PROCITEC®

MANUAL

go2MONITOR

Product Version v20.2

July 8, 2020

PROCITEC®

PROCITEC GmbH
Rastatter Strasse 41
75179 Pforzheim
Germany

Phone +49 7231 155 61-0
Fax +49 7231 155 61-11
sales@procitec.com
www.procitec.com

Imprint

PROCITEC GmbH
CEO: Dipl.-Ing. (FH) Dipl.-Inf. (FH) Jens Heyen
Rastatter Straße 41
D-75179 Pforzheim
Germany

Phone: +49 7231 15561 0
Web: www.procitec.com
Email: service@procitec.com

Register: Mannheim HRB 504702
Tax ID: DE 203 881 534

Printed: July 8, 2020

Contents

1. General

1.1. Welcome to go2MONITOR

go2MONITOR is a modular software solution for classification, demodulation, decoding and recording of LF, HF, VHF and UHF signals.

It includes the following features:

- Wideband input from various digital receivers, pre-recorded files or network streams
- Automatic classification and production using an extensive decoder library
- Parallel processing of multiple narrowband channels
- Manual or automatic search for Signals Of Interest
- Interactive analysis, demodulation and decoding of signals
- Automatic modulation type classification for all detected signals
- Automatic signal recognition based on predefined signal patterns in a spectrogram
- Automatic modem recognition, demodulation and decoding of Signals Of Interest
- Task-based control with selectable analysis depth
- Automatic triggering of modem recognition, demodulation and decoding for specific signals only (based on detected modulation type and parameters)
- Automatic stepping/sweeping through all frequency ranges during a search
- Predefined modem knowledge base (definitions of modems and decoders) stored in the system and used during demodulation and decoding. It can be expanded or changed by the operator
- Recording of wideband input or narrowband signals
- Storage of all system results (e.g. recordings, audio, text) in a database for later data mining and statistical analysis
- Script-based GUI automation
- Powerful TCP-based command interface

The go2MONITOR operator can freely combine the following processing types:

- Automatic processing: Based on a set of rules defined by the operator, the product will automatically search for signals, and demodulate, decode and store the results
- Manual processing: The operator searches manually for signals in the monitoring GUI, selects Signals Of Interest, and issues manual commands to classify, demodulate and decode them

1.2. go2SIGNALS

go2SIGNALS
PROCITEC® SOFTWARE

Monitoring Solutions

The use of radio communication is constantly rising. The traditional approach of monitoring this more and more connected signal scenario with a manual approach of channel stepping and manual search is not promising for future challenges.

The product line go2SIGNALS covers customer requirements from traditional manual signal handling to fully automatic intelligence system. This provides processing speed and user comfort of automatic intelligence systems to single user working positions. It is the perfect solution for mobile, stand-alone and remote controlled applications as well as a start into the world of automatic monitoring.

go2MONITOR
PROCITEC® SOFTWARE

go2MONITOR is a modular software solution for receiver control, classification, demodulation, decoding and recording of HF, VHF, UHF signals.

go2DECODE
PROCITEC® SOFTWARE

go2DECODE is standalone software for signal recognition, demodulation, decoding, speech detection, signal recording and technical signal analysis.

go2ANALYSE
PROCITEC® SOFTWARE

go2ANALYSE is bit stream analysis software for manual determination of code characteristics.

2. Installation

2.1. System Requirements

The following operating systems are supported (64bit only):

Windows®

- Windows® 7 Service Pack 1 (de/en)
  ("Windows® 10 Universal CRT" system patch KB2999226 must be installed,
  see https://support.microsoft.com/help/2999226)
- Windows® 10 (de/en)

Linux®

- CentOS 7.x (7.5 or higher, 7.5 is recommended)

PC or notebook with a minimum of

- one hard disk
- one DVD-ROM drive (for installation only)
- one free USB port (dongle version only).

There may be additional requirements dependig on the selected receiver (see chapter Supported Receivers. For further information please visit our website www.procitec.com or contact our support at service@procitec.com.

2.2. Installation Instructions

Make sure no Dongle is connected to the USB port of your computer.

If the software was delivered on DVD, insert the go2MONITOR DVD into the DVD-ROM drive. If the software was downloaded, unpack the delivered ZIP-archive.

2.3. Copy protection

There are two variants of the copy protection, which will be discussed in more detail below.

2.3.1. Copy Protection via CodeMeter®

An application protected by CodeMeter® can only run if the CodeMeter® is connected and its driver is installed. The CodeMeter® may be shipped with the software or can already be at hand. An encrypted license file (.maw) is needed. It contains information about the CodeMeter® and the unlocked features depending on the licensed configuration of the software.

If you desire to use a CodeMeter® already at hand, please contact our support at service@procitec.com.

2.3.2. Copy Protection via Dongle

If the software is protected with a USB dongle, the software will not run until a dongle (USB WIBU Key) is connected to the port and the respective hardware drivers have been installed.

The dongle is supplied together with the software. An encrypted license-file (.maw) is required; it contains information about your dongle and the enabled features depending on the licensed version.

2.4. Installing the Software on Windows®

Make sure **no** Dongle is yet connected to the USB port of your computer.

Insert the go2MONITOR DVD into the DVD-ROM drive. The setup will start automatically; otherwise start the file "setup.exe" from the DVD. Follow the instructions on the screen. During the setup several applications will be installed. When required confirm the request to continue the installation process.

1. Select the installation language first. This language will be used for the GUI of the installed software. To confirm, click <**OK**>.
2. Carefully read the welcome message and click <**Next**>
3. Read the license agreement carefully. If you agree to the terms and conditions, select the "I accept the terms ..." button and click <**Next**>. If you have objections, cancel the installation.
4. Select the installation folder for go2MONITOR and click <**Next**>
5. To start the installation, click <**Install**>
6. The installation progress of go2MONITOR is shown by a progress bar
7. After successful installation, a completion message will be displayed
8. To exit the setup, click <**Finish**>

2.5. Installing the Software on Linux®

The installation of the application requires superuser rights.

To start the installation, execute the "setup.sh" script, and confirm the installation if asked to do so. The installation routine will set up all components required by the application. Additionally, a pro_postgres system user will automatically be created. This user is mandatory for the application to be operated by the root super user.

2.6. Connecting the Dongle

There are different dongle variants, which are described in more detail below.

2.6.1. Connecting CodeMeter®

2.6.1.1. Local CodeMeter®-Connecting

Connect the CodeMeter® to an available USB Port of the computer. The CodeMeter® must remain connected to the local USB port while using the software.

Note: If the CodeMeter® was perviously connected, diconnect it. Restart and reconnect the CodeMeter®.

The installation is now complete.

2.6.1.2. CodeMeter®-Connecting via Network

Note: The connection of a CodeMeter® on a network is described below for the Windows® operating system. For support with the connection of a WibuKey for the Linux® operating system, please contact our support at service@procitec.com.

Depending on the configuration of the software, copy protection can also be provided by another computer or server on the network. Therefore, a CodeMeter® containing multiple licenses has to be connected to this "copy protection server". These licenses can then be provided via network to the go2MONITOR installations on client computers.

To install a copy protection server, follow the steps below.

1. Uninstall all CodeMeter® components
2. Install the CodeMeter® runtime from DVD (applies only to the server)
3. Connect the CodeMeter®
4. Start the server as described below

2.6.1.2.1. Open Server

The CodeMeter® control center shown in Figure 1 is opened by selecting <**Start Menu**><**All Programs**><**CodeMeter**><**CodeMeter Control Center**>.

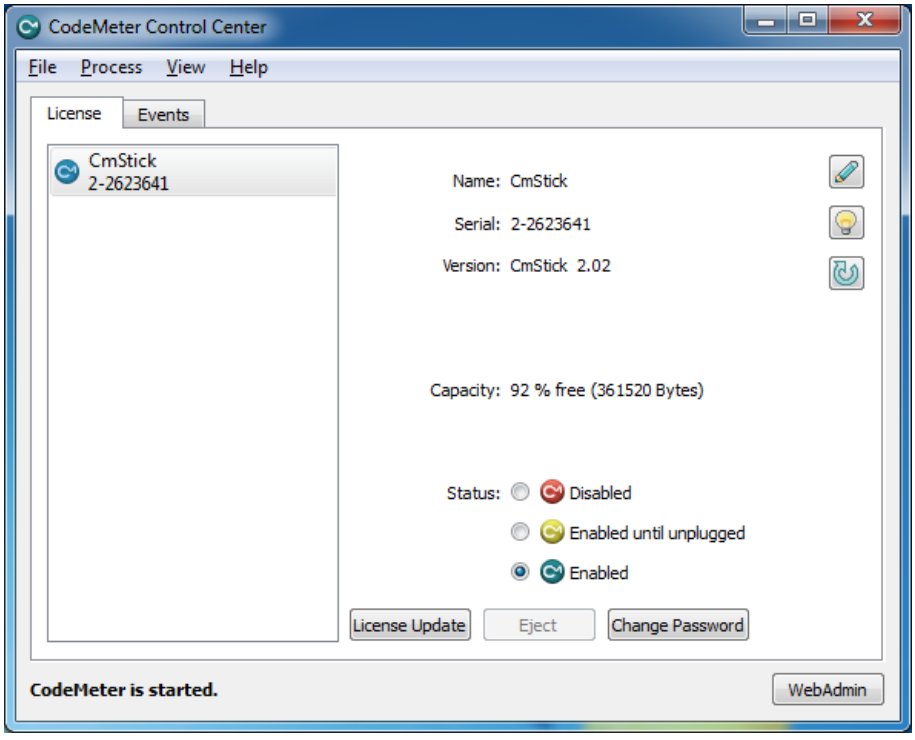


Figure 1.: CodeMeter® Control Center

To call the CodeMeter® WebAdmin module, click <**WebAdmin**> in the CodeMeter® Control Center.

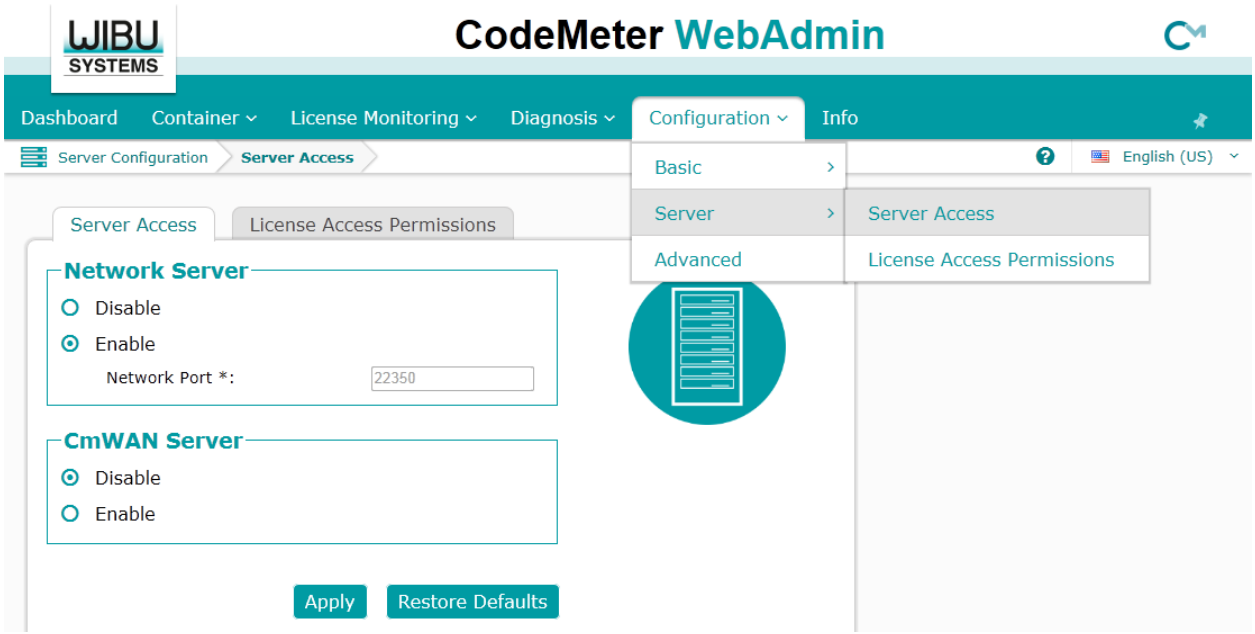


Figure 2.: Setup CodeMeter® Server

In the Network Server section, select <**Enable**> and click <**Apply**>.

Note: The server service can also be disabled (stopped) here.

In the CodeMeter® Control Center (see Figure 1), select <**Process**><**Restart CodeMeter Service**>.

The WebAdmin also provides information about connected CodeMeter® such as the quantity of used and available licenses.

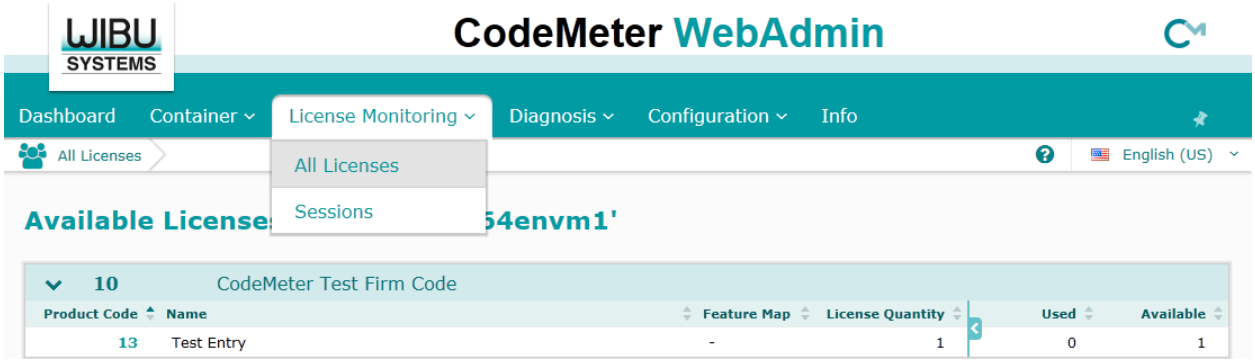


Figure 3.: License Information

The CodeMeter® should now also be accessible by the go2MONITOR installation on the client computer. If not, you can add the server name or its IP address to the Server Search List on the client via the WebAdmin interface.

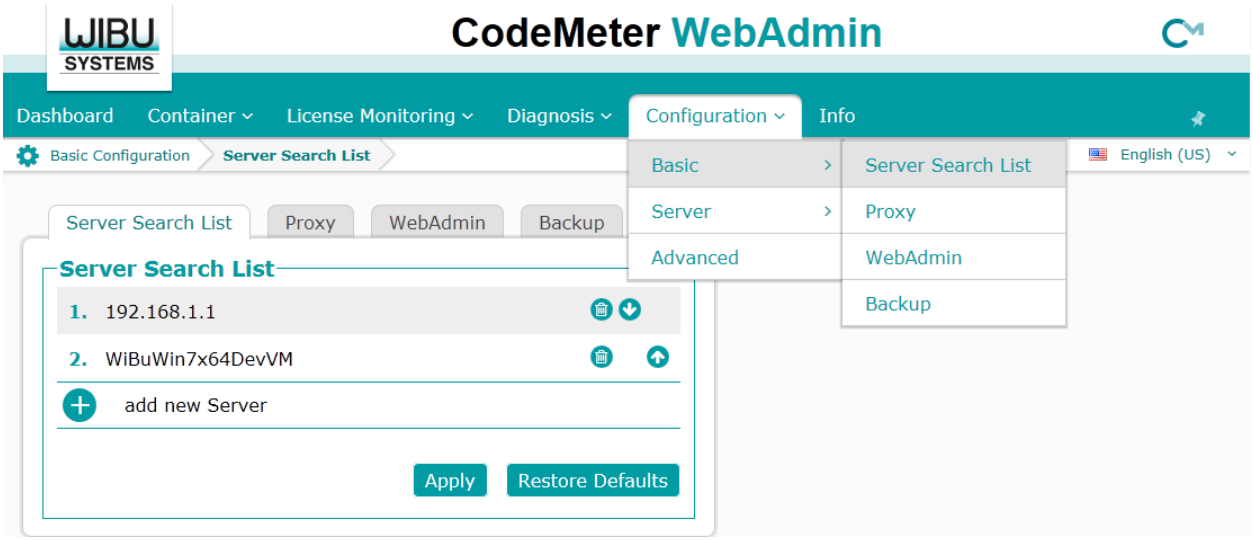


Figure 4.: Server Search List

2.6.1.2.2. Stop Network Server

The network server is terminated via the CodeMeter® WebAdmin module (see Figure 2). Under the Server Access tab, select <**Disable**> and confirm by clicking the <**Apply**> button.

2.6.1.2.3. Troubleshooting

Should the remote client not be able to connect to the server, the firewall should be configured to allow communication on port 22350.

Another possibility to establish a connection is to stop and then restart the server.

2.6.1.2.4. Connected Clients

As soon as the CodeMeter® runtime software is installed on a connected network client, it will be possible to access its WebAdmin module via:

http://<ClientNameOrIPAddress>:22350/index.html

2.6.2. Connecting WibuKey

2.6.2.1. Local Dongle

Connect the USB dongle to an available USB port of the computer. While using the software, the dongle must be connected to a local USB port.

Note: If the dongle was previously connected, disconnect it, restart your computer, and reconnect the dongle.

Now your installation is complete.

2.6.2.2. Connection via Network

Note: The connection of a WibuKey on a network is described below for the operating system Windows®. For support with the connection of a WibuKey with the operating system Linux®, please contact our support at service@procitec.com.

Depending on the software configuration, copy protection may be supplied by a different computer or server via network. A dongle containing one or several licenses is connected to this copy-protection-server and licenses are provided via this network.

For installation of the network license server, follow the steps below:

1. Remove all dongles before installation
2. Install WibuKey runtime from DVD (valid only for server)
3. Connect dongle(s) to server
4. Start server as described below

2.6.2.2.1. First start

Select the <**Network server**> option from <**Start menu**><**All Programs**><**WibuKey**>. The <**Network Server Stopped**> icon  appears. When the mouse cursor is positioned over the icon, the status "WibuKey network server not started" will be displayed.

2.6.2.2.2. Starting License Server

To start the license server, click on the <**Network Server Stopped**> icon  with right mouse button. Network server menu will open.

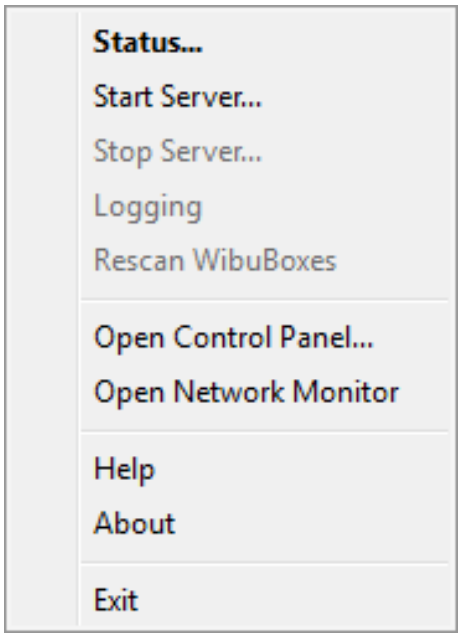


Figure 5.: Stopped Server Context Menu

Selecting <**Start server...**> starts server in background. When the mouse cursor is moved over the <**Network Server Started**> icon  on the task bar, the network server status "WibuKey server has been started" will be displayed.

2.6.2.2.3. License Server Shutdown

Stopping the network server is performed in a similar fashion to starting it. Right-click on the <**Network Server Started**> icon  on the taskbar. The Network Server menu will be displayed.

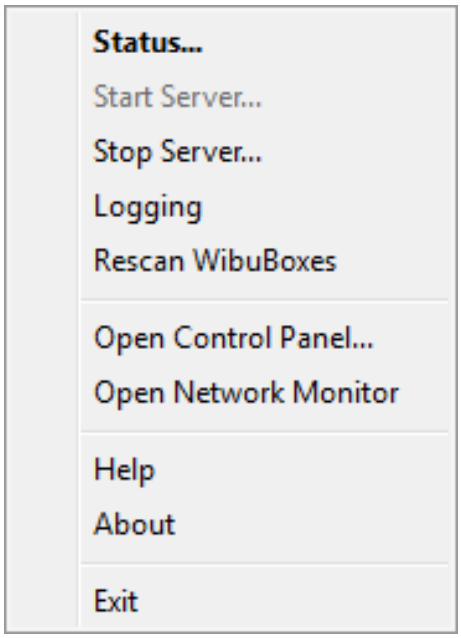


Figure 6.: Running Server Context Menu

Selecting <**Stop server...**> will stop the network server in the background. The status "WibuKey has been stopped" will be displayed. The <**Network Server Stopped**> icon  will be displayed on the taskbar. If you move the mouse cursor over this icon, the status "WibuKey network server has NOT been started" will be displayed.

2.6.2.2.4. Ending

Move mouse cursor over current <**Network Server**> icon  or  and right click it. Select <**End**> from the menu. The server will shut down completely and the icon will be removed from the taskbar.

2.6.2.2.5. Troubleshooting

If a remote computer is not able to connect to the server, open port 22347 in the firewall settings.

Alternatively, stop and restart the server.

2.6.2.2.6. Connected Computers

To view connected devices, select <**Start menu**> <**Control panel**><**WibuKey**>> and a new window will be displayed.

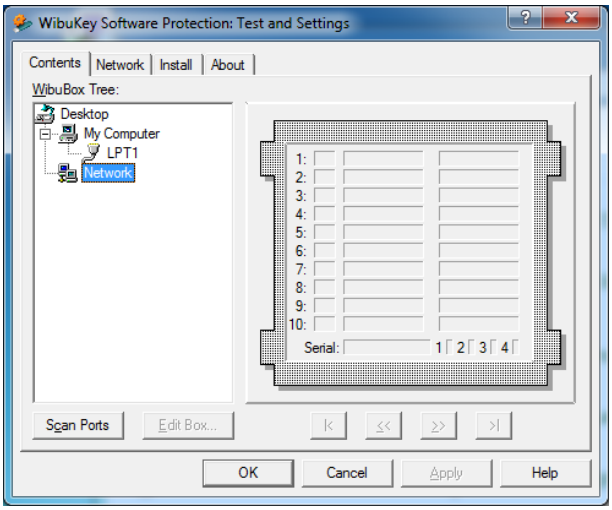


Figure 7.: Connected Computers and Dongles

To list all computers and dongles connected to the network, first select *Network* and then <**Read in**>. The network will be searched for computers running WibuKey network server software.

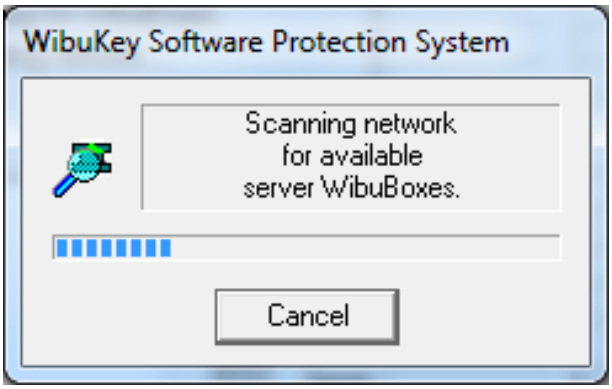


Figure 8.: Searching for WibuKey Servers

After the search has completed, all computers and connected keys will be listed by name.

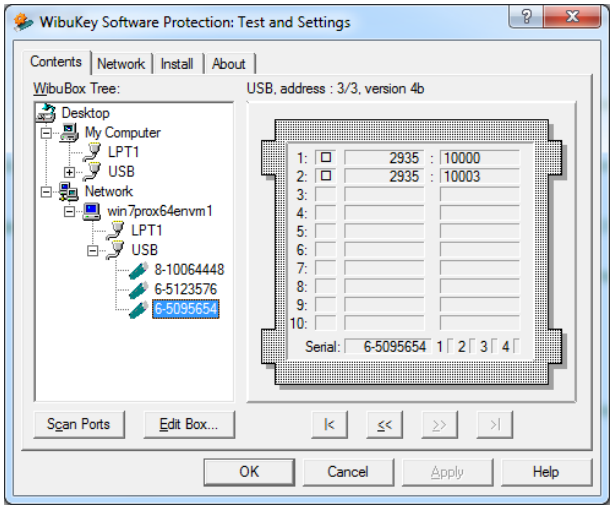


Figure 9.: Connected Computers and Keys

Note: Acvite applications will be automatically terminated if a local or network dongle is removed from the USB port.

If a network dongle is not found, you can select a server by its name or IP address from the <**Network**> tab.

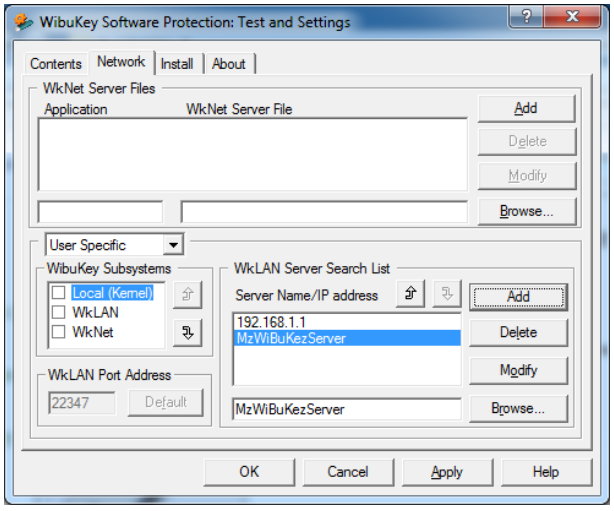


Figure 10.: Server Search List

2.7. Starting the Software

When you start the software for the first time, you will be asked to point to the location of the provided license file. The file will be automatically copied to the appropriate subfolder in your user folder.

1. Start the application
2. Click <**Yes**>
3. In the file dialog, enter the path to the MAW file you received with your WIBU-dongle (via DVD, email, etc.) and select the correct file.
4. The file will be copied to your user folder and renamed to "default.maw".

Note: When you launch the application for the first time, you may receive a warning from the Windows® Firewall. This is because individual applications communicate with each other on localhost via TCP/IP. This communication can be approved without any security risk.

2.8. License Renewal

If you have a new license file - for a new software version or with extended options - you have to delete the old license file from the appropriate user folder:

- Windows®

  %USERPROFILE%\go2SIGNALS\go2MONITOR x.y\default.maw

- Linux®

  $HOME/go2SIGNALS/go2MONITOR x.y/default.maw

Note: "x.y" denotes the old version, e.g. v19.1

After you restart the software, you will be asked to point to the location of the provided license file. The file will be automatically copied to the appropriate subfolder in your user folder.

2.9. Update From Older Versions

go2MONITOR stores all user-modified data (e.g. configuration files, decoders, modems, etc.) in the appropriate user folder:

- Windows®

  %USERPROFILE%\go2SIGNALS\go2MONITOR x.y

- Linux®

  $HOME/go2SIGNALS/go2MONITOR x.y

Note: "x" denotes the major and "y" the minor version, e.g. "19.1" for go2MONITOR v19.1

These files will remain when you uninstall the software.

2.9.1. Results Database

The results database in go2MONITOR contains the following data:

- Decoded text or binary content
- Demodulated audio files
- Wideband and narrowband recordings
- Frequencies and frequency ranges
- Automatic Wideband Monitoring missions and tasks
- Stored filters

All available information about these results is stored in a relational database and can be accessed by using go2MONITOR GUI. Corresponding result files (for example recordings) are stored in a folder structure and referenced from the database entries.

Up to go2MONITOR v17.2, the results database and all results files are stored in a results folder in the appropriate user folder for the specific software version. Other files relating to the user-modified data, like configuration files, are also stored in this folder.

Starting from go2MONITOR v18.1, the results database and all result files are stored in a common, version-independent, folder. This means that all subsequent updates or upgrades will automatically continue to use the results database from the previous version and use the same folder.

The location of the results folder is:

- Windows®

```
%USERPROFILE%\go2SIGNALS\go2MONITOR\
```

- Linux®

```
$HOME/go2SIGNALS/go2MONITOR\
```

If the database structure has changed between the versions, the new version will perform a completely automated database upgrade after the first launch of the go2MONITOR GUI. This upgrade will enable the usage of existing result data with the latest installed go2MONITOR version.

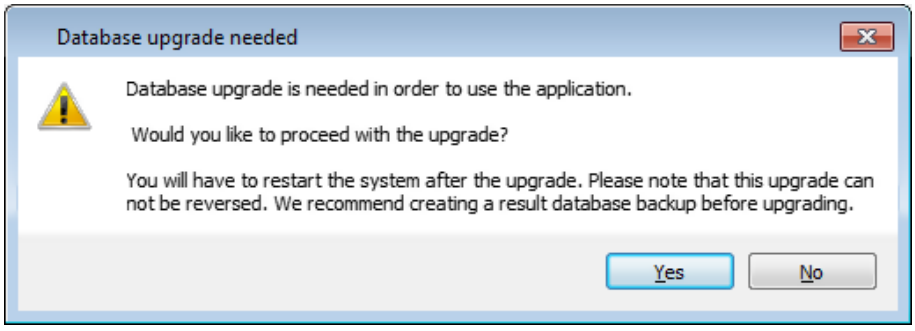


Figure 11.: Database Upgrade Question

Warning: This database upgrade cannot be reversed. If you think you may need to use the database with the old go2MONITOR version in the future, you should back up the entire results folder before upgrading.

Starting with the release of go2MONITOR v19.2 software, all database-related data will in future be stored in a PostgreSQL database.

2.9.2. Automatic Data Migration

When upgrading from earlier application versions to go2MONITOR v19.2, the application will, on the launch of the software, offer automatic data migration. During the data migration, all records from the original application database (source database) are copied into the database of the newly installed application (destination database). The automatic data migration starts when the following conditions are fulfilled:

- The source database is a SQLite database
- The source database contains some result records
- The destination database is in an initial state, i.e. no result records are stored yet

The data migration dialog will appear when the above conditions are met. To start migrating your data, click <**OK**>.

Clicking <**Cancel**> aborts the data migration process and any changes to the destination database will be reversed.

If an error occurs during data migration, the process is aborted. Error messages are displayed in the lower left area of the dialog box.

In addition, the application offers data import functionality. This allows you to configure data migration and provides the option to use the MySQL database as the source database for migration instead of the SQLite database.

2.9.3. Database Import

The database import feature provides similar functionality to data migration. The database import function can be started manually by selecting the <**File**><**Data migration**> menu entry. In the input field of the dialog, either the path to the SQLite database or the connection string to the MySQL database can be specified. When importing data, the option to clean up the destination database can be activated. Selecting this option clears the contents of the destination database before records from the source database are imported. If errors occur during database import, the process is aborted. Error messages are displayed in the lower left area of the dialog box. The database import process can be repeated as often as you want.

Note: If the option to clean up the destination database is activated, all data in the destination database will be deleted. A recovery of deleted data records is not possible!

Note: Repeated database imports where the cleanup option is deactivated may cause duplicate records in the destination database!

2.9.4. Update

If there is only a change in the minor version number (last number of the version, e.g. from v19.1.0 to v19.1.1), go2MONITOR will always use your existing user data.

However, if a clean installation is preferred, the folder go2MONITOR can either be deleted or renamed before installing the update:

- Windows®

  ```
  %USERPROFILE%\go2SIGNALS
  ```

- Linux®

  ```
  $HOME/go2SIGNALS
  ```

2.9.5. Upgrade

It is not possible to have multiple go2MONITOR versions installed and operated independently on the same computer. The installation of a new version will remove the old version first. Existing custom data will not be deleted and will remain in the old user directory.

In order to use your existing custom data (e.g. receiver configuration, etc.), the corresponding files must be copied manually from the old user directory to the new one. For assistance please contact our support at service@procitec.com for assistance.

2.10. Uninstallation

On Windows®, select in the <**Control Panel**><**Programs and Features**>, right-click on go2MONITOR and click <**Uninstall**>.

On Linux®, use the package manager to uninstall the software.

2.11. Signal Sources

This chapter gives an overview of the available signal input types for go2MONITOR.

2.11.1. Files

IQ IF-files (*.wav) can be recorded and played back directly in the main GUI. We recommend using recorded files (provided by go2MONITOR) to get familiar with the software.

When the standard WAV format is used, 1-channel WAV files are interpreted as real signals and 2-channel WAV files as complex signals. The following sample formats can be used:

- PCM 8/16/24/32 bit integer
- PCM 32 bit float, 64 bit double
- A-law
- µ-law
- Blackbird TCI CAP format

Optionally, WAV files can contain additional signal information, e.g. frequency, time or used bandwidth in a separate "custom chunk". The format description of the "custom chunks" can be provided on request.

2.11.2. Wideband Receivers

Wideband receivers can be used to provide signal input to all wideband components of the go2MONITOR, e.g. wideband spectrogram in the GUI, wideband classification, etc.

Wideband receivers are internally controlled by the Receiver Control Module (RCM, "rcm.exe") and configured using the Receiver Configuration Tool (for details, see chapter Receiver Configuration).

Attention: Configurations where the same receiver is activated as a wideband and a narrowband receiver at the same time may cause errors during go2MONITOR execution.

2.11.3. Narrowband Receivers

The narrowband receiver option enables the use of narrowband receivers as signal sources directly in narrowband processing channels as handoff receivers (for details, see chapter Narrowband Receiver Control Option (NRC)).

Narrowband receivers are also controlled by the RCM in a similar way as wideband receivers. The configuration may be edited using the Receiver Configuration Tool (for details, see chapter Receiver Configuration).

Attention: Configurations where the same receiver is used as a wideband and a narrowband receiver at the same time may cause errors and are not supported.

2.11.4. Streaming Signal Sources

Input signal can also be provided as a network stream (TCP or UDP) and used directly in wideband inputs or in narrowband channels for processing.

In wideband inputs, streaming signals are used in the same way as wideband receivers to provide signal input to all wideband components of go2MONITOR, e.g. wideband spectrogram in the GUI, wideband classification, etc.

In narrowband channels, streaming signal input is used in the same way as signals extracted from wideband input, and processed with the narrowband classifier or used for modem recognition and decoding.

The currently supported format is compatible with other PROCITEC products. Format description can be provided on request from our support at service@procitec.com.

Additionally, the PXGF stream (compatible with GEW/Wavecom products) format can be used as stream input in both wideband and narrowband scenarios. The software recognizes the format automatically without the need for the user to switch between these formats.

Configuring streaming sources is different for wideband and narrowband inputs. For details about configuring streaming sources in narrowband channels, see chapter Channels.

2.11.4.0.1. Configuring Wideband Streaming Sources

Wideband streaming signal sources are configured in the "StreamInputs.conf" configuration file. This file is stored in the user directory. It can be edited to add new sources or to change parameters such as IP-address, port, etc. After modifying the configuration file, the software has to be restarted to apply the new settings.

In the program directory, the original "StreamInputs.conf" file is stored as read-only. It should never be edited by the user. If needed, it can be used to restore the original state of the "StreamInputs.conf" file in the user directory.

To configure a receiver, navigate to the user directory. Open the file "StreamInputs.conf" with a text editor of your choice. The configuration file is in XML format. It can be freely edited as a text file, but the correct XML structure must be kept.

The configuration file could have the following contents:

```
<?xml version="1.0" encoding="utf-8" ?>

 <configuration>

<appSettings>

  <SignalInput_0>

    <add key="Type" value="STREAM" />

    <add key="IP" value="127.0.0.1" />

    <add key="Port" value="44001" />

    <add key="DisplayName" value="DANA stream" />

  </SignalInput_0>


  <SignalInput_1>
```

```
    <add key="Type" value="STREAM" />

    <add key="IP" value="127.0.0.1" />

    <add key="Port" value="60100" />

    <add key="DisplayName" value="External stream 2"/>

  </SignalInput_1>

</appSettings>

</configuration>
```

The configuration file example above defines two streaming sources in the sections <**SignalInput_0**> ... </**SignalInput_0**> and <**SignalInput_1**> ... </ **SignalInput_1**>. To add new streaming sources, you can add additional tags: SignalInput_2, SignalInput_3, etc.

Each SignalInput_X tag can contain the following parameters:

Parameters	Description
<add key="Type" value="STREAM" />	mandatory, the type is always "STREAM"
<add key="IP" value="127.0.0.1" />	mandatory, the IP address of the streaming source
<add key="Port" value="60100" />	mandatory, the TCP port of the streaming source
<add key="DisplayName" value="External SW stream" />	mandatory, the descriptive name of the source which will be displayed in the GUI
<add key="OversamplingFactor" value="1.25" />	optional, the ratio between sampling rate and effective bandwidth of the input signal. Must be >= 1.0.

Table 1.: SignalInput_X Tag Parameters

2.12. Remote Control Interface

All go2MONITOR low-level functions (classification, demodulation, decoding, recording, receiver control, etc.) can be accessed by using a comprehensive remote control interface. That way, go2MONITOR can be used as a backend component in another system.

Developer documentation, libraries and test tools for this remote control interface are provided with a separate package, RemoteControlAPI, which can be requested from your software vendor.

All functions accessible through remote control API are located in backend components/processes and do not need go2MONITOR GUI in order to work. go2MONITOR GUI itself is using the same interface in order to communicate with the rest of the system. After starting the RemoteControlAPI functions can be used to control the system directly.

For using go2MONITOR through remote control interface, the following guidelines should be applied:

- go2MONITOR GUI must not be combined with using backend functions from another system. That would cause resource conflicts. To monitor the system during remote control operations, a separate application is provided as a part of RemoteControl API package.

- To start all backend components without GUI, use start_all.bat script file located in application installation directory. To close all applications, use kill_all.bat script file. After starting, use RemoteControlAPI functions to control the system directly.
- You can store your license file directly in the installation directory before the first system start

For further information, see RemoteControlAPI package.

3. Overview

3.1. First Start

Use the provided example IQ signal files (located on the DVD or in the installation package in the Signals directory) to get familiar with the basic software functions.

The following would be a typical procedure to start using go2MONITOR:

1. Add and parametrize your receivers if necessary (for details, see chapter Receiver Configuration). Start the receiver configuration by selecting the <**File**><**Wideband receiver configuration...**> menu option.

