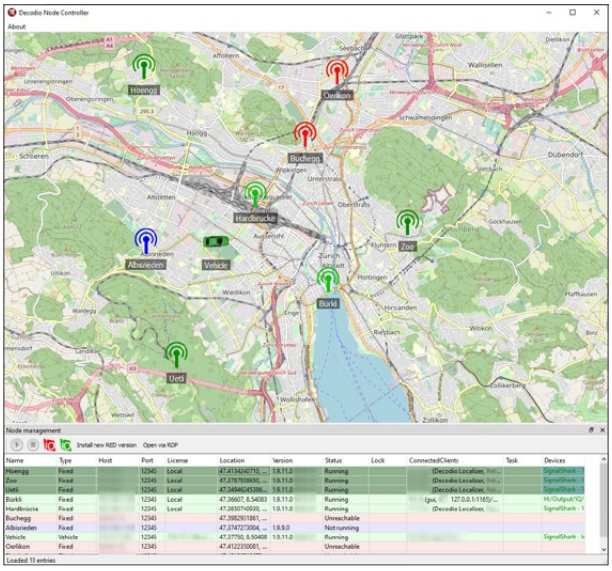
Full Site Monitoring

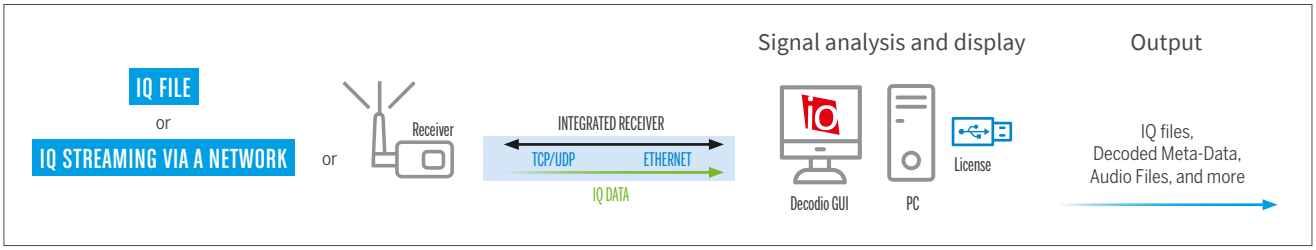
CONTROL ✓ DEPENDABILITY ✓ COMMAND ✓

Control: Choose either Remote or Local control of software through a TCP/UDP interface using JSON API exchanges.

Dependability: For a multi-site spectrum monitoring system, RED runs as a Service, ready to automatically restart if power is lost/restored. Easily continue where you left off with all project presets saved.

Command: Observe each station's health and status via our NODE CONTROLLER command window. Easily execute remote Localization, remote into RED, and see each station easily on a map.





DECODIO RED

HIGHLIGHTS

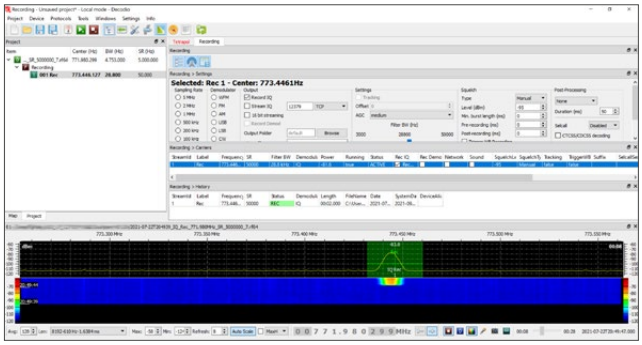
- PC based software
- Decode multiple PMR/LMR protocols simultaneously
- Display decoded locations on custom maps
- Up to 500 analog and decoding streams
- Use with over 20+ commercial RF and DF receivers
- Open interfaces (e.g. TCP/UDP input and output streams, VITA-49)
- Advanced protocol outputs for encryption analysis
- Backend and integration possibilities

SIGNAL ACQUISITION

RED uses multi-pathway signal acquisition, enabling users to work with instantaneous bandwidths up to 80 MHz and higher from RF receivers, saved IQ .wav files, or IQ data streamed over a network in a VITA-49 format. Use RED with over 20+ RF and DF receivers from top industry producers: Rohde & Schwarz, Signal Hound, Tektronix, IZT, NARDA, National Instruments, and more. Easily adjust receiver bandwidths, set receiver dwell times, and enable GNSS/GPS timestamping (where supported) all within the customizable RED GUI.

