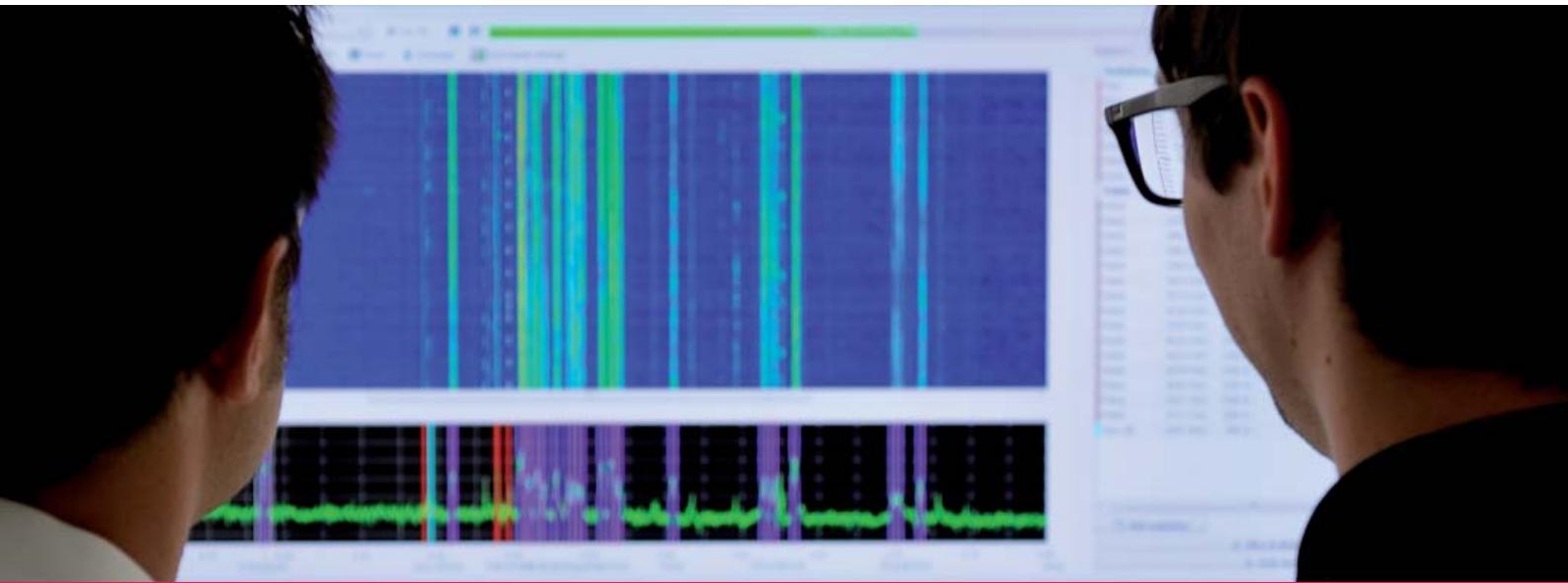




go2MONITOR

## Compact Radio Signal Monitoring Solution



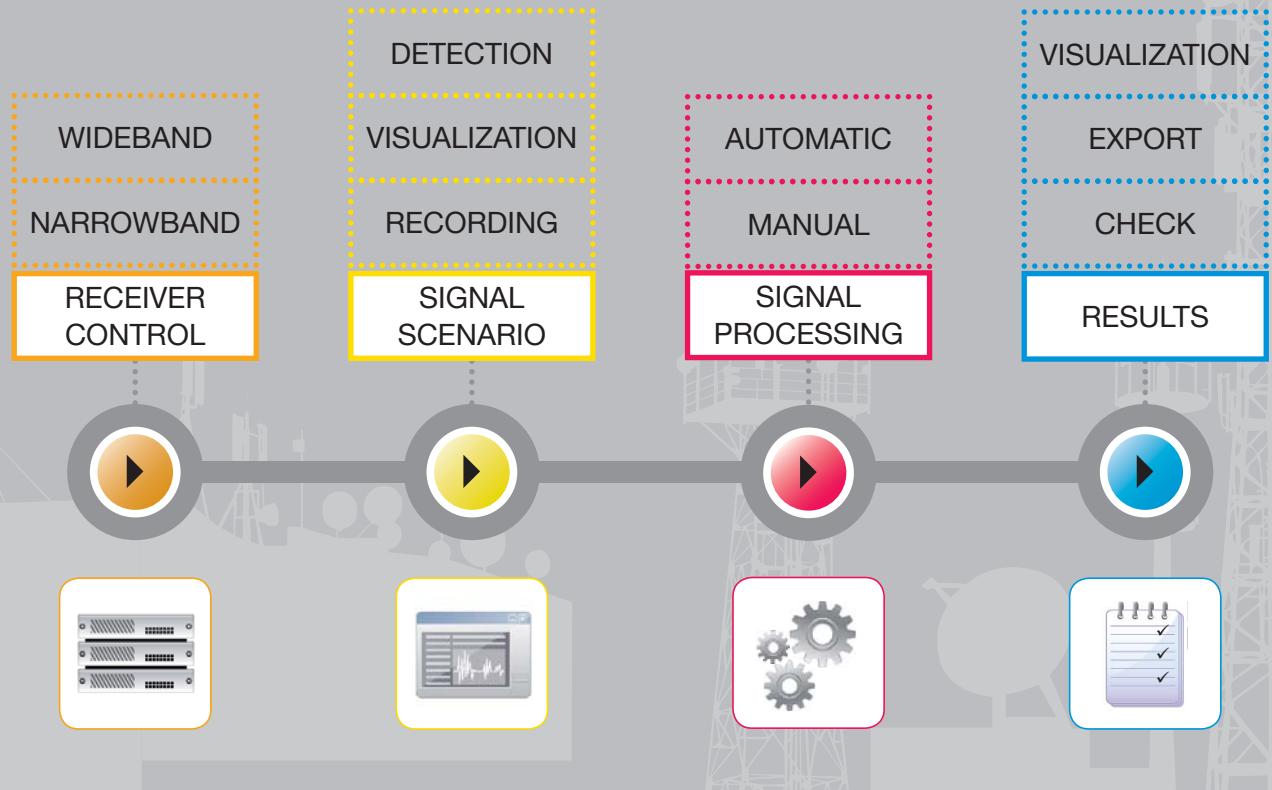
go2MONITOR is a high-performance, automatic radio monitoring solution for multichannel analysing and processing of HF and V/UHF signals.



### Key facts

- Multiple wideband inputs up to 20 MHz each (spectrogram, classifier, recording, DDC)
- Modular scalability from one channel to hundreds of channels
- Automated classification and production using an extensive decoder library
- Integrated receiver control with direct Software Defined Radio (SDR) interface
- Parallel processing production channels either with buffered Digital Down Conversion (DDC) or narrowband receiver input
- User-configurable automatic signal search with task-based control for processing with defined depth of analysis and results
- User-expandable decoder-library via Decoder Description language (DDL)
- State-of-the-art GUI includes window presets, drag & drop, and integrated station list

# WORKFLOW



## go2MONITOR

### Automatic radio monitoring, multichannel analysis and processing of radio signals

go2MONITOR consists of modular HF, V/UHF radio monitoring, classification, decoding and signal recording applications. They are based on a highly modular system architecture using standard COTS hardware.

- 2,4 MHz (HF) / 20 MHz (V/UHF) coherent, 6 GHz Scan mode
- Efficient job control by focusing on signals of interest
- Parallel and permanent classification and production of signals
- More than 250 modes for demodulating and decoding
- Use of standard hardware (COTS) and current receiver models
- Easy integration through open API's
- Expandable with user-defined procedures and decoders

## Automatic interception workflow

go2MONITOR has a fully automatic approach for interception, classification, demodulation, decoding and recording of radio signal emissions in a wideband signal scenario.

In combination with monitoring receivers go2MONITOR defines a full featuring workplace.