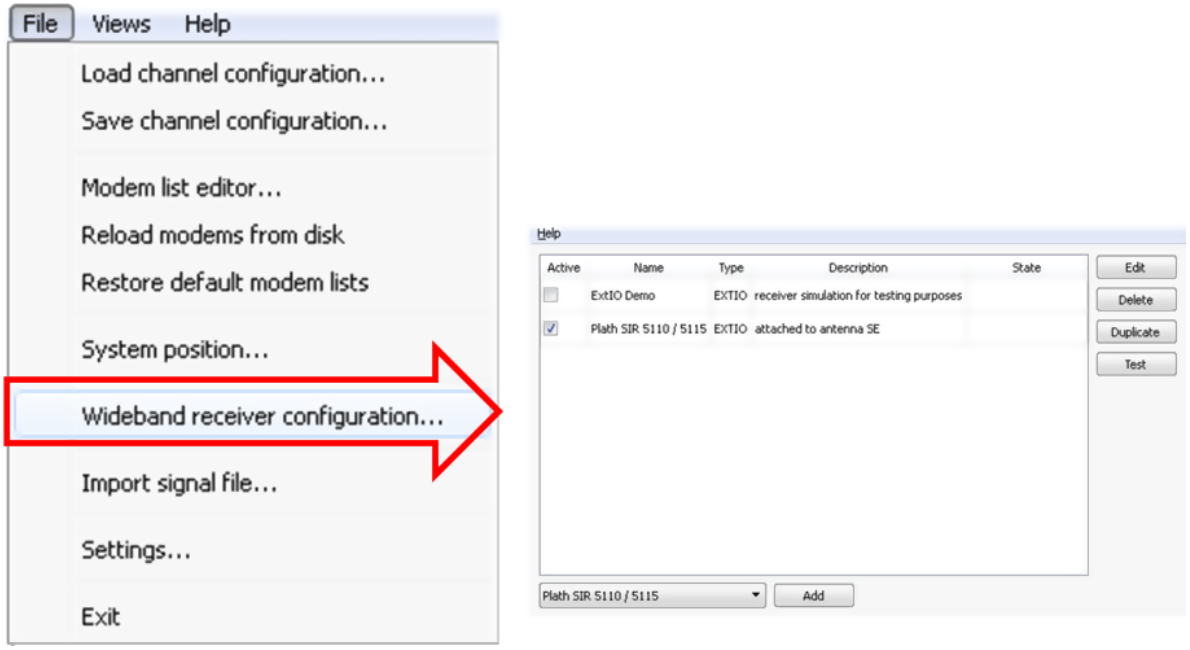


Figure 12.: Configuration of Wideband Receiver

go2MONITOR has to be closed during receiver configuration. Conversely, receiver configuration has to be closed before starting go2MONITOR.

2. The preferred wideband input has to be selected: Receiver, Stream or File (for details, see chapter Input Selection). Here is an example of using signal files as input:
   - Select <**File**><**Input**> as the wideband signal input type.

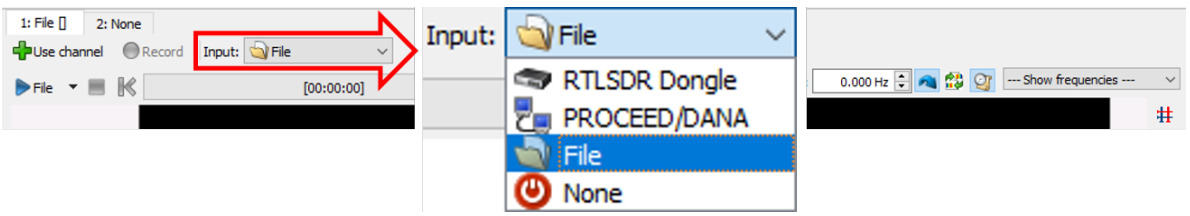


Figure 13.: File Selection as Wideband Signal Input

- Then, click <**File**> toolbar button to open a signal file

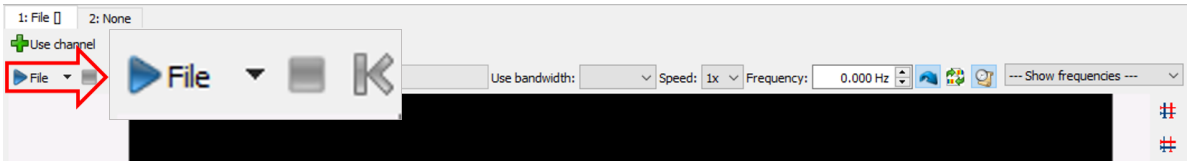


Figure 14.: Open Signal File

3. Observe your wideband signal in the spectrogram (for details, see chapter Spectrum and Spectrogram).

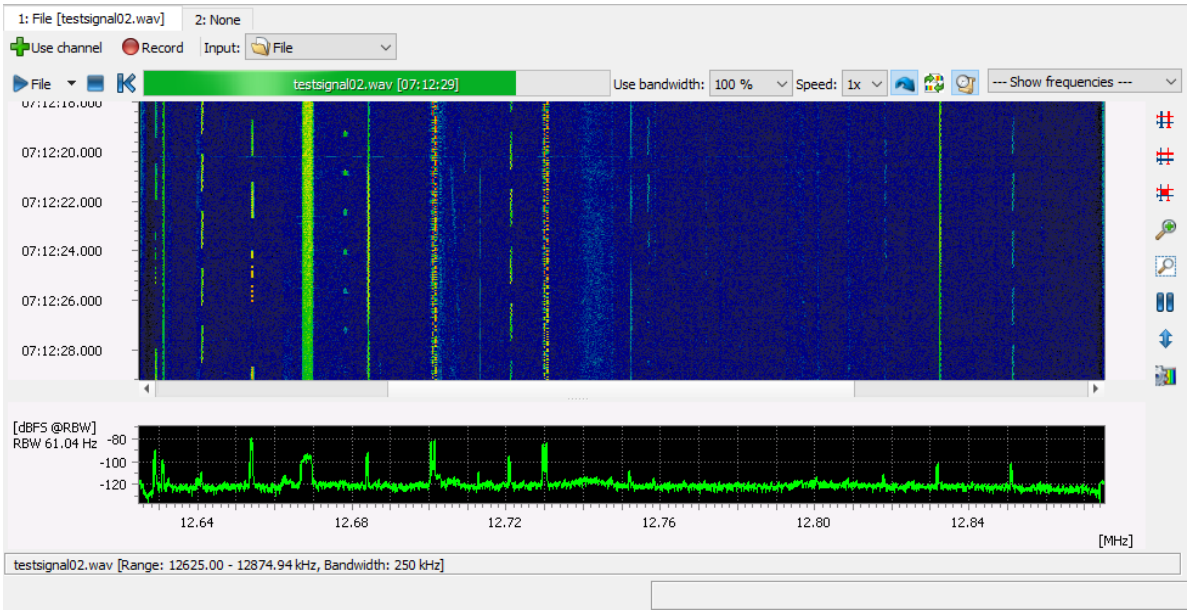


Figure 15.: Wideband Signal in the Spectrogram

4. Click <**Find emissions**> to grab a wideband classification snapshot, which will give you an overview of the emissions from the wideband spectrum (for details, see chapter Emissions).

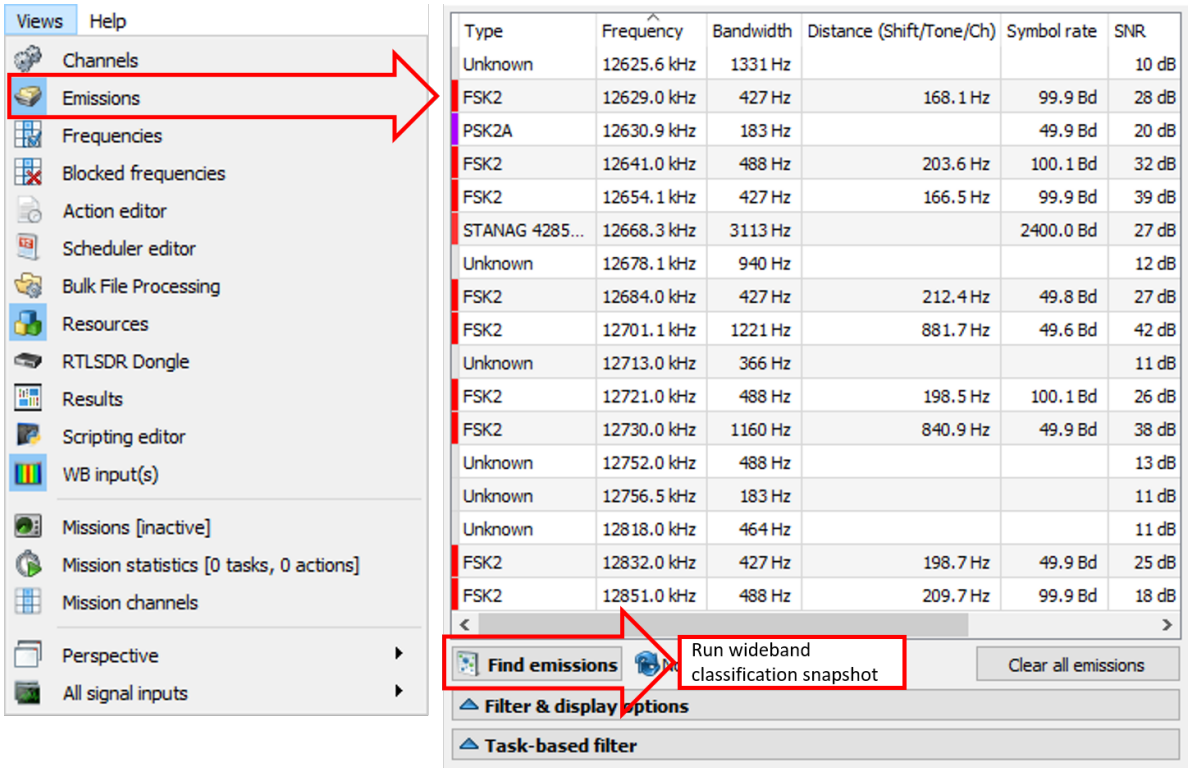


Figure 16.: Emissions View

5. From all encountered emissions, select Emissions Of Interest in the spectrogram or <**Emissions**> View and assign those to the available narrowband channels (for details, see chapter Channels).

   Use the context menu in the <**Emissions**> View to process an emission or simply drag and drop it into the appropriate narrowband channel.

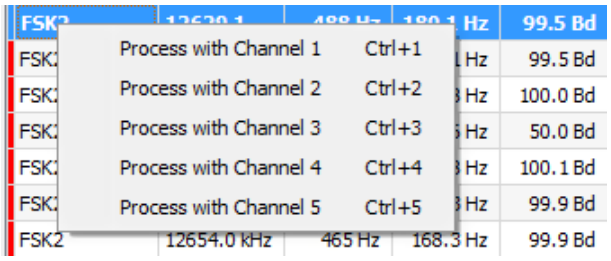


Figure 17.: Context Menu in Emissions View

6. Use narrowband channels to process the Signal Of Interest: classify, recognize modem, decode content, demodulate audio, etc. (for details, see chapter Channels).

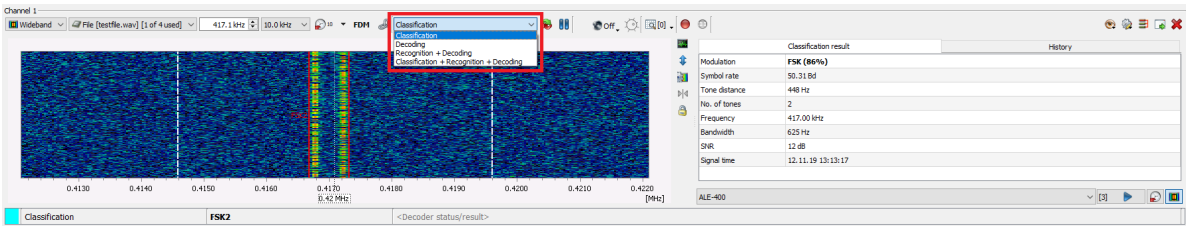


Figure 18.: Mode Selection in Narrowband Channels

7. In addition to this manual processing method, go2MONITOR can be parametrized to automate this process, search for signals automatically and process them in different ways. For details, see chapter Automatic Wideband Monitoring.

3.2. Connectivity

The below graphic shows all the input and output accepted by the go2SIGNALS tools.

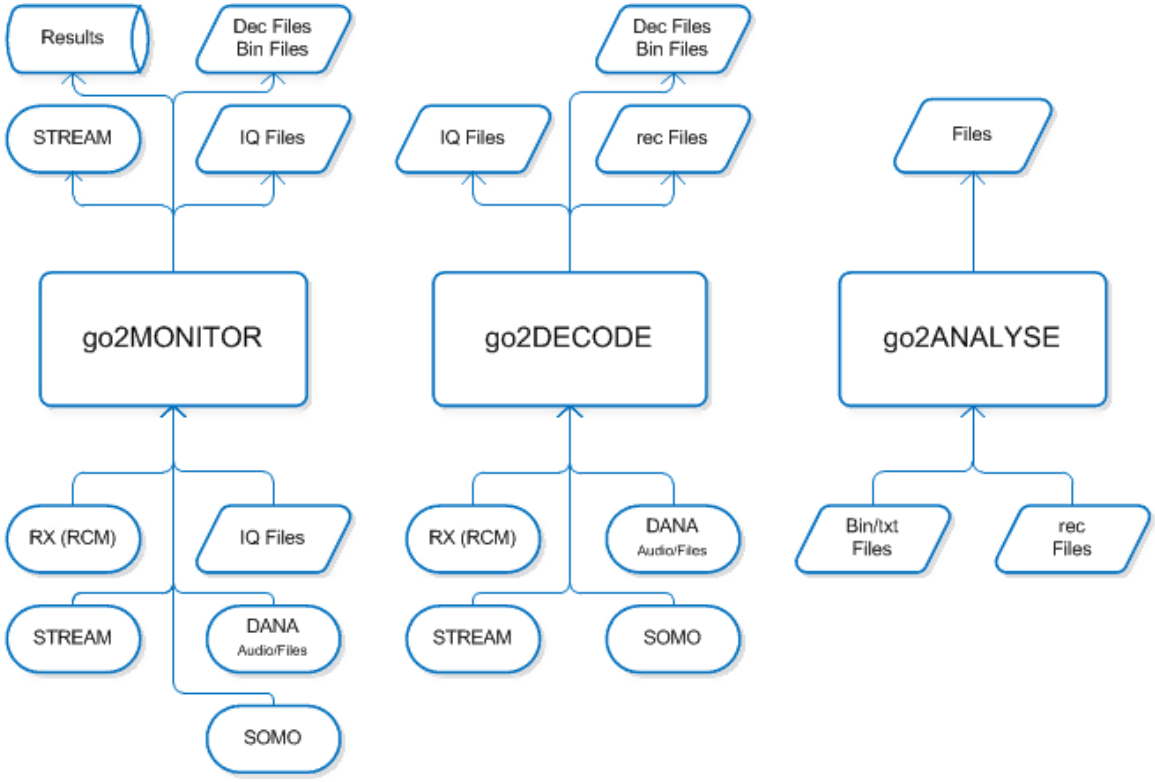


Figure 19.: go2SIGNALS Product Connectivity

3.3. Software Modules

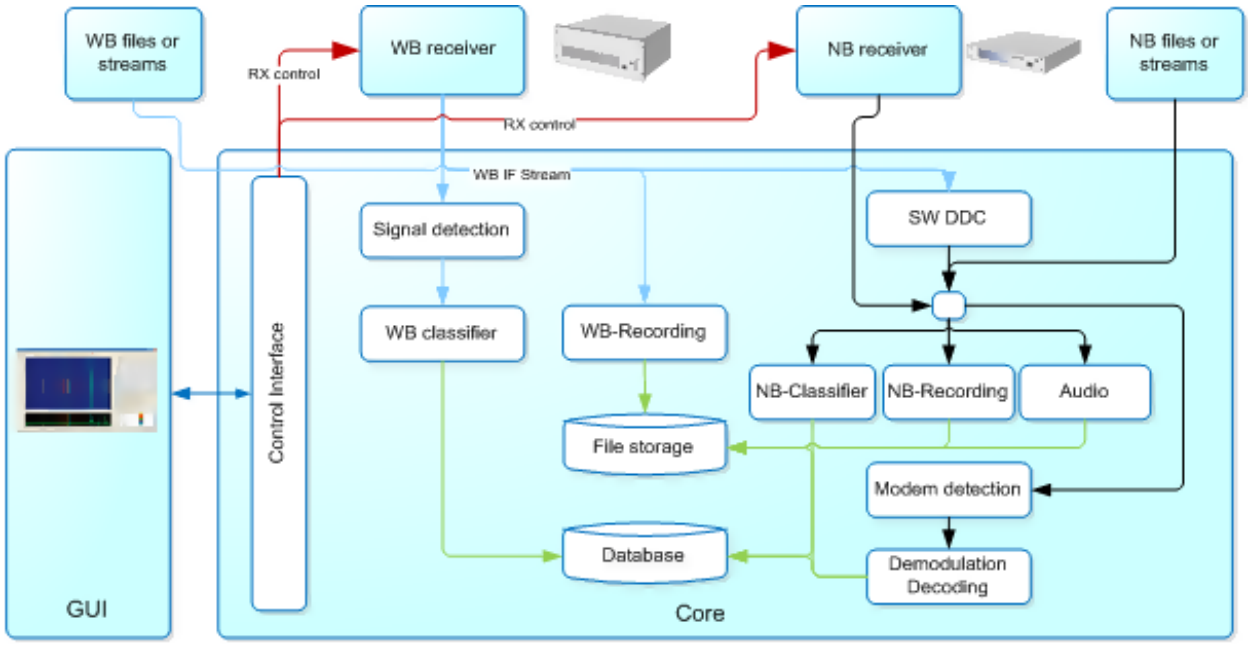


Figure 20.: Main Components Overview

The figure above shows how the different software modules are set up to work together.

3.4. Display

Signals are shown in two ways:

- The wideband spectrum displays the actual spectrum of the frequency range under observation.
- The wideband spectrogram shows the frequency occupation over a certain period (waterfall, spectrogram).

The wideband spectrum and spectrogram provide several configuration options (for details, see chapter Wideband Signal Input).

By using the spectrum or spectrogram views, the operator can select signals for further processing. For each selected signal, a DDC is calculated.

The output of a DDC is assigned to a narrowband processing channel and the additional **Channel** view is displayed.

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

3.5. Narrowband Channel

A narrowband channel features a detailed display and processing results of the selected narrowband signal. The narrowband spectrum and spectrogram are configurable.

A narrowband channel provides different operating modes:

- **Classification:** The signal is continuously classified
- **Decoding:** The signal is decoded by using a manually selected modem
- **Recognition and decoding:** The signal will be decoded automatically by using a modem list
- **Classification, recognition and decoding:** Suitable decoders will be automatically selected depending on the classification result and the signal will be decoded if the matching decoder has been found

Depending on the license, multiple narrowband processing channels can be used in parallel.

The display of the results is configurable using XSLT (Extensible Style sheet Language Transformation).

4. Basics

4.1. Software Start

On computers running Windows®, launch the software either from the Start Menu or by double-clicking the go2MONITOR program icon on the desktop. The main screen, spectrum and spectrogram will be displayed.

On computers running Linux®, the application can be launched from the application folder.

Whenever the application restarts, the settings that were used before the application was stopped are re-applied.

The wideband spectrogram functions asa control center for the software. The operator can control the receiver, select the signals and perform further analyses, such as classification or decoding on these signals, with a simple double-click.

In Figure 21 the screen is divided into different areas:

- Menu bar with <**File**>, <**Views**> and <**Help**> menu options
- Control elements for the spectrogram and spectrum
- Spectrogram and spectrum
- Status bar at the bottom of the spectrogram

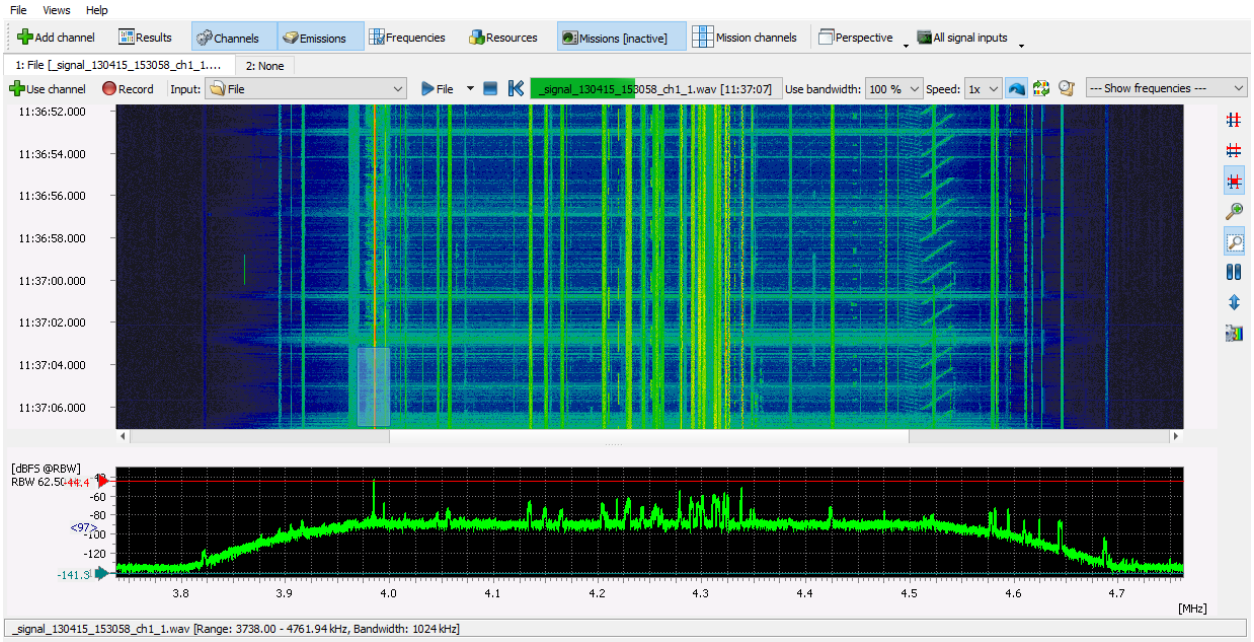


Figure 21.: Main Screen with Spectrogram and Spectrum

The status bar text at the bottom of the spectrogram displays information about the status of the software. If a receiver is connected, the settings of the receiver - including the frequency range, total bandwidth and attenuation - are displayed.

The functions of the above menus will be described in the next chapters.

4.2. File Menu

4.2.1. Load Channel Configuration

To load the settings of a previously stored channel configuration into go2MONITOR, go to <**File**><**Load channel configuration...**>. The configuration file contains the information to set up all the channels and their parameters, such as frequency, bandwidth, mode, etc.

Important: When the center frequency value assigned to a channel is outside of the wideband signal range, the message "Frequency/Bandwidth out of range" will appear in the channel's status bar.

4.2.2. Save Channel Configuration

To store the current channel settings in a configuration file, go to <**File**><**Save channel configuration...**>. This file contains all the parameters, which have been set up in the channels, such as center frequency, bandwidth, mode, decoder list, etc.

- A valid file name has to be entered
- The directory for the storage can be anywhere on the current computer or on the network

4.2.3. Modem List Editor

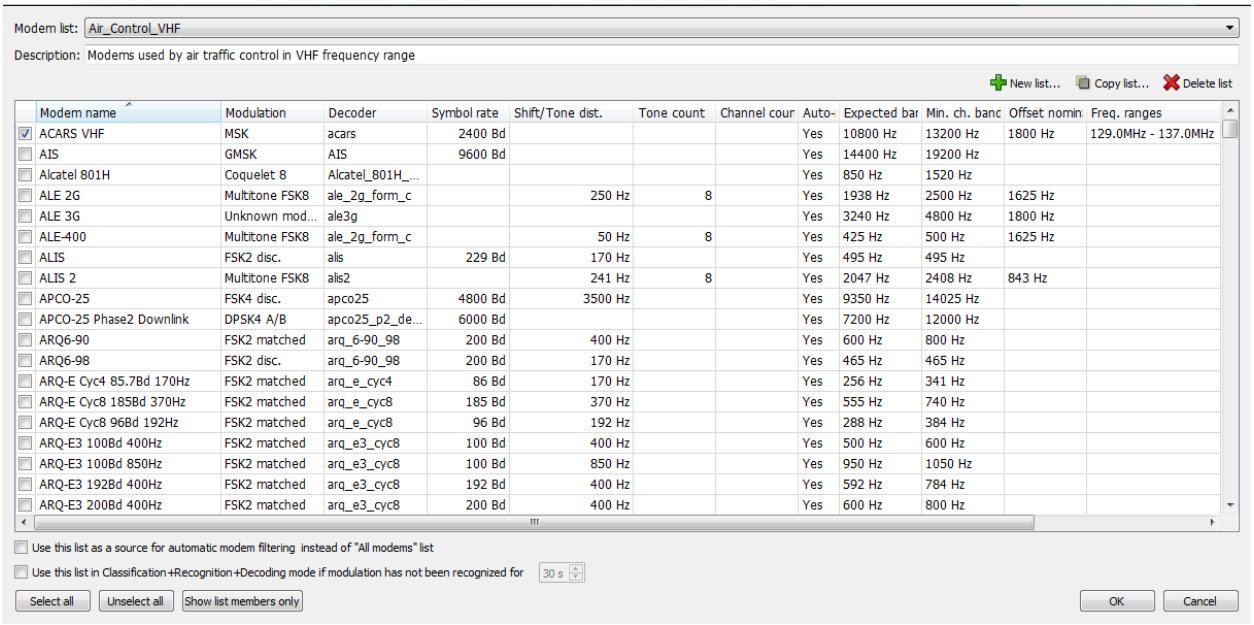
To create and set up specific modem lists, go to <**File**><**Modem list editor...**>. A modem list is a list of modems. In the Modem List Editor, modem lists can be viewed as groups of modems. These modem groups can be used for task parameterization in the software.

In Figure 22 Air_Control_VHF is a modem list that groups multiple modems.

The Modem List Editor displays all the modems, which are available for the application and allows modem lists to be created, deleted or copied. After selecting one or more modems from a list in the Modem list combo-box, all modems belonging to that list will be assigned to a modem list. Modems can be added/removed by selecting/unselecting a checkbox next to the modem name.

A textual modem list description can be entered in the "Description" field. This description will be displayed next to the modem list name each time a modem list choice is displayed in other parts of the software.

A set of predefined modem lists for specific use-cases or frequency ranges is already included in the software installation package.



Modem name	Modulation	Decoder	Symbol rate	Shift/Tone dist.	Tone count	Channel cour	Auto-	Expected bar	Min. ch. banc	Offset nomin	Freq. ranges
ACARS VHF	MSK	acars	2400 Bd				Yes	10800 Hz	13200 Hz	1800 Hz	129.0MHz - 137.0MHz
AIS	GMSK	AIS	9600 Bd				Yes	14400 Hz	19200 Hz		
Alcatel 801H	Coquelet 8	Alcatel_801H_...					Yes	850 Hz	1520 Hz		
ALE 2G	Multitone FSK8	ale_2g_form_c		250 Hz	8		Yes	1938 Hz	2500 Hz	1625 Hz	
ALE 3G	Unknown mod...	ale3g					Yes	3240 Hz	4800 Hz	1800 Hz	
ALE-400	Multitone FSK8	ale_2g_form_c		50 Hz	8		Yes	425 Hz	500 Hz	1625 Hz	
ALIS	FSK2 disc.	alis	229 Bd	170 Hz			Yes	495 Hz	495 Hz		
ALIS 2	Multitone FSK8	alis2		241 Hz	8		Yes	2047 Hz	2408 Hz	843 Hz	
APCO-25	FSK4 disc.	apco25	4800 Bd	3500 Hz			Yes	9350 Hz	14025 Hz		
APCO-25 Phase2 Downlink	DPSK4 A/B	apco25_p2_de...	6000 Bd				Yes	7200 Hz	12000 Hz		
ARQ6-90	FSK2 matched	arq_6-90_98	200 Bd	400 Hz			Yes	600 Hz	800 Hz		
ARQ6-98	FSK2 disc.	arq_6-90_98	200 Bd	170 Hz			Yes	465 Hz	465 Hz		
ARQ-E Cyc4 85.7Bd 170Hz	FSK2 matched	arq_e_cyc4	86 Bd	170 Hz			Yes	256 Hz	341 Hz		
ARQ-E Cyc8 185Bd 370Hz	FSK2 matched	arq_e_cyc8	185 Bd	370 Hz			Yes	555 Hz	740 Hz		
ARQ-E Cyc8 96Bd 192Hz	FSK2 matched	arq_e_cyc8	96 Bd	192 Hz			Yes	288 Hz	384 Hz		
ARQ-E3 100Bd 400Hz	FSK2 matched	arq_e3_cyc8	100 Bd	400 Hz			Yes	500 Hz	600 Hz		
ARQ-E3 100Bd 850Hz	FSK2 matched	arq_e3_cyc8	100 Bd	850 Hz			Yes	950 Hz	1050 Hz		
ARQ-E3 192Bd 400Hz	FSK2 matched	arq_e3_cyc8	192 Bd	400 Hz			Yes	592 Hz	784 Hz		
ARQ-E3 200Bd 400Hz	FSK2 matched	arq_e3_cyc8	200 Bd	400 Hz			Yes	600 Hz	800 Hz		

Figure 22.: Modem List Editor

Setting	Description
<**New list...**>	Begin the creation of a new modem list by entering a name and description and then select the available modems required in the new list. Close the dialog by clicking on the <**OK**> button to persistently store the newly created list. This function is useful to generate lists depending on the actual Mission tasking or frequency ranges.
<**Copy list...**>	A copy of the current list is created. The new list name has to be entered.
<**Delete list**>	Deletes the current list with user confirmation
Use this list as a source for automatic modem filtering instead of the "All modems" list	The list designated by this option replaces the default *"All modems"* list, which will be used for modem filtering purpose on classification results. For example, the selection of a list holding only HF modems when working in the same frequency range would avoid the faulty matching of VHF modems contained in the *"All modems"* list.
Use this list in Classification+ Recognition+Decoding mode if modulation has not been recognized for	The list identified by this selection is utilized for modem recognition and decoding when the classification has not recognized the signal modulation for a specified period of time
<**Select all**>	Select all modems in the list
<**Unselect all**>	Unselect all modems in the list
<**Show list members only**>	Show only selected modems in the list
<**OK**>	Saves all changes and closes the dialog
<**Cancel**>	Closes the dialog without saving the changes

Table 2.: Modem List Editor Functions

Important: A single list may not contain more than 200 modems if it will be used for "Recognition + Decoding" in a narrowband channel.

4.2.4. Reload Modems from Disk

All modem parameters (such as displayed name, baud rate, shift, etc.) are stored in specific *.ver files in the modems subdirectory of the installation directory. The software retrieves these parameters during initialization, builds up the modem list and distributes modem information to all system components.

To load new modems into go2MONITOR and make them available to the system, go to <**File**><**Reload modems from disk**>. Note that reloading modems from disk will cause all running demodulations / decodings to be briefly interrupted.

4.2.5. Restore Default Modem Lists

If any predefined modem lists are changed and saved by mistake, their original content can be restored using the <**File**><**Reload modems from disk**> menu option. The content of all predefined modem lists will be restored. The content of user-defined modem lists will not be changed.

4.2.6. System Position

To set the current geographical position of the system, go to the <**File**><**System position...**> menu entry. All results produced in the future will include this position information. The selection of the system position is accomplished by using a map. The map can be moved with the mouse cursor and zoomed by using the mouse wheel. If the <**Ctrl**> key is pressed and held, the cursor shape will change to a cross cursor and the system position can be set by clicking on the desired place on the map. To delete the system position, click <**Clear**>.

Figure 23.: Definition of the System Position

The currently set system position is represented by a blue marker on the map. The latitude and longitude of this position are also displayed in the status bar of the main window. This position information is specified in angular minutes.

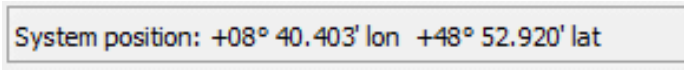


Figure 24.: Display of the Set System position on the Status Bar

4.2.6.1. Retrieving System Position from External GPS-Receivers

go2MONITOR also provides generic capabilities for retrieving position information automatically from some external GPS receivers.

For this purpose, integrators can develop their own plugins to retrieve the position information. The standard go2MONITOR installation includes the implementation of a plugin, which is able to retrieve the position information from most NMEA 0183-compatible GPS receivers connected to the serial or USB port. In order to set up the connection with the GPS receiver, some changes have to be made manually in the "gpsdll.dll.settings" file in the go2MONITOR installation directory. The first row in this file must contain the name of the COM port to which the GPS receiver is connected (for example COM1 or COM6). The second row must contain the baudrate used by the GPS receiver. This information can be found in the documentation of the GPS receiver.

If the settings are correct, a new position will be retrieved from the GPS receiver in 10-seconds intervals.

Once a position has been retrieved, it will be retained even if the GPS receiver stops delivering it. The current position can always be reset/cleared manually from the <**System Position**> dialog described above. Also, a position retrieved from the GPS receiver will always overwrite any position manually set from the <**System Position**> dialog.

Note: If an integrated plugin cannot retrieve the position from certain GPS receivers, an integrator can also develop its own, device-specific, plugin in the form of a dynamically linked library. For technical details and interface description, contact your software vendor.

4.2.7. Wideband Receiver Configuration

To configure wideband receivers, go to <**File**><**Wideband receiver configuration...**> (for details, see chapter Receiver Configuration).

4.2.7.1. Starting the Receiver Configuration Tool

Receiver Configuration is a standalone tool and can be started directly from the menu bar within the application. For configuring narrowband receivers, the same tool will be used.

The Receiver Configuration Tool requires the main application to be closed. When the Receiver Configuration tool is opened, a dialog box will prompt the user to close the main application.

Alternatively, the Receiver Configuration Tool can be started from the app's installation directory:

- Windows®
  using the batch file ReceiverConfiguration_wb.bat
- Linux®
  using the shell script file ReceiverConfiguration_wb.sh

The wideband Receiver Configuration Tool can also be opened from the <**Start Menu**>.

4.2.8. Narrowband Receiver Configuration

To configure narrowband receivers, go to <**File**><**Narrowband receiver configuration...**>. Narrowband receivers can be configured in a similar way as wideband receivers (for details, see chapter Receiver Configuration). The configuration of narrowband receivers is available with the licensing option Narrowband Receiver Control Option (NRC) only.

4.2.9. Import Signal File

To import an externally created signal file (complex WAV files are supported) into go2MONITOR results storage, go to <**File**><**Import signal file...**> (for details, see chapter Results).

After selecting this menu item, the user can select one or more WAV signal files to be imported. If multiple files are selected, each of the files will be imported as a separate result.

Since the import process can take a while, it is performed in the background. When the process is complete, a popup is displayed describing, which file has been imported and which target directory has been used as the destination. Any errors during the process will be shown in the same popup. The popup can be removed by clicking on it. It will become visible again only if there is new information about the import.

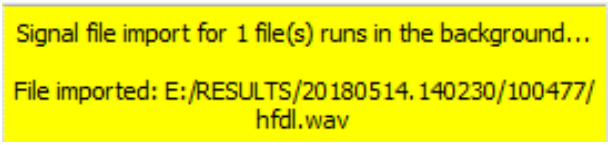


Figure 25.: Signal Import Feedback

After the import, these files can be used in the ResultViewer in the same way as if they were created with go2MONITOR. All imported files can be found in the ResultViewer as results of the Narrowband recording type. In the *Source* field, all imported results will have the following content: "[Import: <filename>]".

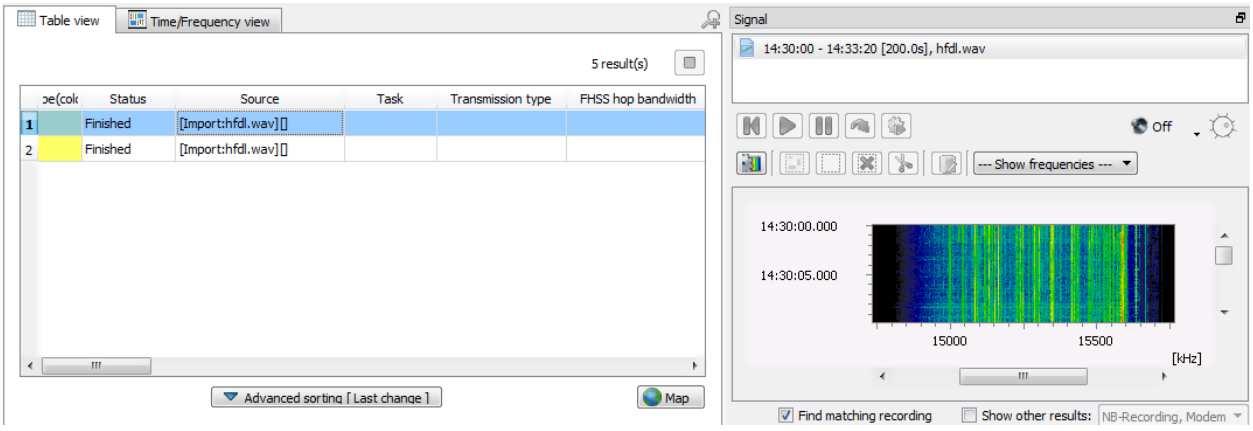


Figure 26.: Imported Signal File in the ResultViewer

The signal time will be retrieved from the file itself if a compatible "custom chunk" in the WAV file exists. Otherwise, a file creation date and time will be used.

4.2.10. Settings

To configure general settings and those related to result storage options, go to <**File**><**Settings...**>.