SIGNAL EXTRACTION, RECORDING AND STREAMING

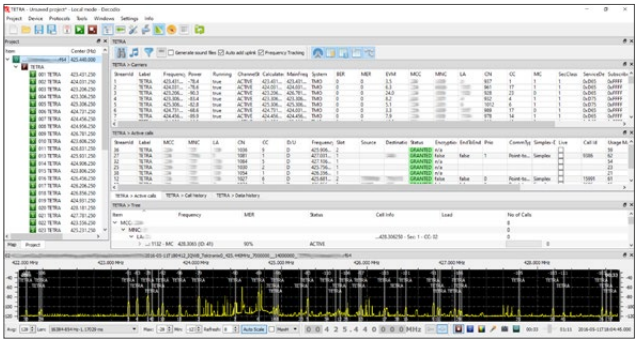
Conduct narrowband channel extraction and demodulation using modern software-defined radio techniques. RED supports a maximum of 500 analog and decoder streams based on CPU performance. With costs savings in mind, users can customize the number of streams required to meet exact operational needs.



Signal Analysis and interference recording

SPECTRUM PLANNING AND REGULATION

Set unlimited markers over the live spectrum display, defined by bandwidth. Add custom labels and color each marker segment. Markers stay set even as the receiver center frequency changes. Load spectrum plans from spreadsheets or licensed databases quickly. Pair this feature with our automatic emissions detection and signal classification for fast interference and jamming mitigation. Regulate your licensed users and assigned frequencies fast and accurately.



Automatic TETRA decoding and meta-data display

COMPREHENSIVE DECODING

Besides standard analog modulations, RED supports full meta-data decoding (voice, content, and payload) of all major PMR/LMR protocols (TETRA, TETRAPOL, dPMR, DMR, NXDN, P25 Phase 1+2 … and more). RED uses auto-detection, classification, and decoders together, decreasing user actions.
Support for air and maritime decoders is also available by request. See the backside of this brochure for a full decoder list.

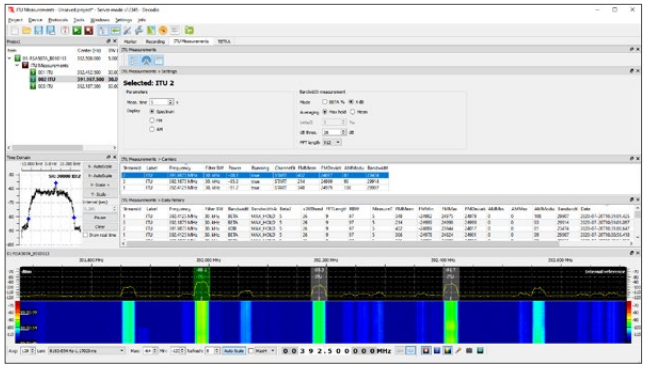
ITU MEASUREMENTS

Conduct measurements such as: burst durations, zero-crossing for symbol-rate estimation, auto correlation, DFT or cepstrum. Use signal cursors to measure and display estimated values. Inline with ITU Requirements: SM.328, 337, 443, 854, 1600, 1880, 2117.

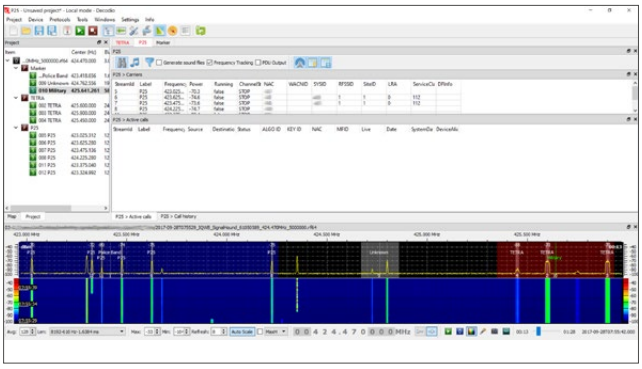
DIRECTION FINDING

Optimize your DF receiver (both single and multi-channel) through RED's remote control capability. Display lines of bearing and turn them into heat maps.