A frequency range is intercepted and its signal scenario monitored fully automatic. Detected activities are classified and technical parameters of the signals are determined. Known signals are automatically recorded, demodulated to listen in or passed to decoding, gathered results are stored into a database.

Unknown signals can be recorded for more in depth manual analysis. This enables the operator to concentrate on signals of interest for his daily work. Analysing new unknown signals to expand the software with own decoders keeps it up to date with the signal scenario.

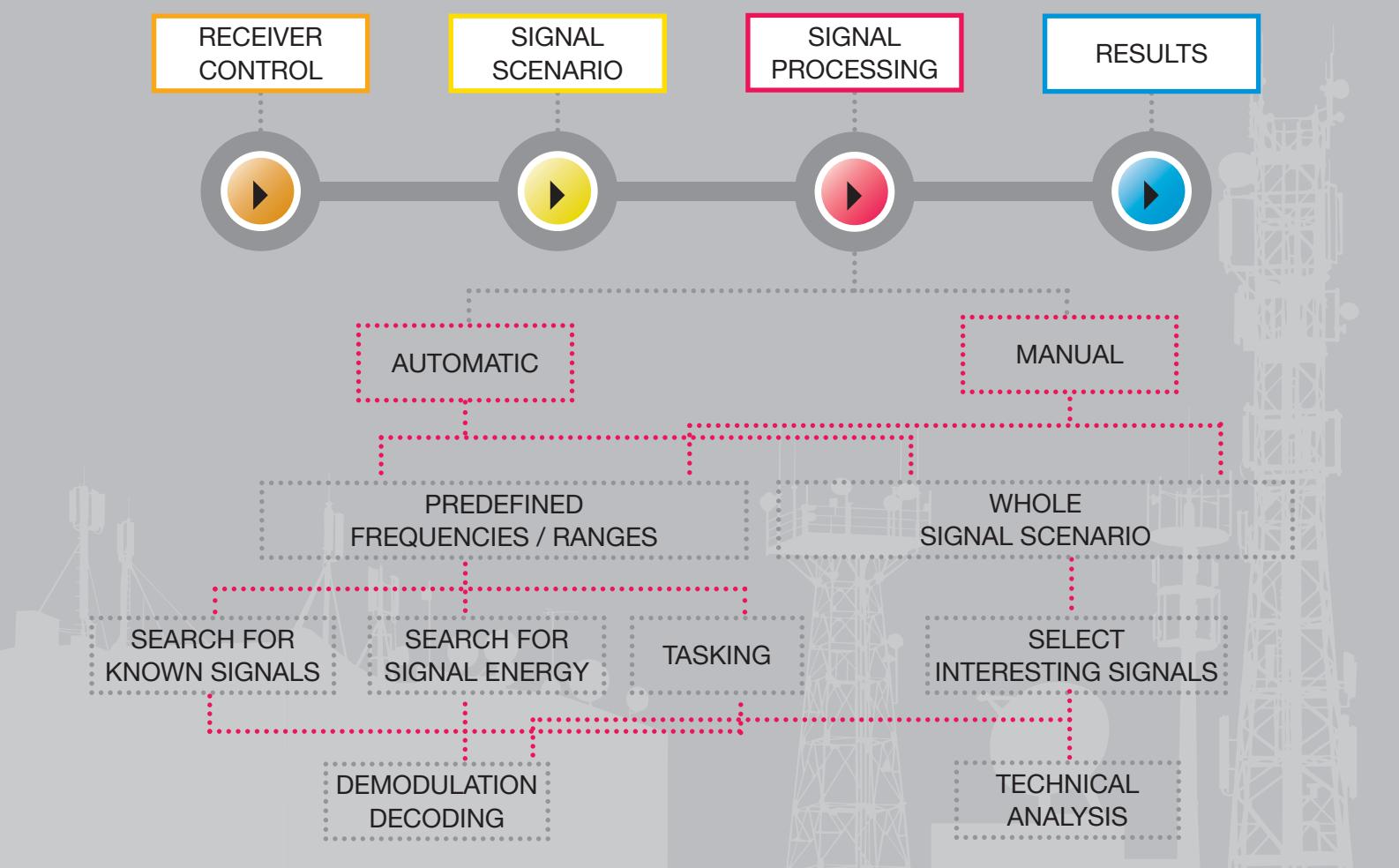
The entire functionality is available for manual, and automatic operation: From manual signal processing and quick analysis of an individual signal up to fully automatic signal search, interception and processing.

## MODULAR SCALABILITY

The modular and scalable design enables several different component combinations to create customised product setups perfectly suited for specific applications: From a manually operated wideband signal workstation over a fully automatic working radio monitoring solution to a signal processing component integrated in a larger system.



# USE CASES



## Use Cases

### Automatic search and production of known signal types

The user is able to search in predefined frequency ranges for well-known signal types. This feature includes the search for analogue transmissions (voice / morse) and for all signals matching a list of digital transmission methods of interest. The system will run in automatic mode, search for all signals using one of these transmission methods in the defined frequency range, extract and store these signals in a storage server. Results like decoded text or demodulated audio signals are stored in the storage server for further evaluation and export.

### Automatic determination of frequency allocation

A main use case of automated systems is to provide an overall survey of the signal scenario without having any preknowledge about the frequency allocation. In this use case the system searches for energy in a predefined frequency range and determines if the energy could be a signal. The detected energy is processed up to the level of information that is parameterised for this task: signal detection, specific signal parameters (e.g. SNR, bandwidth), modulation type or transmission method.

## Automatic frequency monitoring with production

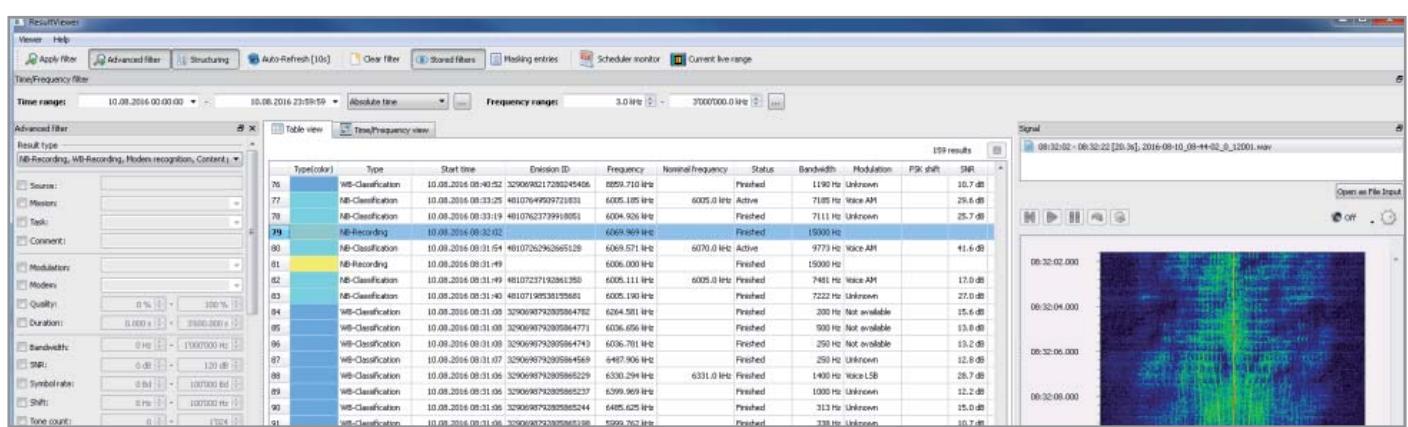
For some operations it is necessary to monitor specific frequencies. After starting a frequency monitoring task, the defined frequencies are constantly checked for signal activity. In case of activity the signal is processed without delay. If the type of the active signal matches the list of interesting transmission methods the signal is recorded, demodulated and decoded.