4.2.10.1. General Settings

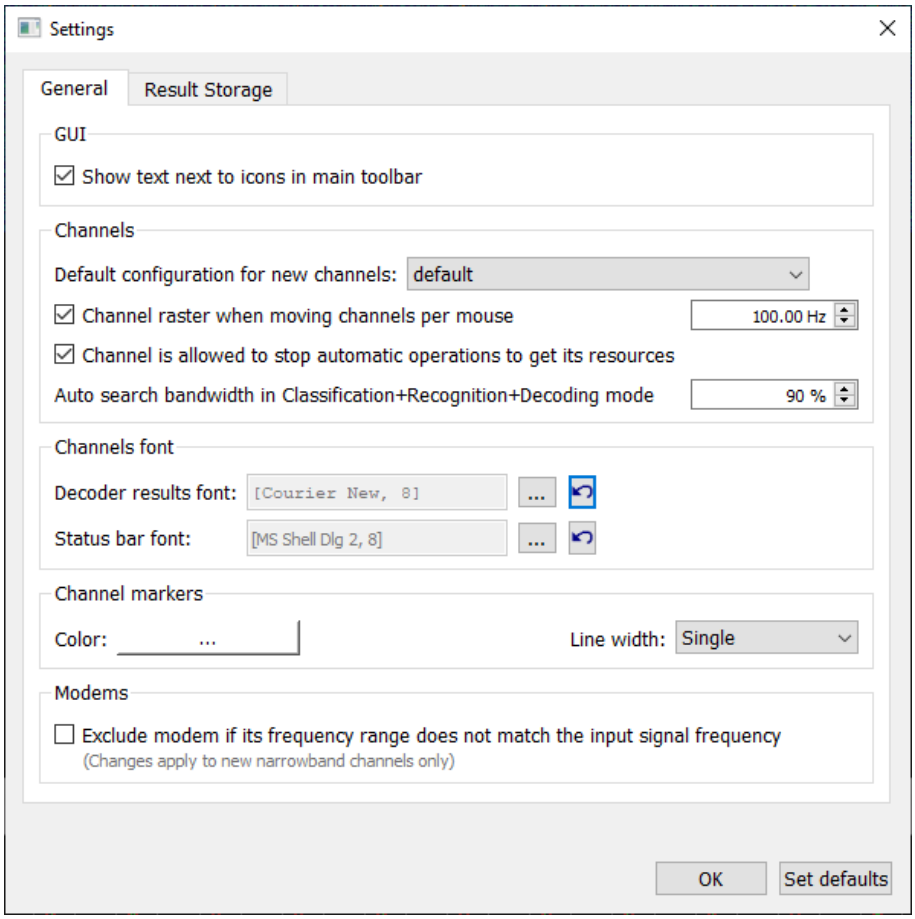


Figure 27.: General Window

Group	Setting	Description
GUI	Show text next to icons in main toolbar	If enabled, text explaining the function of each icon is displayed on the toolbar
Channels	Default configuration for new channels	Select the default configuration to be used if a new channel is opened. The configuration includes its functional and visual settings, refer to chapter Channels.
	Channel raster when moving channels per mouse	Grid used if a channel gets selected by a double-click or by moving the center line in the spectrogram of the wideband signal
	Channel is allowed to stop automatic operations to get its resources	Manual channels will stop Automatic Wideband Monitoring actions running in background in order to acquire its resources if needed.

Group	Setting	Description
	Auto search bandwidth in Classification + Recognition + Decoding mode	Percentage of the configured channel bandwidth in which the automatic signal processing takes place.
Channels font	Decoder results font	Select the font used for the text output. Reset font to the default font by using button.
	Status bar font	Select the font used for the status bar text display. Reset font to the default font by using button.
Channel markers	Color	Select the color used to mark the channel in the spectrogram
	Line width	Select between single, double or triple width of the lines used to mark the channel in the spectrogram
Modems	Exclude modem if its frequency range does not match the input signal frequency.	Any modem whose assigned frequency range (refer to chapter Modem List Editor) is outside the frequency of the input signal will be excluded from the signal processing. This setting is displayed in application's status bar.
Buttons	<**OK**>	Accept all modifications and close the window. Closing the window using the "X" in the window title has the same effect as pressing OK.
	<**Set defaults**>	Restore default settings

Table 3.: General Settings Functions

4.2.10.2. Results Storage Settings

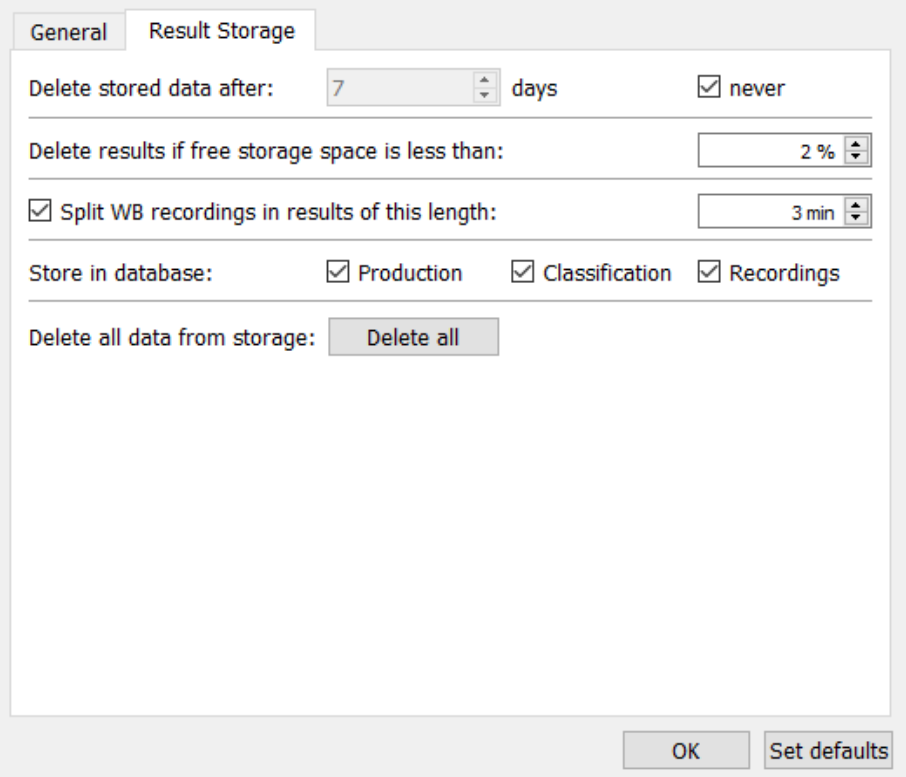


Figure 28.: Results Storage Settings Window

Setting	Description
Delete stored data after	This setting controls the automatic result deletion process. All results older than the defined number of days will be automatically deleted. By selecting the "Never" option, the results will be automatically deleted only if the amount of free space of the hard-disk falls below 2% (can be changed by using the following option). The default setting is 7 days.
Delete results if free storage space is less than	This settings controls when the storage will be regarded as almost full and automatic deletion of the oldest data will begin. The settings is specified in percent of the free space on the corresponding drive. Default value is 2%.
Split WB Recordings in results of this length	This setting controls if and how the system should split long wideband recordings. If automatic splitting has been turned on, each wideband recording will be automatically splitted in multiple separate results, based on the duration parameter. If the result storage gets almost full, this splitting will enable the automatic deletion process to delete only the oldest parts of the wideband recordings instead of deleting the whole recording at once. Using this option effectively provides endless wideband recording function, which will be automatically shortened by deleting the oldest parts. The user can start recording once (manually and automatically) and the system will keep the newest recording parts, which fit in the re-sult storage. Default value is ON and the default duration is 30 minutes.
Store in database	This option determines, which result classes will be stored in the database (<**Production**>, <**Classification**>, <**Recordings**>). It can be used to reduce the amount of stored data, i.e. database size.
Delete all data from storage	This function can be used to delete all stored results (database and files). This operation cannot be undone or canceled. The deletion runs in the background and can last several minutes depending on the amount of stored data. It is not recommended to use the software to create new results during the deletion process.
<**OK**>	Accept all modifications and close the window. Closing the window using the "X" in the window title has the same effect as pressing OK.
<**Set defaults**>	Restore default settings

Table 4.: Results Storage Settings Functions

4.2.11. Exit

Close the application and store all settings.

4.3. Views Menu

From the <**Views**> menu, different views can be opened.

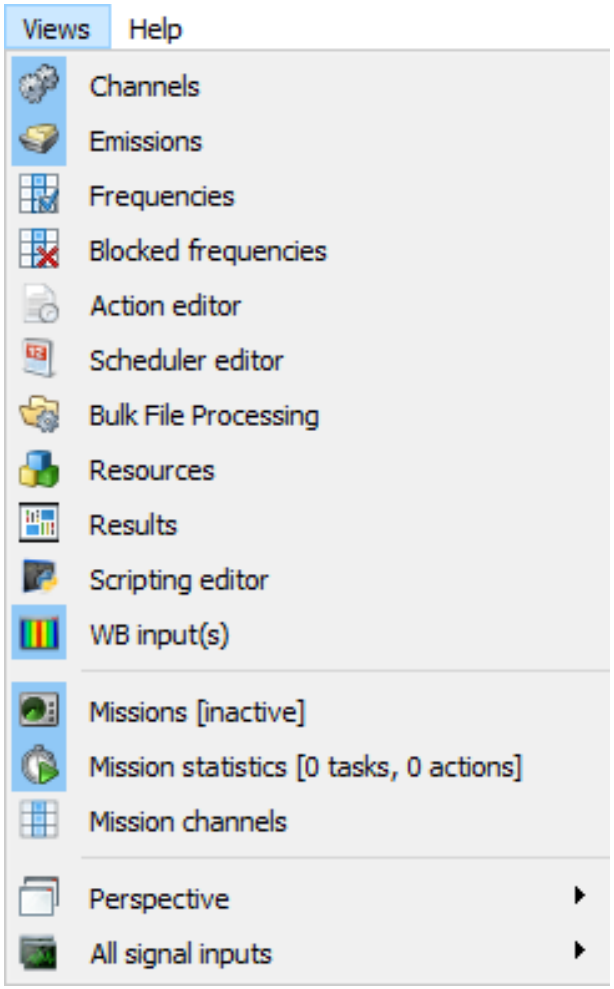


Figure 29.: Main Menu - Views

All views can be docked to the main window or undocked into a single window, either by drag-and-drop or by double-clicking with the left mouse button on the view's title bar. For example, in a two-monitor system the channel window displaying 1, 4 or 8 channels can be moved to a second monitor.

4.3.1. Channels

This view displays the <**Channels**> window for narrowband classification, recognition and decoding of signals (for details, see chapter Channels).

4.3.2. Emissions

This view displays the **Control and Result** window for wideband classification (for details, see chapter Emissions).

4.3.3. Frequencies

This view displays the <**Frequencies**> window (for details, see chapter Frequencies).

4.3.4. Blocked Frequencies

This view displays the <**Blocked frequencies**> window (for details, see chapter Blocked Frequencies Window).

4.3.5. Action Editor

The <**Action editor**> is the GUI for managing scheduling actions, which can be used later in the Scheduler Editor to create scheduling items (for details, see chapter Action Editor).

4.3.6. Scheduler Editor

The <**Scheduler editor**> is the GUI for managing scheduling items (for details, see chapter Scheduler Editor).

4.3.7. Bulk File Processing

This view provides functions for automated processing of signal files by using available GUI channels. For details, see chapter Bulk File Processing.

4.3.8. Resources

This view provides a graphical display of the actual product configuration and the status. The actual set of included components depends on the configuration and on the license.

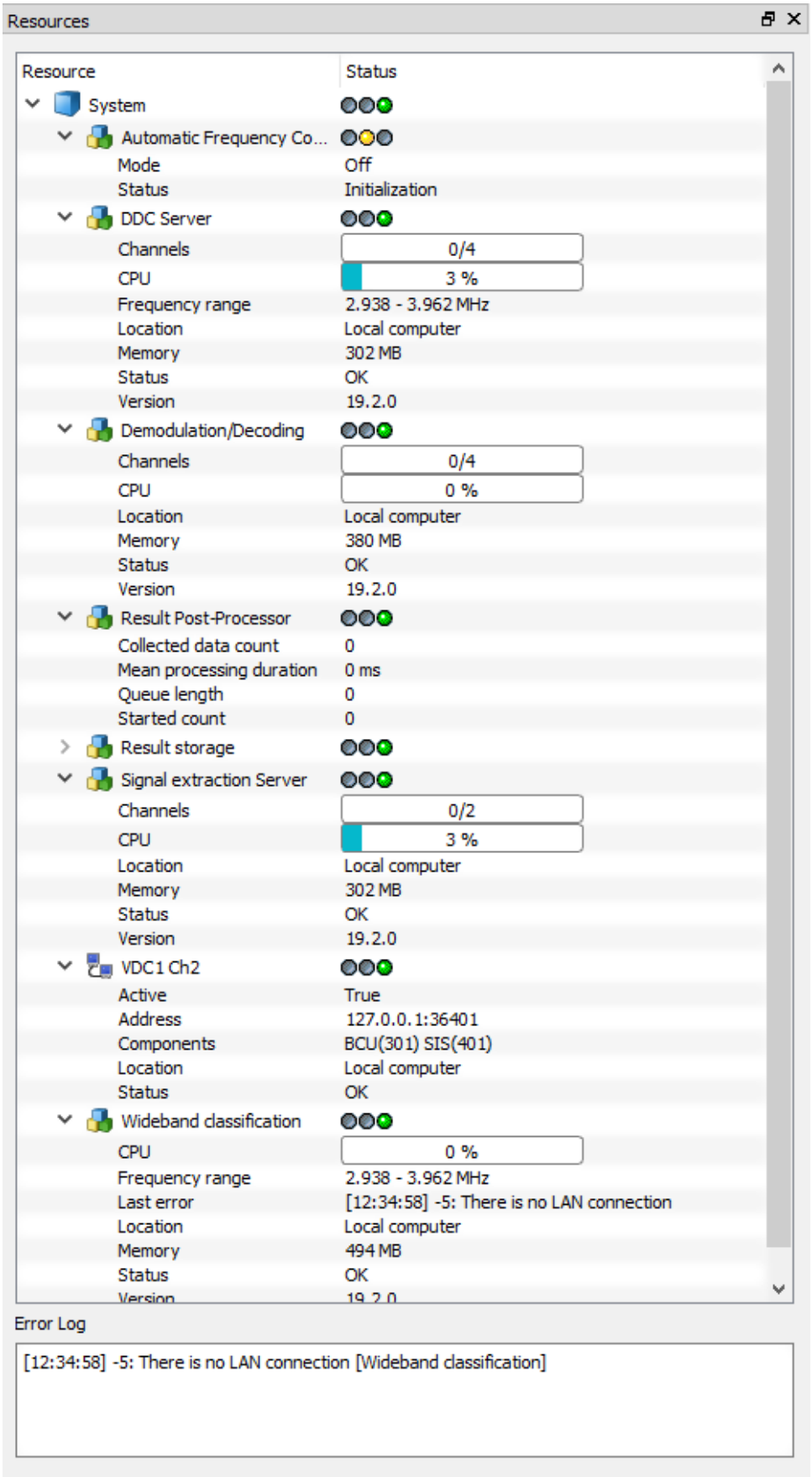


Figure 30.: Resources View

The overall system status and component status is displayed in the form of icons with following states:

-  Working state, everything is OK
-  The system or component is in initialization or transition state, e.g. waiting for an input signal or some other requirement
-  The component/system is stopped or has reported an error

If applicable for a specific component, this view will show the current resource usage of the component, e.g. number of total/used channels.

If there are any problems during normal usage of the product, the <**resources**> view should be opened to investigate the system status. Any information about errors can be useful when contacting support address the problem.

The default resource display shows all items in the collapsed state, i.e. only the name of the component and its status are visible. To see all information, the <**Expand all items**> context menu option provides more details.

The last error message from a specific component will be displayed as a *Last error* item in its tree view status field and include error code, error description and error time. If needed, all *Last error* information from all components can be removed using the <**Remove all "Last error" information**> context menu option.

In addition, critical errors, e.g. connection or licensing problems, are displayed in the error log at the bottom of the view. For each error, the time of error and the component where it occurred are logged.

4.3.9. Results

Display the <**Result**> window (for details, see chapter Results).

4.3.10. Scripting Editor

Optional feature. For details, see chapter GUI Scripting Option.

4.3.11. WB input(s)

This menu option switches the view with wideband inputs on/off. Note that switching wideband input view off and then on will reset its appearance to the standard layout. For details, see chapter Wideband Signal Input.

4.3.12. Missions

This view displays all Missions for Automatic Wideband Monitoring.

4.3.13. Mission Statistics

This view displays Mission Statistics for the currently active Automatic Wideband Monitoring Mission.

4.3.14. Mission Channels

This view displays channels triggered from Automatic Wideband Monitoring and their current channel status. For details, see chapter Mission Channels.

4.3.15. Perspective

Provides functions for either saving the current GUI layout to a file or deleting the previously saved layout file (for details, see chapter GUI Layout Perspective).

4.3.16. All Signal Inputs

This menu entry contains entries to be applied to all available signal inputs at the same time (for details, see chapter Functions Applicable to All Signal Inputs). This menu item is only available with the Multiple Wideband Signal Inputs licensing option.

4.4. Help Menu

4.4.1. User Manual

Shows the user manual (PDF).

4.4.2. Decoder List

Shows the list of available decoders (PDF).

4.4.3. Decoder Data Sheets

Shows data sheets for available decoders (PDF).

4.4.4. About

Displays additional information about the release and build.

4.5. Receiver Configuration

This chapter describes the necessary configurations to use a receiver in the go2MONITOR product line environment. Receivers are controlled by the Receiver Control Module (RCM). With the help of the Receiver Configuration Tool it is possible to define receiver parameters such as IP address, control port, etc., and to enable or disable the support for certain receivers. After making changes to the configuration, it might be necessary to restart the software to apply the new settings.

4.5.1. Receiver Configuration Dialog

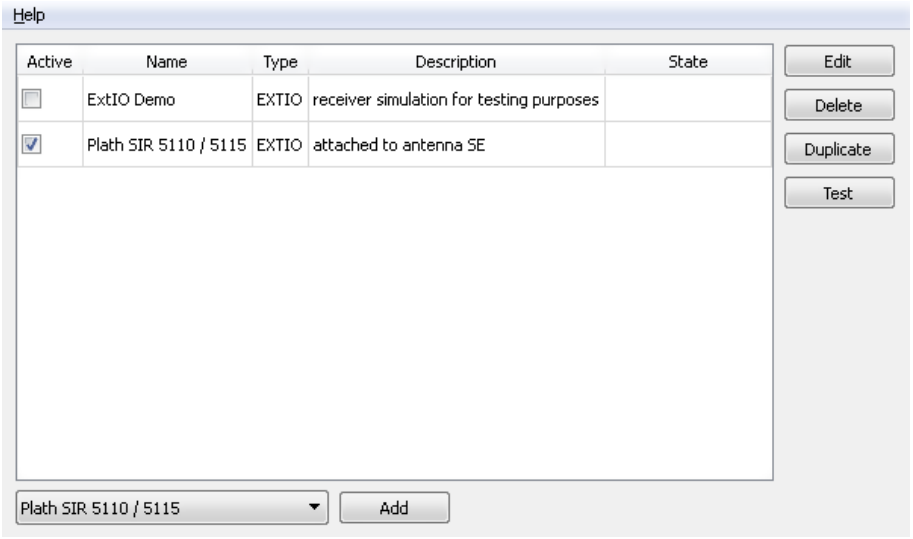


Figure 31.: Receiver Configuration Tool

On startup, the RCM will show a list of currently configured receivers. The fields have the following meaning:

Active

This indicates if a receiver is enabled or not. Disabling a receiver makes it unavailable but keeps its configuration. It is recommended to disable unconnected receivers. The status can be changed by selecting or deselecting the checkbox.

Name

Name of the receiver.

Type

Type of receiver connection.

Description

An individual description of the receiver.

State

This field shows the status and result of the test procedure.

4.5.2. Supported Receivers

The following receivers are supported:

Receiver	Interface	Comment	Linux®	Windows®
Plath SIR 51xx	LAN	Plath WinDF/Winmon application is needed to perform basic receiver settings (ports, addresses, etc.). Each single sub-band (768 kHz bandwidth for SIR 51xx) can be used as a virtual receiver.	yes	yes
Plath SIR 21xx	LAN	Plath WinDF/Winmon application is needed to perform basic receiver settings (ports, addresses, etc.). Each single sub-band can be used as a virtual receiver. SIR 21xx usage is recommended only under Linux®. Packet loss might occur under Windows®.	yes	not recommended
IZT R3000 series	LAN	Default configuration uses one spectrum overview channel and one data channel for up to 2 MHz bandwidth. Other configurations available upon request. Multiple templates are available: • wideband usage with one overview spectrum and one IQ channel up to 2.4 MHz • wideband usage with only one IQ channel, up to 20 MHz bandwidth, using multicast • for use as Narrowband receiver (with NRC license only).	yes	yes
IZT SignalSuite R4000	LAN	Support of R4000/Signal Suite. Control can be carried out directly from our software or via IZT Signal Suite. Block size up to 64 K supported.	yes	yes
R&S®EM100 / PR100	LAN	Other compatible R&S receivers may also work by using this driver.	yes	yes
R&S®EB500	LAN	Bandwidth up to 5 MHz supported	yes	yes
R&S®EB510	LAN		yes	yes

Receiver	Interface	Comment	Linux®	Windows®
R&S®ESMD	LAN	Maximum bandwidth approx. 15 MHz, depending on the operating system and the hardware. Initialization can be done by included Python script. For the initialization with a python script, the path to the Python executable must be entered in the PATH variable of the operating system. Alternatively, the absolute path to the Python executable can be parameterized via the receiver configuration tool. An additional python script can be used to control the receiver (see chapter R&S® ESMD Control with Python).	yes	yes
WinRadio G31DDC Excalibur	USB	Receiver driver (from CD or manufacturer's website) has to be installed first. Recommended/tested version is v1.69 (other versions not officially supported).	no	yes
WinRadio G33DDC	USB	Receiver driver (from CD or manufacturer's website) has to be installed first. Recommended/tested version is v2.13 (other versions not officially supported).	no	yes
WinRadio G35DDC	PCI-e	Receiver driver (from CD or manufacturer's website) has to be installed first. Recommended/tested version is v1.42 (other versions not officially supported).	no	yes
WinRadio G39DDC Excelsior	USB	Receiver driver (from CD or manufacturer's website) has to be installed first. Recommended/tested version is v1.58 (other versions not officially supported).	no	yes
Grintek GRXLAN	LAN	See below for IP-settings instructions	no	yes
narda® NRA-3000 / NRA-6000 / IDA 2	LAN		yes	yes
Microtelecom PERSEUS	USB	Native support only for USB 2.0. Experimental support for USB 3.0 by using ExtIO driver with limited functionality. Receiver driver (from CD or manufacturer's website) has to be installed first. The following files have to be copied manually from the driver installation to the "32bit" subdirectory of the installation directory: • All perseus*.sbs files • All perseususb*.dll files	no	yes
RFSPACE SDR-14	USB		no	yes

Receiver	Interface	Comment	Linux®	Windows®
ThinkRF WSA5000-408	LAN	VITA49 protocol is used. Maximum bandwith is 781 kHz.	yes	yes
ThinkRF WSA5000-427	LAN	VITA49 protocol is used. Maximum bandwith is 781 kHz.	yes	yes
ThinkRF R5500-408	LAN	VITA49 protocol is used. Maximum bandwith is 6.25 MHz.	yes	yes
ThinkRF R5500-427	LAN	VITA49 protocol is used. Maximum bandwith is 6.25 MHz.	yes	yes
RTLSDR / Noxon USB-sticks	USB	Experimental support. Libraries are not included. See chapter Installation of Missing ExtIO Libraries.	no	yes
SDRplay RSP	USB	Experimental support. Separate configurations for RSP1 and RSP2 variants. Libraries are not included. See chapter Installation of Missing ExtIO Libraries.	no	yes
AirSpy	USB	Experimental support. Libraries are not included. See chapter Installation of Missing ExtIO Libraries.	no	yes
Test Reciever		Receiver simulation for testing purposes	yes	yes
CommsAudit CA7851	LAN	No receiver control, only VITA 49 wideband signal interface	yes	yes
CommsAudit CA7852	LAN		yes	yes
Signal Hound BB60C	USB	Receiver software/driver (from CD or manufacturer's website) has to be installed first (32-bit version for Windows®, 64-bit version for Linux®). Recommended/tested version is BB API v4.2.0 (other versions not officially supported). The following files have to be copied manually from Spike installation to the "32bit" subdirectory of the installation directory: • bb_api.dll (libbb_api.so on Linux®) • ftd2xx.dll (libftd2xx.so on Linux®) • libusb-1.0.dll (Windows® only) • All msvc*.dll files (Windows® only)	yes	yes
Other generic "Winrad ExtIO" supported receivers		Not included, experimental support possible	no	yes

Receiver	Interface	Comment	Linux®	Windows®
Generic VITA 49	LAN	Generic VITA-49 driver, which has to be parametrized for a specific receiver type. It is supposed to be used only by experienced technician familiar with VITA-49 protocol details. Experimental support.	yes	yes
narda® SignalShark® 3310	LAN	Control of bandwidth, frequency and gain is possible. Support of Vita-49 streams up to 20 MHz. Three templates are available for configuration: 1. SignalShark with RCM. Data is delivered to the components by the RCM. Maximum bandwidth approx. 6 MHz. 2. SignalShark with direct delivery of data to the components via multicast. The receiver is reset and configured on start. Up to 20 MHz bandwidth is possible, depending on the operating system and the hardware. 3. SignalShark with direct delivery of data to the components via multicast. The receiver has to be configured before the start manually. Up to 20 MHz bandwidth is possible, depending on the operating system and the hardware.	yes	yes (only for configuration 1.)
RFSPACE NetSDR	LAN	Separate HF/VUHF- configurations.	yes	yes

Receiver	Interface	Comment	Linux®	Windows®
USRP X310	LAN	Receiver driver (from CD or manufacturer's website) has to be installed first (32-bit VS2017 version for Windows®, 64-bit version for Linux®). Recommended/tested version is v3.15, Firmware v36 (other versions not officially supported). Note that the driver version has to be compatible with the USRP Firmware version. The UHD library (uhd.dll / libuhd.so) has to be copied manually from the driver installation to the "32bit" subdirectory of the installation directory. If necessary, the environment variable UHD_RFNOC_DIR has to contain a subdirectory of the UHD-installation (usually: <UHD_install_dir>/share/uhd/rfnoc). Installation under Linux® may require building your own UHD driver to support CentOS 7 platform. The Boost library has to be installed additionally version must be compatible with UHD driver). Installation under Windows® requires installation of the "libusb" library. The library (libusb-1.0.dll) has to be located in the "32-bit" subdirectory of the installation directory. See receiver documentation and online resources for further details.	yes	yes

Table 5.: Supported receivers

Maximal supported bandwidth may be less than the maximum bandwidth of the actual receiver. This depends on performance and license issues.

4.5.3. R&S® ESMD Control with Python

An ESMD receiver is controlled with a python script. For this reason, the option "GUI Scripting" is required.

To control an ESMD receiver open the script editor and load the script "ESMD_Control.py" from the "32bit" folder of your installation directory. Save this script as a plugin for your system as described in Saving Scripts as Plugins.

It is important to make sure that the execution type of the exported script is set to "Blocking".

If the script is exported as a plugin, the control interface can be started via the toolbar. The script can be used to control the frequency and bandwidth of the ESMD receiver.

4.5.4. Adding a Receiver

To add a new receiver, select a template from the dropdown list at the bottom of the main window and then click <**Add**>. A new dialog window will appear showing various receiver parameters. The type of parameters and thus the layout of this dialog depends on the selected receiver.

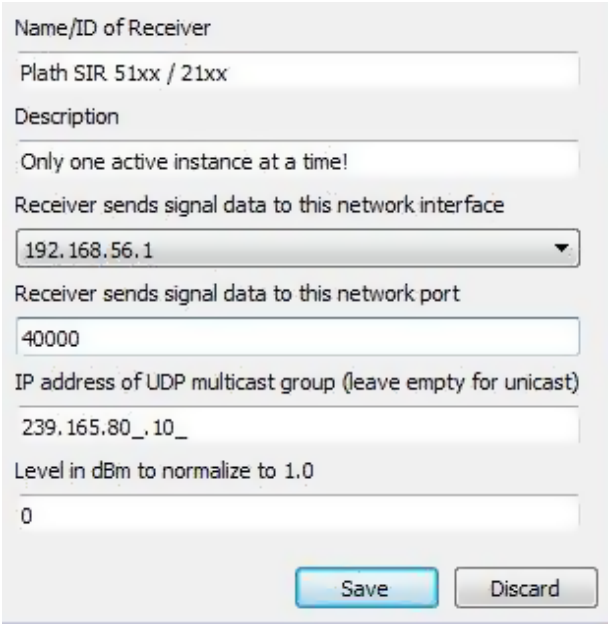


Figure 32.: Edit Receiver Parameters

If the default parameter values are okay, close the window by clicking on the <**Discard**> button. If any changes were made, e.g. to the IP address in the case of a network receiver, click <**Save**> to update the new parameters and close the dialog.

For technical reasons, adding more than one receiver of the same type is not supported for some receivers. In this case, after adding the first receiver configuration, the <**Add**> and <**Duplicate**> buttons will be disabled and the selection of the affected template in the dropdown will be deactivated.

If support for more than one receiver of certain type is needed and the Receiver Configuration Tool does not support it, please contact our support for help (see chapter Support).

4.5.5. Edit Receiver Parameters

To edit the parameters of a receiver, which is already in the list, either select it and then click <**Edit**> on the right side or double-click on the row. The previously described parameter dialog will appear.

4.5.6. Delete Receiver

To remove a selected receiver from the list, click <**Delete**>. If a receiver should only be temporarily deactivated, it is recommended to disable it instead by unchecking the receiver "Active" checkbox. This will retain its configuration parameters for later use.

4.5.7. Duplicate Receiver

To create a copy of the selected receiver configuration, click <**Duplicate**>. The parameters of the newly created receiver configuration must be edited afterwards. If adding more than one of the selected receiver is not supported the <**Duplicate**> button is disabled.

4.5.8. Test Receiver

It is possible to test the connection to a configured receiver with the <**Test**> button. It will start a new RCM instance in the background with the current configuration and check the data connection. This might take some time. The result of the test connection will be shown in the "State" table column. It is recommended to disable all but one receiver for testing.

4.5.9. Troubleshooting

LAN receivers

To connect to a receiver over a LAN-interface, the IP-address and control port of the receiver has to be provided. Consult the receiver handbook if you would like to know the default IP-address or change the IP-address of the receiver.

The following hints should be considered for using network receivers delivering UDP Unicast or Multicast data:

Attention: Make sure that the receiver and the PC on which RCM is running are on the same network.

Attention: Activating unconnected network receivers might produce delays and problems during initialization.

Attention: To operate LAN-receivers, any security questions regarding firewall rules after the first start of your product must be acknowledged. You may also need to do this after connecting a new receiver and adding it into the product. If the communication between the product and the receiver does not work, it may be that the used firewall interferes with or even prevents the data exchange.

USB receivers

Make sure that the USB-drivers are installed properly. Also, check the connection between the receiver and the PC.

Attention: Activating unconnected USB receivers might produce delays and problems during initialization.

4.5.10. Remote Installation

It is possible to install RCM and the Receiver Configuration Tool on a different computer without an additional license. However, it is the customer's responsibility to automatically start RCM on this computer.

4.5.11. Complex Receiver Configurations

The receiver configuration tool enables easy creation of prevalent configurations. Complex configurations, such as some WinRadio receivers or Plath SIR receivers with several sub-bands, are also supported. They do, however, require some tuning regarding configuration files. In this case, please contact our support for guidance and further details (see chapter Support).

4.5.12. Using Receivers with Higher Bandwidths (> 5 MHz)

Default receiver configurations, which can be added using the receiver configuration tool, will support bandwidths of typically up to 5 - 7 MHz. Higher bandwidths, up to the maximum bandwidth supported by the receiver, are possible, but require some manual configuration, especially for network receivers. In this case, please contact our support for guidance and further details (see chapter Support).

4.5.13. Installation of Missing ExtIO Libraries

To put some of the supported receivers into operation, external ExtIO libraries are necessary. These libraries are, if possible under the terms of license, delivered with go2MONITOR.

For the following receivers, this is not possible:

- RTL-Stick
- AirSpy
- SDRPlay

To put the above receivers into operation, it is necessary to install the ExIO libraries manually. If this is not done yet, the RCM configuration tool shows a warning when one of these receivers is added.

It is recommended to use the libraries that come with the receiver. If these are not available, the latest version from the manufacturer/developer website should be downloaded.

The libraries have to be renamed to a specific filename for each of the receivers:

Receiver	Name
RTL-Stick	ExtIO_RTL.dll
AirSpy	extio_airspy_cmake_mgw-v1.0.7.dll
SDRPlay RSP1	ExtIO_SDRplay_RSP1.dll
SDRPlay RSP2	ExtIO_SDRplay_RSP2.dll

Table 6.: ExIO Libraries

Note: If the library you purchased is named differently, rename it accordingly.

To install the library in go2MONITOR, copy the library file (after renaming if necessary) to the 32 bit folder in the installation directory of go2MONITOR. Typical folders are:

- Windows®

  <installation path> \32 bit, for example C:\Program Files (x86)\ go2SIGNALS\go2MONITOR\32 bit

- Linux®

  /opt/go2SIGNALS/go2MONITOR/32bit/

To determine if the installation was successful, start the Receiver Configuration Tool (restart if already running) and add the corresponding receiver (see chapter Adding a Receiver). If the installation was successful, no warning is shown.

4.6. GUI Layout Perspective

A layout perspective stores the position and the size of the main GUI views. As the GUI contains multiple views, the application has been equipped with a perspective management feature, which allows quick and simple layout adaptation. Perspective management offers the possibility to store the current GUI layout into a perspective file and to apply the previously stored layout by loading a perspective from a file. The application installer provides some default perspectives.

The perspective management feature provides a useful tool when a quick rearrangement of GUI views is needed. However, there are a few limitations to be considered.

- The storage location for user-defined perspectives is limited to the user home directory
- The deleting of user-defined perspectives is limited to the user home directory
- The deletion of default perspectives is not allowed
- The reuse of file names already occupied by some default perspectives is not allowed

If any of the above rules are violated, the application will display an error message.

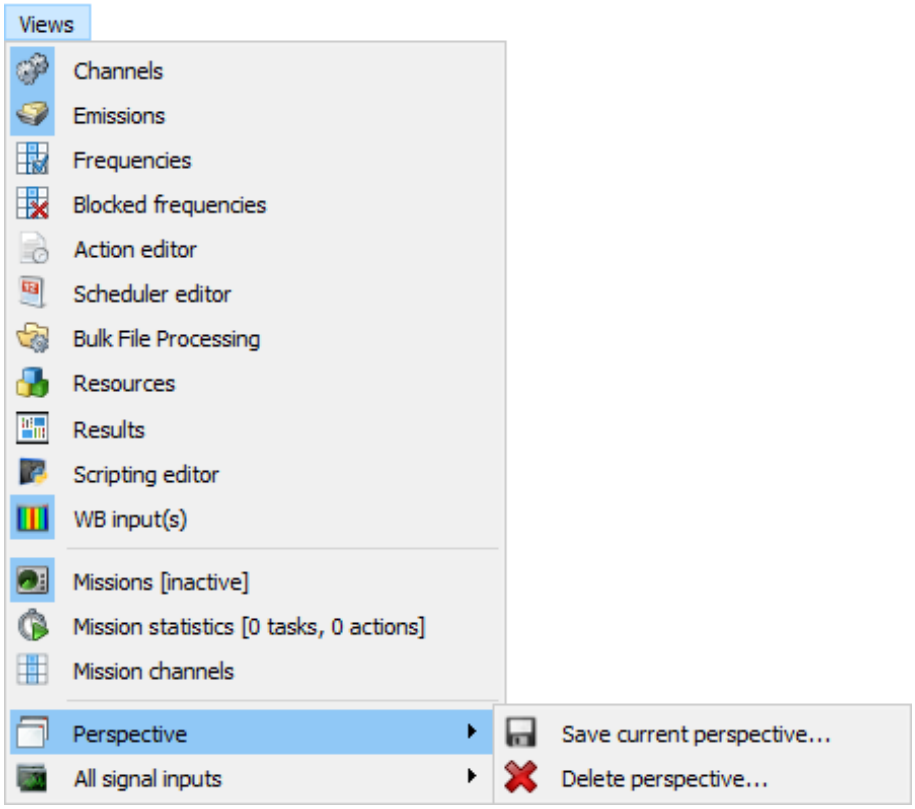


Figure 33.: Views Menu Entry

The application saves the GUI layout on exit and restores the GUI to the stored layout on start.

4.6.1. Save a New Perspective

To save the current GUI layout, click <**Views**><**Perspective**><**Save current perspective...**> menu option as displayed in Figure 33. Specify the file name in the opening dialog and click <**Save**>. The application places the perspective data into the specified file. After saving, them perspective is enabled for selection by its file name (without extension) as outlined in chapter Load Perspective.

4.6.2. Load Perspective

To load a perspective, click <**Perspective**> located on the main toolbar and select the perspective by name from the dropdown list.

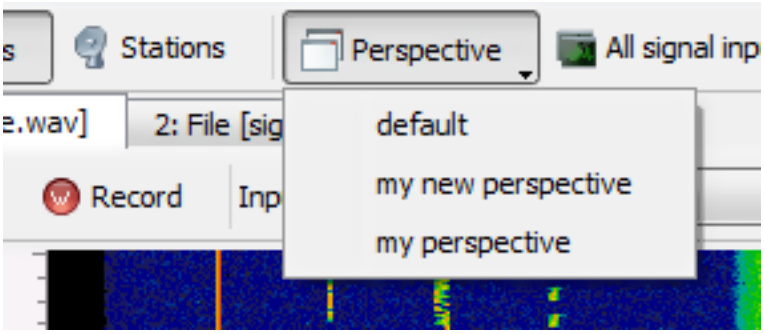


Figure 34.: GUI Perspectives Selection in Main Toolbar

4.6.3. Delete Perspective

To delete a perspective, click <**Views**><**Perspective**> <**Delete perspective...**> menu option as displayed in Figure 33. Specify the file name in the opening dialog and click <**Open**>. To confirm deleting the file holding the perspective data, click <**Yes**>.

Important: Restoring a deleted perspective is not possible!

4.7. Wideband Signal Input

The central part of the GUI is reserved for selection, display and control of the wideband signal input. In the default configuration, only one signal input can be processed, but there is also an option to use Multiple Wideband Signal Inputs simultaneously.

4.7.1. Input Selection

To view all defined receivers and streaming sources, click <**Input**>. At the top of the menu are the receivers, followed by the streaming sources. At the bottom of the list are "File" and "None" options. The signal source can be selected at any time.

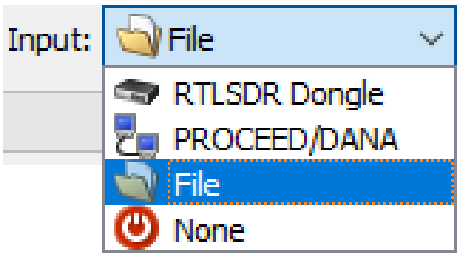


Figure 35.: Input Selection

4.7.1.1. File Input

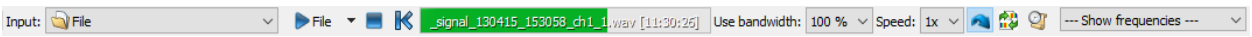


Figure 36.: Functions for Files as Signal Source

If a file is selected as the signal source, the toolbar provides the following options:

- Starting and stopping of the file playback
- Jumping to the start of the file
- Selection of the used bandwidth
- Control of the playback speed
- Setting of the center frequency of the signal

To open the dialog to select input files, click <**File**>.

Note: The max sampling rate of WAV files is set to 3 MHz by default. This adjustment can be increased with custom configurations.

Note: The performance of the executing computer has to be high enough to play back the signal file at least at real time speed otherwise the results may be incorrect.