DECODIO RED

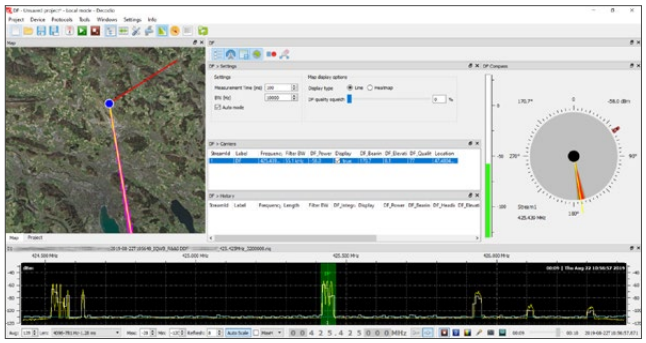


Multi-Channel ITU Measurements including time domain analysis

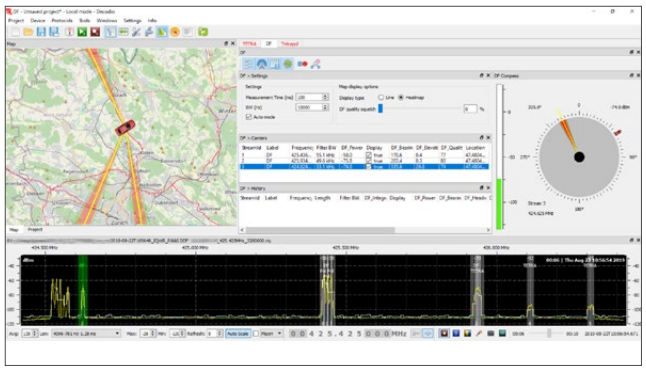


TETRA and P25 simultaneous decoding within a displayed spectrum plan

ADVANCED DIRECTION FINDING

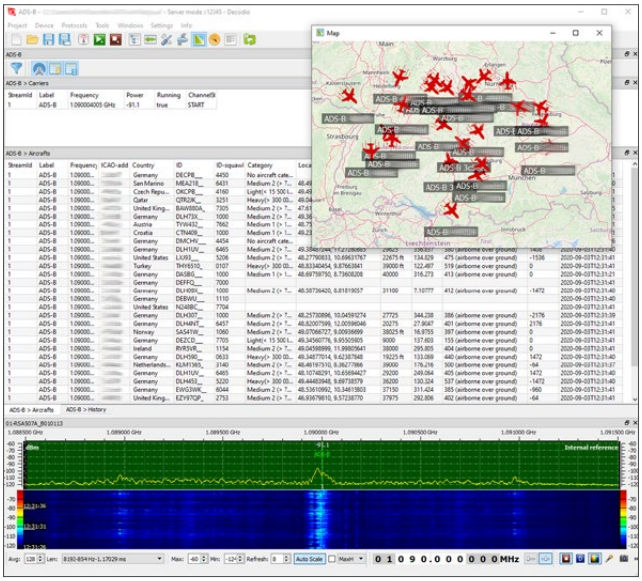


Single-channel DF with Lines of Bearings

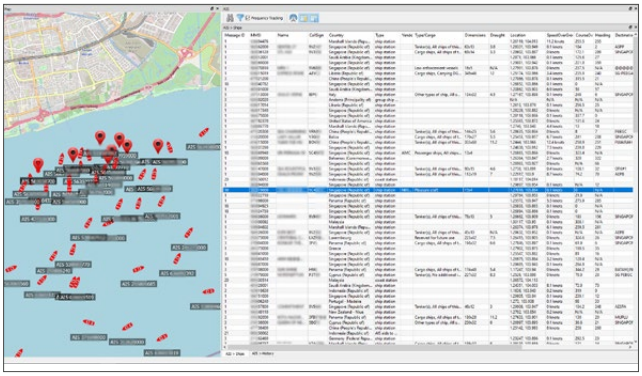


Multi-channel DF, heatmaps, with multi-protocol decoding

AIR AND MARITIME DECODING



Easily display and save ADS-B, ACARS, VDLM2, and FLARM meta-data



Help deter spoofing by decoding AIS directly from your receiver

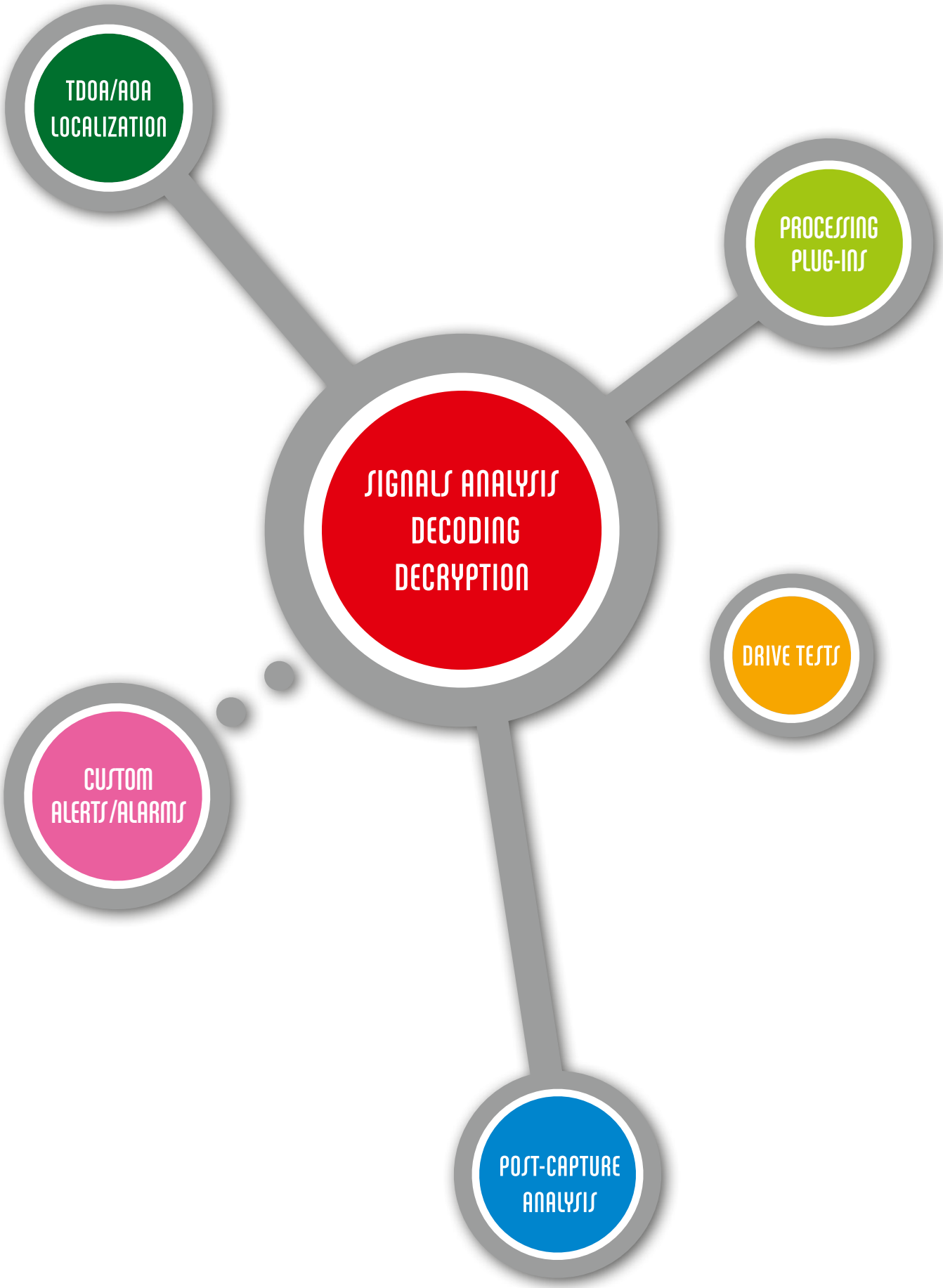
DECODIO RED SUB-PRODUCTS

ReX