## Manual online monitoring of frequencies

For visual real-time monitoring of the electromagnetic spectrum an online spectrogram is provided. The operator observes the current signal scenario in a spectrogram display. Zoom and cursor functionality allow for rough estimation of signals. The operator selects signals of interest directly in the online spectrogram for decoding and listening or to pass them to narrowband analysis software for technical analysis.

## Recording and offline analysis of frequency ranges

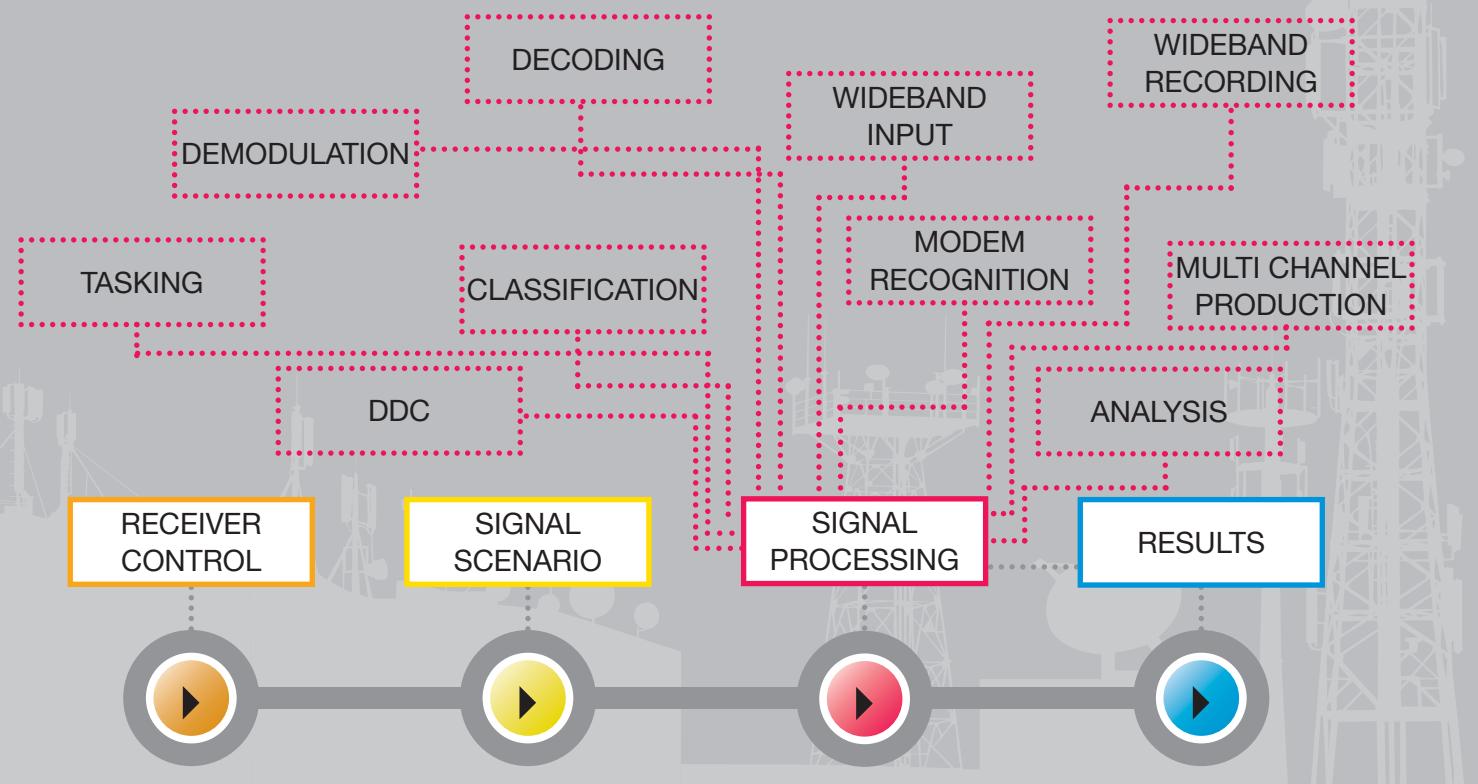
The recording of frequency ranges can be triggered by system events, is parameterised as a time based task or is started manually by an operator observing a frequency range. For evaluation the operator uses an offline spectrogram for a quick overview and navigation within the recorded signal scenario. Specific emissions can easily be selected and highlighted and a description and text annotation can be added. Selected signals can be exported to files or streamed to arbitrary external signal analysis tools.



ResultViewer:

Result post processing with filtering, pre-view, editing and export

# FUNCTIONS



## Functions

### Signal selection in wideband input

go2MONITOR displays an overview of the signal scenario utilising a spectrogram and a spectrum FFT. Various display settings, cursors and a dynamic zoom are available.

Using the wideband view the operator is able to select signals to be extracted by Digital Down Conversion (DDC) simply by selecting them in the display.

The output of the DDC is assigned to a production channel, the user interface is enhanced to show the results.

Alternatively, the wideband classification results can be used to select signals of interest. Modulation, bandwidth, symbol rate, shift and other parameters are shown for all classified signals within the wideband frequency range.

### Narrowband channel processing

Signals of interest can be selected from the wideband spectrum to a production channel by drag and drop. All production channels can be reviewed at a time and can be configured individually.

A production channel shows a detailed display of the selected signal. Spectrograms, FFT displays and the wideband view are easily configurable.

Up to eight production channels can be set up in parallel in manual mode, up to hundreds of channels in automatic mode.

Operating modes of the production channel:

- Classification mode: detailed determination of frequency allocation and classification of modulation type.
- Decoding mode: the channel works as a decoder. The suitable decoder/ modem is manually selected from a decoder-/ modemlist.
- Recognition and decoding mode: an assigned signal will be decoded automatically.
- Classification, recognition and decoding mode: suitable decoders/ modems will be automatically selected depending on the classification result.

## Automatic recognition and decoding

A production channel uses a configurable list of decoders/modems and checks which of them matches the signal.

The signal is demodulated, decoded and the results are displayed in the result view. The decoder/modem lists can be configured, loaded and saved.

This way the operator defines specific decoders/modems to be used according to his monitoring task. A previous classification enhances the production. go2DECODE (go2SIGNALS product for analysis