4.7.1.1.1. Open

In the <**File Open**> dialog that is opened when the <**File**> button is pressed, one or more *.wav-files can be selected. By clicking on the <**Open**> button of the dialog, the selected files will be automatically added to a file playlist (in alphabetic order) and the file list will be used as signal input. The name of the associated file stream input source is set to the first file in the playlist.

4.7.1.1.2. History

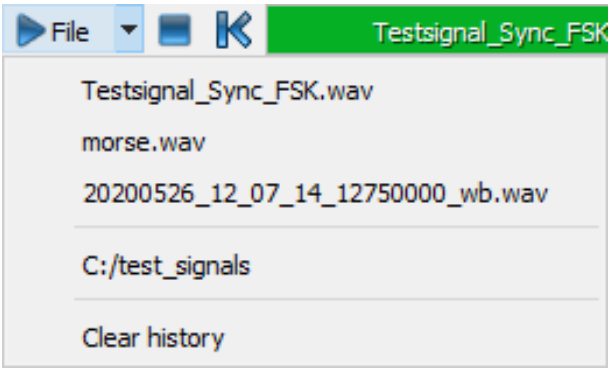


Figure 37.: History of Previously Played Files

By clicking on the downwards arrow next to the <**File**> button, the history of previous played files is shown. Select one of the entries in the history to play the corresponding file or file list again.

To delete the history, click <**Clear history**>.

4.7.1.1.3. Drag-and-Drop

For loading WAVE files using drag-and-drop, open the file explorer, select one or more WAVE files and then drag them into the playback's progress bar area. Drop the files when the format of the mouse cursor changes and the + sign appears at the lower end of the arrow cursor. Playback will start immediately and the name of the currently played file is displayed in the progress bar.

4.7.1.1.4. File Playback Toolbar

During the playback of the WAVE file, the following functions are available:

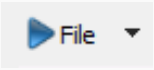
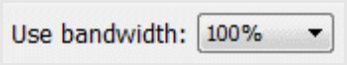
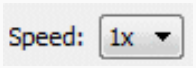
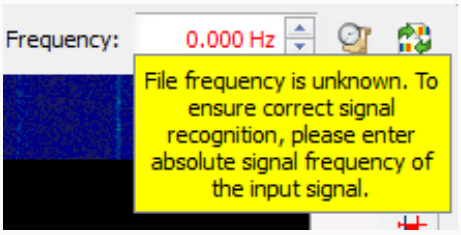
Button	Description
	Opens the <**Add signal**> file dialog. The file will be played in a loop until the <**Stop**> button is clicked.
	Stop the playback of the file
	Start the playback at the beginning of the file
	Select the effective signal bandwidth for the playback. A value of 50 % will reduce the effective bandwidth from 200 kHz to 100 kHz bandwidth. It should be used for signal sources, which do not define effective bandwidth themselves (for example, signal files without frequency/bandwidth information).
	With this combo-box, the playback speed of the file(s) can be chosen Note: The performance of the executing computer has to be sufficient to process the data with increased speed. If not, here may be problems like incomplete or incorrect production results. By default, the playback speed can be set to 1x and 2x. Playback speeds up to 5x are available with custom configurations.
	This button turns the playback loop function on/off
	This button will mirror the signal display. If there has been a carrier on the left side of the center frequency it will be moved to the right side of the center frequency. This function will display the correct spectrum and spectrogram when files have been recorded with a converter.
	On activation, the signal time is generated from the time information stored in the input file. Otherwise the signal time is generated based on the system time of the executing computer (default).
	This field is displayed only if the current file has no center frequency set. In this case the original center frequency of the file can be specified using this field. The file itself is not modified by this action. The center frequency is needed to determine a preselection for the modems matching the contained signal. If the center frequency is missing, this can lead to classification errors. It is still possible to play a file with a center frequency of 0.0 Hz.

Table 7.: Functions of the File Playback Toolbar

4.7.1.1.5. File Input Progress Bar

During file playback, a progress bar will show the name of the current file and the current position in the file. When the WAVE file is played, any position on the progress bar can be clicked. The replay will start directly at the selected position of the bar.

Additionally, the progress bar's tooltip displays the playlist content along with the time specified by the position of the mouse cursor.

4.7.2. Spectrum and Spectrogram

4.7.2.1. Overview

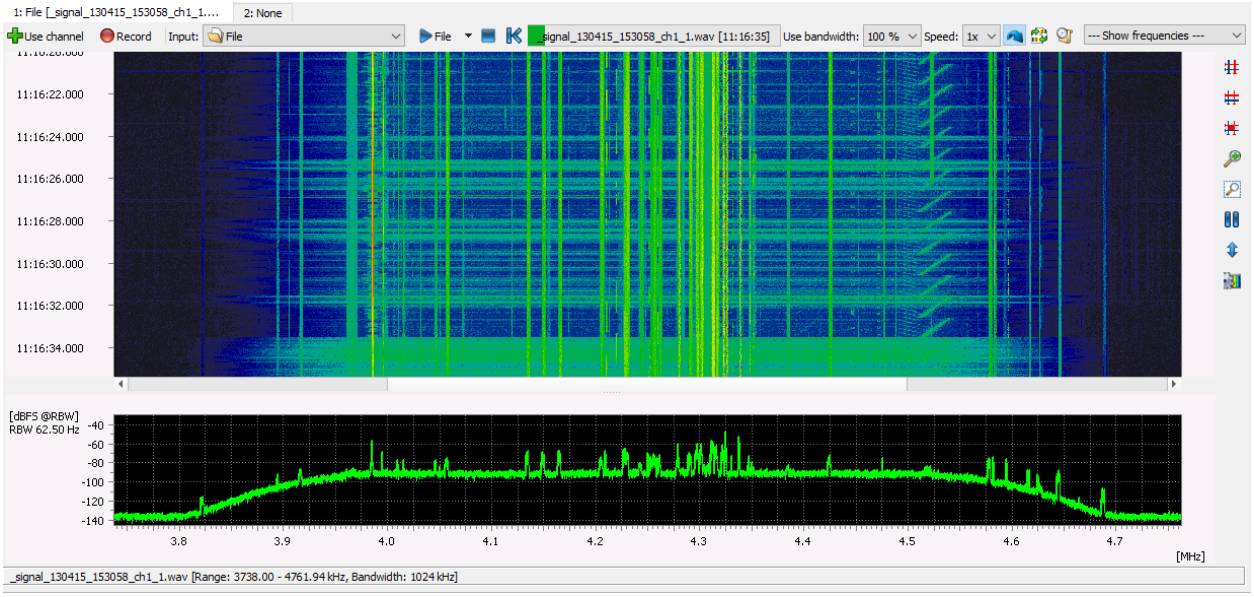


Figure 38.: Spectrum and Spectrogram

This window displays all the signals within the selected receiver bandwidth. The lower part displays the spectrum and the upper part the spectrogram.

Main functions are accessible from the menu bar at the top of the window.

Button	Description
Use channel	Adds a channel for this wideband input. The center frequency of the channel is set to the center frequency of the spectrogram of this wideband input. "Wideband" is selected as the input source in the channel. If the signal input is set to "None", no action is executed in the narrowband channel.
Add channel	<**Add channel**> is independent of the wideband input view. Clicking this button always adds a new channel in the <**Channel**> view. This is also the case if the signal input of the wideband signal is "Off" or if the Wideband Input View is not visible.
Record	Start a wideband recording of input signal. The corresponding data - such as the file name holding the recorded signal, or start and end time of recording, as well as the recording duration - is available in the ResultViewer (see chapter ResultViewer). Additionally, the duration of the running recording is present in the application title bar. Additionally to storing input signal in a file, this function will also calculate preview spectra of the input signal and store them in a file for later quick preview.

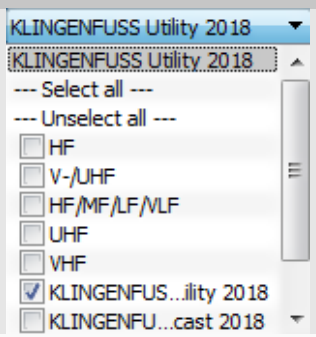
Button	Description
	Frequencies overlay selection. One or more frequency groups can be selected and displayed as overlay in the spectrogram.
	Displays the frequency cursor for spectrum and spectrogram. The number and type of cursors do depend on the configuration of spectrogram settings.
	Displays two time cursor in the spectrogram window
	Displays two amplitude cursor in the spectrum window
	When selecting the <**Zoom**> button, the mouse cursor will change to a magnifier glass. The magnifier can be moved to an interesting signal and clicked on again. The selected frequency will be the new center frequency with the half bandwidth. If the total bandwidth of the spectrum or spectrogram is 100 kHz the <**Results**> window will have a bandwidth of 50 kHz. To zoom out, either use the spectrum's context menu entry or the button in <**Spectrogram Settings**><**Cursor**> dialog. Optionally hold down <**Ctrl**> (the "+" sign in the magnifier symbol attached to the mouse pointer will change to "-") and click the left mouse key.
	To display a selected area in a new window, select a rectangular area of the spectrogram and click on the <**Magnifier**> button.
	Pauses the signal displayed in the spectrum
	Automatic analysis of the best amplitude range for the spectrum and spectrogram
	Shows the <**Settings**> window for the spectrum and spectrogram

Table 8.: Toolbar Functions

4.7.2.2. Spectrogram Settings

To display the context menu for the spectrogram settings, right-click in the spectrum or spectrogram window.

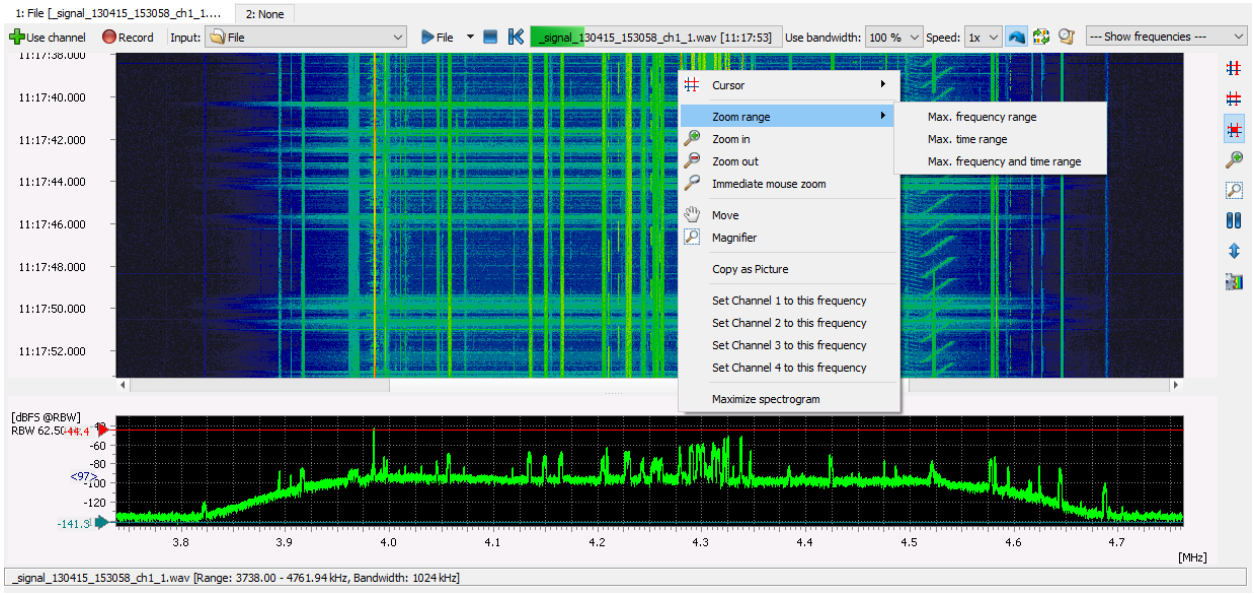


Figure 39.: Spectrogram Settings - Context Menu

The following settings are possible with the context menu:

Context Menu	Sub Menu	Description
<**Cursor**>	X-Cursor	Displays the amplitude cursors
	Y-Cursor	Displays the frequency cursors. The number of cursors is defined in the spectrogram settings.
	Z-Cursor	Displays the time cursors. The number of cursors is defined in the spectrogram settings.
	2 Cursor mode	Two cursors are displayed
	Harmonic	The defined number of cursors is activated at equidistant intervals. In this mode, the first cursor will move all other cursors. The intervals are defined by grabbing and moving the second or any following cursor.
	Mirrored	The defined number of cursors is activated at equidistant intervals on the left and the right sides of the first cursor. In this mode, the first cursor will move all other cursors. The intervals are defined by grabbing and moving the second or any following cursor with the first cursor remaining at its fixed position.
	Centered	The defined number of cursors is activated at equidistant intervals on the left and the right sides of the first cursor. In this mode, the first cursor will move all other cursors. The intervals are defined by grabbing and moving the second or any following cursor with the cursor mirrored at the first one remaining at its fixed position.

Context Menu	Sub Menu	Description
<**Zoom Range**>	Max. frequency range	The maximum frequency range will be displayed in the **Spectrum** view
	Max. time range	
	Max. frequency and time range	
<**Zoom in**>		When clicking <**Zoom in**> theselected frequency will be the new center frequency with the half bandwidth. If the total bandwidth of the spectrum or spectrogram is 100 kHz, the <**Results**> window will have a bandwidth of 50 kHz.
<**Zoom out**>		This option will reverse the <**Zoom in**> step
<**Immediate mouse zoom**>		Zoom in by clicking the mouse at the desired position. Zoom out by pressing <**Ctrl**>
<**Move**>		When selecting the <**Move**> menu item, the spectrum can be dragged to the left or right side
<**Magnifier**>		After selecting a rectangle area of the spectrogram a new window will be opened displaying the selected area
<**Copy as picture**>		Creates a shortcut of the current spectrogram content. The shortcut will be copied to the clipboard of the operating system and can be used in further applications.
<**Set channel 1 to this frequency**>		When selecting this menu item, channel 1 will be displayed. The frequency under the mouse cursor will be the center frequency of the channel window.
<**Set channel 2 to this frequency**>		When selecting this menu item, channel 2 will be displayed. The frequency under the mouse cursor will be the center frequency of the channel window.
<**Set channel 3 to this frequency**>		When selecting this menu item, channel 3 will be displayed. The frequency under the mouse cursor will be the center frequency of the channel window.
<**Set channel 4 to this frequency**>		When selecting this menu item, channel 4 will be displayed. The frequency under the mouse cursor will be the center frequency of the channel window.
Maximize spectrogram		This option increases the size of the spectrogram display by removing all toolbars, and the time-axis and spectrum display.

Table 9.: Context Menu Spectrogram

The spectrogram can also be manipulated using the mouse wheel:

Parameter	Description
Mouse wheel	If the mouse is on a spectrum, moving the mouse wheel forward zooms in on the spectrum. Moving the mouse wheel backwards zooms out the spectrogram.
Mouse wheel + <**Shift**>	If the spectrum has a horizontal scroll bar, pressing the <**Shift**> key and moving the mouse wheel forward will shift the spectrum to the right. <**Shift**> and mouse wheel downward will shift the spectrum to the left.
Mouse wheel + <**Ctrl**>	If the spectrum has a vertical scroll bar, pressing the <**Ctrl**> key and moving the mouse wheel forward will shift the spectrum upwards. <**Ctrl**> and mouse wheel down shift the spectrum down.

Table 10.: Spektrogram Settings - Mouse Wheel

4.7.2.2.1. Spectrogram Settings Dialog

Item	Description
<**Pause**>	Click <**Pause**> to stop the display (not the signal processing). A change of parameters is possible for a more detailed analysis of the current signal.
<**Autorange**>	Automatic setting of the displayed range to view the total amplitude
<**Peak hold**>	If activated, the highest and average values are determined and displayed as a second curve in red

Table 11.: Spectrogram Settings - Common Controls

4.7.2.2.2. Spectrogram Settings - Parameters

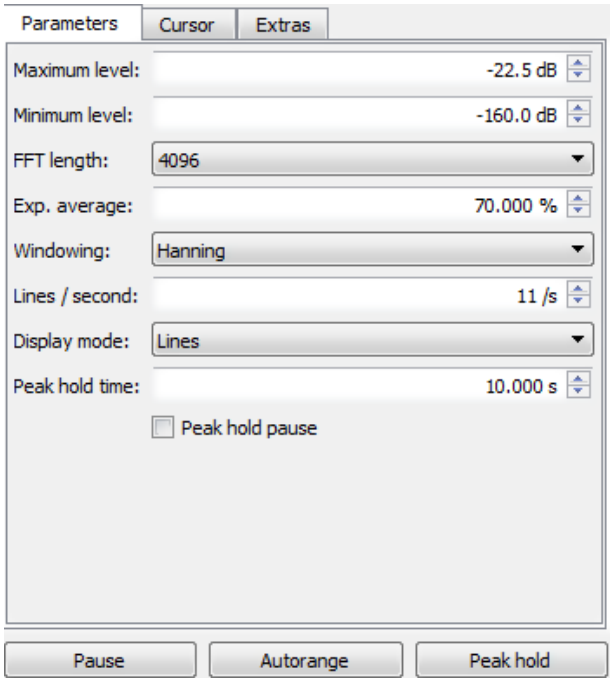


Figure 40.: Spectrogram Settings - Parameters

In this window, the parameters for the spectrogram can be set up.

Parameter	Description
<**Maximum level**>	Defines the maximum level of the display
<**Minimum level**>	Defines the minimum level of the display
<**FFT length**>	Number of frequency values in which the signal is displayed. To get a higher resolution of the displayed frequency range, the FFT length should be increased.
<**Exp. average**>	The spectrum is displayed in average of several spectrums. The result of a change of the spectrum will be a total view of the spectrum. 0 %: No average <80 %: Low average 80 % - 99 %: High average 100 %: No updating of the spectrum
<**Windowing**>	The FFT algorithm is used for the calculation of the spectrum. This algorithm indicates inaccuracies in the amplitude (attenuation) as well as in the bandwidth (expansion) of a signal due to the finite signal probe. These inaccuracies can be reduced by using different windows.
<**Lines / second**>	Number of spectrums that can be calculated and displayed within one second. This parameter sets the time resolution for the spectrogram, which is directly related to the scroll speed of the display.
<**Display mode**>	Line: the spectrum is displayed as a closed curve Beam: the individual values are displayed as bars
<**Peak hold time**>	When the time adjusted has elapsed, the peak hold (the red curve in the spectrum) will be reset to the current values. 0 means no reset.
<**Peak hold pause**>	This check box is used to freeze the continuous display after a period specified in the <**Peak hold time**> spin box (the <**Pause**> button is clicked and locked). It can only be selected if the <**Peak hold pause**> button has been clicked. This function will not stop the signal flow between the signal processing modules. To reactivate the continuous update of the display, click <**Pause**> again (toggle switch).

Table 12.: Spectrogram Settings - Parameters

4.7.2.2.3. Spectrogram Settings - Cursor

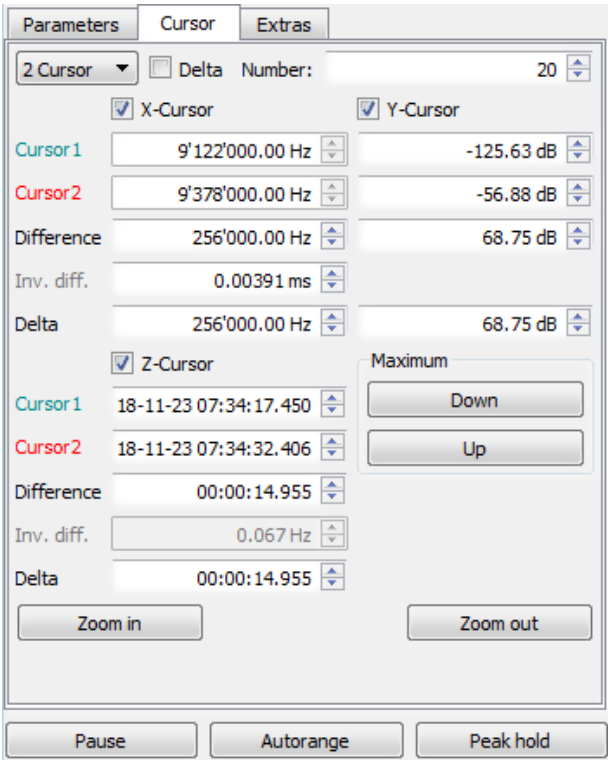


Figure 41.: Spectrogram Settings - Cursor

In this window, the cursor functions can be set up.

Cursor		Description
<**Cursor Mode**>	2 Cursor mode	For measuring tasks, two cursor are displayed at the same time.
	Harmonic	The defined number of cursor is activated at equidistant intervals. In this mode, the first cursor will move all other cursor. The intervals are defined by grabbing and moving the second or any following cursor.
	Mirrored	The defined number of cursor is activated at equidistant intervals on the left and the right sides of the first cursor. In this mode, the first cursor will move all other cursor. The intervals are defined by grabbing and moving the second or any following cursor with the first cursor remaining at its fixed position.
	Centered	The defined number of cursor is activated at equidistant intervals on the left and the right sides of the first cursor. In this mode, the first cursor will move all other cursor. The intervals are defined by grabbing and moving the second or any following cursor with the cursor mirrored at the first one remaining at its fixed position.

Cursor		Description
<**Delta**>		Affects the position of cursor. When activated, the cursor are placed at equidistant intervals between the leftmost and the rightmost cursor. Otherwise the cursor are placed either on the right side of the first cursor (in the "Harmonic" mode) or on both sides of the first cursor (in the "Mirrored" and "Centered" modes).
<**Number**>		With this spin box, the number of cursor is selected to be displayed in "Harmonic" or "Mirror" mode
<**X-Cursor**>		The cursor are activated/deactivated in X-direction. They are used to measure frequencies in Hz.
	Cursor1	Frequency for cursor 1
	Cursor2	Frequency for cursor 2
	Diff. Cur. 1/2	Frequency distance between cursor 1 and cursor 2
	Inv. diff.	Inverted difference is a function for direct time readout according to the formula $\frac{1}{Difference}$
	Delta	Frequency distance between the first and last cursor in 2 cursor mode, harmonic or mirror mode.
<**Y-Cursor**>		The cursor are activated/deactivated in Y-direction. They are used to measure the level of signals in db.
	Cursor1	Frequency for cursor 1
	Cursor2	Frequency for cursor 2
	Diff. Cur. 1/2	Frequency distance between cursor 1 and cursor 2
	Delta	Frequency distance between the first and last cursor in 2 cursor mode: "Harmonic" or "Mirror" mode
<**Z-Cursor**>		The cursor are activated/deactivated in Z-direction. They are used to measure values of time.
	Cursor1	Time of cursor 1
	Cursor2	Time of cursor 2
	Diff. Cur. 1/2	Time difference between cursor 1 and 2
	Inv. diff.	Inverted difference is a function for direct frequency readout according to the formula $\frac{1}{Difference}$
	Delta	Time distance between the first and last cursor in 2-cursor mode: "Harmonic" or "Mirror" mode
<**Maximum**>	<**Left**>	Moves the visible cursor down the frequency range
	<**Right**>	Moves the visible cursor up the frequency range
<**Zoom in**>		With enabled cursor, the <**Zoom in**> button allows the user to graphically zoom into the area delimited by the cursor. With disabled cursor, the zoom enlarges the area by a factor defined by the relative factor in the spectrogram settings of the total bandwidth around the center frequency. Additionally, a rectangle can be drawn in the display window and this section can be zoomed into.

Cursor		Description
<**Zoom out**>		Each time the <**Zoom out**> button is activated, the Zoom in function is reversed

Table 13.: Spectrogram Settings - Cursor

4.7.2.2.4. Spectrogram Settings - Extras

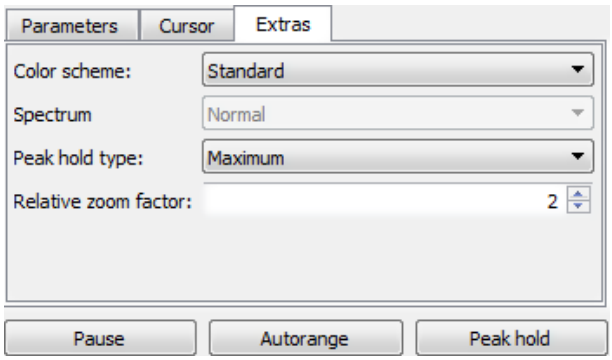


Figure 42.: Spectrogram Settings - Extras

In this window, different display types are selectable and the peak hold factor can be adjusted.

Item		Description
<**Color scheme**>	Inverse	Activates the inverse color display
	Standard	Activates the standard color display
	Monochrome	Activates the monochrome color display
<**Spectrum**>	Normal	exponential averaged spectrum
	At Cursor 1	the spectrum exactly at the position of Cursor 1
	Average value Cur.1/2	the averaged spectrum between the two cursor
<**Peak hold type**>	Maximum	Aggregates the maximum values during aggregation time
	Minimum	Aggregates the minimum values during aggregation time
	Average	Aggregates the average values during aggregation time
<**Relative zoom factor**>		The relative factor is used for the zoom process to determine the zoom factor

Table 14.: Spectrogram Settings - Extras

4.7.2.3. Magnifier

After selecting a rectangle area of the spectrogram with this menu item, a new window will be opened displaying the selected area.

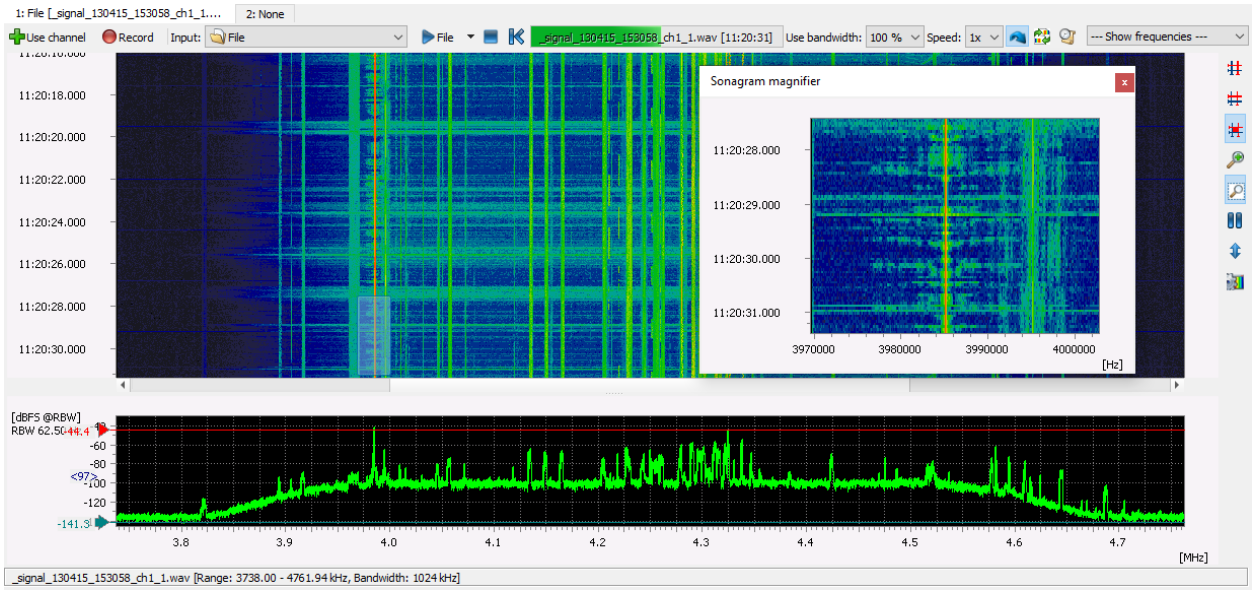


Figure 43.: Spectrogram - Magnifier

4.7.3. Multiple Wideband Signal Inputs

go2MONITOR can use Multiple Wideband Signal Inputs simultaneously. The maximal number is limited only by the license. The GUI provides a separate WB input view for the display and management of each input signal. Various functions for simultaneous control of all signal inputs are available (for details, see chapter Functions Applicable to All Signal Inputs).

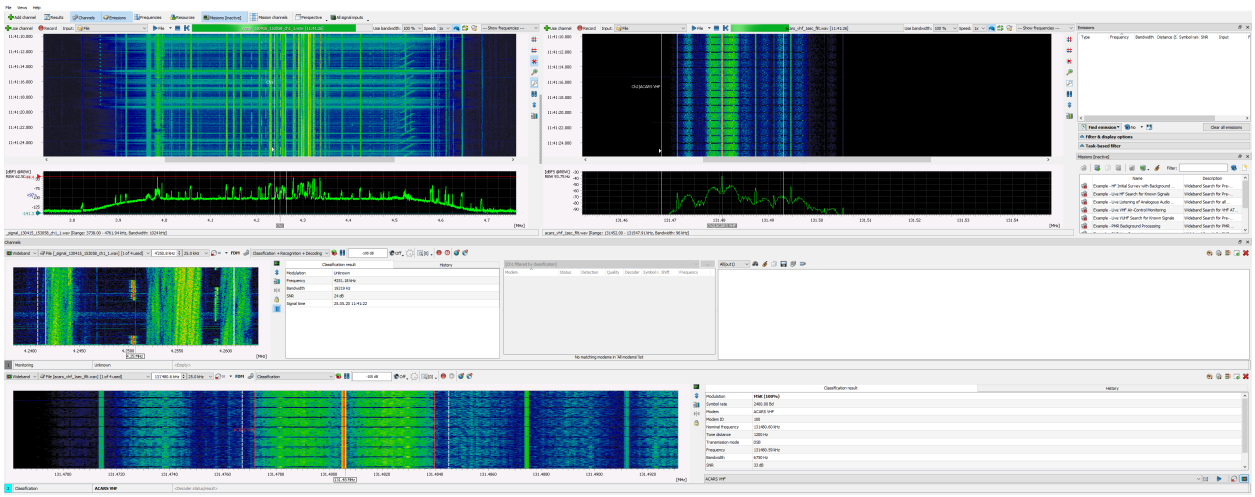


Figure 44.: Main Window Showing two Wideband Signals

Below the spectrogram of every WB input view is a status bar with the name of the signal source along with some signal-related parameters.

4.7.3.1. Signal Input Components

Each wideband signal input allocates and uses separate instances of system components (i.e. BCU and SignalServer) for processing the wideband signal. This enables the simultaneous use of all system functions for all wideband signal inputs in parallel.

Every signal input requires separate BCU and SignalServer components. Additionally, an optional Wideband-Recording component can be allocated if available.

The application automatically detects compatible components for a composition into a signal input and executes the set up procedure for their integration. On creation, the signal input is deactivated by default, requiring the user to explicitly activate it through input selection as described in chapter Input Selection.

4.7.3.1.1. System View on Signal Input Components

Each signal input with its components is represented by a "WB-Components" entry in the <**Resource**> view (for details, see chapter Resources). As shown in Figure 45, this entry also displays the unique system identifiers of the assigned components in an active state.

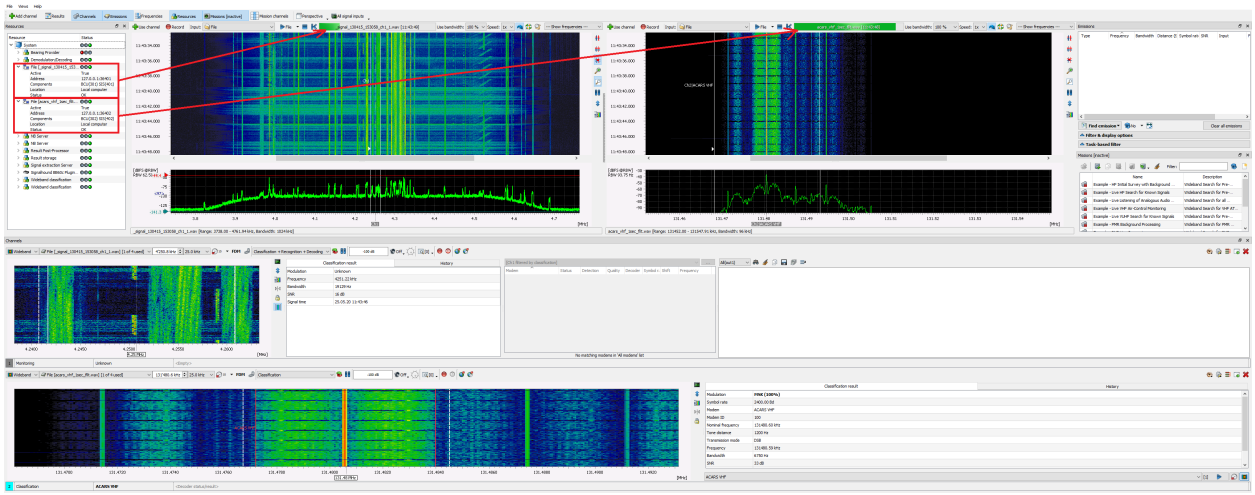


Figure 45.: Input Choice with Associated Signal Inputs

4.7.3.2. Receiver Input Signal

The wideband receiver signal is exclusive to a specific WB input view. An already selected receiver input signal is therefore not available for another WB input view.

4.7.3.3. Stream/File Signal Input

Unlike the receiver input signal, the multiple selection of a stream signal input is possible for several WB input views at the same time, assuming the required signal input components are available. This also applies to the file input described in chapter File Input.

4.7.3.4. Wideband Signal Classification

The snapshot classifier can be started either for a single signal input or for all available signal inputs at once by clicking on the <**Find emissions**> button (for details, see chapter Classification of Modulation). When classifying all input signals, the reported classification results of every BCU are aggregated into the classification results table.

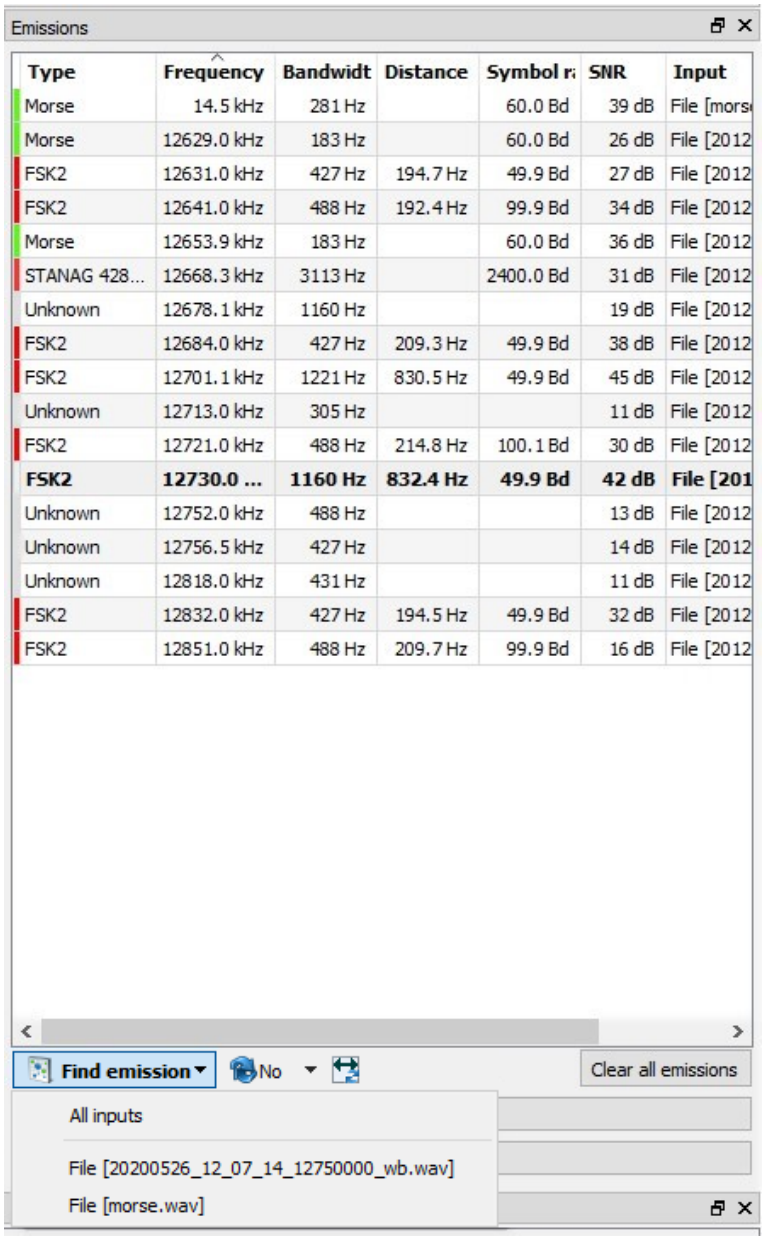


Figure 46.: Select Wideband Signal Input for Classification

The <**Filter & display options**> dialog offers the "Show emissions from" option for filtering the classification results on a specific signal input (see Figure 47).

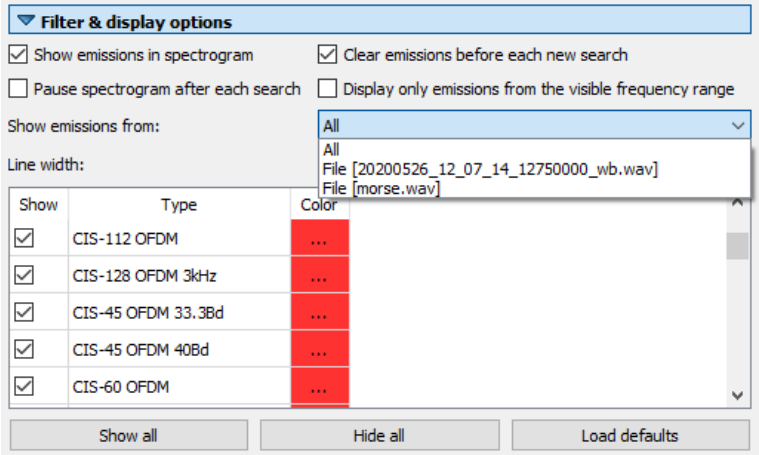


Figure 47.: Classifier Option for Multiple Signal Inputs

4.7.3.5. Narrowband Channels

The available number of narrowband channels can be shared among all wideband inputs. After creating a narrowband channel from one wideband input (by using double-click or using the spectrogram context menu), a created channel will be assigned to that source signal input. The name of the source signal input will be visible in the combo-box in the narrowband channel UI.

To change a wideband input a channel is assigned to, simply select its name in the signal input combo-box in the <**Channels**> view. The tuned frequency will be kept until the user explicitly changes it, as described in chapter Channels.

The flexibility of channel assignment enables an optimal usage of system resources especially when processing a variety of signals in a complex scenario. For example, a channel processing a Signal Of Interest could be shifted from a wideband receiver to a narrowband handoff receiver in order to free DDC channel resources.