RED software, but without decoders. Analog analysis only.

NET

Signal protocol decoder version of RED. (e.g NET for TETRA)


TDOA/AOA
LOCALIZATION
PROCESSING
PLUG-INS
SIGNALS ANALYSIS
DECODING
DECRYPTION
DRIVE TESTS
CUSTOM
ALERTS/ALARMS
POST-CAPTURE
ANALYSIS

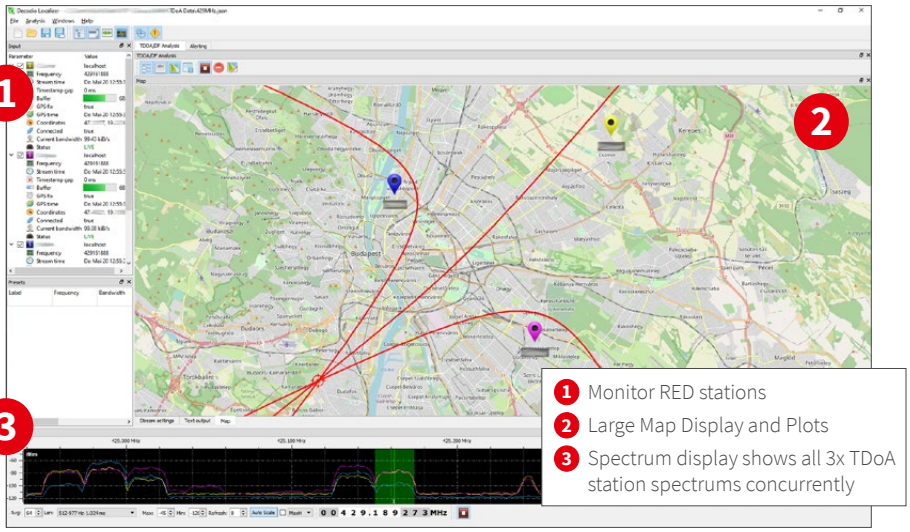
DECODIO LOCALIZER

Signal Geo-location

HIGHLIGHTS

- Multi-Channel TDoA, AoA, or Hybrid TDoA/AoA
- Centralized control of multiple direction finders
- Compatible with a larger number of RF receivers and direction finders
- Live, interactive map display with markers
- User friendly logging and visualization
- Integrates with existing infrastructure
- Offline analysis and replay