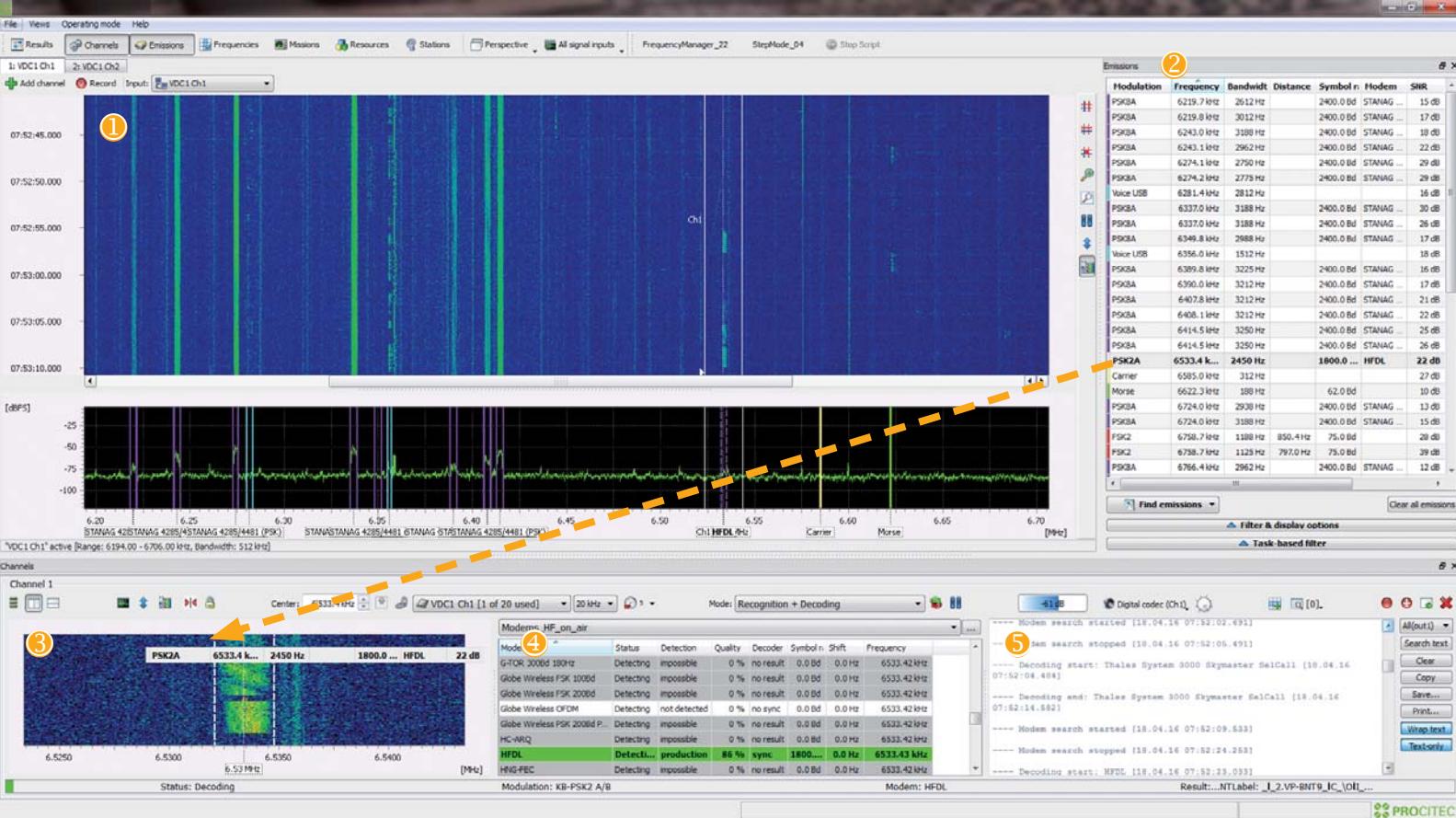
recognition, demodulation and decoding) can be used for analysis and creation of customer specific decoders (using DDL programming language), which can be used directly in go2MONITOR.

## Result processing and export

The ResultViewer shows all collected results in detail as tabular or graphical representation. Results can be filtered, sorted, grouped, marked, listened to, viewed, edited and exported. All results are stored in a database up to several weeks for later post-processing and result history.



- ① Configuration of wideband spectrogram
- ② Wideband signal scenario displayed in a spectrogram and a spectrum FFT
- ③ Production of a selected narrowband signal in production channel 1, operation mode: recognition and decoding
- ④ Recognition results: found decoder / modem
- ⑤ Decoding results: decoded text
- ⑥ Production of a second selected narrowband signal in production channel 2, operation mode: classification
- ⑦ Classification results: detected modulation type and parameters



- ① Wideband signal scenario displayed in a spectrogram and a spectrum FFT
- ② Emission list with classified signals
- ③ Select a signal in the emission list, import the signal per drag and drop to a production channel and start production of the signal
- ④ List of possible decoders/modems for automatic modem recognition
- ⑤ After automatic decoder/modem recognition the system starts to decode the signal content

## Modes

### Interactive manual mode

#### Using classification and decoder/modem recognition, monitoring of wideband input

go2MONITOR features the operator in manual mode with two types of classifiers and an automatic decoder/modem recognition and content decoding mode.

1. Monitoring of a wideband input band means a lot of signals to process. The Wideband Classifier function helps you by automatic detecting and classifying all signals. With the emission list the operator gets a quick and easy overview.
2. Simply select a signal in the emission list to start further signal operation. Narrowband Classification

helps to track parameters in detail.

3. With the classification result, the operator gets a list of possible decoders/modems types matching to the modulation type.
4. If modulation parameters are unique, even the decoder/modem is detected. If not, a matched list of decoders/modems is generated ready to use with the decoder/modem recognition function.
5. The automatic decoder/modem recognition evaluates the correct decoder of the signal and changes into the decoding of the signal content. Internal signal buffers and processing faster than realtime take care that no bit is lost (decoding of the first bit) even during tracking of signal changes.

### IMPORT OF SIGNALS PER DRAG & DROP

Signals of interest can easily be added from the emission list or directly from the spectrogram view per drag and drop to a production channel.

## Automatic mode with tasking

### Fully automatic signal detection with configurable, loss-free automatic processing

The option automatic monitoring and tasking turns go2MONITOR into a fully automated signal search and processing system. To use automatic processing features, the operator creates tasks and missions. The results are stored into a database for further evaluation. An advanced ResultViewer shows a tabular or graphical representation of the stored data. The operator can define various tasks which are automatically processed. Task definition consists of three parts.

Trigger = Select signal types the system should search for. Parameters are:

- Time ranges (from-to)
- Frequency ranges (from-to)
- Geographical areas (activate signal trigger at specific site)
- Signal energy found
- Modulation type recognized
- Modulation parameters

Action = Defines the action to be executed when the signal or event defined in the trigger was detected. Possible actions are (actions could be combined):

- Alert (send network notification to an external system)
- Record signal
- Classify modulation type
- Demodulate/decode signal (with predefined decoder/modem)
- Detect decoder/modem demodulate/decode (with search decoder/modem list)

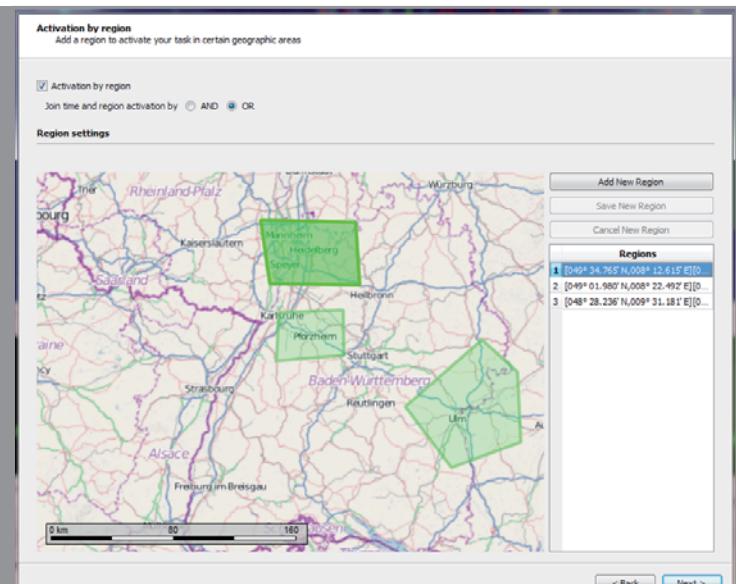
Stop criteria = Defines, when the task is finished. Stop if:

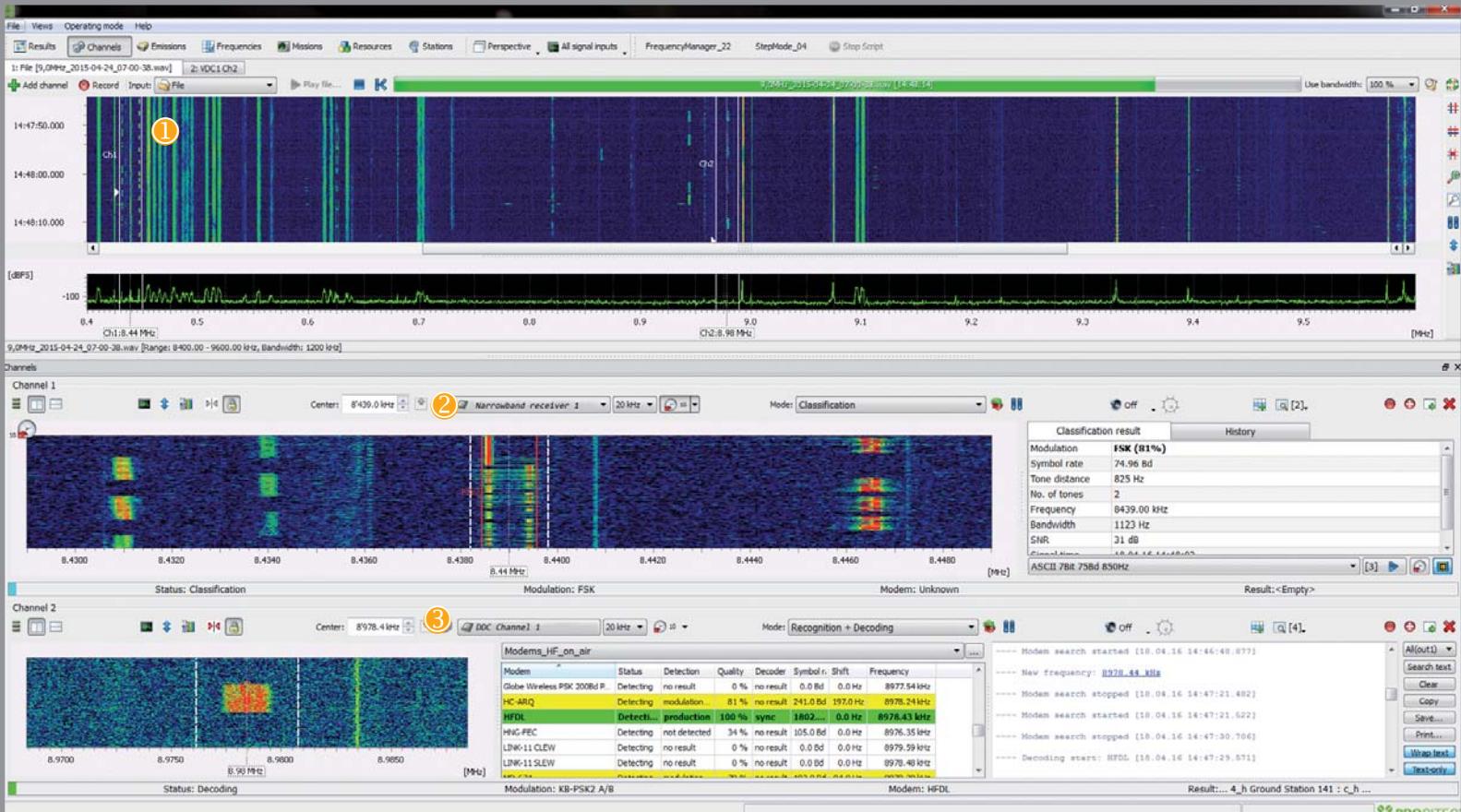
- Signal energy lost (incl. dwell time)
- Signal lost during decoding
- Maximum duration

Alert actions can be defined by the operator by specifying an external application which will be started in the case of an alert. This interface makes it possible that go2MONITOR can work with other software without modification.

## TASKING BY GEOGRAPHICAL POSITION

Define the geographical locations where the task should be active. They are defined as a list of map-based polygons. A graphical map display is provided for the operator to define these polygons. Additionally, it can be defined whether time and position activations will be combined by using the “AND” or “OR” operator.





Seamless usage of DDC channels and narrowband receivers:

- ① Wideband signal scenario displayed in a spectrogram and a spectrum FFT
- ② Production channel 1 classifies the selected signal using a hand-off narrowband receiver
- ③ Production channel 2 is recognising and decoding the selected signal using a DDC channel

## Special Functions

### Using hand-off narrowband receivers

#### Continuous searching for new emissions in a wide frequency range with additional narrowband receivers

Software DDC-channels are used as signal input for the processing channels. This limits the input band to the bandwidth of the wideband receiver and pauses the processing during receiver scan mode.

The option "Narrowband receiver control" allows the usage of additional narrowband receivers as a signal input for processing channels. The operator can choose the emission/ frequency in the GUI and decide if it should be extracted from the wideband input by using a DDC-channel or by using external narrowband-receivers. All receiver types supported for the wideband input can also be used for this. The bandwidth of a channel using a narrowband receiver can be up to 500 kHz.

The advantage of a narrowband receiver based channel against a software DDC channel is the independency from the input frequency range of the wideband receiver. Also in many cases a better receiver sensitivity is available.

Frequency ranges of narrowband channels are marked in the wideband spectrogram. An interactive interface for processing and fine-tuning the narrowband signal is available in the GUI. This interface can also display a zoomed-in spectrogram of the single channel with much higher spectrum resolution than in the wideband spectrogram.

The required frequency of the channel can be selected directly in the wideband spectrogram by using the mouse or by entering numerical values directly in the channel fine-tuning interface.

## Fast navigation and signal extraction in 20 MHz recordings

The option “Wideband Recording 20 MHz“ extends the recording bandwidth up to 20 MHz. To achieve this, a separate wideband recording component is used. Additionally to recording the signal input, the Wideband Recording option will calculate the FFT of the input signal and store it along with the wideband IF-signal files to enable fast spectrum display and navigation. Operation

modes are sequential recording and recording scheduler.

From the wideband recordings narrowband signals can be reviewed, edited, filtered and extracted.

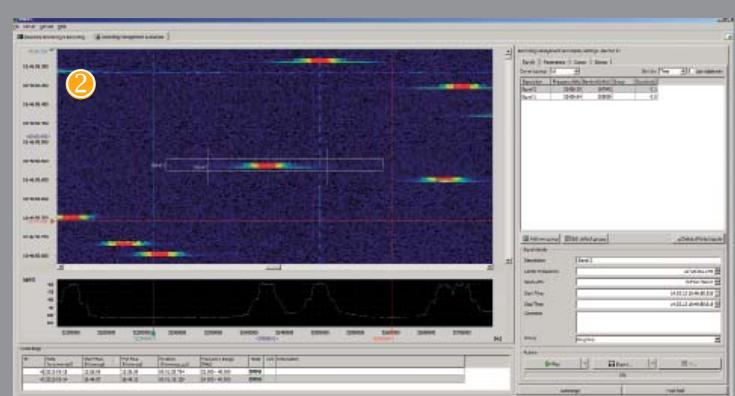
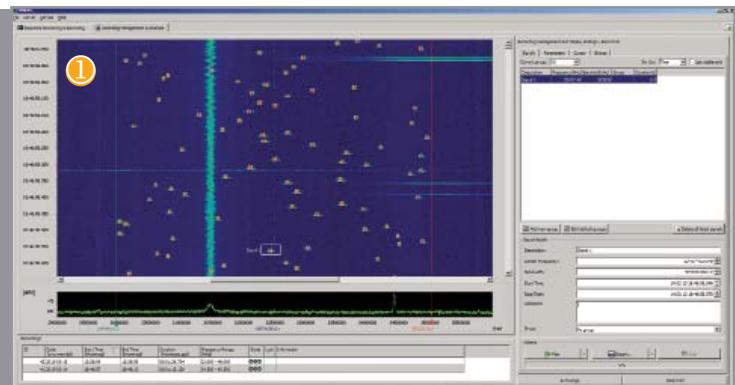
Extracted signals can be used as new input in go2MONITOR or for further signal operation.

Even manual dehopping is possible by exporting a signal group to the same frequency merged in one file.

## MANUAL DEHOPPING

Select and mark all single hopper bursts in the go2MONITOR wideband recording, save them as playlist and open them as playlist in go2DECODE (go2SIGNALS product for analysis, recognition, demodulation and decoding) for further signal analysis and fingerprinting. Demodulation and decoding on the stitched/de-hopped signal is possible – whereas a content production most likely will fail, since frequency-hopped (military) communication usually is encrypted.