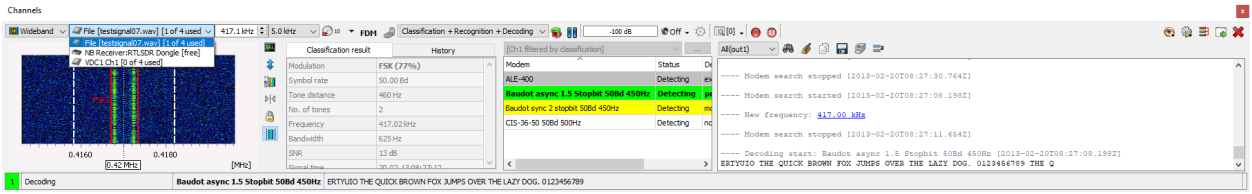


Figure 48.: Signal Input Choice Change on a Channel

4.7.3.6. Using Multiple Signal Inputs with Automatic Wideband Monitoring

When processing multiple signal inputs with Automatic Wideband Monitoring, all active signal inputs are automatically used for action triggering and processing. The specific frequencies of the tasks are automatically matched with all active signal inputs. Therefore, Automatic Wideband Monitoring usage is basically the same as with single signal input. Refer to chapter Automatic Wideband Monitoring for further information on this mode.

4.7.3.7. Functions Applicable to All Signal Inputs

For convenience, the application provides the ability to apply certain activities to all available signal inputs at once.

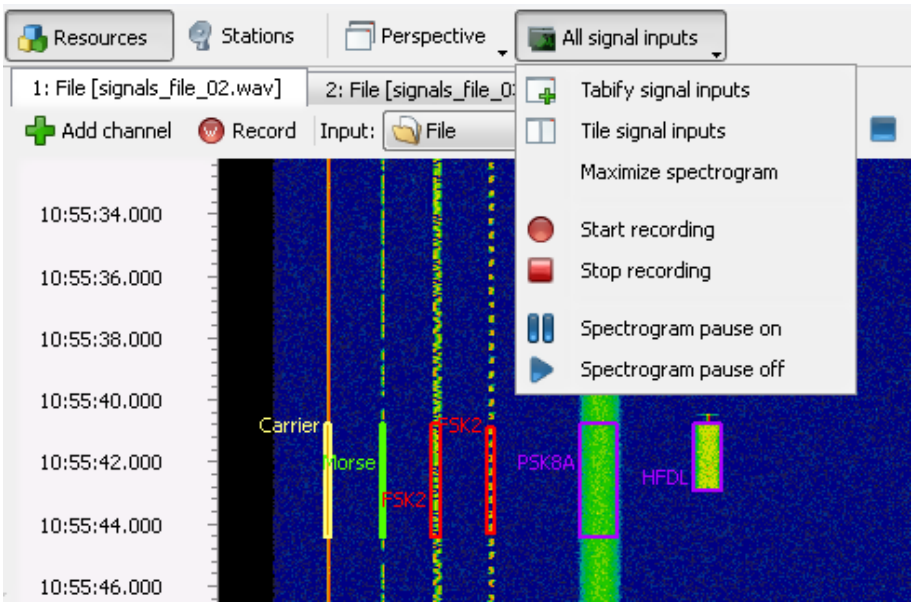


Figure 49.: All Signal Inputs on Main Toolbar

4.7.3.7.1. Layout Selection

<**Tabify signal inputs**> and <**Tile signal inputs**> arrange the single WB input views either in tabbed or tiled presentation mode. When switching to a tiled layout the order of a tabbed layout is preserved. When in tiled layout, clicking <**Tile signal inputs**> again will distribute the available space equally among available signal inputs.

4.7.3.7.2. Maximize Spectrogram

This option increases the size of the spectrogram display in each WB-Input by removing all toolbars, and the time-axis and spectrum display. It is useful for displaying neighboring channels next to each other by using tiled layout with as small a gap between them as possible.

4.7.3.7.3. Wideband Signal Recording

<**Start recording**> and <**Stop recording**>: Select the appropriate entry to either start or stop the recording of the wideband signal input. The action affects only WB input views where a signal input is selected.

Note: Wideband recordings are stored in 16 bit resolution. This can lead to a signal information loss in the recording, especially if the signal is weak.

4.7.3.7.4. Wideband Spectrogram Signal

<**Spectrogram pause on**> and <**Spectrogram pause off**>: Pause or continue the spectrograms in all WB inputs.

4.8. Receiver Control

The control of receivers takes place using the receiver control function. Each configured receiver has its own control window, which is opened via the <**Views**> menu item.

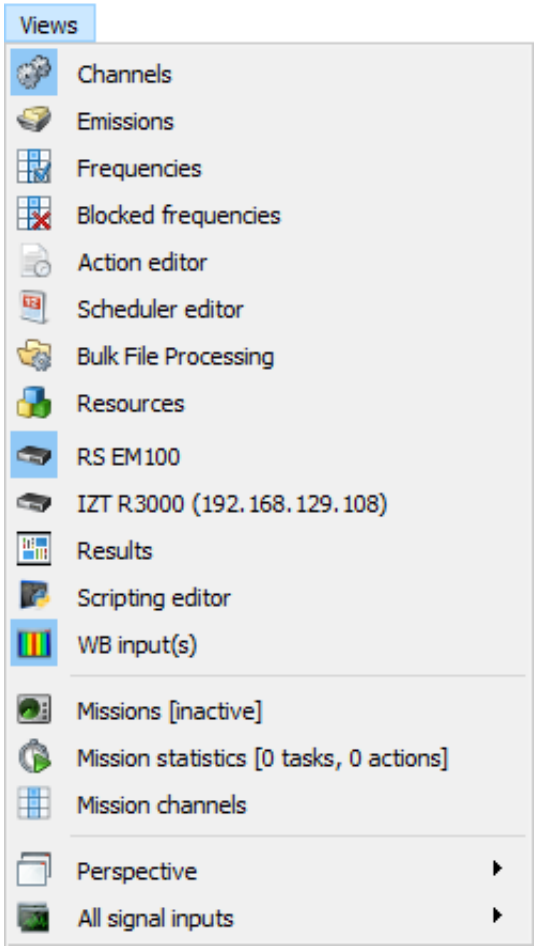


Figure 50.: Menu with Receiver Controls

Figure 50 shows the <**Views**> menu with two configured receivers, a Rohde & Schwarz EM100 receiver and an IZT R3000 receiver.

If a receiver view entry is selected, the visibility of the docking window of the receiver control will be changed.

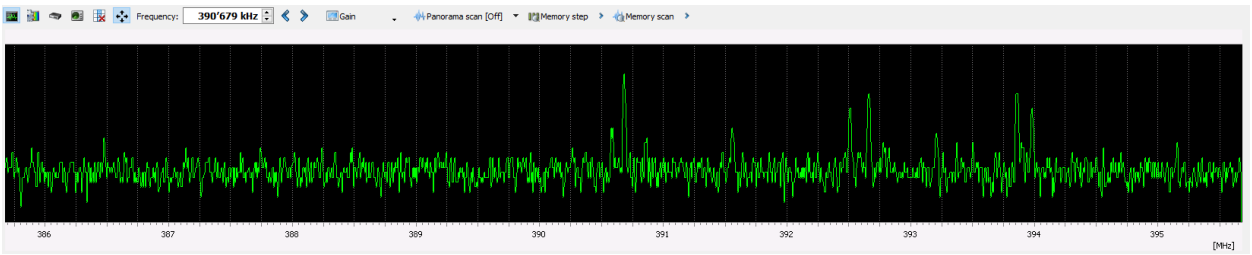


Figure 51.: Receiver Control with Spectrum Overview

The receiver control for an IZT receiver is shown in Figure 51. Depending on the receiver type, different settings are available on the toolbar of the receiver control.

Receiver-specific settings are:

- Spectrogram settings
- Turning different markers on/off
- Frequency control
- Gain/Attenuation
- Panorama scan control
- Memory step/scan functions

Receiver-specific settings are automatically switched on and off depending on their availability, i.e., if a receiver does not have scan functionality, or scan is not supported, the scan control is automatically hidden or disabled.

4.8.1. Spectrum Overview

The Spectrum overview shows spectra provided by the receiver in a panorama display. Since not all receivers provide the necessary data, the Spectrum overview is not available for all receivers. See the product description to find out for which receivers a Spectrum overview is available.

The bandwidth of the Spectrum overview is sometimes specified by the respective receivers and cannot be changed by the user. In other cases, the spectrum bandwidth is the same as the current effective bandwidth of the IQ signal output of the receiver. Typical bandwidths are:

- IZT R3000: 20 MHz
- Winradio G39: 16 MHz
- R&S®EM100: 10 MHz

4.8.1.1. Toolbar

If the Spectrum overview is available, the following buttons for configuring the Spectrum overview are available:

Button	Description
	Switch between spectrogram and spectrum
	Opens the spectrogram and spectrum settings window (for details, see chapter Spectrogram Settings - Parameters)
	Turn marker display for active wideband signal inputs (channels of this or other receivers) within the Spectrum overview on or off (for details, see chapter Markers for Receiver Channels or other Wideband Signal Inputs)
	Turn marker display for signal activity within the Spectrum overview on or off (for details, see chapter Markers for Spectrum Activity)
	Turn marker display for search and blocked frequency markers within the Spectrum overview on or off (for details, see chapter Markers for Search/Blocked Frequencies)
	Maximizes the Spectrum overview. If the maximization is deactivated, levels or time information are displayed.

Table 15.: Buttons for the Administration of Markers

Right-click on the Spectrum overview to open the context menu shown in the following figure. Various

actions can be started from the menu.

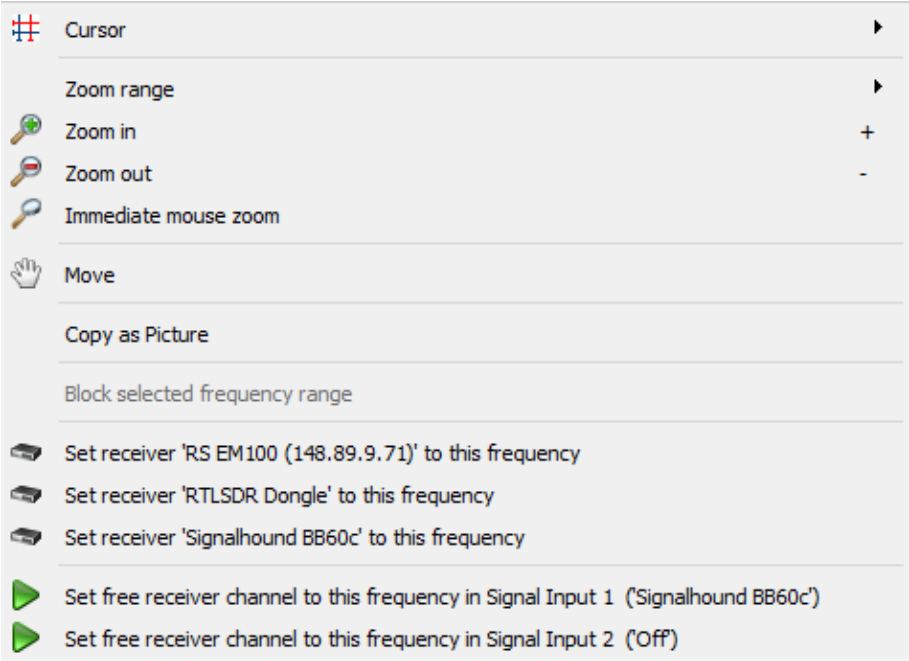


Figure 52.: Context Menu for the Spectrogram Overview

The first four sections of the context menu correspond to the spectrogram settings from chapter Spectrogram Settings and chapter Magnifier. The other entries in the context menu are divided into two sections:

Icon	Context menu entry	Description
	<**Block selected frequency range**>	Add frequency range currently selected in the spectrum or spectrogram to the global list of blocked frequency ranges.
	<**Set receiver ‚X' to this frequency**>	By selecting this menu entry, the selected receiver is set to the frequency of the cursor position
	<**Set free receiver channel to this frequency in Signal Input Y**>	This menu entry sets a free receiver channel to the frequency of the cursor position

Table 16.: Spectrogram Context Menu Actions

The entries in the <**Set receiver ...**> section allow the frequency of existing receivers to be set to a selected frequency. The frequency of the cursor position will be chosen as the frequency to set when calling the context menu. It is thus possible to move additional receivers to the displayed frequencies via the context menu of a receiver.

Entries in the last section allow the receiver channels to be set to the frequency of the current cursor position. The prerequisite is that the receiver supports several channels and at least one channel is currently free and thus not used in any signal input.

If several receiver channels are free, the next free receiver channel is selected. In the case of a configuration with several signal inputs, a corresponding menu entry appears for each signal input. The current selection of the signal input is appended in brackets (e.g., "IZT R3000 Channel 2" or "File"). If all receiver channels are busy, the entry for setting the frequency of a receiver channel is not visible.

Only the receiver channels of the receiver of the **current** receiver control can be set. For example, it is not possible to set a Winradio G39 channel via the receiver control of an IZT R3000 receiver. To set the G39 channels, the corresponding Winradio G39 receiver control must be opened. Only the frequency control of the entire receiver is performed across the entire representation.

4.8.1.2. Markers for Receiver Channels or other Wideband Signal Inputs

To display frequency ranges currently being processed by channels belonging to this receiver or other receivers/signal inputs,  toolbar button can be used.

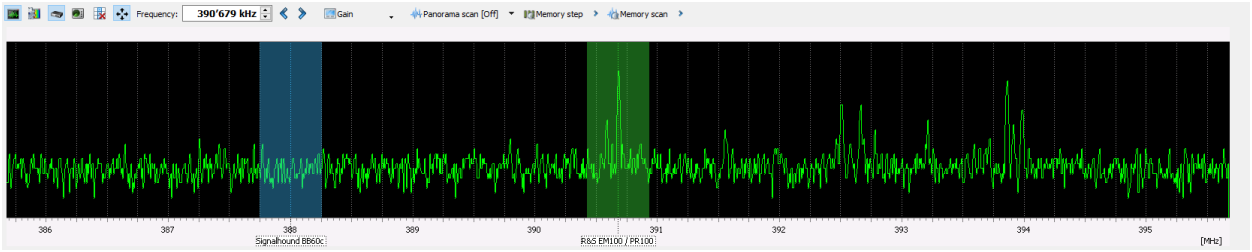


Figure 53.: Markers in the Spectrum Overview

Markers are displayed in different colors depending on the type of wideband signal source. A receiver's own channels are shown in green as in Figure 53 above.

If there is another online source, e.g. a further receiver, then its marker is displayed in blue (for example, "SignalHound BB60C" in Figure 53).

An offline source, e.g. a file input with activated date stamp, is displayed in gray color.

4.8.1.3. Markers for Spectrum Activity

To display the results of the spectrum activity detection,  toolbar button can be used. If this marker display is turned on, all active frequency ranges will be displayed as dark green markers. The spectrum activity detection is available only in scan modes "Panorama Scan" or "Memory Scan".

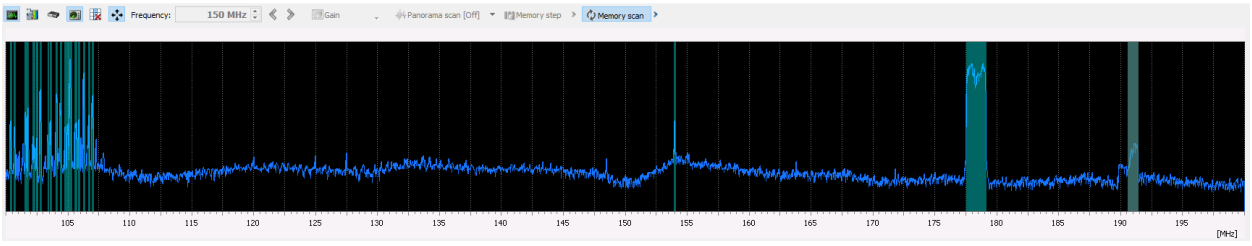


Figure 54.: Markers for Spectrum Activity

4.8.1.4. Markers for Search/Blocked Frequencies

To display currently active and inactive frequency ranges,  toolbar button can be used. Active/Blocked frequency ranges will be calculated from the frequency scenario of all currently active tasks, combined with the global list of blocked frequencies. Resulting blocked ranges are displayed by using diagonal cross brush and active ranges are normally visible.

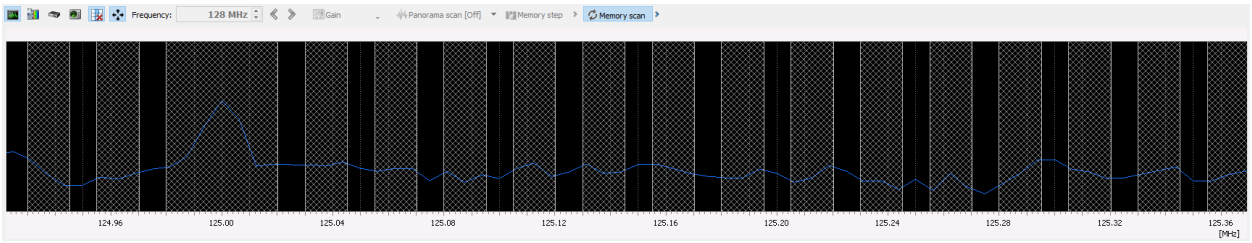


Figure 55.: Markers for Search/Blocked Frequencies

4.8.2. Parametrize Receiver Channels

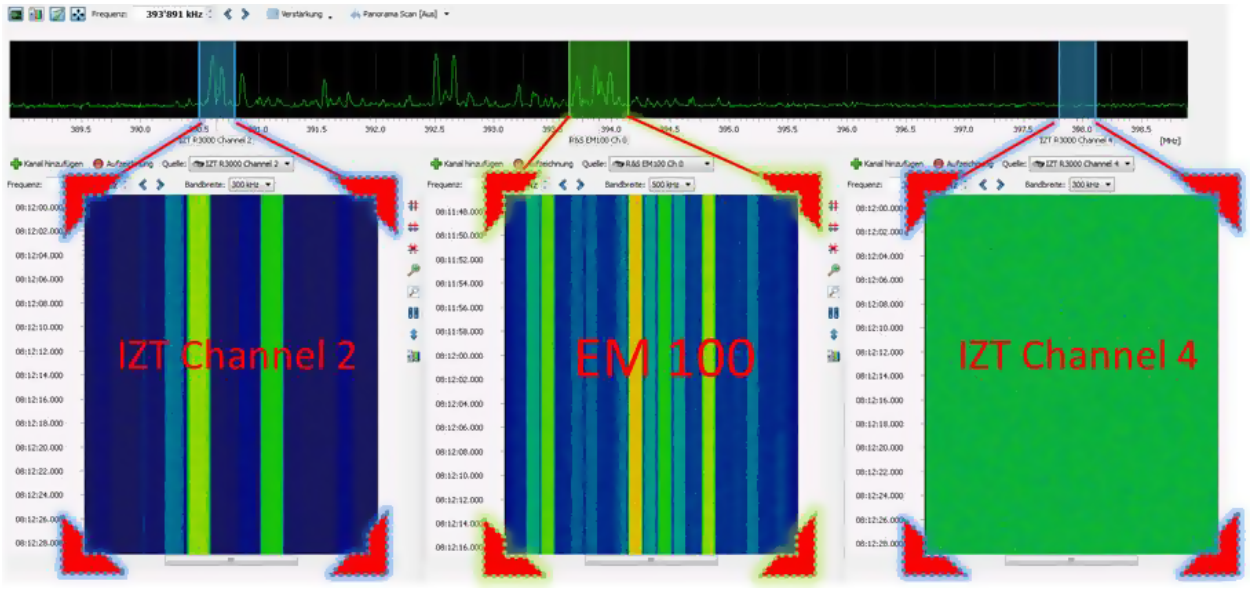


Figure 56.: Representation of Receiver Channels

Figure 56 shows the receiver control of an IZT R3xxx receiver and three signal inputs arranged as tiles. The signal inputs show the areas, which can be seen as markers in the Spectrum overview and correspond to the channels of a receiver.

A receiver channel can be controlled from the Spectrum view of the receiver control by moving the green markers using your mouse. The signal input changes according to the newly selected frequency. The frequency of a receiver channel can also be entered directly via the toolbar of the signal input. If the bandwidth of a receiver channel is changed in the signal input, the size of the marker automatically adjusts to the new bandwidth.

If a receiver has only one channel and does not have a Spectrum overview, the behavior when changing the receiver frequency is identical to changing the channel frequency from the corresponding signal input. In this case, the bandwidth and frequency of the channel correspond to the receiver bandwidth and the receiver frequency.

When selecting a receiver channel as a wideband signal input, the toolbar in the corresponding Wideband Signal Input will provide functions according to the following Figure 57.

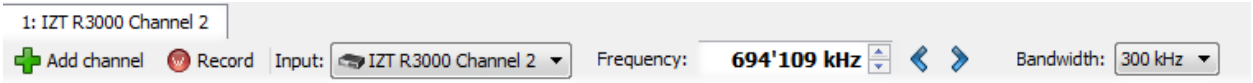


Figure 57.: Receiver Control

4.8.2.1. Setting a Center Frequency

The center frequency for a receiver channel can be entered directly as a value into the <**Frequency**> field.

If a frequency has been entered into this field, it is possible to tune the frequency in steps related to the selected bandwidth with the two arrows on the right side of the <**Frequency**> field. The Left arrow will tune the frequency to a lower value, the Right arrow to a higher value.

It is also possible to tune the frequency with the mouse wheel. For this function, the mouse cursor has to be placed on the right side of the digits. Moving the mouse wheel will also change the frequency up and down.

4.8.2.2. Setting the Receiver Channel Bandwidth

The bandwidth of the input receiver can be set via the <**Bandwidth**> dropdown list.

4.8.2.3. Setting the Receiver Gain

It is not possible to change the receiver gain individually for every receiver channel. Therefore, the receiver gain is changed for all channels with the corresponding receiver control window (see chapter Receiver Control).

4.8.2.4. Selecting a Frequency for a Channel

By double-clicking a position on the wideband signal range in the signal spectrum, any signal can be selected and will be transferred to a channel. This is described in chapter Spectrum and Spectrogram.

4.8.3. Behavior of the Frequency Control

The behavior of the receiver frequency control in the receiver control varies depending on the receiver used. This is due to different frequency control concepts of the respective receiver models. In the following paragraphs, special features of the frequency controls for selected receivers are described.

Winradio G39

The receiver frequency of a Winradio receiver can only be set to certain frequencies in a fixed 10 MHz grid. The channels of the Winradio receiver are not affected by this restriction. They can be freely parameterized ± 8 MHz within the set receiver frequency.

If the receiver frequency changes by a value > 10 MHz, the new frequency of the receiver is set. If the channels of the receiver are not visible within the new frequency limits, they are also shifted by the difference between the old and the new receiver frequency.

IZT R300

The receiver frequency of an IZT R3000 receiver can be selected freely. In contrast to a Winradio G39 receiver, the IZT receiver has the feature that any channels of the receiver, which are not in the range of the receiver frequency ± 10 MHz do not send data. In such a case, a channel can be assigned comfortably and quickly by double-clicking on the desired frequency in the Spectrum overview. The prerequisite for this is that an IZT channel is selected as the signal input within the windband input and it does not display any data.

If the channel frequencies are not adapted when the receiver frequency is changed, these channels do not display any data until the receiver is parameterized again into the range of the channel frequency.

This means that no signal data is displayed in an IZT channel, unless these rules apply:

$$F_{\text{ChannelX}} > F_{\text{Rcv}} - 10\ MHz$$

$$F_{\text{ChannelX}} < F_{\text{Rcv}} + 10\ MHz$$

Rohde & Schwarz EM100

For R&S®EM100 receivers, the channel frequency is always the same as the receiver frequency. This means that a parameterization of the channel frequency results in a parameterization of the receiver frequency (and vice versa).

4.8.4. Receiver Gain

High-level signals near the signal to be demodulated may cause intermodulation. To avoid this kind of interference, the receiver input can be attenuated. The signal gain is set via the <**Gain**> dropdown. The range of available values depends on the receiver, e.g. the value of + 20 dB means signal amplification, the value of 0 dB leaves the signal unchanged, while some negative values such as -20 dB cause signal attenuation. The gain or attenuation affects all receiver channels of the receiver.

4.8.5. Panorama Scan

Various receivers like the IZT R30xx or R&S® have a scanning mode to rapidly scan across wide frequency ranges. If the scanning mode is supported by a receiver, a selection of possible scan bandwidths will be listed when the <**Panorama scan**> dropdown arrow is clicked.

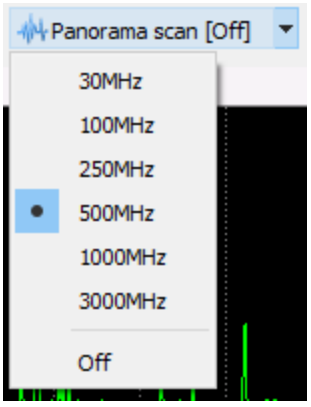


Figure 58.: Panorama Scan Bandwidth Selection

If a scanning bandwidth is selected, scan mode in the receiver will be activated. The incoming scan data will be displayed in blue within the Spectrum overview. The range to be scanned results from the set

receiver frequency ± *scan bandwidth*/2 . The illustrated scanning range in Figure 59 is thus approximately 344 MHz - 536 MHz.

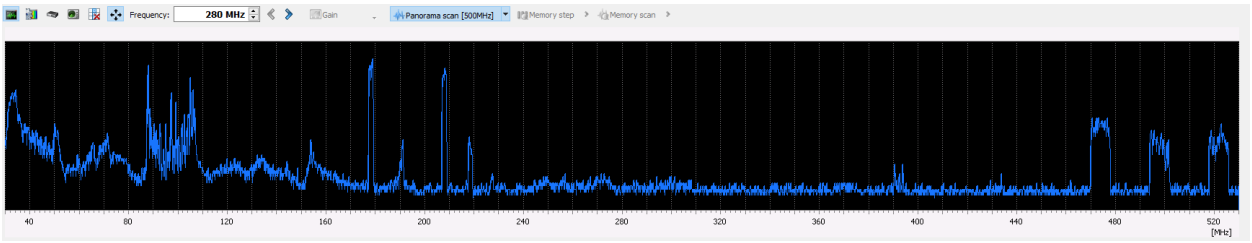


Figure 59.: Activated Panorama Scan Mode

By changing the receiver frequency, the scan range is re-parameterized, as well as when selecting a new scan bandwidth. The update rate of the Spectrum overview in scanning mode is dependent on the scan bandwidth and scan speed of the receiver. This can cause the display to be updated only about every second when very large scan bandwidths are used.

The Panorama scan mode is stopped by clicking again the <**Panorama scan**> button. The scan mode can also be stopped via the <**Set receiver ‚X' to this frequency**> context menu item.

Some receivers do not actually have a native scan function, but the option may be provided in the GUI nevertheless. In that case, the scan mode is implemented in the software by switching receiver frequency as fast as possible, collecting signal snapshots and calculating a contiguous scan spectrum. This scan simulation is normally much slower than a native scan would be. If receiver bandwidth cannot be controlled from the GUI, as for most ExtIO based receivers, scan simulation will use the current receiver bandwidth for scan simulation. This can be very slow if the receiver uses low bandwidth.

Panorama Scan is possible only in the frequency range supported by the receiver, but only for frequencies above 30 MHz. If the parametrized frequency and bandwidth would cause panorama scan to leave this range, the center frequency will be automatically adjusted so that the complete scan stays in the allowed frequency range.

4.8.6. Memory Step and Memory Scan

Both Memory-Step and Memory-Scan functions allow automated receiver control based on the frequency scenario used in the active Automatic Wideband Monitoring mission ("Memory"). These functions require a wideband receiver with controllable frequency and bandwidth and an active Automatic Wideband Monitoring mission.

By using these functions, the receiver is automatically controlled by the system to cover all frequency ranges of all currently active tasks in the best possible way. The system constantly checks, which tasks are active (based on time or geographical position), collects all search frequency ranges defined in these tasks and commands the receiver according to the selected strategy.

The possible strategies are described in the following chapters.

4.8.6.1. Memory Step

If using Memory step, the receiver is controlled to visit all required frequencies in round-robin mode. The wideband receiver stays on each frequency range for a defined period of time, performs detection, classification and other task actions, and then proceeds to the next frequency range. The last used receiver bandwidth and the parametrized dwell time will be used in this process. Figure 60 shows how this mode works:

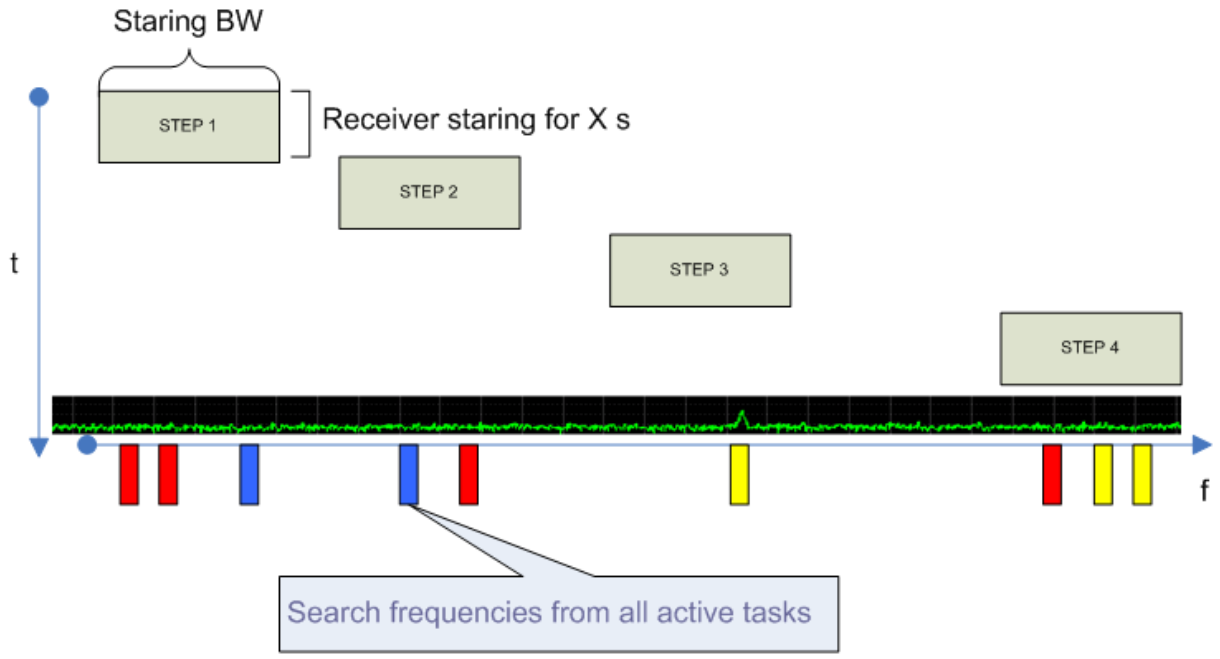


Figure 60.: Memory Step - Receiver Stays on Each Range for a Defined Dwell Time

Additionally, a "fast stepping" option can be turned on to recognize if there is any energy in a new frequency range. If not, the frequency range will be skipped and the system will switch receiver to the next frequency range. This will speed-up the stepping if there are many steps, which do not contain any energy on frequencies of interest. Figure 61 shows how this mode works:

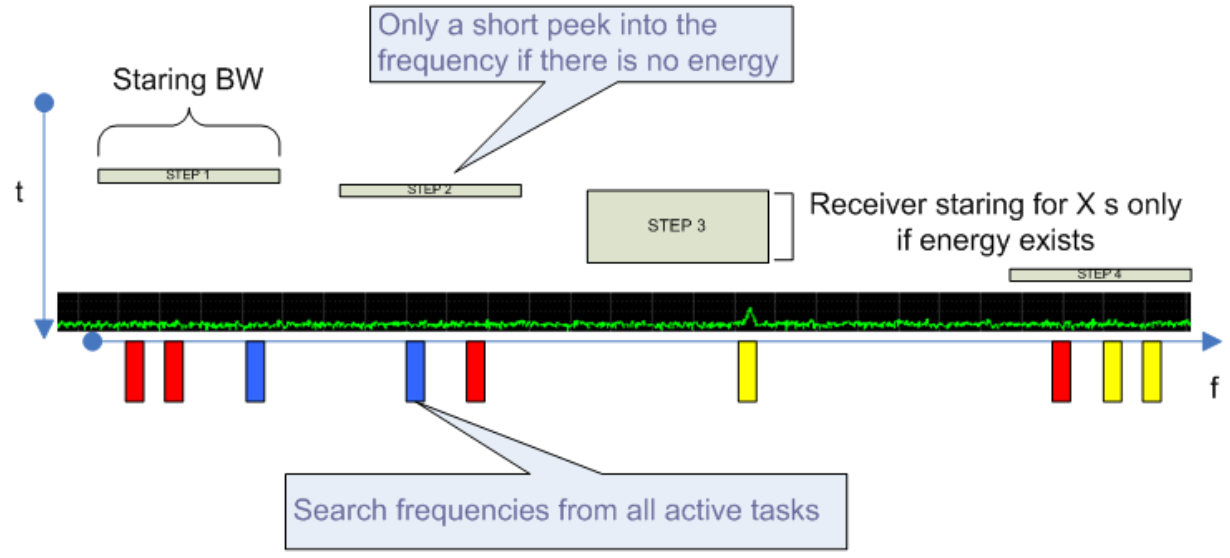


Figure 61.: Memory Step - Receiver Skips Frequency Range if no Energy Found

4.8.6.2. Memory Scan

If using Memory scan, the receiver's scan mode and staring (fixed frequency) operations are combined in order to monitor very wide frequency ranges.

As a first step, the receiver is controlled to switch to the scan mode covering all frequencies of the current scenario. The signal activity in the scan spectrum is monitored based on scan spectra provided by the re-

ceiver. If a new signal activity is detected, the receiver switches to the staring mode on detected frequency, allowing wideband classification and other system components to process the signal. All parametrized task actions like detection, classification and decoding are executed. After some processing time in staring mode, depending on the current Memory scan parameters, the receiver is commanded to switch back to the scan mode and the whole activity monitoring process starts again. Figure 62 illustrates the process:

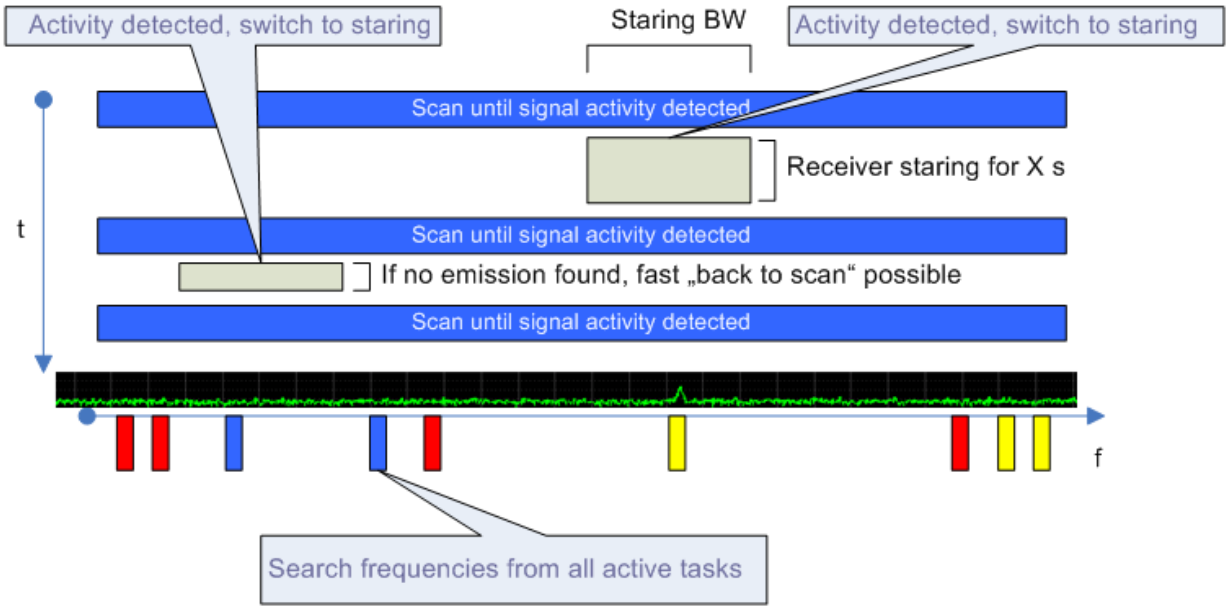


Figure 62.: Memory Scan Procedure

Note: Memory Scan is possible only in the frequency range supported by the receiver, but only for frequencies above 30 MHz.

Note: If using very short "Dwell time" for Memory step or "Back to scan" time for Memory scan , wideband classification quality may reduce compared to the continuous mode or to the longer dwell times. These short dwell times are provided only for fast overview purposes and will not perform well for some modem types (e.g. "Voice", "Morse", etc.) or for signals with lower quality.

4.8.6.3. GUI Controls for Memory Step/Scan

If all prerequisites for using Memory step/scan functions are fulfilled, an additional toolbar part will appear in the Receiver Control window next to the Panorama Scan button:

Figure 63.: Panorama Scan Toolbar

By using these two buttons, Memory step and Memory scan functions can be turned on or off. Next to each of these two buttons is an arrow button, which opens additional settings for the corresponding function.

Options for Memory step

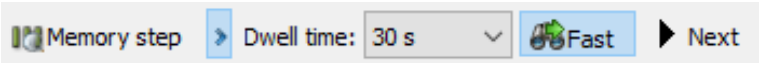


Figure 64.: Memory Step Toolbar

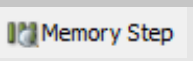
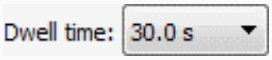
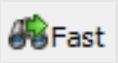
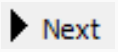
Button	Description
	Turns Memory step function on or off
	Defines how long a receiver should stay on each frequency range. Different time intervals are available, as well as an "Unlimited" value.
	If this option is on, a fast energy check will be performed for active frequencies in each new step frequency range (typically needs 500 - 700 ms). If no energy has been found, the stepping will skip immediately to the next frequency range range. If this option is turned off, the receiver will stay on each frequency for exactly the parametrized dwell time.
	By using this button, the user can leave the current frequency range and skip to the next frequency range even if the parametrized dwell time has not yet been reached

Table 17.: Memory Step - Options

Options for Memory scan

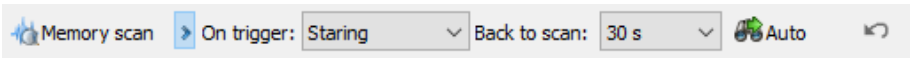
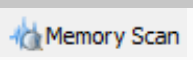
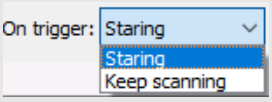
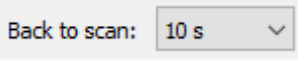


Figure 65.: Memory Scan Toolbar

Button	Description
	Turns Memory scan function on or off
	Defines which action should performed if energy has been detected during scan: • Staring: Switch receiver to staring mode on the detected frequency • Keep scanning: Keep scanning with the receiver, but inform Automatic Wideband Monitoring about the energy event. This option can be used only if narrowband receivers, which can process the emission while wideband receiver keeps scanning, are available.
	Defines how long a receiver should stay on each staring frequency after activity detection in scan mode. Different time intervals are available, as well as an "Unlimited" value.