LOCALIZER DISPLAY



2x Site AoA Cross-Fix

TIME DIFFERENCE OF ARRIVAL (TDOA) WITH RF RECEIVERS

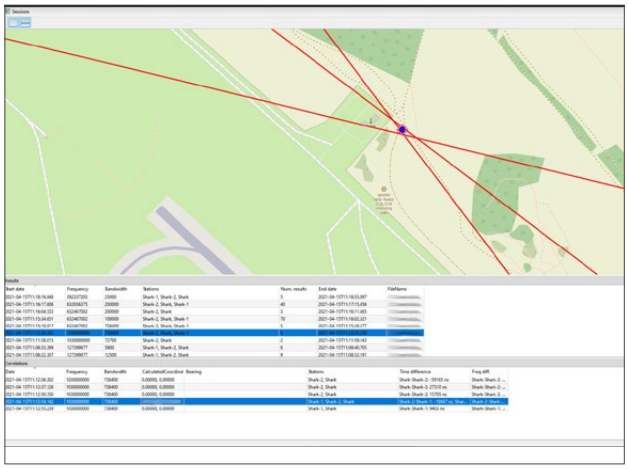
Control remote acquisition stations running Decodio RED. Display all stations on a map and selectively enabled or disabled each one. Station data streams are time-aligned and correlated (based on signal level and burst detection) and the emission origin is estimated. Almost instantly, a heat map is displayed from synchronized measurements. All correlation results are stored in session files along with their corresponding hyperbolas and can be displayed on the map offline. Decodio offers an optional protocol characteristic-based TDoA, increasing confidence and precision within the PMR/LMR, maritime and aeronautic domains.

ANGLE OF ARRIVAL (AOA) WITH DIRECTION FINDERS

Supported direction finders (single/multi-channel) are seamlessly integrated into RED. Parameters, such as center frequency, bandwidth, squelch, etc. can be easily changed within the GUI. Where supported by the direction finder, it is possible to use a combined IQ and DF mode to perform signal localization and decoding/analysis in parallel.

HYBRID TDOA/AOA

One or more direction finders (AoA) can be combined with two TDoA stations to form an advanced emitter localization system.



Store all direction finding results and generate reports containing full datasets. If supported by the direction finder, multiple frequencies can be monitored, localized and displayed in parallel.

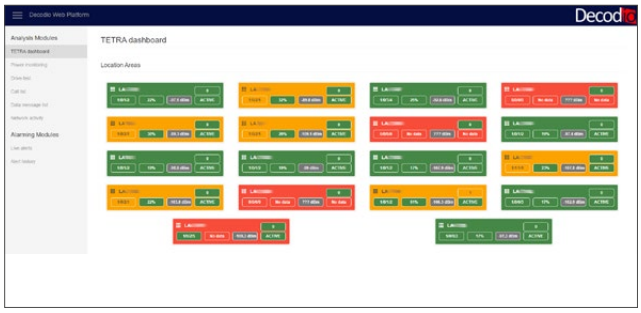
DECODIO BLUE

Database and web-based visualization

Decodio BLUE is a web server and database application offering storage, logging and browser-based visualization of the data generated by **Decodio RED**.

Decodio BLUE reads data from multiple instances of RED and saves the decoded data and signal properties within a centralized database. Saved parameters include base station broadcast parameters, call information, short data messages, and position reports as well as signal power and demodulation quality. BLUE supports different structures of custom databases and web-visualization front ends.

The web interface provides access to all collected data items and their visualization in different views. Advanced filtering, sorting and combining features create different charts for deeper analysis of the received content. Comprehensive protocol data unit output analysis is preformed and visualized inside various graphs.



TETRA Network Dashboard

DECODIO PINK

Alarming, Tasking, and Network Monitoring

Decodio PINK is an automated monitoring component, continuously collecting decoded information and measurements from multiple instances of **Decodio RED**. It can run at a single field sensor and a centralized control site.