The following screenshots show the recording and analysis of a newest generation Harris V-/UHF hopper (captured at a hop rate of 125 Hops per second – insofar applicable even for higher hop-rates than can be found for HF hoppers).



① go2MONITOR - recorded V-/UHF Harris Hopper with a hop-rate of 125 hops per second

② go2MONITOR - marked hopper bursts can be exported directly to the go2DECODE signal analysis software for further processing





Wideband classifier

## Scenario Analysis Functions

**Wideband modulation classification**

The feature “Wideband input 20 MHz” extends the signal input bandwidth and the continuous, real time wideband classifier and signal tracking up to 2.4 MHz in HF or 20 MHz in V/UHF. It offers also a snapshot classification. It is possible to automatically detect, measure and determine RF parameters for all signals in the available frequency range. The results are displayed in the GUI and can be used as an input for further processing.

## Multichannel production

To handle wideband signal input bands, automatic processing of many signals of interest at the same time may be necessary. Therefor, the number of processing channels can be increased by the feature “Multi channel production”. The number of processing channels and software-DDCs for automated processing is extendable in steps of 32. The software can be increased to hundreds of channels installing the option multiple times.

Additional “Offline processing” will be included into the processing channels. This separates the realtime part (recording) from the processing (narrowband classifying and decoding) part, and enables processing faster than realtime.

## PROCESSING OF SIGNALS FASTER THAN REALTIME

The signal is recorded to a signal file first and then processed with the APC (automatic production channel).

Advantages of this strategy are:

- Increase of the overall system throughput
- Automatic storage of the IF for each signal
- Reduction of the number of production channel licenses needed

## Multiple wideband signal input

### Control multiple wideband receivers using the same GUI

go2MONITOR provides the opportunity to control multiple wideband receivers (even ones made by different manufacturers) using one and the same user interface. The user now no longer needs to alternate between different operation applications, but can use in parallel the same user-friendly control interface for all receivers connected to the system.

**Highlight:** Multiple receivers can be used in parallel, this makes the simultaneous processing of different frequency bands using the same software possible.

### Wideband input overview display

With the overview display the features (fast scan mode, overview PSD data ) from modern digital receivers are now available within go2MONITOR.



Wideband input overview display shows

- ① Signal scenario overview
- ② Wideband input selection
- ③ Channel setting
- ④ Zoom spectrogram for easy signal selection

# Technical specifications

| Specifications overview |  |
|-------------------------|--|
| Data acquisition        | Digital IF (complex I/Q), bandwidth up to 20 MHz (1 MHz in basic version)<br>Digital AF (complex WAV 8, 16, 32 Bit)<br>Multiple signal inputs simultaneously possible, depending on configuration<br>Others on request   |
| Localization            | English or German; Others on request   |
| Documentation           | PDF Online-Help  |
| Recommended PC hardware | Min. Intel i5 4 Core, 2 GHz, 4 GB RAM for 4 channels version<br>Min. Intel i7 8 Core, 2 GHz, 8 GB RAM for 8 channels version<br>HDD: min. 500 GB recommended (depends on recordings)<br>Screen Resolution: min. 1920 x 1080 pixel or two displays 1280 x 1024 pixels (multiple monitors recommended)<br>Fast Ethernet for digital IF input |
| OS                      | Windows 7 / 10 64 bit, Linux (CentOS/Redhat 6/7) 64 bit  |

| Features               |  |
|------------------------|--|
| Software Feature       | Remarks  |
| Alphabets              | Can be added to the decoder, freely configurable<br>Requires go2DECODE   |
| Classifier             | 1 MHz bandwidth, (2.4 / 20 MHz with option WCL)<br>Manually triggered or repetitive snapshots (at 10, 20, . . . sec intervals) or continuous (with option AMT)   |
| Decoders               | 1, 2, 4 or 8 channels or more in steps of 32 (with options WMPC)<br>Automatic change of decoder if signals change in „Recognition + Decoding“ mode<br>Customizable decoder lists for automatic decoding<br>Buffering for lossless decoding<br>No loss of data during analyzing and protocol changes<br>Proprietary Decoder Description Language (DDL)<br>Custom extendable decoder list (with go2DECODE) |
| Demodulators           | Universal demodulators with AGC and AFC<br>Automatic baud rate synchronization (less problems with playback of files recorded on other inaccurate devices)<br>For types and parameter details please refer to the go2DECODE datasheet  |
| GUI                    | Simple and intuitive to operate user interface<br>Supports multiple monitors<br>Drag-and-drop of frequencies, classifier results, stations<br>Receiver control<br>Wideband input spectrogram and spectrum<br>Manual channel control<br>Result database view<br>Simultaneous working with multiple receivers and with multiple narrowband channels  |
| Input Files            | Digital IF (complex baseband I/Q 32bit), Bandwidth <= 1 MHz (standard) or up to 20 MHz (with option WCL)<br>Playback of standard wav files<br>Digital AF (WAV 8, 16, 32 Bit)<br>File processing faster than real time  |
| Input TCP/IP Streaming | Generic PROCITEC/PLATH format<br>VITA 49 (on request)<br>PXGF (on request)   |
| ISO 9001:2015          | Company is certified (not only hardware)   |
| License                | USB-Dongle (WIBU-KEY/CodeMeter)<br>License sharing with license server   |

| Features   |   |
|--|---|
| Software Feature                                     | Remarks   |
| Option: AMT<br>Automatic Monitoring and Tasking      | <p>Full automatic job based monitoring (decoding, recording, classification)</p> <p>Continuous classification</p> <p>Missions and Tasks based on time, frequencies (ranges), RX location, modulation, modulation parameters, modems, ...</p> <p>Powerful filtering functions</p> <p>Easy overview over decoded, classified or recorded signals</p> <p>ResultViewer with continuous updates</p>  |
| Option: NRC<br>Narrowband Receiver Control           | <p>Frequency independent production on all 1/2/4 or 8 production channels</p> <p>Monitor signals in different frequency ranges</p> <p>Narrowband receivers offer a better sensitivity compared to wideband receivers</p> <p>Narrowband receivers consume less resources, as no DDC is required</p> <p>Possibility to add „virtual“ receivers using ExtIO, which can connect to third party DDCs or streams</p>  |
| Option: WCL<br>Wideband Input, Classification 20 MHz | <p>Continuous Mode (only if AMT option available)</p> <p>Snapshot Mode</p> <p>Wideband spectrogram display 2.4 MHz (HF) / 20 MHz (VUHF)</p> <p>Wideband classification 2.4 MHz (HF) / 20 MHz (VUHF)</p> <p>Delivered as a complete package with server and receiver</p>   |
| Option: WMPC<br>Wideband Multi Production Channels   | <p>Extends the number of channels in steps of 32</p> <p>Each channel supports DDC, demodulation, decoding, narrowband classifier and narrowband recording functionality</p> <p>Easy overview over decoded, classified or recorded signals</p>   |
| Option: WRC<br>Wideband Recording 20 MHz             | <p>Lossless recording of up to 20MHz digital IF IQ data in standard WAV files</p> <p>Parallel storage of spectrum data for fast preview</p> <p>Recording replay and signal extraction</p> <p>Recording scheduler (with option ATM)</p> <p>Delivered as a complete package with server and receiver</p>  |
| Output   | <p>Visual decoder result output, configurable using XSLT</p> <p>All results are continuously saved in files and SQL data base</p> <p>Protocol detection and production down to the content (text, audio, binaries)</p> <p>Various export functions</p>  |
| Recording  | <p>Wideband (1 MHz, 20 MHz with option WCL)</p> <p>Narrowband up to 300 kHz for each DDC IQ channel</p> <p>Bitstream (demodulated bits)</p>   |
| ResultViewer   | <p>Display, filter and export result data</p> <p>Display of:</p> <p>Decoder output, demodulated audio files (CW, TETRA etc.), text output (ALE, HFDL, etc.), binary files</p> <p>Audio demodulation and playback</p> <p>Recognized modems (protocols)</p> <p>Wide-/Narrowband classification results</p> <p>Recorded wide-/narrowband IF-signals, Advanced filter, Result detail and Time/frequency filter are implemented as docking/floating windows and can be freely positioned</p> <p>Table and graphical (time-frequency plane) result display</p> <p>Filter data using GUI, SQL or scripting</p> |
| Third party decoder                                  | <p>Interface to the DDC channel output</p> <p>Interface to the audio output</p>   |
| Training   | <p>Very short training period</p> <p>Same technology as in large decoding systems</p>   |