Button	Description
	If this option is on, the system will try to detect if staring frequency range contains any Signals Of Interest and will automatically switch back to scan mode if it is not the case, even if the parametrized "Back to scan" time has not been reached. The following methods for the detection will be used: • A fast energy check will be performed for active frequencies in each new staring frequency range (typically needs 500-700ms). If no energy has been found, the receiver will switch back to scan mode immediately • If no Automatic Wideband Monitoring action has been triggered after ~ 10 s, the receiver will switch back to scan mode
	By using this button, the user can leave the staring mode and switch the receiver back to scan mode immediately

Table 18.: Memory Scan - Options

Note: Memory step/scan buttons may be disabled if the current frequency scenario or receiver capabilities do not allow the functions to be executed. For example:

- Scan frequency range is wider than the maximal scan range for the receiver
- If only HF frequencies are in the scenario, scan will not be available
- No active frequencies, all frequencies are blocked

The specific cause for disabling the function will be stated in the corresponding button tooltip.

Note: Memory step/scan and Panorama scan are mutually exclusive. If you start one of these functions, the other two will be disabled. Also, the manual receiver control will not be possible if any of these functions is active.

4.9. Channels

The channel window is for the processing of a single signal; this includes classification, recognition and decoding.

The following signal input types are available for selecting the signal of a narrowband channel:

- Wideband spectrogram
- File playback
- Receiving a signal datastream via network (streaming)

When using channels via the wideband spectrogram, free channels can be assigned with a double click. Specific or already occupied channels can be assigned by the context menu of the spectrogram (right click).

Drag-and-drop of classifier results onto channel windows is also possible.

The number of channels depends on the software configuration and license of go2MONITOR.

The channel window provides four different working modes:

- Classification
- Decoding

- Recognition + Decoding
- Classification + Recognition + Decoding

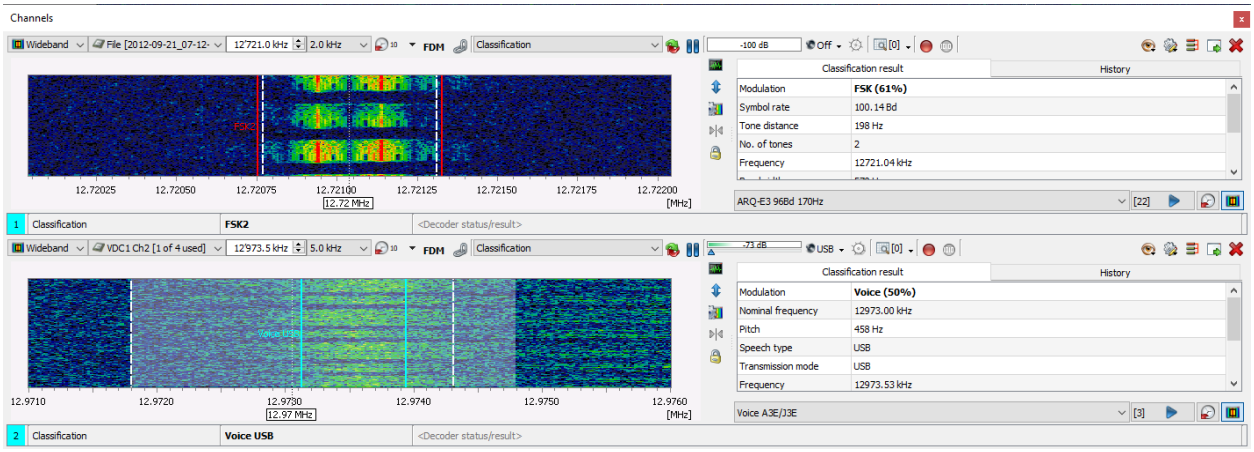


Figure 66.: Channel Window

4.9.1. File Playback in a Narrowband Channel

Files can be used as the input type for narrowband channels.

When a file is selected as the input source, the toolbar provides functions to start and stop file playback, jump to the beginning of the file, select the bandwidth and select the playback speed.

4.9.2. Streaming

With the streaming function of a narrowband channel, any external stream can be processed, provided that it corresponds to a format that is supported by go2MONITOR.

4.9.2.1. Establishing Connections

In order to connect to a stream, the connection type must first be selected (see "1" in Figure 67). There are three different connection types:

- TCP stream
  Direct TCP connection between the data source and the processing components. An IP address and a port must be specified.
- TCP Stream with GUI Proxy
  TCP connection between the data source and the user interface. This distributes the data to the processing components. An IP address and a port must be specified.
- UDP stream
  The processing components register at a multicast signal source. A multicast IP address, the address of the receiving network interface and a port have to be specified.

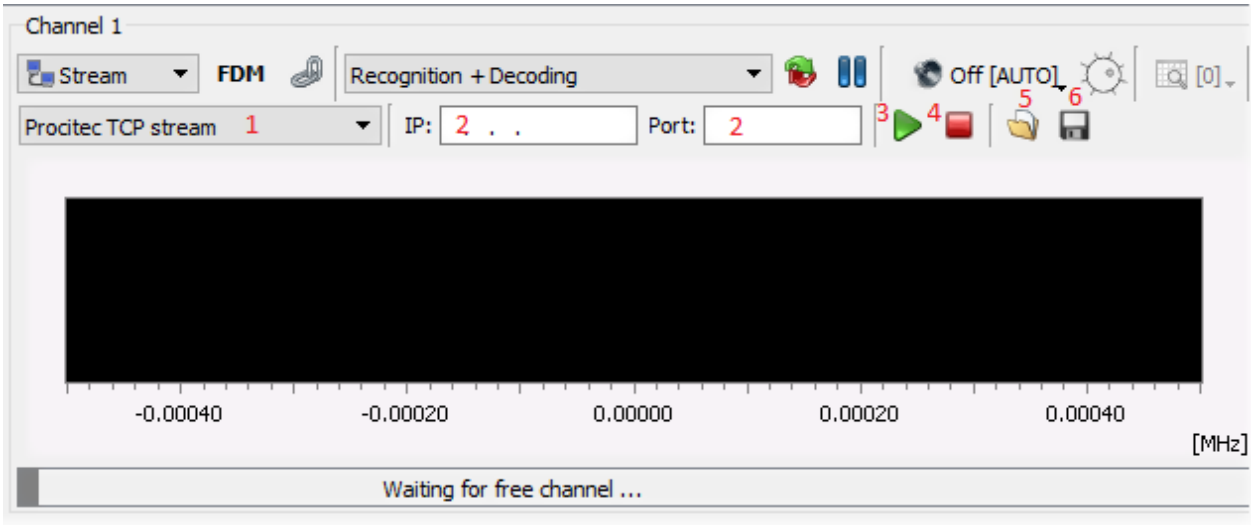


Figure 67.: Single Channel in Stream Mode

Depending on the type of stream (see "1" in Figure 67) selected, different connection data will be needed. Accordingly, input fields are displayed (see "2" in Figure 67).

After entering the connection data, the connection can be established by clicking on the <**Play**> button (see "3" in Figure 67).

When a connection to a stream is active, no changes can be made to the connection data or the type of stream. To deactivate the connection, click <**Stop**> (see "4" in Figure 67).

If the connection to a particular stream is needed more often, previously entered connection data can be saved by clicking on the <**Save**> button (see "5" in Figure 67). By clicking on the <**Load**> button (see "6" in Figure 67), previously saved connection data can be loaded into the input fields.

4.9.3. Delays

go2MONITOR provides the option to use a delay buffer between the signal input and the narrowband signal used for the channel. This delay in seconds can be set via the  dropdown list. Clicking on the left part of the icon enables or disables the delay.

Important: If the delay is changed during a narrowband recording, the recording will be stopped because the signal time in the channel changes. After the recording has been properly stopped, a new recording will be started automatically.

4.9.4. Working with Multiple Channels

Depending on the license, go2MONITOR can display between one and eight channels at the same time. Figure 68 shows a version with four channels.

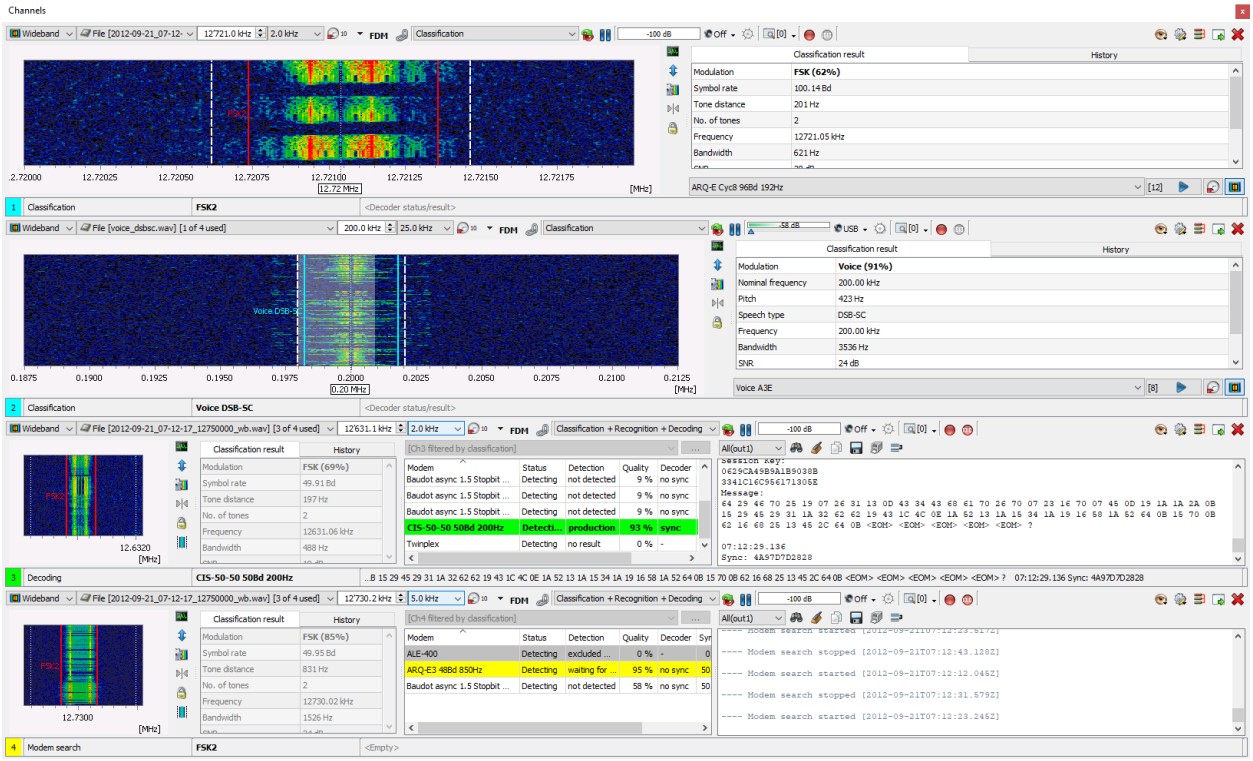


Figure 68.: Channel Window with four Channels

4.9.5. Channel Layout

The layout of each channel includes the elements

1. Toolbar
2. Spectrogram
3. Classification
4. Modem list
5. Decoder result
6. Status bar

Figure 69 illustrates the different areas in the visual representation.

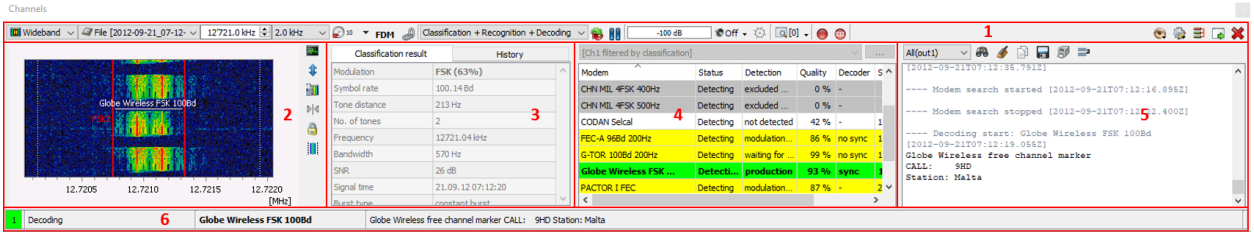


Figure 69.: Visual components of a Channel

The visibility of these components, except for the status bar, can be adjusted as needed, and each item can be displayed or hidden independently of the others. Thus, the freed up program interface can be made available to the remaining elements. The visibility of elements can be controlled via entries in the context

menu (see Figure 70). The context menu is displayed via the button  in the toolbar (for details, see chapter Channel Window Toolbar). The current state of visibility is to the left of the item name.

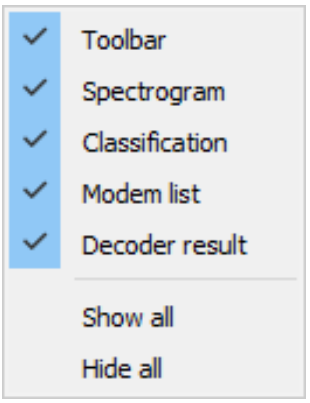


Figure 70.: Visibility of Visual Components

The visibility of the visual elements also depends to the processing mode, e.g. the "Decoder result" component remains hidden in the "Classification" processing mode, even if its visibility has been explicitly turned on. When hiding all visual components, the channel display is reduced to the status bar (see chapter Minimal View).

4.9.6. Channel Configuration

The complete configuration of a channel includes its functional and visual settings. The functional settings relate to the functions of the channel, like the current processing mode. While the visual settings include the state of the channel layout or the visibility of its visual components. Configuration management can be used to save, load and delete configurations. The corresponding context menu can be displayed via the button  in the toolbar (see Figure 71).

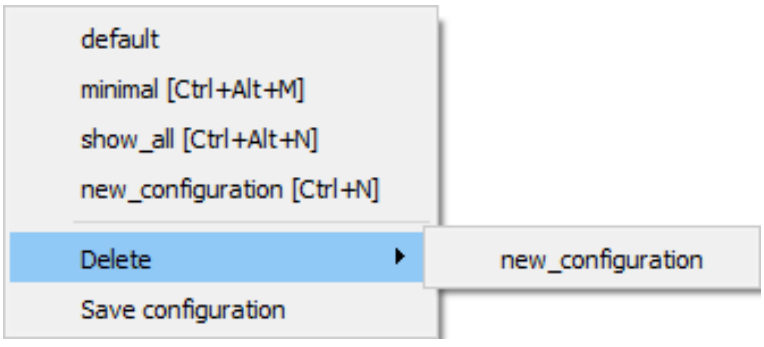


Figure 71.: Channel Configuration Menu

The upper section contains a list of existing configurations. The supplied configurations are listed at the beginning, followed by the user-defined configurations. The configurations can be individually applied to each channel by clicking on the configuration name.

<**Delete**> shows a list of configurations which can be deleted by clicking on the configuration name. Only user-defined configurations are allowed for deletion.

With the item <**Save configuration**> you can distinguish whether the complete configuration or only the layout should be saved (see Figure 72):

- Storage of the complete configuration (note that applying a full configuration will restart signal processing in the channel)
- Save layout only

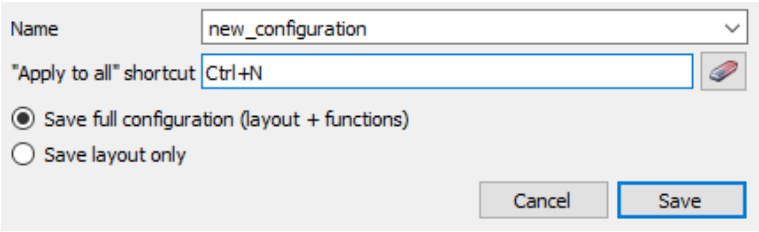


Figure 72.: Save Channel Configuration

The fields of the dialog are described below.

Parameter	Description
<**Name**>	Input field for the name of configuration to be saved. The drop-down list allows selection of an already stored configuration. Overwriting existing configurations must be confirmed. The field accepts the uppercase and lowercase letters, numbers and underscore character. On invalid input the <**Save**> button is deactivated and a corresponding message is displayed at the bottom of dialog.
<**"Apply to all" shortcut**>	Input field for a key combination which can be used to apply the configuration to all other channels. The field captures the input of the key combination as soon as it is selected e.g. by moving the cursor from the <**Name**> field using <**TAB**> key or by clicking into this field. The button with the eraser symbol deletes the key combination.
Save complete configuration (layout + functions)	The configuration to be saved contains all channel settings
Save layout only	The configuration to be saved contains only settings for the visual components of the channel
<**Cancel**>	Aborts the saving of configuration and closes the dialog
<**Save**>	Saves the configuration under the specified name

Table 19.: Save Channel Configuration - Parameters

4.9.6.1. Minimal View

When channels are displayed in minimal view style, only the status bar is displayed. All other window components are hidden.

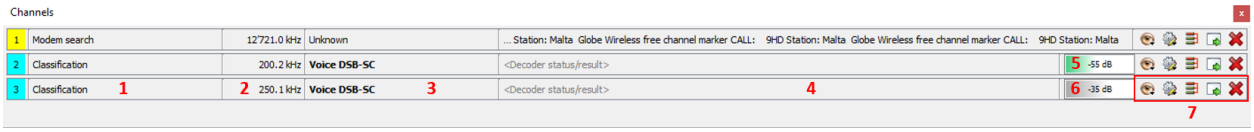


Figure 73.: Channels Displayed in Minimal View Style

The information in the status bar provides an overview of the channel's current status.

In the first field the channel id along with processing mode is shown in color representation for quick visual recognition. In addition the processing mode name is displayed to the right (see to "1" in Figure 73).

In field "2" the current channel center frequency is displayed.

In field "3" either the modulation type or the name of the modem is displayed, if this can be determined.

In latter case the decoder output appears in field "4", either as scrolling text or as status information, if it can be determined by the decoder.

With enabled audio demodulation the audio squelch control is shown, refer to field "5".

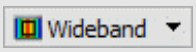
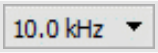
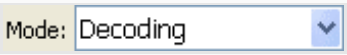
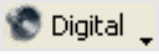
A double click on that control will mute the audio volume, the control's background will turn grey in that case, refer to field "6". Another double-click switches the volume on again.

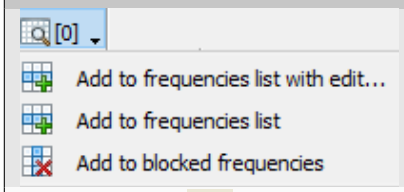
The buttons in area "7" allow to manage the channel configuration, change the channel view or close the channel (for details, see chapter Channel Window Toolbar).

A double-click on the fields "1", "2", "3" or "4" will switch between minimized and complete channel view.

4.9.7. Channel Window Toolbar

Depending on the signal input type, different entries are available on the toolbar.

Button	Description
	Selection of signal input. It can be selected between "Wideband signal", "Stream" and "File". Depending on the selection of the input, additional entries appear on the toolbar. The exact usage of the entries is described in chapter Establishing Connections and File Playback in a Narrowband Channel.
	Center frequency of the channel (if signal input is "Wideband" or "File")
	Channel bandwidth
	Delays (see chapter Delays)
	Enables FM demodulation for the signal input of the narrowband channel
	Set receiver to follow this channel
	Mode selection
	Restart processing
	Pause processing
	Audio squelch
	Audio demodulation and digital audio playback
	Volume

Button	Description
	Shows matching frequencies from the frequency list and allows adding the current channel frequency to the frequencies or blocked frequencies list.
	Start a continuous recording (see chapter Channel Recording)
	Store symbols during decoding in a REC-file. Turning this function on/off will restart running production
	Show / hide visual elements. If the toolbar is hidden, the button is displayed in the status bar.
	Save new configuration, apply existing configuration or delete user defined configuration. If the toolbar is hidden, the button is displayed in the status bar.
	Apply the configuration of this channel to all other channels. When the toolbar is hidden, the button is displayed in the status bar.
	Detach/attach channel from/to docking window. If the toolbar is hidden, the button is displayed in the status bar.
	Close manual channel. If the toolbar is hidden, the button is displayed in the status bar.
	Close live channel. If the toolbar is hidden, the button is displayed in the status bar. A live channel is set up through Automatic Wideband Monitoring on processing of task type "Wideband signal search with live processing" (for details, see chapter Automatic Wideband Monitoring.
	Switch between spectrogram and spectrum
	Automatically adjust the range of values in spectrogram/spectrum
	Spectrogram settings (see chapter Spectrogram Settings)
	Exact Frequency The exact frequency selection is available in "Decoding" and "Recognition + Decoding" mode. When active, recognition and decoding processing will be performed on a fixed frequency. Therefore, the nominal frequency for all modems is computed based on the frequency selection marker. When inactive, an automatic signal frequency determination within a frequency search range defined by the frequency and frequency range selection markers is performed. In "Decoding" mode, the exact frequency selection will be activated by default. In "Recognition + Decoding" mode, it can be activated if the automatic signal frequency determination is impeded by e.g. adjacent channel interference.
	Lock Signal This option locks the channel center frequency to the frequency selection marker. On activation or if the marker is moved to a different frequency, the channel center frequency will be automatically changed to the frequency of the marker. This way the selected frequency is always at the channel center.

Button	Description
	Manual signal selection Can be used in the "Classification + Recognition + Decoding" mode to manually adjust the signal processing range by moving the signal selection markers. On default the manual signal selection is active. Otherwise, the signal processing range is set automatically to a percent of a total channel bandwidth.

Table 20.: Channel Window Toolbar

4.9.8. Spectrogram Settings

4.9.8.1. Spectrogram Settings Dialog

The settings here are broadly similar to the wideband spectrogram (see Overview).

Parameter	Description
<**Pause**>	When a process is paused, the display is stopped (not the signal processing). A change of parameters is possible for a more detailed analysis of the current signal.
<**Autorange**>	Automatic setting of the displayed range to view the total amplitude

Table 21.: Channel Spectrogram Settings - Common Controls

4.9.8.2. Parameters

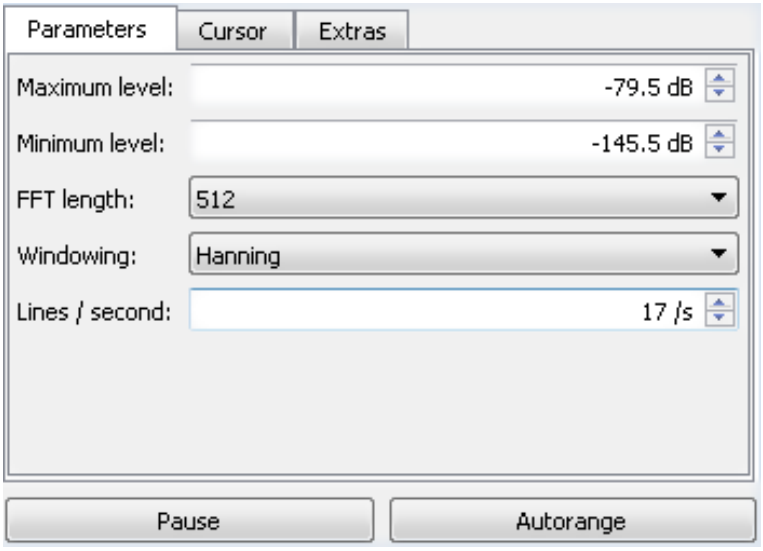


Figure 74.: Spectrogram Settings Channel - Parameters Window

In this window, the parameters for the spectrogram can be set up, providing additional functions.

Parameter	Description
<**Maximum level**>	Defines the maximum level of the display
<**Minimum level**>	Defines the minimum level of the display

Parameter	Description
<**FFT length**>	Number of frequency values in which the signal is displayed. To get a higher resolution of the displayed frequency range, the FFT length should be increased.
<**Windowing**>	The FFT algorithm is used for the calculation of the spectrum. This algorithm indicates inaccuracies in the amplitude (attenuation) as well as in the bandwidth (expansion) of a signal due to the finite signal probe. These inaccuracies can be reduced by using different windowing. Figure 75 shows the supported windowing algorithms and their effect on bandwith and maginuted accuracy.
<**Lines / second**>	Number of spectrums that can be calculated and displayed within one second. This parameter sets the updating rate for the spectrogram which is directly related to the scroll speed of the display.

Table 22.: Spectrogram Settings Channel - Parameters

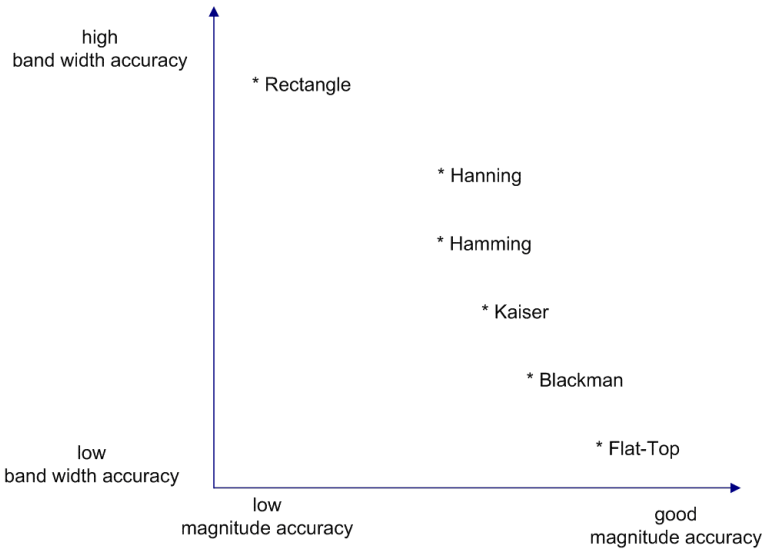


Figure 75.: Windowing

4.9.8.3. Cursor

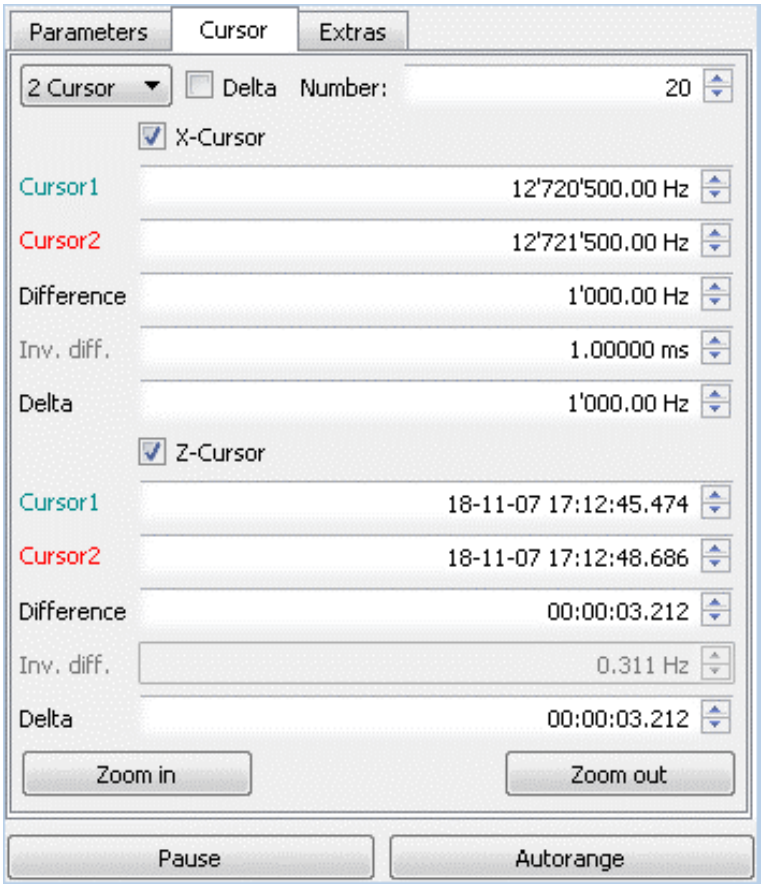


Figure 76.: Spectrogram Settings Channel - Cursor

In this window, the cursor functions can be set up. It also provides the function to zoom in and out to the display.

Cursor		Description
<**Cursor Mode**>	2 Cursor mode	For measuring tasks, two cursors are displayed at the same time
	Harmonic	The defined number of cursors is activated at equidistant intervals. In this mode, the first cursor will move all other cursors. The intervals are defined by grabbing and moving the second or any following cursor.
	Mirrored	The defined number of cursors is activated at equidistant intervals on the left and the right sides of the first cursor. In this mode, the first cursor will move all other cursors. The intervals are defined by grabbing and moving the second or any following cursor with the first cursor remaining at its fixed position.

Cursor		Description
	Centered	The defined number of cursors is activated at equidistant intervals on the left and the right sides of the first cursor. In this mode, the first cursor will move all other cursors. The intervals are defined by grabbing and moving the second or any following cursor with the cursor mirrored at the first one remaining at its fixed position.
<**Delta**>		Affects the position of cursors. When activated the cursors are placed at equidistant intervals between the left most and the right most cursors. Otherwise the cursors are placed either on the right side of the first cursor (in the "Harmonic" mode) or on both sides of the first cursor (in the "Mirrored" and "Centered" modes).
<**Number**>		With this spin box, the number of cursors is selected to be displayed in "Harmonic" or "Mirror" modes
<**X-Cursor**>		The cursors are activated/deactivated in X-direction. They are used to measure frequencies in Hz.
	Cursor1	Frequency for cursor 1
	Cursor2	Frequency for cursor 2
	Difference	Frequency distance between cursor 1 and cursor 2
	Inv. diff.	Inverted difference is a function for direct time readout according to the formula $\frac{1}{Difference}$
	Delta	Frequency distance between the first and last cursor in 2-cursor mode: "Harmonic" or "Mirror" modes
<**Z-Cursor**>		The cursors are activated/deactivated in Z-direction. They are used to measure values of time.
	Cursor1	Time of cursor 1
	Cursor2	Time of cursor 2
	Difference	Time difference between cursor 1 and 2
	Inv. diff.	Inverted difference is a function for direct frequency readout according to the formula $\frac{1}{Difference}$
	Delta	Time distance between the first and last cursor in 2-cursor mode: "Harmonic" or "Mirror" modes
<**Zoom in**>		With enabled cursors, the <**Zoom in**> button is used to graphically zoom into the area delimited by the cursors. With disabled cursors, the zoom enlarges the area around the center frequency by a factor defined in the spectrogram settings. Alternatively, a rectangle can be drawn in the display window and zoomed in on.
<**Zoom out**>		Each time the <**Zoom Out**> button is clicked, the Zoom in function is reversed.

Table 23.: Spectrogram Settings Channel - Cursors

4.9.8.4. Appearance of Cursors

When operating with channels, there are different appearances of cursors in the spectrogram.

One set of cursors consists of two wide and a weak dotted line. These are the search range and the center frequency for the signal. The weak dotted line can be moved within the spectrogram to select the center frequency of the signal. Both wide dashed lines can also be moved towards the center line or away from it to set the range that is used to find the correct center frequency for processing.

Another set of cursors consists of two fixed grey lines, which indicate the bandwidth of the signal as determined by the classifier. The distance of these lines will change as the result of the classifier depends on the signal quality.

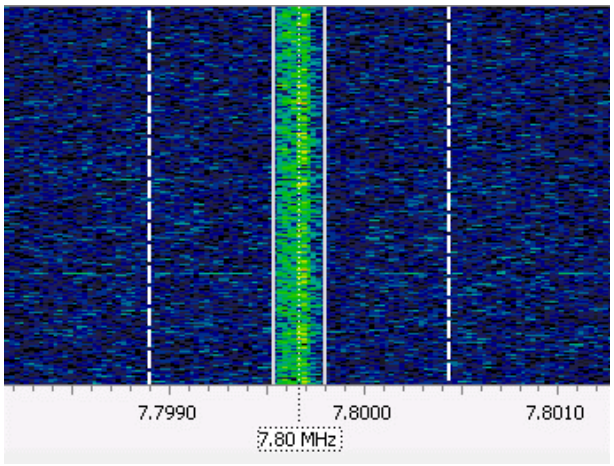


Figure 77.: Channel Cursor

When the classification process has finished with a result, the line color will change according to the colors defined in the Emissions View (see Figure 16).

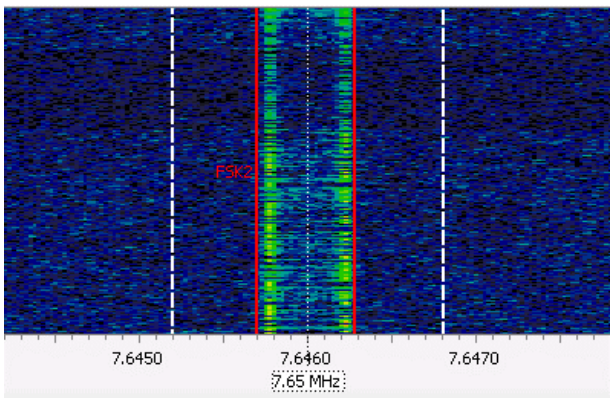


Figure 78.: Channel Cursor - Classification with Result

The name of the detected mode is shown adjacent to these lines:

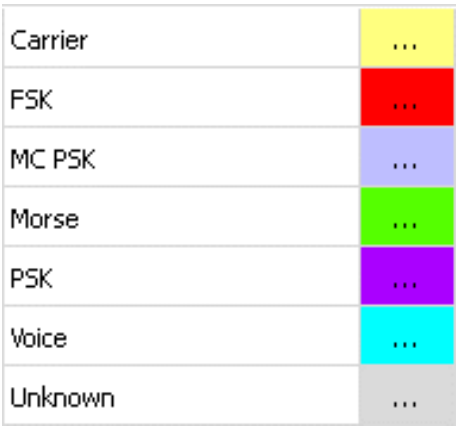


Figure 79.: Colors Classification Results

When selecting one of the demodulators such as USB or AM, the bandwidth of the demodulator will be displayed in the **Channel** view as a white transparent overlay. The demodulator bandwidth can be changed using the mouse.

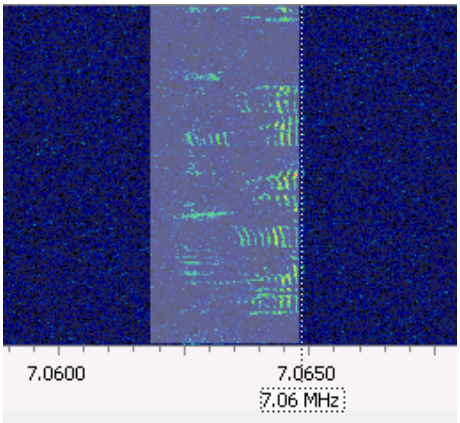


Figure 80.: Channel View with Demodulator Bandwidth

4.9.8.5. Extras

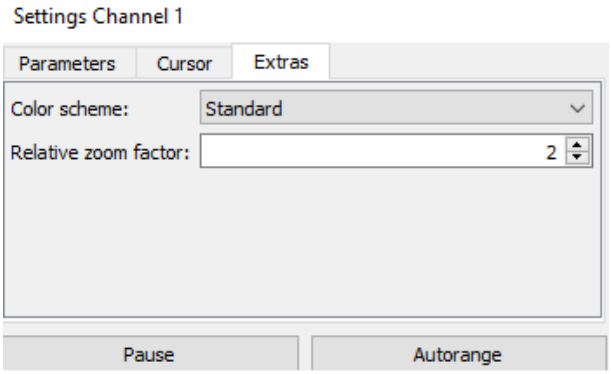


Figure 81.: Spectrogram Settings Channel - Extras

In this window, different display types and the relative factor can be adjusted. The display can be paused and adjusted to the signal levels.

Item		Description
<**Color scheme**>	Inverse	Activates the inverse color display
	Standard	Activates the standard color display
	Monochrome	Activates the monochrome color display
<**Relative zoom factor**>		The relative factor is used for the zoom process to determine the zoom factor

Table 24.: Spectrogram Settings Channels - Extras

4.9.8.6. Channel Frequency and Bandwidth Control

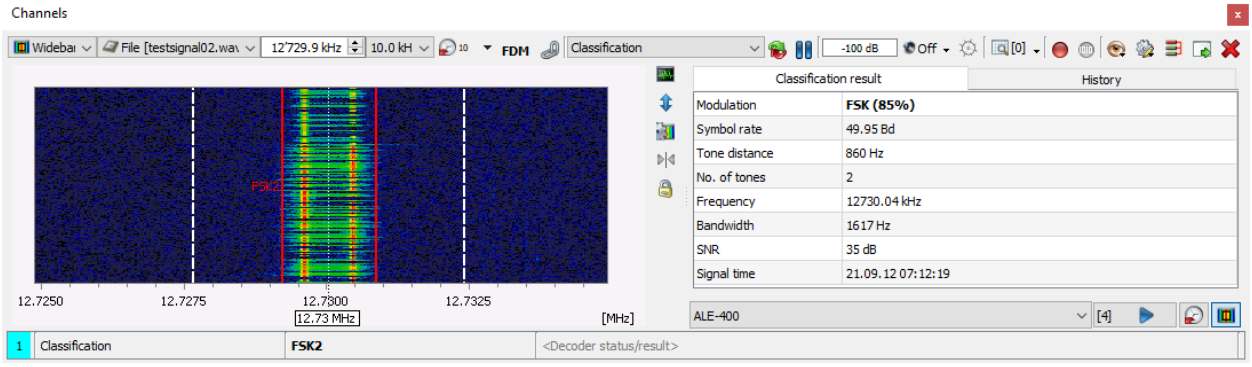
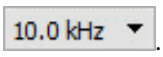


Figure 82.: Adjusting Frequencies and Display Bandwidth

If necessary, the channel center frequency can be adjusted with the mouse by moving the center line of the channel in the wideband spectrogram of the signal input or by entering a new frequency using the <**Frequency**> 

selector. It is also possible to place the mouse cursor on the right side of a digit in the center field and to change the frequency with the mouse wheel.

The bandwidth of the channel can be adjusted using the textbfBandwidth dropdown list 

.

Depending on the bandwidth of the signal source, it is possible to set the bandwidth in various discrete steps from 2 kHz to 300 kHz. Additionally, this list includes an entry for the maximum bandwidth of the channel. The channel bandwidth will also be indicated by markers in the wideband spectrogram of the signal input.