HIGHLIGHTS

- Flexible alerting framework for quality of service and threat detection
- User-defined trigger conditions
- Interaction with existing infrastructure (e.g. countermeasure, alarming, network management systems)
- Easy monitoring of large-scale networks

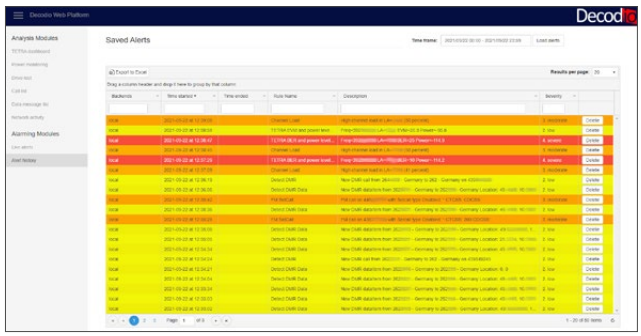
PINK triggers an alert when a decoded parameter breaks a list of user-defined rules. Rules can involve any metric or parameter available in RED, such as signal strength and quality, network parameters or call metadata like callsigns/IDs. Even triggers comprised of several parameters combinations are possible.

PINK allows for precise event detection, accurate quality-of-service assessment, and/or threat detection. The list of both active and past alerts are accessible through a web database.

NETWORK MONITORING (HEALTH & STATUS)

The software can automatically respond to an alert with a series of actions, such as sending an SNMP trap to a network management system (NMS), sending user-defined TCP messages, or starting an IQ-recording or direction finding job.

Along with each alert, detailed context information is saved, including start/end time, and the decoded data fields breaking the rule and response taken.



Web-based Alarming List

DECODIO GREEN

API Custom Signal Processing and Acquisition

Decodio GREEN provides a plugin-based C/C++ application programming interface (API) for extending the usability **Decodio RED** for specific surveillance needs.

Through multiple DLL interfaces, load user-defined cryptographic implementations for various custom protocols and integrate additional user-defined demodulators/decoders and signal analysis modules into RED.

DECODIO IQ OUTPUT API

GREEN's IQ output interface allows the user to retrieve one or multiple narrowband channels from RED in an IQ form. Next, the system will process the data within an external DLL, and finally visualize the results directly inside RED's GUI. The narrowband channels are either manually or automatically set by RED's inherent emission detection function.

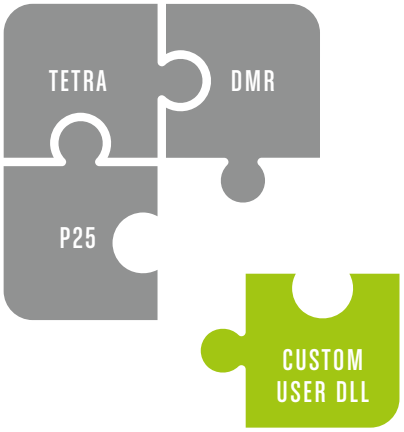
The GUI is defined based on Decodio's standard GUI elements (tables, text/sound outputs) within the DLL. Also, the IQ output API allows the user to load multiple DLLs with different signal processors. Making it the perfect solution for custom signal processing and measurement of multiple channels.

CRYPTO-INTERFACE

RED is capable of providing live protocol outputs via an DLL interface to external decryption algorithms. Outside Decodio's core processor, the user operates their own approaches, feeding back the deciphered data into RED's live processing chain. This mechanism interfaces with standardized decryptions in TETRA and DMR. By feeding back the deciphered data, the higher layer implementations of RED is used for further processing, with all information visualized easily within the RED GUI.

HIGHLIGHTS

- Processing of multiple IQ streams simultaneously
- Usage of multiple processing DLLs as C++ real time implementations
- Open plug-in architecture for crypto- and signal-processing
- Simple GUI definition based on standard elements

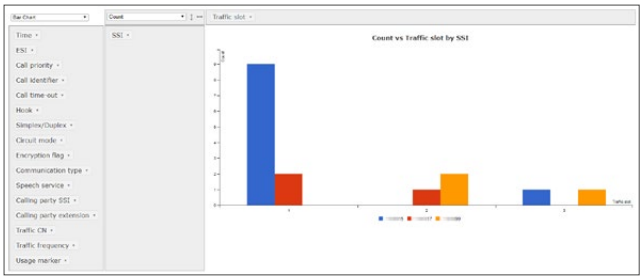


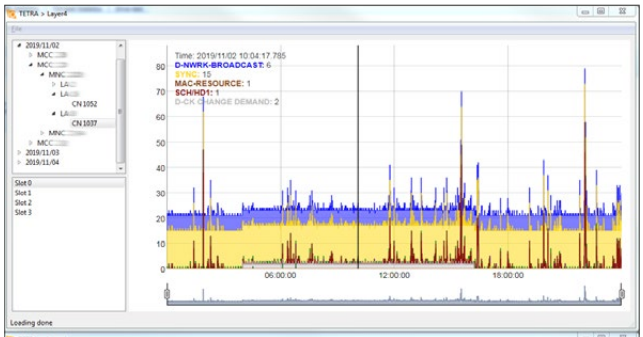
Green enables users to program their own Dynamic Link Library (DLL) protocols into RED.