# Technical specifications

| Classifier Modulations                       |   |  |
|--|---|--|
| Modulation                                   | Specification   | Recognition quality (Eb/No) for a detection rate > 90% and false alarms < 1% |
| Max. signal bandwidth                        | HF 20 kHz, V/UHF 50 kHz/300kHz  |  |
| Signal detection min. carrier to noise ratio | 6 dB  |  |
| Analog modulation types                      | J3E USB, J3E LSB, A3E AM, F3E NFM/WFM, DSB-SC (optional)                          |  |
| MORSE  | 30 - 250 CPM  |  |
| FSK 2  | HF: 25 - 4800 Bd<br>V/UHF: 1,2 - 25 kBd<br>m = 1 - 10                             | 11 - 15 dB   |
| FSK 4  | HF: 25 - 4800 Bd<br>V/UHF: 1,2 - 25 kBd   | 11 - 15 dB   |
| MSK  | HF: 100 - 4800 Bd<br>V/UHF: 1,2 - 25 kBd  | 14 - 16 dB   |
| Multitone FSKn                               | 3 - 200 ms (5 - 330 Bd)<br>5 - 64 tones   | 11 - 15 dB   |
| (D)PSK 2 A/B                                 | HF: 31,25 - 4800 Bd<br>V/UHF: 1,2 - 25 kBd  | 7 - 10 dB, A/B Decision: 8 - 10 dB   |
| (D)PSK 4 A/B                                 | HF: 31,25 - 4800 Bd<br>V/UHF: 1,2 - 25 kBd  | 8 - 12 dB, A/B Decision: 10 - 12 dB  |
| (D)PSK 8 A/B                                 | HF: 31,25 - 4800 Bd<br>V/UHF: 1,2 - 25 kBd  | HF: 8 - 12 dB, A/B Decision: 10 - 14 dB                                      |
| PSK 16                                       | HF: 300 - 4800 Bd<br>V/UHF: 1,2 - 25 kBd  | 14 - 16 dB   |
| Multichannel (D)PSK 2, 4 A/B                 | max. 10kHz signal bandwidth<br>50 - 300 Hz channel spacing<br>2 - 64 channels     | 13 - 15 dB   |
| OFDM   | 25-200 Bd<br>30-250 Hz channel spacing<br>25-512 channels                         | 14 - 18 dB   |
| QAM  | HF: 1600-4800Bd<br>V/UHF: 1,6 - 25 kBd<br>Order: 16, 32, 64                       | 22 dB  |
| ASK 2/4                                      | V/UHF: 1,2-25 kBd   | 20 dB  |
| MCFSK2 (optional)                            | 40-250 Bd<br>Modulation index >=1<br>120-1000 Hz channel spacing<br>2-64 channels | 17 dB  |
| FM Broadcast                                 | Freq: 65 MHz - 108 MHz<br>Bandwidth 50 kHz - 350 kHz                              |  |
| OTH Radar                                    | detection only  |  |

### Classifier Modem-Classifications

|                           |  |                        |
|---------------------------|--|------------------------|
| APCO-25                   | LINK 11 (CLEW)   | PACTOR-4               |
| CODAN 3212 16 Channel PSK | LINK 11 (SLEW)   | STANAG 4285/4481 (PSK) |
| CODAN 3012 16 Channel PSK | MIL-STD-188-110A Serial (single-tone) mode (a.k.a. STANAG 4539 ) | STANAG 4529            |
| DMR                       | MIL-STD-188-110B/C App. C (a.k.a. STANAG 4539 HDR )              | TETRA Downlink         |
| DMR Continuous            | MPT1327 1200Bd MSK   | TETRA Uplink           |
| dPMR                      | NXDN 2400 Bd   | TETRAPOL               |
| D-STAR                    | NXDN 4800 Bd   |                        |
| HFDL                      | PACTOR II FEC  |                        |

### Measured modulation type parameters

| Parameter       | Description                                     | OFDM | Carrier | FSK | FSKn | MSK | CW | PSK | MCPSK | QAM | ASK | MCFSK | Voice | FM Broadcast | Unknown |
|-----------------|---|------|---------|-----|------|-----|----|-----|-------|-----|-----|-------|-------|--------------|---------|
| Modulation      | The type of modulation and its probability      | x    | x       | x   | x    | x   | x  | x   | x     | x   | x   | x     | x     | x            | x       |
| Pitch           | Pitch of the modulated voice                    |      |         |     |      |     |    |     |       |     |     |       | x     |              |         |
| Type            | Type of voice like LSB, USB, AM, FM             |      |         |     |      |     |    |     |       |     |     |       | x     |              |         |
| Symbol rate     | The symbol rate in Bd                           | x    |         | x   | x    | x   |    | x   | x     | x   | x   | x     |       |              |         |
| Order           | Modulation order, number of symbol states       |      | x       | x   |      |     |    | x   | x     |     | x   | x     |       |              |         |
| Version         | Version of PSK A or B                           |      |         |     |      |     |    |     | x     | x   |     |       |       |              |         |
| CPM             | Transmitted character per minute                |      |         |     |      |     |    | x   |       |     |     |       |       |              |         |
| Dash Dot Ratio  | The ratio between the length of dashes and dots |      |         |     |      |     |    | x   |       |     |     |       |       |              |         |
| Shift           | The measured shift                              |      | x       | x   | x    |     |    |     |       |     |     | x     |       |              |         |
| Channel spacing | The measured distance between channel in Hz     | x    |         |     |      |     |    |     | x     |     |     | x     |       |              |         |
| Frequency       | The center frequency of the signal              | x    | x       | x   | x    | x   | x  | x   | x     | x   | x   | x     | x     | x            | x       |
| Bandwidth       | The overall bandwidth of the signal             | x    | x       | x   | x    | x   | x  | x   | x     | x   | x   | x     | x     | x            | x       |
| SNR             | The signal to noise ratio in dB                 | x    | x       | x   | x    | x   | x  | x   | x     | x   | x   | x     | x     | x            | x       |
| Signal time     | Time of measurement                             | x    | x       | x   | x    | x   | x  | x   | x     | x   | x   | x     | x     | x            | x       |