4.9.9. Audio Demodulation and Playback

Each narrowband channel includes functions for demodulating input signal as analog audio. Additionally, digital audio decoded by the APC component (only during modem decoding) can be played. Both functions are accessible from the Audio menu on the channel toolbar (see Figure 83).

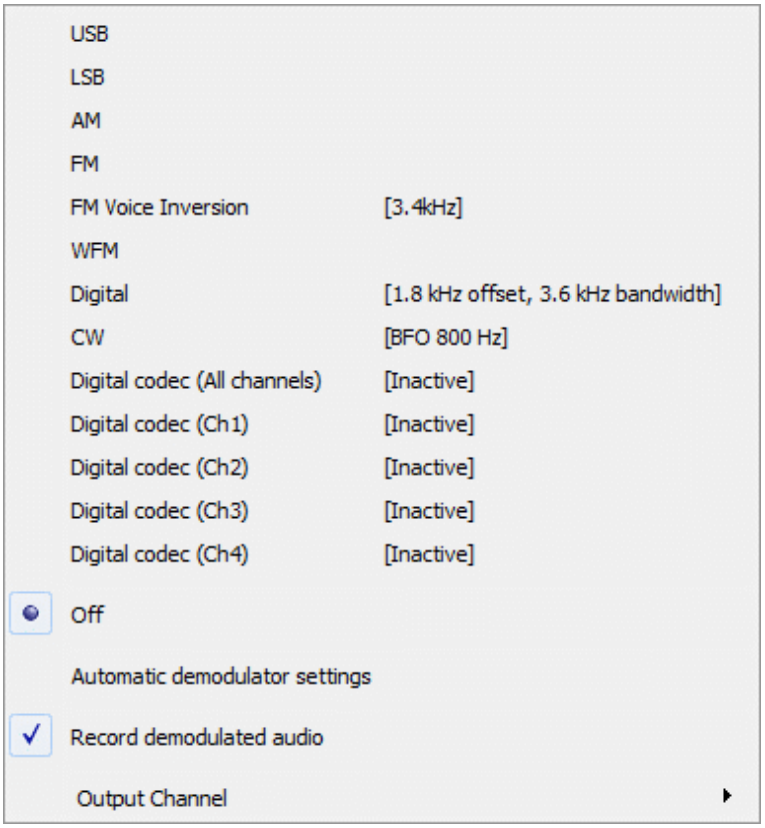


Figure 83.: Audio Menu

4.9.9.1. Analog Audio Demodulation

The following analog demodulators are included:

Demodulator	Description
USB	Single sideband, upper side band
LSB	Single sideband, lower side band
AM	Amplitude modulation
FM	Frequency modulation
FM Voice Inversion	Frequency modulated analogue voice inverted at 3.4 kHz
WFM	Frequency modulation (200 kHz bandwidth)
Digital	1.8 kHz offset from the center frequency, bandwidth 3.6 kHz
CW	Continuous wave/Morse with an BFO of 800 Hz
Off	No audio output

Table 25.: Channel Window - Demodulators

4.9.9.2. Audio Demodulation Options

Option	Description
Automatic demodulator settings	The audio demodulator will be parametrized automatically based on the last classification result or modem recognition
Record demodulated audio	The channel will store the demodulated audio signal as described in chapter Recording Audio Demodulated Signal
Output channel	Audio output to the left, right or center audio channels

Table 26.: Channel Window - Audio Options

4.9.9.3. Recording Audio Demodulated Signal

To store the audio demodulated signal for later analysis, the channel will by default automatically record signal data in an audio WAV file associated with a content production result. The result entry can be viewed in the Result content view (for details, see chapter Content View). To distinguish from a decoder production result, this result's source field carries the value "Audio-Recording".

On change to some channel or audio demodulator settings, the currently running audio recording will be closed and a new one reflecting the new settings will be started.

When this option is unchecked, the currently running recording is finished immediately. The option remains unchecked until the channel is closed.

4.9.9.4. Changing Audio Bandwidth Interactively

The demodulator bandwidth can also be fine-tuned in the spectrogram by resizing or moving the white transparent overlay indicating the signal bandwidth currently being demodulated, but only if the automatic demodulator setting is not active.

In the case of the USB demodulator, the nominal frequency will be the lower edge of the bandwidth selection, for LSB it is the upper edge. For all other demodulators, the nominal frequency will be at the center of the bandwidth selection.

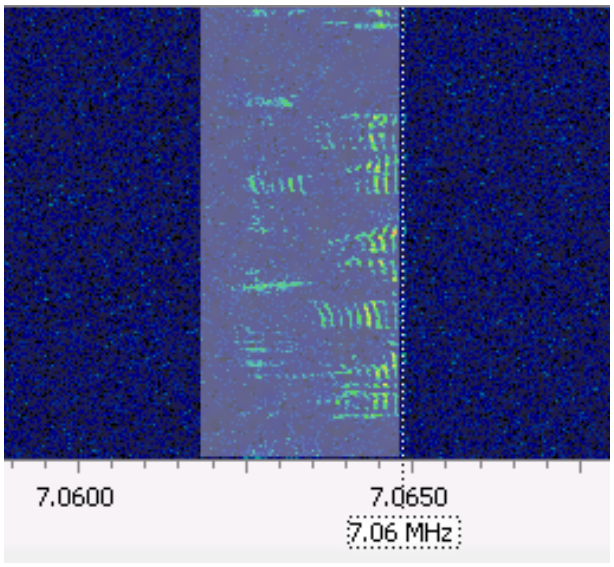


Figure 84.: Audio Demodulation Display in the Spectrogram

4.9.9.5. Digital Codecs

For some modems containing digitally encoded audio (e.g. Tetra, DMR, etc.), audio content may be extracted and decoded by the production channel during decoding (depending on the license and signal content/encryption). This audio content is streamed to the GUI and can be played back by using the following context menu options:

- Digital codec (All channels): Plays back all available channels at the same time
- Digital codec (Ch1): Plays back audio channel 1
- Digital codec (Ch2): Plays back audio channel 2
- Digital codec (Ch3): Plays back audio channel 3
- Digital codec (Ch4): Plays back audio channel 4

The maximum number of digital codec channels is limited to four. Each menu item shows if it is currently active, i.e. if any signal has actually been received in the last few seconds.

4.9.9.6. Automatic Demodulator Settings

If the <**Automatic demodulator settings**> option has been selected, the audio demodulator and its parameters will be chosen automatically based on the current classification result (if available). The manual changing of the demodulator type will not be possible in this mode.

For example, if the modulation type recognized by the classifier is "Voice USB", the audio demodulator will be set to "USB". If the classifier could determine the nominal frequency of the signal, the audio demodulator will be automatically tuned to this frequency. Each time the nominal frequency or modulation type changes, the audio demodulator will be parametrized automatically to adjust to the classifier result. This may cause frequent audio interrupts in the case when the signal frequency is not stable.

For all classifier results other than "Voice" or "Morse", the **Digital** audio demodulator will be selected. The audio marker will be automatically positioned on the center frequency of the signal detected by the classifier.

The following table shows a matching between modulation type recognized by the classifier and corresponding audio demodulator chosen in automatic mode.

Modulation type	Audio demodulator
Voice USB	USB
Voice LSB	LSB
Voice AM	AM
Voice FM	FM
Morse	CW
All other	Digital

Table 27.: Matching Between Modulation Type and Audio Demodulator

Note: Digital codecs are not supported by the automatic demodulator settings option.

4.9.10. Channel Recording

The signal within a channel can be recorded and stored as a result by the recording function. With a click on the <**Record**> icon , a recording for each channel can be started. Clicking on the <**Record**> icon again will stop recording.

If there is a change in the channel parameters during recording (e.g. frequency, bandwidth, signal source, time jumps, switch to FDM), the recording is continued in a new file and a new result is created.

If the signal source changes, the new source contains the frequency set in the channel and a new recording is started. Otherwise, the active recording will be finished.

The recordings can be viewed in the Signal View.

4.9.11. Result Window

When production of a modem is started, the decoded text will be displayed in the Result window. The most recent decoded text will also be displayed in the right part of the status bar. This has the added benefit that in case of a minimized channel window the output of a decoder can still be monitored.

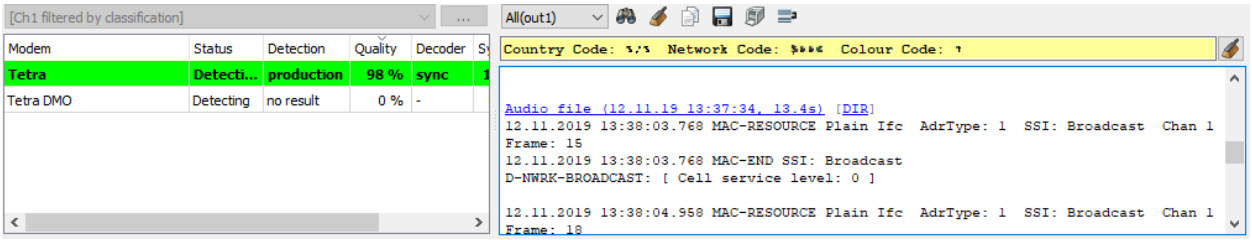
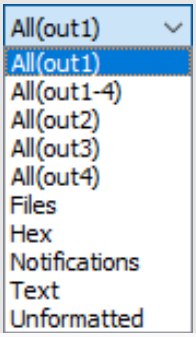


Figure 85.: Result Window

4.9.11.1. Result Window Toolbar

Button	Description
	Output format selection: Select output channel(s) Result files Text/Hex output Raw output including control statements
	Activates free text search on the decoder results. The search field will be shown right under the result window when activating the button. 
	Clear decoder results
	Copy decoder results
	Saves the decoder results in the Decoder Result Window by opening a <**File save**> dialog.

Button	Description
	Opens the standard <**Print**> dialog for printing the current decoder results in the Decoder Result Window
	Activates wrap of the decoded text at the right edge of the window in the Decoder Result Window.

Table 28.: Result Window Functions

4.9.12. Classification Mode

4.9.12.1. General

The classification tool analyzes the signal and determines the type of modulation.

By using the classification unit, the modulation type of a signal in the current frequency range can be determined. The resulting information will be displayed in the GUI and can be used as an input for further automatic or interactive processing.

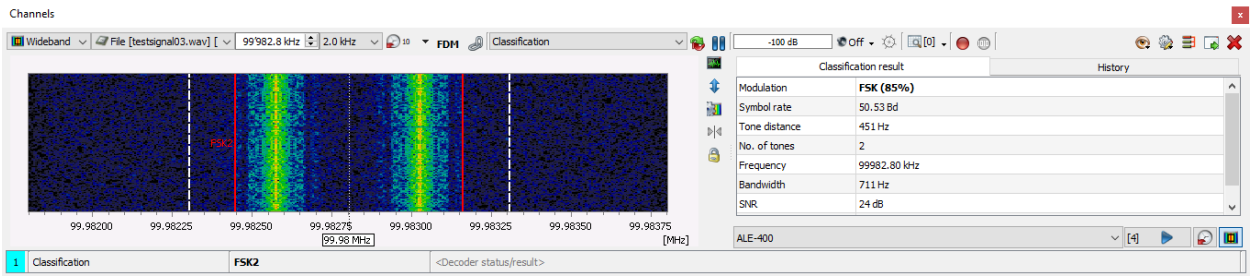


Figure 86.: Classification Window with Result

4.9.12.2. Classification Results

The software measures various analysed parameters. From these parameters, the modulation of the signal will be determined. Depending on the type of modulation, additional signal parameters, such as the symbol rate, are displayed in the classification results.

4.9.12.3. Dynamic Modem List

According to the classification result, the software will propose a selection of modems which may match the signal. This reduced list can be opened with the dropdown list below the **Result** window. All these modems are stored in a dynamic list **[CHn filtered by classification]** which can be used later on when switching to the "Decoding" or "Recognition + Decoding" modes.

Figure 87.: Dynamic Modem List

The button on the right side of the dynamic modem list displays the number of possible modems in the list. By selecting this button, the "Recognition + Decoding" mode will be opened containing the suggested modem list.

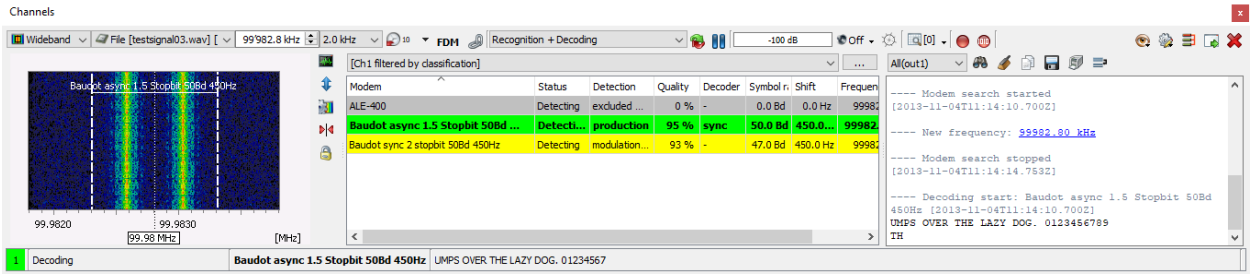


Figure 88.: Recognition + Decoding with the Dynamic Modem List

4.9.12.4. History

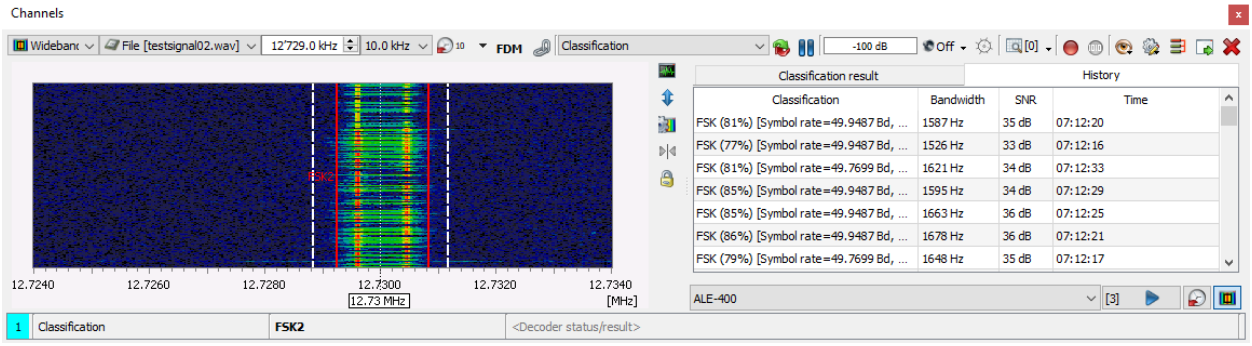


Figure 89.: Channel Classification - History View

All classification results are stored in a history list which can be opened via the **History** tab. This list contains:

- Classification result with mode, detection quality and additional parameters
- Bandwidth
- Signal to Noise Ratio (SNR)
- Time of recognition (Time)

The list will be cleared when the application is stopped.

4.9.13. Decoding Mode

4.9.13.1. General

In this mode, the channel works as a decoder. A modem can be selected from the modem list. The decoded alphanumeric text or metadata will be displayed in the Result Window.

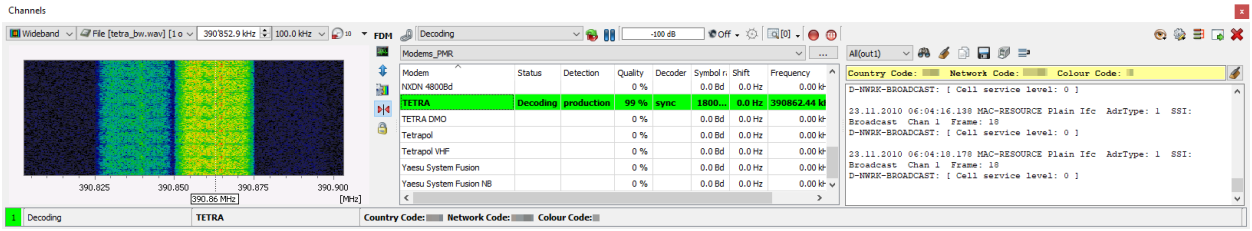


Figure 90.: Channel Mode Decoding

4.9.13.2. Modem Selection

From a dropdown list, different modem lists - e.g. for HF or VHF-UHF - can be selected. See chapter Modem List Editor for instructions on how to modify or add a new modem list.

A modem is selected by a click on the modem row. The selected modem row will show a green background color.

Note: Multi-modems (for example Pactor I/II/III) cannot be used in this mode because they need recognition capabilities in order to switch to the right modem type.

A modem row consists of the following columns:

Parameters	Description
Modem	The name of the modem
Status	Used during recognition: "Detecting"
Detection	Detection status of modem: No result — No statement on modem status possible Inactive — Modem is deactivated (either manually or automatically during search) Impossible — Modem has been excluded during search due to segmentation results None — Modem has not been detected No decoder — Results from decoder still pending Modulation — Modem has been detected on the basis of the modulation parameters Modem — Modem has been detected Lost — Modem was detected but is lost now Production — Modem is in production Modulation tracking — The modulation type has been detected, tracking parameters Modem tracking — The modem has been detected, tracking parameters
Quality	Quality of signal in %

Parameters	Description
Decoder	Status of decoder: No sync — Decoder not detected Identified — Decoder has detected modem characteristics in the data stream Accepted — Decoder has definitely identified the modem Sync — Decoder has found some modem characteristics but not identified it Error — Decoder runtime error
Symbol rate	Measured symbol rate
Shift	Measured shift of a FSK signal
Frequency	Center frequency of the demodulator for the signal

Table 29.: Decoder Status

4.9.13.3. Decoder List

From a dropdown list, different modem lists, e.g. for HF or VHF-UHF, can be selected. See chapter Modem List Editor for instructions on how to modify or add a new modem list.

4.9.13.4. Result Window

When the decoder starts with the production, the result text will be written to the output window including a time stamp and a status. The most recently decoded text is also displayed in the status bar below the output window.

4.9.14. Recognition + Decoding Mode

4.9.14.1. General

In this operation mode, the software is searching for the correct modem within a modem list. The modem list can be selected from a dropdown list and is displayed in the table below.

See chapter Modem List Editor for instructions on how to modify or add a new modem list. Using this function, the operator can define specific modems to be used according to the monitoring use case. go2DECODE can be used for analysis and creation of new decoders. These new decoders can further be used in go2MONITOR.

If the production channel can determine a matching modem, the signal is demodulated, decoded and the results are displayed in the Result Window.

Signals Of Interest can easily be added to the integrated frequencies database. Entries from the frequency database can be later assigned to production channels from the emission view by using drag-and-drop or the context menu.

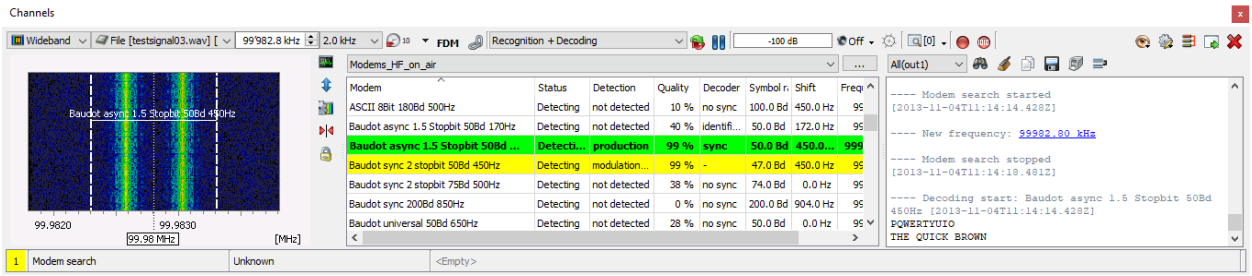


Figure 91.: Recognition and Decoding of Signals

4.9.14.2. Modem Search

On starting the "Recognition + Decoding" mode, the spectrogram displays the signal (Figure 91 shows a Baudot signal). In the Result Window, the modem search will be shown first. The color of the modem in the list varies depending on the state of recognition, e.g. the Baudot line first turns yellow then green. This indicates that the signal has been recognized by the search routine (yellow); a moment later production starts (green) and the decoded text is displayed in the Result Window.

4.9.15. Classification + Recognition + Decoding Mode

In this mode the following steps are executed sequentially:

- Classification of the signal
- Building a dynamic modem list according to the parameters of the classifier results. The overall list of modems to be considered in this step can be defined in the Modem List Editor. Default is to consider all available modems.
- Starting the modem recognition with the modem list matching the classification result. By using the Modem List Editor, it is possible to define a "fallback" modem list which will be used for modem recognition if the classification can not deliver any recognition after certain timeout.
- If successful, starting the decoding of the signal, otherwise restarting from the beginning

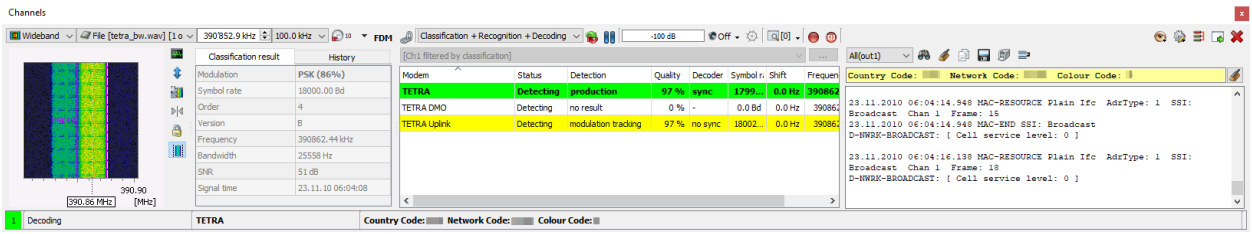


Figure 92.: Classification, Recognition and Decoding of Signals

4.10. Automatic Wideband Monitoring

Automatic Wideband Monitoring function provides fully automated wideband signal search and processing in go2MONITOR. To use the automatic processing features, the operator creates rule-based tasks and groups them into missions.

Each task contains information about Signals Of Interest and actions to be performed if one of those signals is detected. Tasks and missions are processed automatically by go2MONITOR. Signals Of Interest are detected and automatically processed based on task settings.

Various views for creating monitoring missions and tasks are available in the GUI. By using these views, missions and tasks can be created and activated and their results can be monitored. Manual channel functions can still be used and freely combined with automatic operations.

All results generated from Automatic Wideband Monitoring are stored in the same way as results generated from manual processing channels. Both can be accessed through the ResultViewer.

4.10.1. Automatic Wideband Monitoring variants depending on the License

There are two different Automatic Wideband Monitoring modes, depending on the go2MONITOR license:

- **Live Automatic Monitoring**: This mode is available in the standard go2MONITOR product license. It allows the creation and execution of Missions and Tasks, with some limitations:
  - One task type can be used, "Wideband signal search with live processing". With this task type, narrowband signal processing is performed interactively in the GUI.
  - Snapshot wideband classification can be used as a trigger for narrowband actions. Continuous classification is not available.
  - The processing of narrowband channels is limited to the channels available in the GUI and is generally limited to real-time processing
- **Advanced Automatic Monitoring (option)**: If go2MONITOR is used with the license option "Automatic Monitoring and Tasking" (AMT), the functionality will be extended so that all task types, continuous classification and processing with all system resources are available.

4.10.2. Example missions

The go2MONITOR setup already includes some example missions and tasks, which can be used as templates for creating user-specific missions. The exact list of these example missions depends on the go2MONITOR license.

If one of these missions has been accidentally deleted or changed, it can be imported again by using <**Import Mission**> function in the <**Missions**> View. The missions are located in the "mission" subdirectory of the go2MONITOR installation directory.

4.10.3. GUI Appearance if Automatic Wideband Monitoring Mission is Active

After activating Automatic Wideband Monitoring Mission (see chapter Creating and Handling Missions), the GUI will change:

- If the mission uses wideband classifier in continuous classification mode, the <**Emissions**> View will change: the <**Find emissions**> button will disappear because the continuous classification starts automatically. Emissions detected during task execution will be displayed. The emissions will be automatically removed from the list after 10 - 30 s (sooner if the number of emissions is high).
- Manual wideband recording will still be possible, but only if no automatic wideband recording is currently running for the corresponding task. If automatic wideband recording is running, the wideband recording toolbar button will be disabled.
- If a GUI perspective was defined for this mission, it will be applied as soon as the mission is activated. If the mission is deactivated, the GUI perspective will be restored to the state before activating the mission. See also Figure 94 and Table 31.

4.10.4. Combining interactive use of GUI channels with the Automatic Wideband Monitoring

go2MONITOR has limited system resources which are used for both manual processing in narrowband channels and for automatic processing. Therefore, a resource usage strategy has to be defined if both processing types are used simultaneously.

go2MONITOR always gives a higher priority to the manual processing in a narrowband channel. If a channel is active, it will always reserve 1 DDC channel and 1 demodulation/decoding channel for this purposes. This will be the case even if certain functions are not needed at the time (for example there is no signal or the channel is in Classification mode).

Automatic processing will use all remaining resources which are currently not reserved by the manual narrowband channels.

If a narrowband channel is started for manual processing and it cannot allocate the resources it needs, it will take the resources from the automatic processing function. There are two ways to do this:

- Force resources to become available by stopping some tasks currently running as automatic processes. This is the fastest way to get the resources, but it will interrupt some active operations undergoing automatic processing.
- Wait until resources become available and allocate them afterwards. This method can take much more time, but no automatic processing operations will be interrupted.

The user can select between these two modes by changing the corresponding setting in the General Settings dialog. This setting is turned on by default, enabling fast starting of narrowband channels, even if some automatic operations have to be interrupted.

4.10.5. Using Signal Inputs and WB-Receivers for Automatic Processing

All functions for switching signal input between receiver, stream and file are also available if automatic processing is active. This enables the automatic processing of live signals from any of the available receivers, and automatic processing of signal files.

Missions and tasks work simultaneously on all active signal inputs, depending on the search/block frequencies defined in the tasks.

Additional options for automatic receiver control are available with Memory Step/Scan functions.

4.10.6. Creating and Handling Missions

A mission contains a group of tasks which should be executed at the same time. Multiple missions can reside in the system, but only one can be active at a given moment. Mission activation/deactivation is performed manually by the operator.

The starting point for handling missions is the <**Mission**> window. It lists all missions available in the system along with their status.

The following example shows that the mission named “Search Mission” is active and all other missions are inactive.

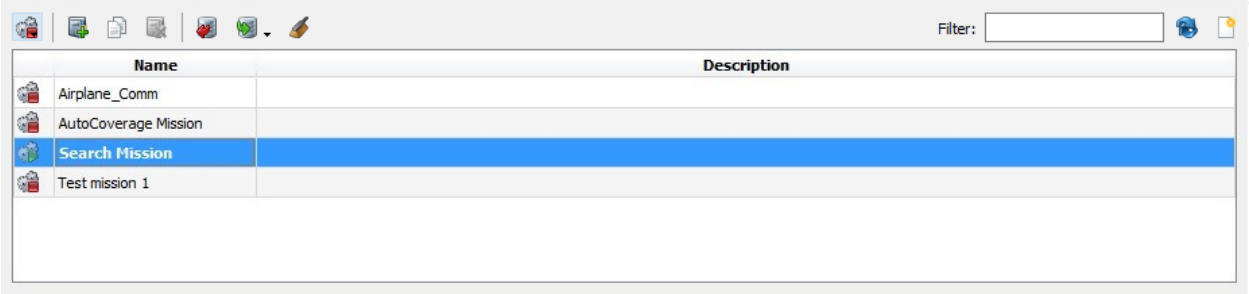


Figure 93.: Mission Docking Window

The main functions are accessible from the menu bar at the top of the Mission docking window:

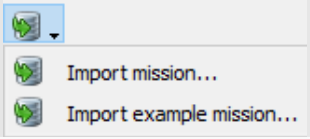
Button	Description
	Activate/deactivate selected mission
	Add new mission
	Duplicate selected mission
	Delete selected mission
	Export selected mission in a file
	Import mission from a file or import a mission file from the mission examples directory in the user directory
	Simple text search over mission name and description
	Reload missions from database. Only needed in multi-user environments.
	Clear filter

Table 30.: Mission Window Functions

After selecting <**Add new mission**> on the toolbar, a dialog will appear. The user can define can various mission properties and create mission's tasks.

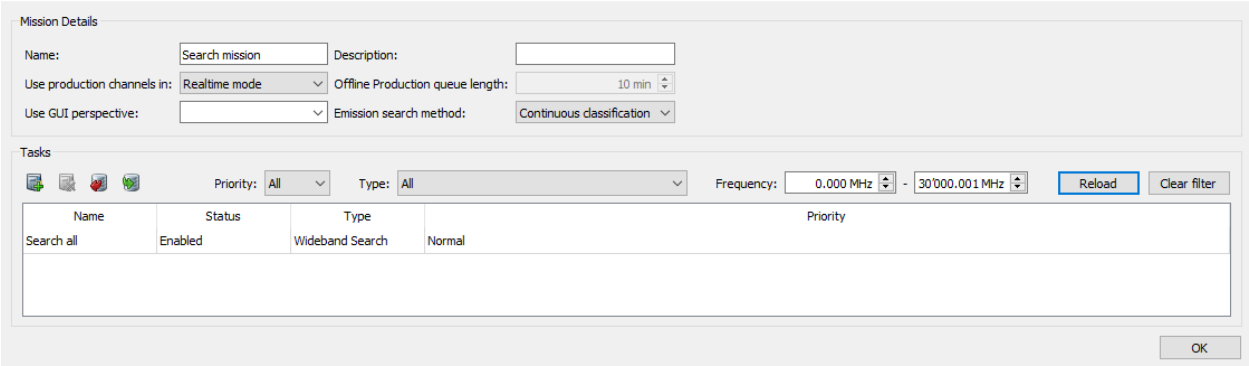


Figure 94.: Edit Mission Window - Mission Details

The following mission properties can be defined:

Function	Description
<**Use production channels in**>	Defines a mode for using production channels (real-time or offline). See chapter Offline vs. Online Processing for details about available modes and parameters.
<**Offline production queue length**> (only for Offline production channel usage)	After a defined period, recordings waiting for offline processing with production channels will be deleted.
<**Use GUI perspective**>	If this mission is activated, the specified GUI perspective should be applied. By using this option, user can automatically activate a perspective which matches the use case implemented with this mission.
<**Emission search method**>	Defines which type of emission search should be used. It can be continuous classification where Classifier processes all input signals automatically or snapshot classification where user has to trigger each wideband classification explicitly from the GUI.

Table 31.: Edit Mission Window - Mission Details Functions

A newly created mission will not be automatically activated.

4.10.7. Creating and Editing Tasks

Each task is created using a wizard. The operator will be guided to select the task type and all relevant task properties and actions.

The same dialog is used for editing existing tasks. A task can be edited at any time, even during execution. In that case, task changes will take effect after ~10 s.

Deleting task will not delete results from that task.

The following task types and task properties can be set during a task creation or editing procedure.

4.10.7.1. Task Type

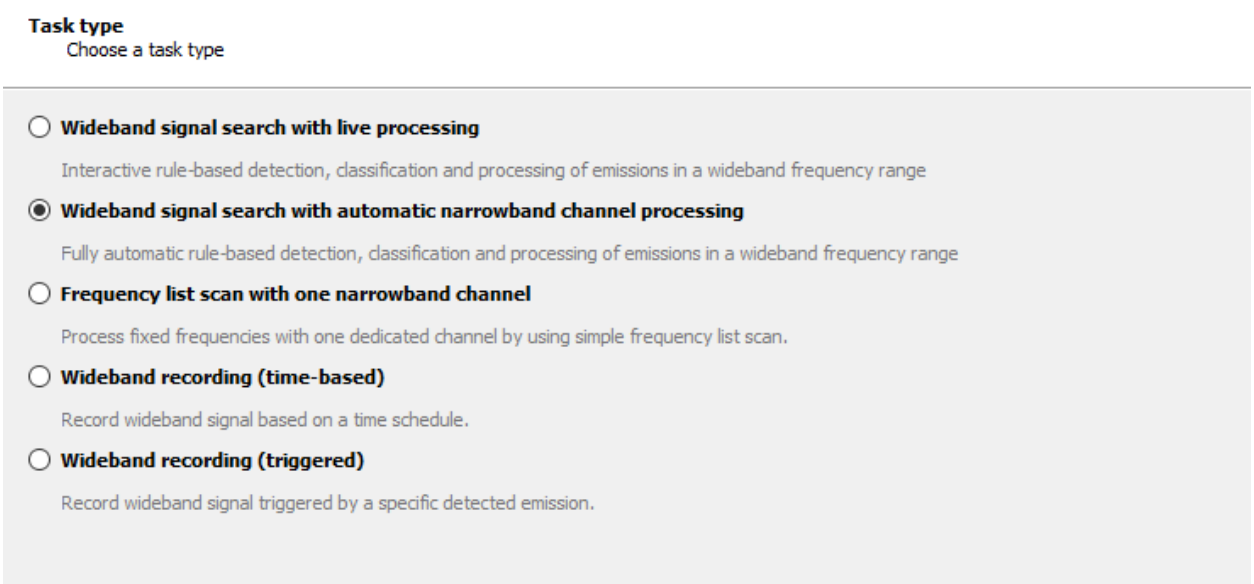


Figure 95.: New Task Creation Window

Wideband signal search with live processing

This type of task is used to search for emissions in wideband frequency range and to process found emissions interactive and live in the narrowband channels in the GUI.

Wideband signal search with automatic narrowband channel processing

This type of task is used to search for emissions in wideband frequency range. Intercepted signals are processed automatically by using all available system resources.

Frequency list scan with one narrowband channel

This type of task is used to process fixed frequencies or frequency lists with the NB-channel (frequency list scan). The signals on these frequencies can be "Classified", "Recorded" or "Decoded". Wideband search functions are not used for these tasks.

Wideband recording (time-based)

This type of task is used to record wideband portions of the spectrum at pre-determined times.

Wideband recording (triggered)

This type of task is used to record wideband portions of the spectrum triggered by a specific signal recognized in the wideband classification.

4.10.7.2. General Task Information

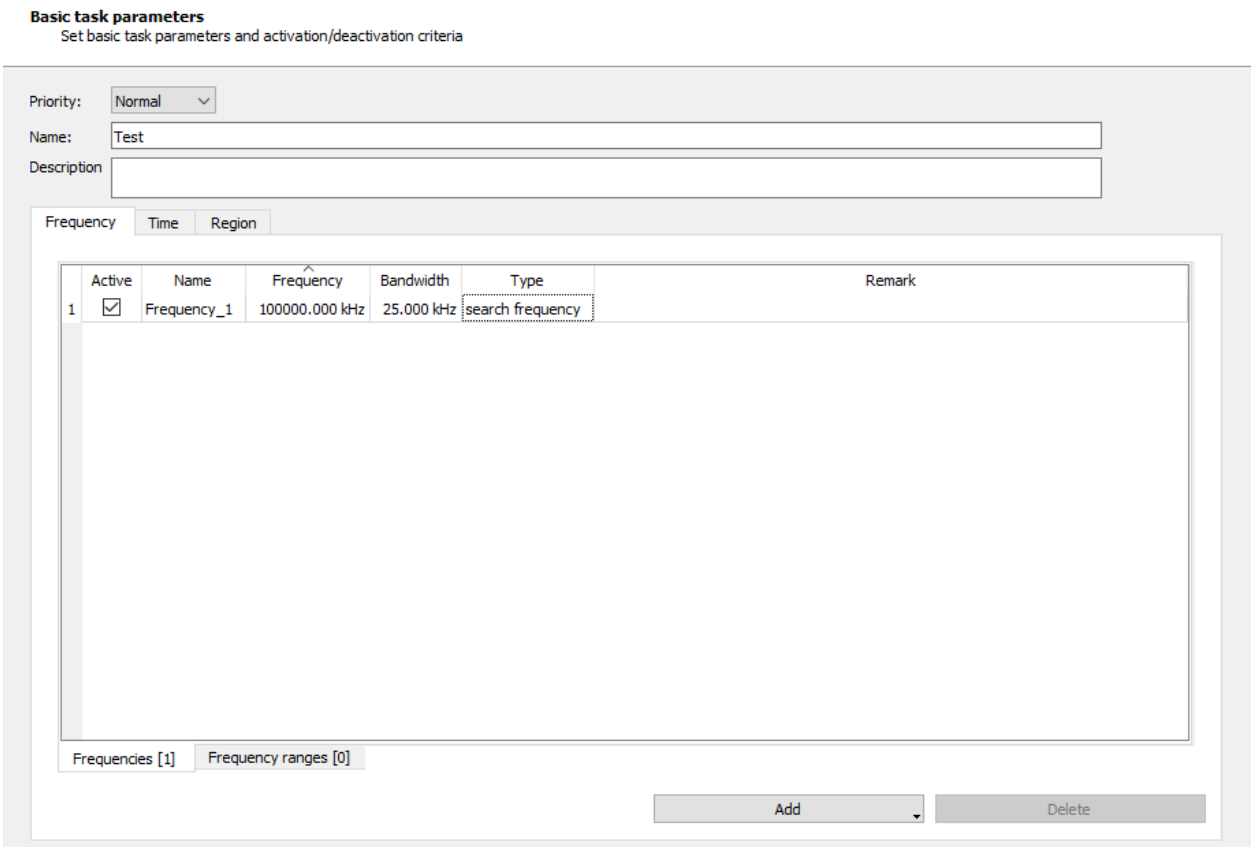


Figure 96.: Task Editing Window - General Task Information

On this page, the user can enter general information for this task and activate the task depending on frequencies. Additional limitations can be added, depending on time and region, if needed.

Function	Description
<**Priority**>	Critical, Normal, Low or Idle
<**Name**>	Enter a short name
<**Description**>	Additional information about the task

Table 32.: Task Editing Window - General Task Information Functions

4.10.7.3. Task Activations

4.10.7.3.1. Frequencies and Frequency Ranges

For every task, both single frequencies and frequency ranges can be specified. As displayed in Figure 97, these can be created separately via the corresponding tabs. To the right of the tab label is the number of previously created frequency entries.