DECODIO ORANGE

PMR/LMR Meta-data Visualization

A database visualization tool for protocol data, with a convenient interface to display results within custom charts and tables.





Using the protocol data unit (PDU) and measurement values generated by Decodio RED, a wide range of analysis modules give the user a deep understanding of a PMR/LMR network's behavior.

NETWORK OPTIMIZATION

Network load and capacity bottlenecks are quickly analyzed with visualizations such as the number of calls within a network cell, number of calls by logical group, and call duration distribution or control channel usage.

CHARTS, PIVOT-TABLES, AND HISTOGRAMS

Several pivot table-based analysis modules enable users to combine different metadata types and study their relationship (such as for example call type by source and destination ID or call length by talk group). The available charts also include histograms for the visualization of call setup time and call length distribution. The collected data and generated charts are exported for easy integration into an existing workflows and/or for documentation purposes

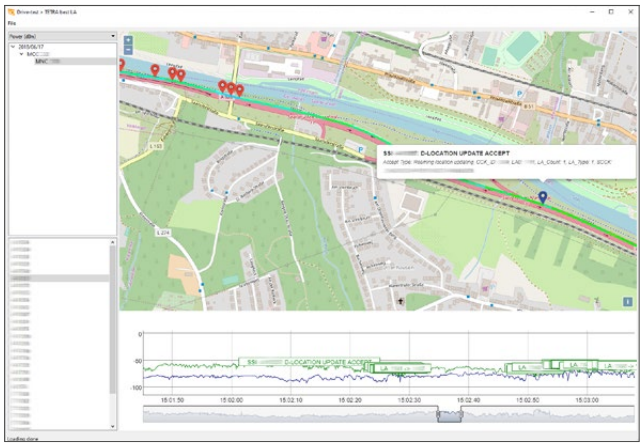
RUNNER

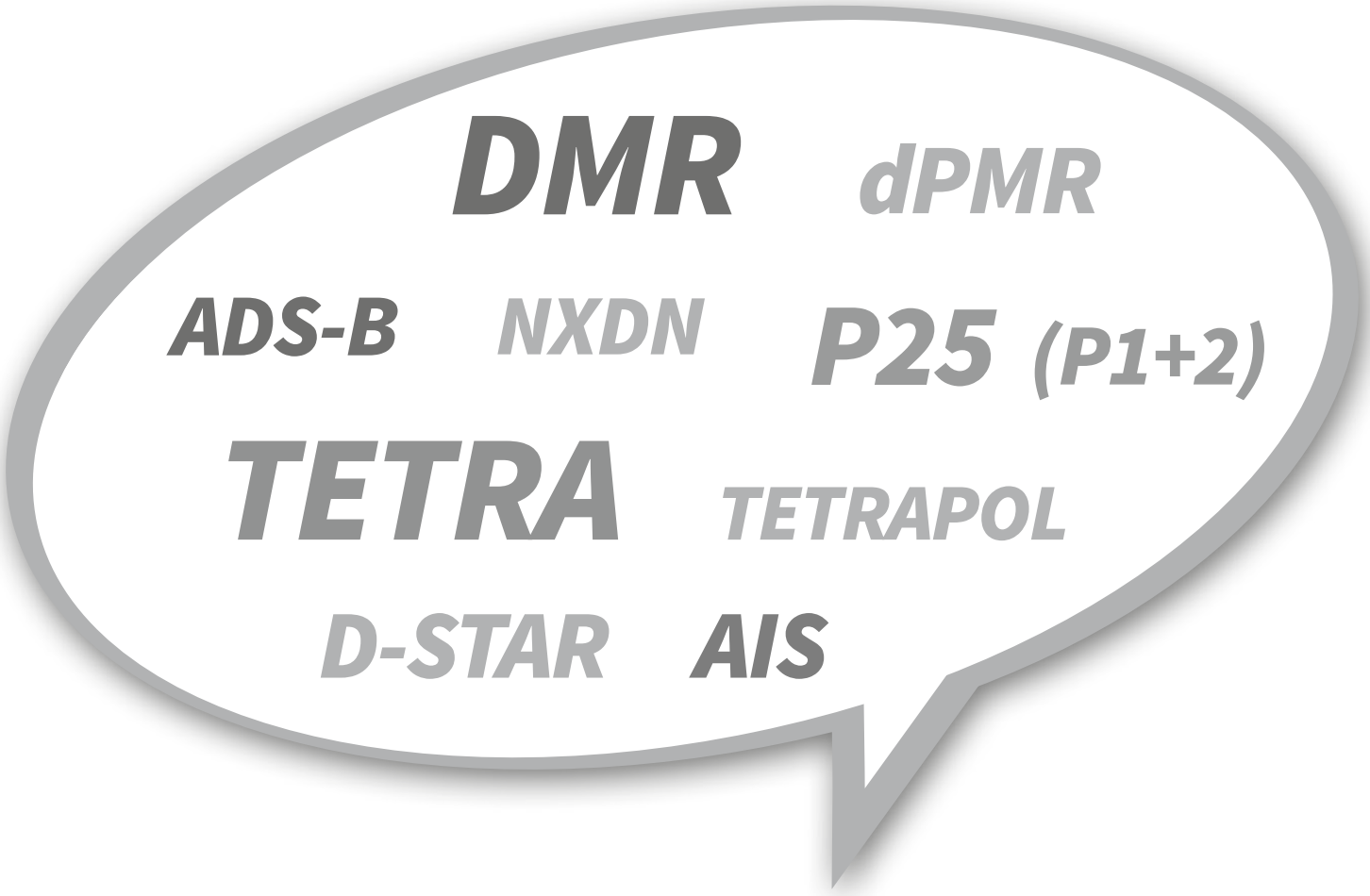
Drive Tests

A sub-feature of **Decodio ORANGE**. RUNNER is an advanced mobile drive-test solution for network verification, coverage assessment and troubleshooting that combines the signal analysis of RED and data display of ORANGE. Save vehicle space through our PC-based software, requiring just a RF receiver, laptop/tablet and GPS/GNSS sync.

APPLICATION

- Coverage tests:
  perform real-time network coverage tests and get cartographic information with power and quality values
- Network planning and verification:
  verify your network planning with "real world" measured coverage parameters
- Interference tests:
  find interfering channels and signals





Decodio

DETECT | DECODE | VISUALIZE

RED TECHNICAL DATA	