# Technical specifications

| Supported receivers*                             |                         |                   |      |  |
|--|-------------------------|-------------------|------|--|
| Receiver   | Max. Rx bandwidth       | Spectrum overview | Scan | Remark   |
| AirSpy   | 8 MHz                   |                   |      | Experimental support   |
| CommsAudit CA7851                                | 5 MHz                   |                   |      | VITA 49  |
| Grintek GRX Lan                                  | 1 MHz                   |                   |      |  |
| IZT R3xxx series                                 | 20 MHz                  | X                 | X    | Up to 3 channels + spectrum                                    |
| IZT R4000 (SignalSuite)                          | 1 MHz                   |                   |      | 1 channel only   |
| Microtelecom PERSEUS                             | 800 kHz                 |                   |      | Limited USB 3.0 compatibility                                  |
| NARDA NRA-3000 RX                                | 320 kHz                 |                   |      |  |
| NARDA NRA-6000 RX                                | 320 kHz                 |                   |      |  |
| NARDA IDA 2                                      | 320 kHz                 |                   |      |  |
| PLATH SIR 2110                                   | 20 MHz                  |                   |      |  |
| PLATH SIR 2115                                   | 4x20 MHz                |                   |      | Preliminary support only                                       |
| PLATH SIR 5110                                   | 12 MHz                  |                   |      | 16x768 kHz subbands  |
| PLATH SIR 5115                                   | Full HF                 |                   |      | 40x768 kHz subbands  |
| R&S EM100 / PR100                                | 500 kHz                 | X                 | X    |  |
| RFSPACE SDR-14                                   | 190 kHz                 |                   |      |  |
| RTLSDR/Noxon USB-sticks                          | 3.2 MHz                 |                   |      | Experimental support.<br>Continuous signal up to 2.4 MHz       |
| SDRplay RSP1 & RSP2                              | 6 MHz                   |                   |      | Experimental support   |
| ThinkRF WSA5000-427                              | 780 kHz                 |                   |      | VITA 49  |
| WiNRADiO G31DDC                                  | 800 kHz                 |                   |      |  |
| WiNRADiO G33DDC                                  | 4 MHz                   | X                 |      |  |
| WiNRADiO G39DDC                                  | 4 MHz                   | X                 |      | Up to 2 channels + spectrum                                    |
| Generic VITA 49 receiver support                 | Max. receiver bandwidth |                   |      | Can be configured in a wide range for different receiver types |
| Other generic „Winrad ExtIO“ supported receivers | Max. receiver bandwidth |                   |      | Experimental support   |

Not all listed receivers are supported with Linux operation systems.

| Demodulators    |                      |                       |                      |                          |
|-----------------|----------------------|-----------------------|----------------------|--------------------------|
| AM / A3E        | Clover 2000          | FSK 2, 3, 4 disc.     | MPSK 2, 4, 8, 16 A/B | PSK 2, 4, 8, 16 A/B      |
| Analogue Selcal | Clover 2500          | FSK 2,3 auto shift    | MT63                 | PSK data aided           |
| ASK 2, 4        | Coquelet             | MSK / GMSK            | MultiModem           | QAM 16, 32, 64, 128, 256 |
| ASK2PSK4        | DPSK 2, 4, 8, 16 A/B | J3E (USB, LSB)        | MultiTone (FSKn)     | TFM3                     |
| ASK2PSK8        | FM / F3E             | MDPSK 2, 4, 8, 16 A/B | OFDM                 | THROB / THROBX           |
| ASK4PSK8        | F6/F7B               | MFSK 2                | OQPSK                |                          |
| Clover II       | FSK 2 matched        | Morse                 | Pactor II, III, IV   |                          |

| Decoders and Demodulators  |  |
|--|--|
| 1.   | MIL and PMR decoders may need an End-User-Certificate (depending on the country of the user) |
| 2.   | Automatic sideband detection can be achieved via two modems set to inverse sidebands.        |
| 3.   | A gap between message bursts and acknowledge burst must be detectable.                       |
| 4.   | Separation of slow selcall types cannot be guaranteed.                                       |
| 5.   | Slow multitone modems are recommended to operate with fixed nominal frequency                |
| Our set of standard, military, SAT and PMR decoders is subject to continuous development. Please download the current list of available decoders on our website <a href="http://www.go2signals.de">www.go2signals.de</a> . |  |

Subject to modifications, available from software version 17.2.



## go2MONITOR TRAINING

go2MONITOR training comprises the complete signal flow from connected receiver to content output of a radio signal. We place particular emphasis on the efficient and task oriented application of the comprehensive operating possibilities.

The aims of our training courses are therefore, in particular, rapid assimilation of information as well as successful application of the presented instructions. Training on the semi and fully automatic operation of go2MONITOR can be organised on request.

Training content:

- Introduction to operation
- Receiver control
- Scenario analysis (overview of numerous simultaneous emissions)
- Signal processing (processing a concrete signal, classification, demodulation, decoding)
- Display of results (temporal, spectral, merger of raw data and content output)
- Optional: Transfer from manual to automatic mode, creation of automated tasks
- Practical exercises



# go2SIGNALS

... monitoring a connected world

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[www.procitec.de](http://www.procitec.de)



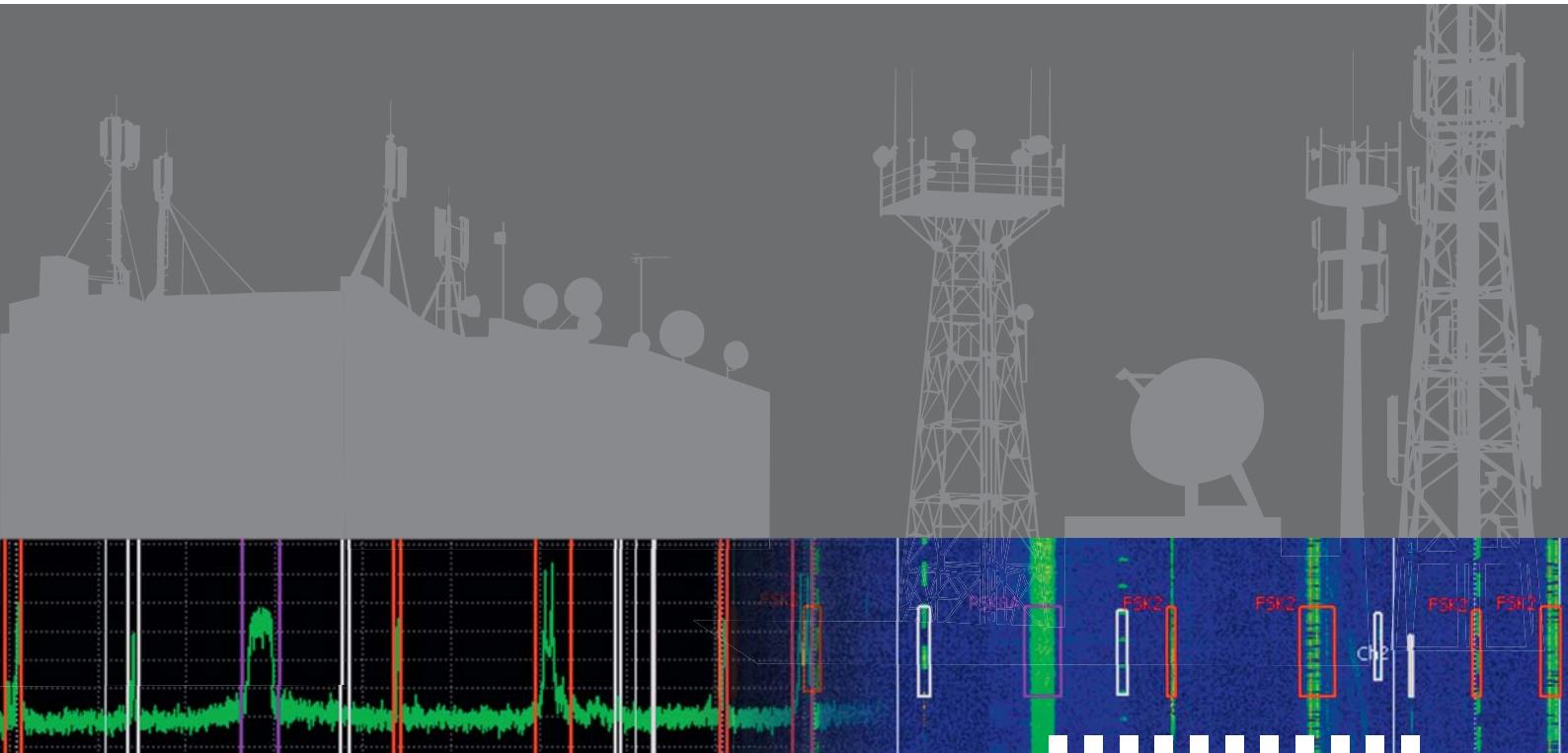
go2DECODE



go2MONITOR



go2ANALYSE



Management System  
ISO 9001:2015

17.2.01/2018 (Subject to modification)