Max. number of parallel analog/digital Decodio channels	Up to 500 (depends on PC processing power)
Narrowband bandwith	12.5 kHz up to 5 MHz
Filter width for narrowband channels	625 Hz to 5 Mhz
Analog demodulators	CW, USB, LSB, AM, FM, WFM
CTCSS and Selcall decoding	EIA, EEA, CCIR, PZVEI, DZVEI, ZVEI_1, ZVEI_2, ZVEI_3
Decoders PMR/LMR	TETRA, DMR, TETRAPOL, P25 Phase 1+2, dPMR, NXDN, MPT 1327, POCSAG
Decoders Amateur	C4FM, Packet Radio, DSTAR
Decoders Air and Maritime	ADS-B, ACARS, VDLM2, FLARM, AIS, DSC (GMDSS-ATIS)
IQ inputs	VITA-49, IQ WAV/RF64 files, Direct from over 20+ commercial RF Receivers
Operating System	Windows (Linux upon request)
Licensing Options	USB-dongle based or server floating license
Remote Control and Access	JSON based IP interface

RED OPTIONS	
Advanced Classifier	CW, FSK, (incl. F7B), DPSK, QPSK, 8PSK, 16PSK, 8QAM, 16QAM and OPSK), OFDM and several military modes like MIL-STD-188-110, MIL-STD 188-141B or STANAG-4285 (further details on request)
Direction Finding	Custom maps (street, topo), display single and multi-channel DF LOBs

LOCALIZER TECHNICAL DATA	
GNSS Inputs	GPS, Gallieo, GLONASS
Minimum Site Configurations	TDoA: 3 AoA: 2 Hybrid TDoA/AoA: 2 TDoA and 1 AoA
Network Options	Fiber, Ethernet, LTE/4G, Microwave Point to Point, Wifi
Minimum Network Speeds	TDoA: 120kBit/s-2MBit/s per site AoA: 10-30kBit/s per site

DECODIO INTEGRATED RECEIVERS BRANDS
Visit our Website for the Current List of Specific Models
ROHDE & SCHWARZ, NARDA, SIGNAL HOUND, TEKTRONIX, NATIONAL INSTRUMENTS, IZT, HACK RF, AIR SPY, RTL-SDR, SDR-PLAY

GENERAL SYSTEM REQUIREMENTS

- Windows 10 64 Bit
- Quad-Core Processor min. 3 GHz (e.g. Intel i7-4770)
- Gb Ethernet card supporting jumbo frames
- 16 GB RAM
- Optimum screen resolution: 1920 x 1200
- Sound card (optional)
- SSD (recommended, depending on recording requirements)

Decodio Software is designed, developed, and produced in Switzerland.

SWISS MADE

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