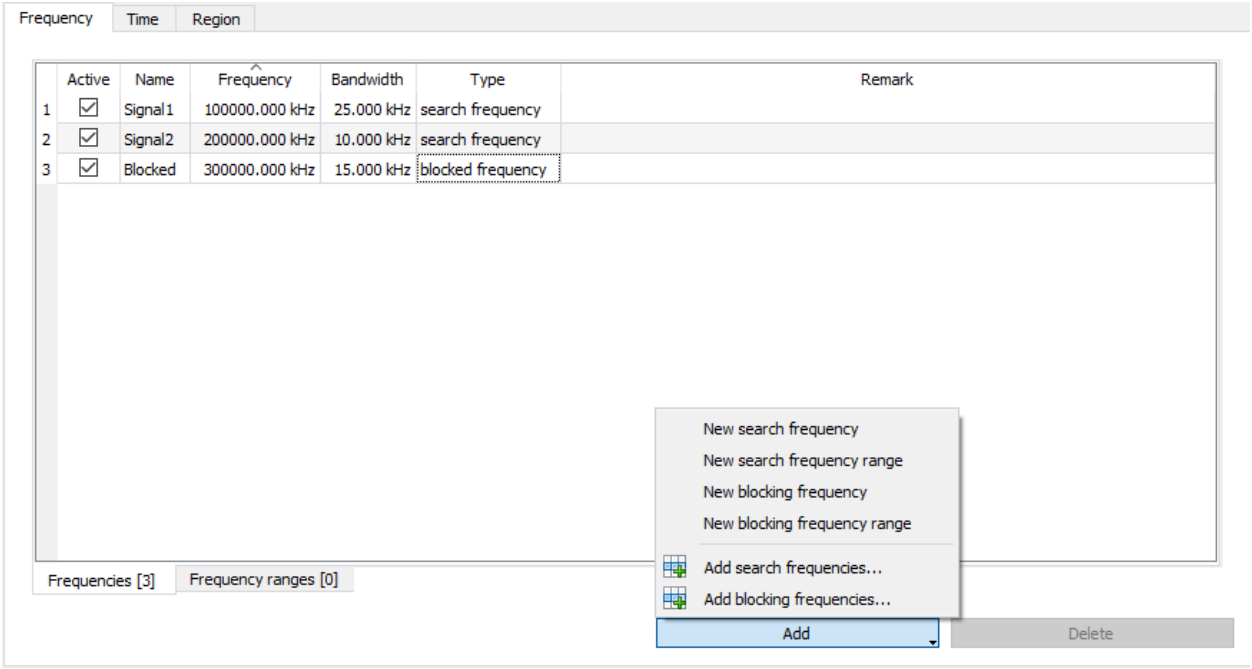


Figure 97.: Task Editing Window - Frequency range

For every frequency type there are two types of frequency entries:

- **Search:** Only signals which appear in these frequency ranges will be considered for further processing by this task. If the operator would like to process signals on fixed frequencies, the frequency and the expected bandwidth of the signal must be entered.
- **Blocked:** All signals which appear in these frequency ranges will be ignored. For tasks based on fixed frequency lists, no blocked frequencies are permitted. Blocked frequencies have higher priority than the search frequencies.

If no frequency ranges are defined on this page, all signals from all frequency ranges will be considered as relevant.

By using the "Active" checkbox, frequency entries can be activated or deactivated. Deactivated entries will be ignored during task execution.

<**New search frequency**> resp. <**New blocking frequency**> inserts either a new search or a new blocking frequency entry into the selected table. The fields of the new entry are assigned default values.

Use the <**Add search frequencies...**> and <**Add blocking frequencies...**> buttons to add frequencies already stored in the database. After closing the selection dialog all selected entries will be transferred to the tables. Note, that the selected entries will be copied into the tables, so editing these entries will not affect the frequencies entries stored in the database.

<**Delete**> deletes the selected entries.

The fields of an entry can be edited after a double-click on the corresponding table cell. Once a value has been edited, the <**TAB**> key can be used to edit the next or the <**Alt**>+<**TAB**> key combination to edit the previous value. The entered frequency entries are validated when the <**Next**> button is clicked. An error message is displayed on table lines with invalid entries. After correcting all invalid entries, the task configuration can proceed to the next page.

The time-based broadband recordings can record only complete wideband input signals. The frequencies entered here are therefore used only to select input signals for recording. As soon as an input signal contains one of the search frequencies entered here, it is recorded.

Channel raster / Channel bandwidth

By specifying channel raster and channel bandwidth, a frequency range can be divided into adjacent channels. In the search frequency range, the search for signals takes place only in the frequency band occupied by the channels, see Figure 98.

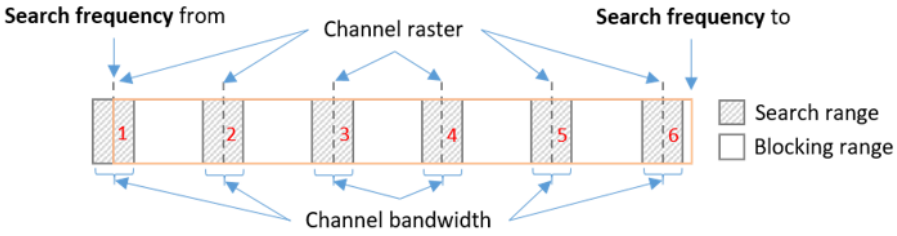


Figure 98.: Channel Raster /-Bandwidth in Search Frequency Range

In the blocking range, all signals in the frequency band specified by the channels are ignored, see Figure 99.

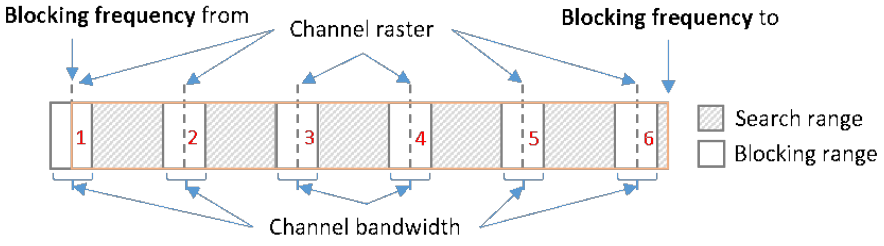


Figure 99.: Channel Raster /-Bandwidth in Blocking Frequency Range

The arrangement of the frequency range by channel raster and channel bandwidth specification is explained below. The start frequency of the frequency range is the center frequency of the first channel. Based on this, the channel raster specifies the center frequency of all subsequent channels up to the end

of the frequency range. Note, that depending on the configuration, certain frequencies at the limit of the frequency range may not be covered by any channel.

When storing signals to the database, the associated channel information is also stored with the result. The channel information is composed of the name of the frequency entry (see Figure 97), and the channel identification as well. For example, when a signal is detected in the frequency range of channel 5, the field "Name" in the stored result is expanded to the value "FrequencyRange_2 CH5".

4.10.7.3.2. Time Ranges

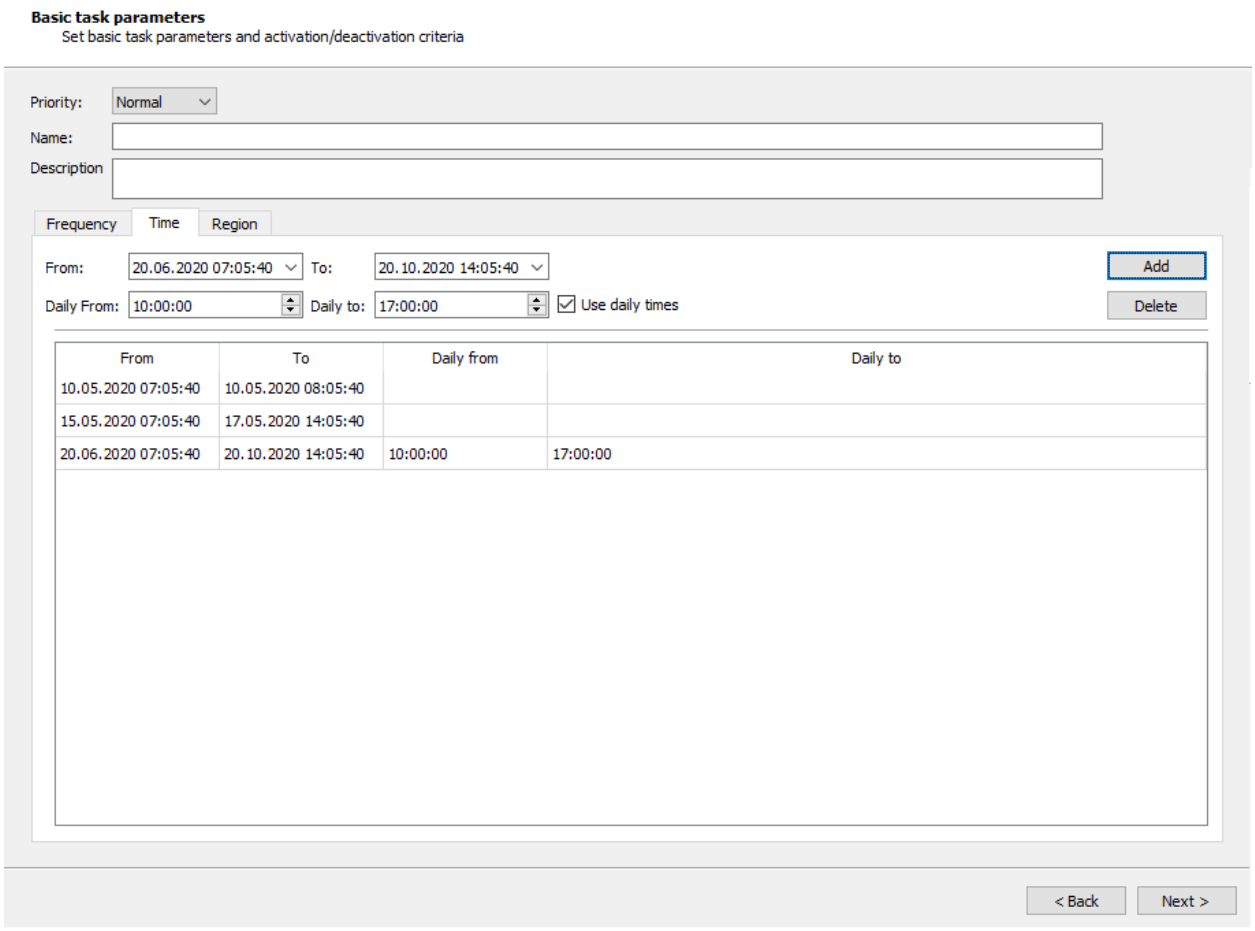


Figure 100.: Task Editing Window - Time Range

The tab <**Time**> defines the time range in which the task should be active. These can be relative (each day between a from- and to-time) or absolute (date/time from - date/time to). For each absolute time range (for example from 01.05.2019 – 07.05.2019), one activation based on daily time range can be defined (each day from 08 – 10 h).

All times in the system are defined in UTC.

If daily times are not inside the range defined by the absolute time range, the overlap between both will be used (19.08. 00.00.00 – 21.08. 01.00.00, daily 00.00.00 – 02.00.00 will finish at 21.08. 01.00.00).

If no time ranges are defined on this page, the task will always be active. At least one time-range must be defined for time-based wideband recording tasks.

4.10.7.3.3. Geographical Position (Optional, for Mobile Systems with GPS-Support)

With the tab <**Region**> you can define the geographical locations where the task should be active. These are defined as a list of map-based polygons. A graphical map display is provided for the operator to define these polygons. Additionally, you can define whether time and position activations will be combined by using the AND or OR operators.

By double-clicking on a region entry in the "Regions" list, position entries can be edited manually.

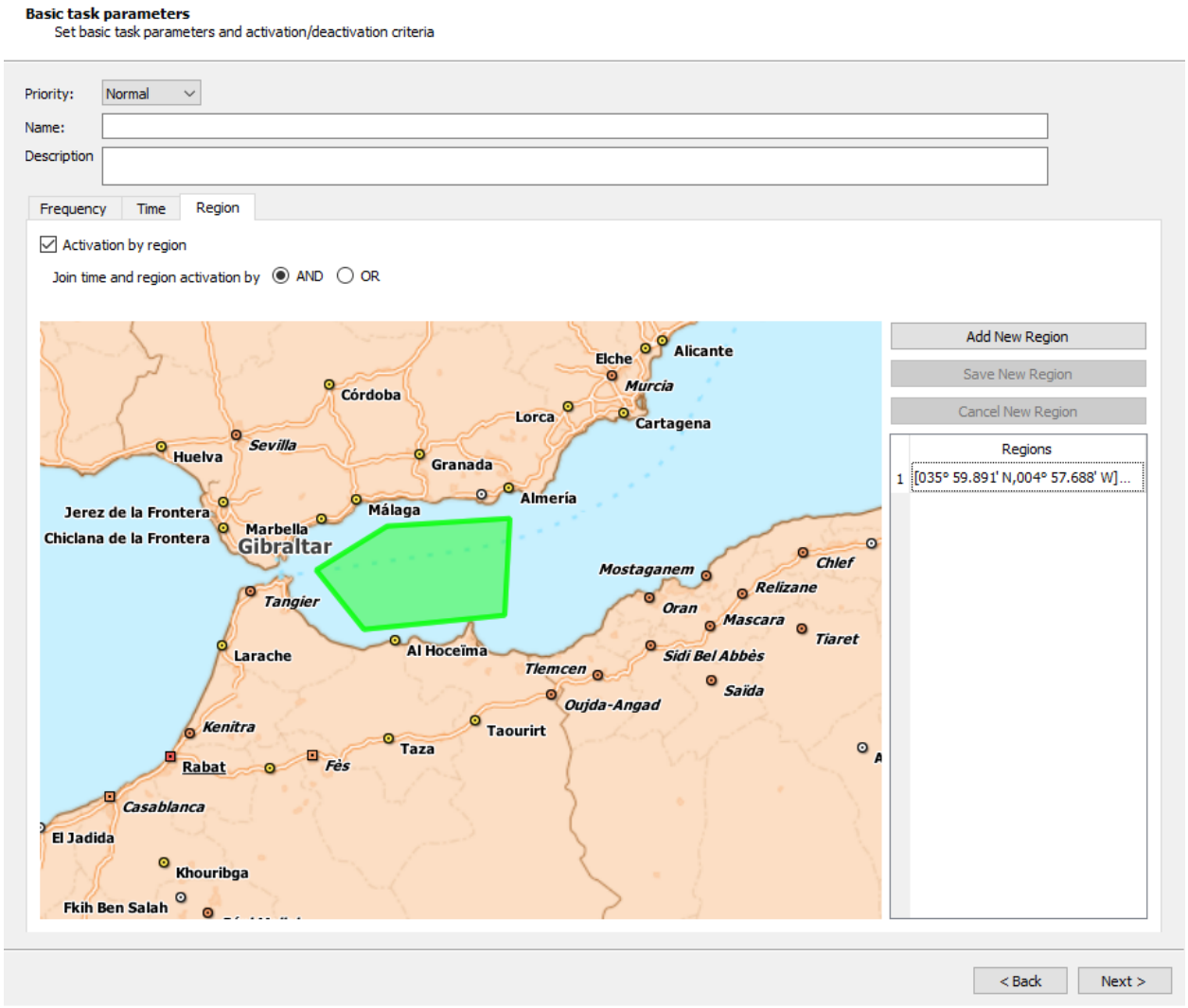


Figure 101.: Task Editing Window - Geographical Position

Important: For the frequency list scan with one narrowband channel task type, only search frequencies defined as single frequency entry can be added (see chapter Frequencies).

Important: For the wideband recording (time-based) task type, no further settings after this page are needed. The <**Summary**> page will be shown and the task creation will be complete.

4.10.7.4. Trigger for Wideband Classifier Tasks

4.10.7.4.1. Trigger Type

This part of the task defines which signals will be processed further by using task actions. Triggers are mostly based on the result from the wideband classifier (emission detection and classification) but can also use energy detection from the overview (panorama) spectrum generated by the receiver.

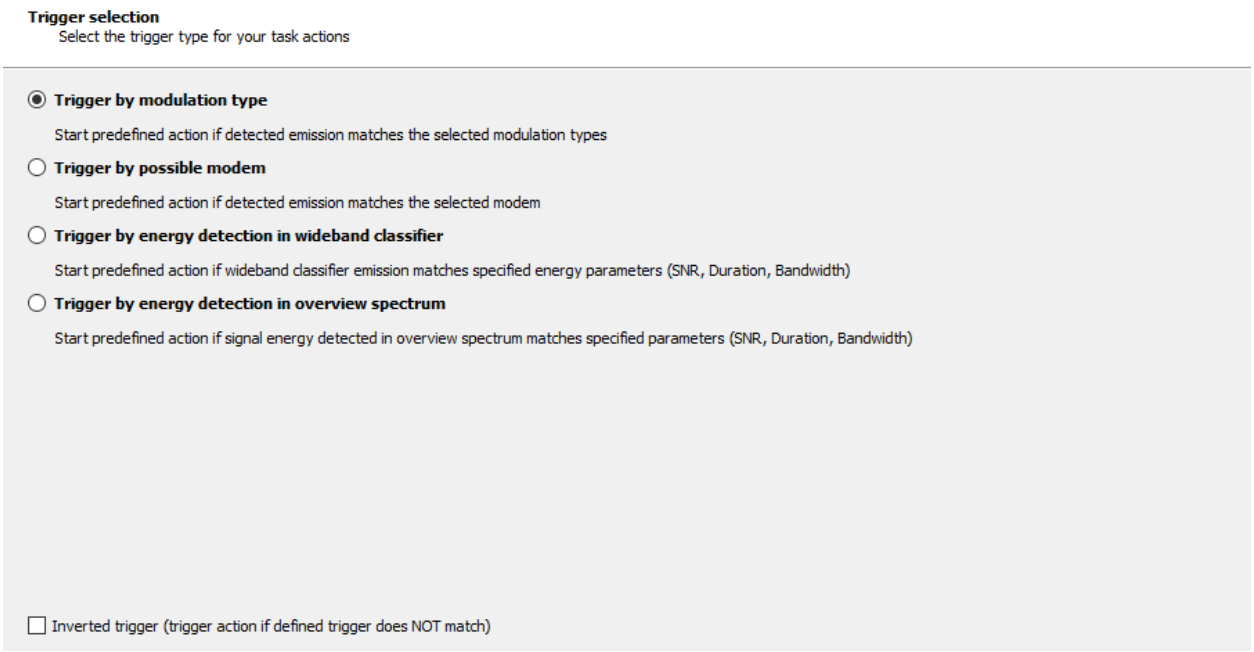


Figure 102.: Task Editing Window - Trigger selection

The type of trigger defines implicitly the receiver's behavior during the processing of this task (if the Auto-Coverage module is available and active).

Several types of triggers are available. For each trigger type, different search parameters can be selected. Most trigger parameters are related to the emission results of the wideband classifier. For all trigger types, additional energy triggering options based on relative signal energy (SNR), signal duration and signal bandwidth will also be available.

The operator can select only a single trigger type per task. Both modulation-type and modem-type triggers will include all settings available in the energy detection trigger as well.

In the bottom of the wizard page, there is an option to use "inverted trigger", i.e. to trigger actions if detected signal **does not** match the defined trigger.

4.10.7.4.2. Trigger by Modulation Types

Only if an emission detected by the wideband classifier fits the requested modulation type and its parameter will the emission be processed further.

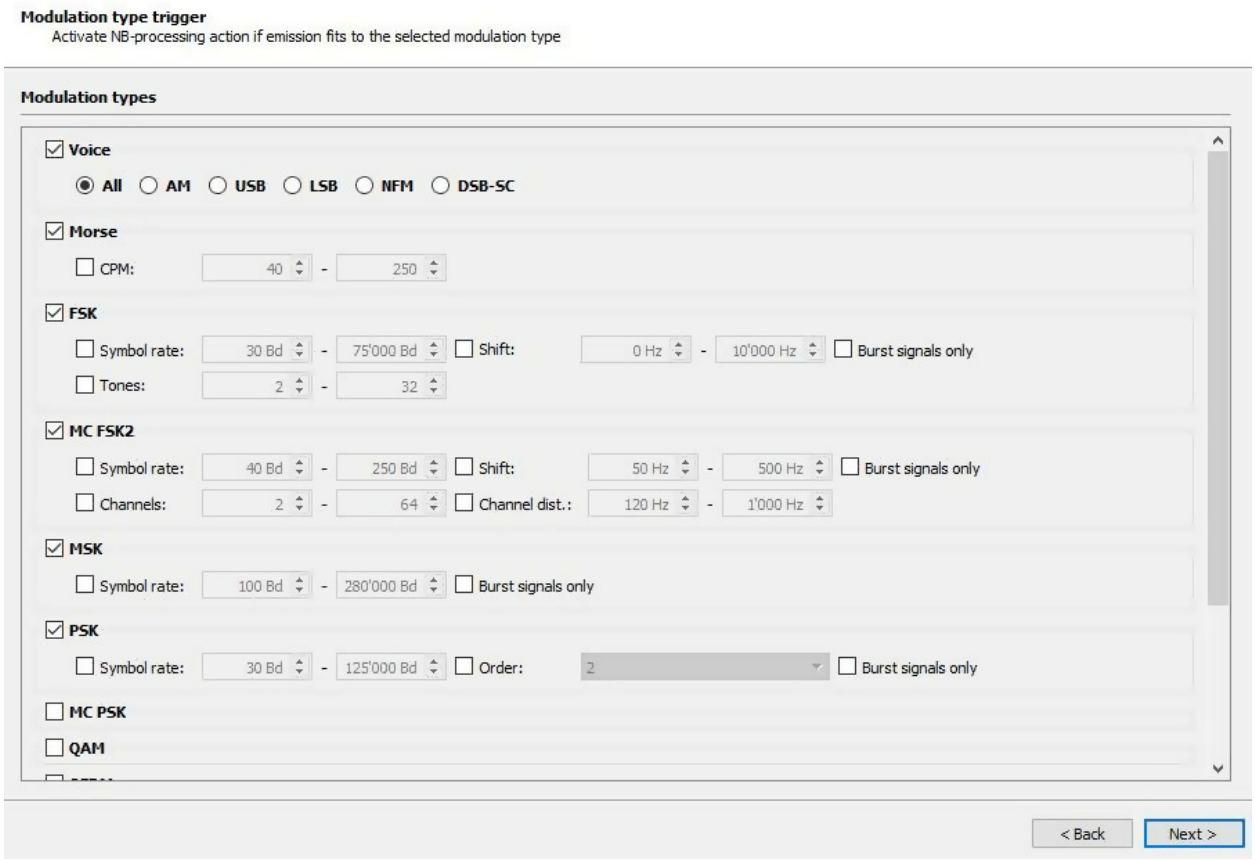


Figure 103.: Task Editing Window - Modulation Types

The following parameters are available to further verify the signal:

- Modulation type as multiple selection filter (PSK, FSK, Voice USB, Voice LSB, etc.)
- Symbol rate from – to
- Shift from – to
- Burst type
- ...

4.10.7.4.3. Trigger by Possible Modems

Wideband classification can match detected emission parameters (e.g. detected modem, modulation type or energy distribution) to the parameters of modem definitions existing in the system. The list of possibly matching modems is delivered with each detected emission and can be used to decide whether the emission should be processed further.

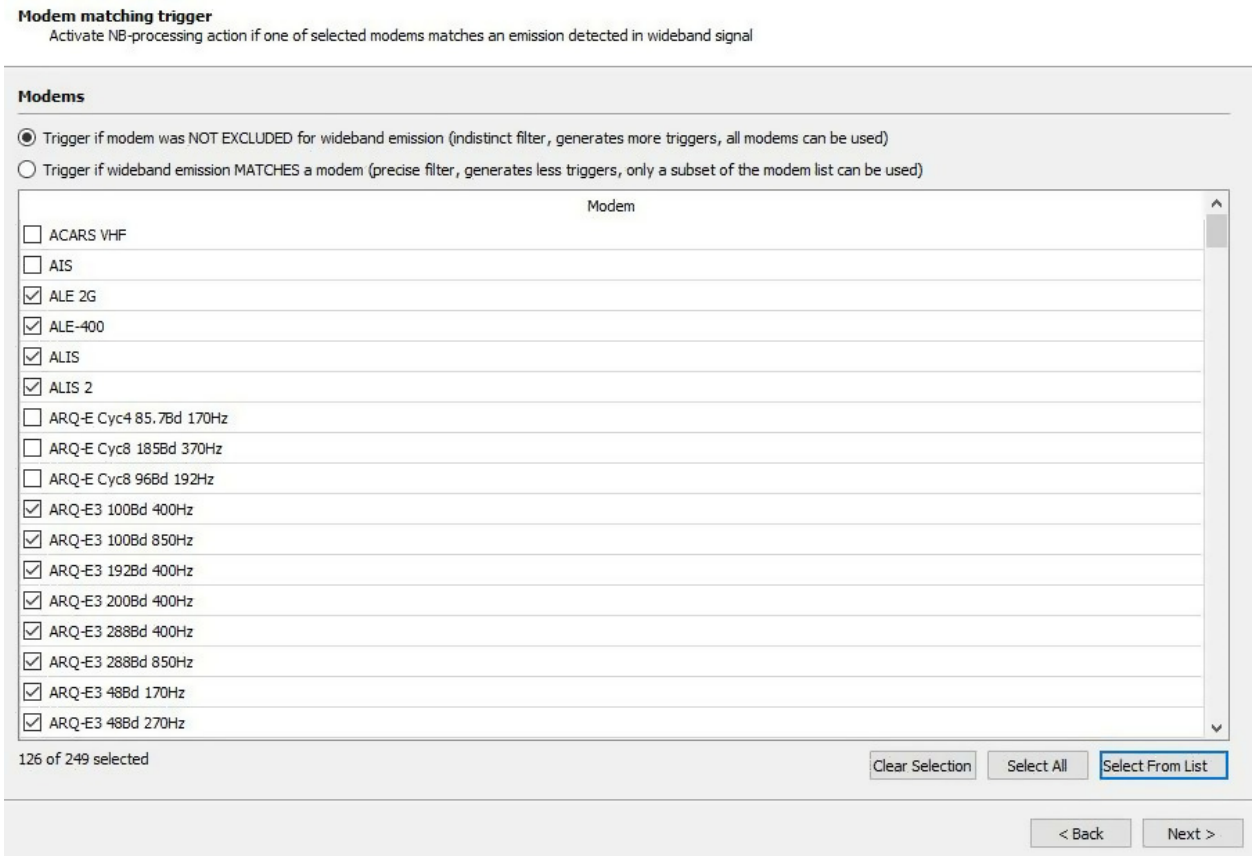


Figure 104.: Task Editing Window - Possible Modems

There are two methods for determining which modems fit a specific emission detected in the wideband classifier:

- Based on **Modem-EXCLUSION** in wideband classifier
  - All modems which are not explicitly excluded by the wideband classifier will be used for modem recognition and decoding. This filter is intentionally quite loose because it uses parameters such as bandwidth and duration for emissions where modulation type could not be determined. This method is possible for all modems.
- Based on **Modem-MATCH** in wideband classification
  - This is a precise filter which matches only modems which fit modulation type and parameters as detected in the wideband classifier. Emissions where modulation type could not be recognized are discarded. This method can be used only for modems which use modulation types recognizable by the wideband classifier. If this trigger option is chosen, the modem list will only display these modems.

There are two methods to select modems:

- Manual selection of modems from the displayed modem list. Each modem is a combination of a demodulator definition, decoder and, optionally, a spectrum pattern definition.
- Selection of modems from predefined modem lists (see chapter Modem List Editor for details about Modem List management)

4.10.7.4.4. Trigger by Energy Detection in Wideband Classifier or by Energy Detection in Overview Spectrum

Both energy detection triggers are defined in the same way, but will use detections from different sources:

- Energy detection in wideband classifier: Emission detections from wideband classifier will be used for triggering
- Energy detection in overview spectrum: Energy detection in overview spectrum is performed only if receiver delivers overview (panorama) spectra. If receiver delivers scan spectra, those will also be used (for details, see chapter Spectrum Overview). This type of trigger will only detect and trigger new emissions. Long, continuous emissions will be ignored. This type of triggering can be used to skip wideband signal processing completely by triggering from scan spectrum and using only narrowband receivers to process the signal. This type of detection, especially if using scan spectra, will typically have lower quality than detection in wideband classifier.

If a detected emission has a SNR above the defined level or duration/bandwidth in a certain value range, it will trigger a narrowband action. This filter should be used with caution because it can generate many narrowband actions. It should be used only in specific limited frequency range or combined with other triggers.

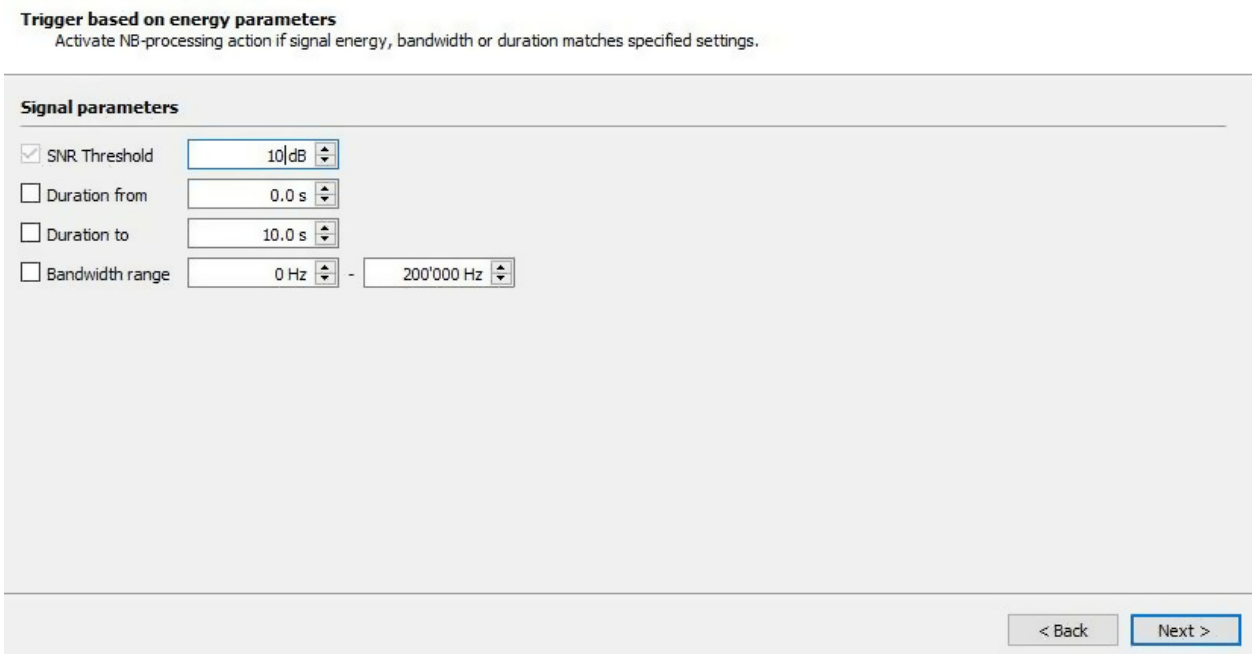


Figure 105.: Task Editing Window - Signal Energy Parameters Trigger

The following emission parameters can be described:

- Minimum signal noise ratio (SNR in dB)
- Minimum emission duration (in seconds)

- Maximum emission duration (in seconds)
- Bandwidth range (from – to in Hz)

4.10.7.4.5. Channel Actions (for "Wideband signal search with automatic narrowband channel processing" Task Type)

These settings define which functions will be performed in the system if a signal which matches trigger settings is found. Multiple selections are possible.

For triggered wideband recordings tasks, this page will not be displayed because the action always is a wideband recording.

For tasks with a fixed frequency list type, these actions will be performed for each frequency on the list.

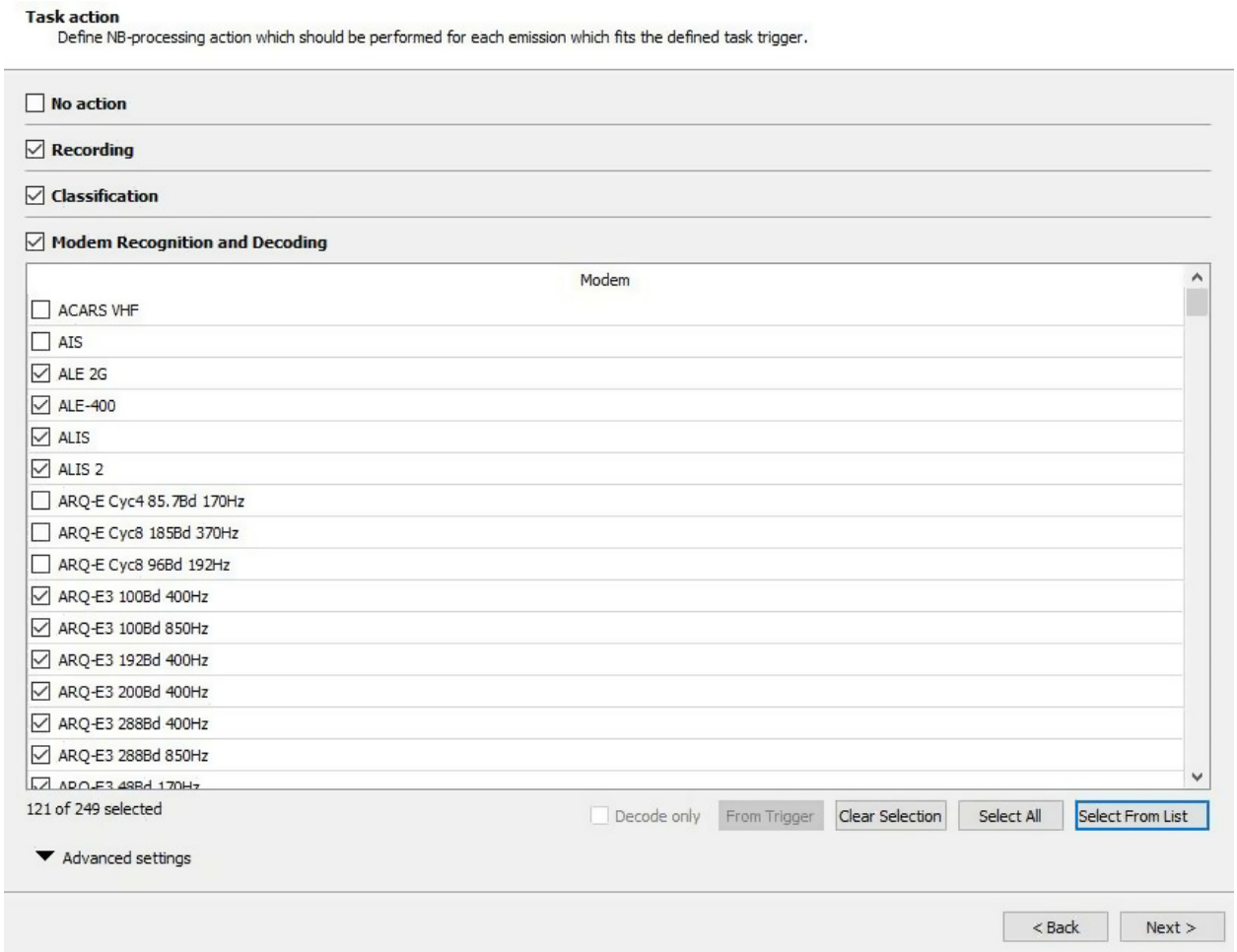


Figure 106.: Task Editing Window - Modem Recognition and Decoding

Each action delivers a result of a specific type. The results for each action are listed below.

Actions	Type	Result
<**No action**>	No NB-action will be performed	Only wideband classification results will be generated and stored into the database (depending on the specific system configuration). When selected, other options described below are automatically deselected and the **End Trigger** dialog is skipped.
<**Recording**>	NB-signal will be recorded	Recorded IQ files in WAV format
<**Classification**>	Modulation type detection in the narrowband channel is done continuously. A new classification will take place every 3 - 4 s and the results are stored in the database.	Modulation type and parameters
<**Modem Recognition and Decoding**>	If a modem-based trigger is used, the modem list defined for the trigger will be used	Recognized modem, decoder text and audio or binary data

Table 33.: Task Editing Window - Actions

4.10.7.4.6. Advanced Settings for Channel Action

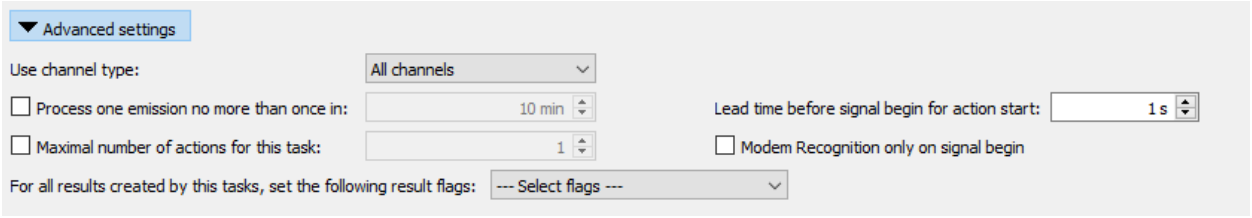


Figure 107.: Task Editing Window - Advanced Settings for Channel Action

Advanced options

Various fine-tuning options which can be used to maximize system performance are available. For standard system usage, default settings are mostly sufficient.

Function	Description
<**Use channel type**>	This option defines which type of narrowband channels will be used for executing actions defined in this task: DDC channels (i.e. narrowband channels extracted from the wideband signal in software components), NB-receivers (handoff receivers independent of the wideband signal (for details, see chapter Narrowband Receiver Control Option (NRC)) or all available channels regardless the type. This option is especially useful for the use case where action triggering is done directly from the overview scan spectrum. In that case, it does not make sense to use DDCs because there is no continuous wideband signal to extract from and the task would typically use only NB-receivers.

Function	Description
<**Process one emission no more than once in**>	This setting can be used to prevent processing a specific emission too often and starting a new trigger on each emission update report from classifier. The processing of one emission can be blocked for certain amount of time. It is applicable only if continuous wideband classification is used.
<**Lead time before signal begin for action start**>	Recording action starts with the signal recording ~1 s before the emission start reported by the classifier. By using this option, the user can increase this lead time. This option should not be used if the modem recognition and decoding action is selected because it may lead to false recognition in the prolonged lead time signal segment.
<**Maximal number of actions for this task**>	This option can be used to limit number of actions performed by the task. It can be useful if the user wants to collect a limited number of results without using system resources afterwards.
<**Modem Recognition only on signal begin**>	If the modem recognition and decoding action is used, production channels will go through the whole signal and search for requested modems. This can be a very performance-intensive operation for long modem lists. The process can be optimized by using modem recognition only on signal begin (~10 s). If no modem has been found, modem recognition will quit without processing the whole signal.
<**Result flags**>	Selected result flags will be set for each result created by this task's actions. WB-classification results which served as a trigger will also get the same set of flags. If a single WB-emission was used as a trigger for multiple tasks, it will contain a sum of all flags defined in all triggered tasks.

Table 34.: Task Editing Window - Advanced Options

For more details about execution procedures for this type of task, see chapter Task Execution Procedure for Search Tasks.

4.10.7.4.7. Channel Actions (for "Wideband signal search with live processing" Task Type)

For <**Live processing**> task type, Channel Action page includes a reduced set of options which are applicable for interactive action execution.

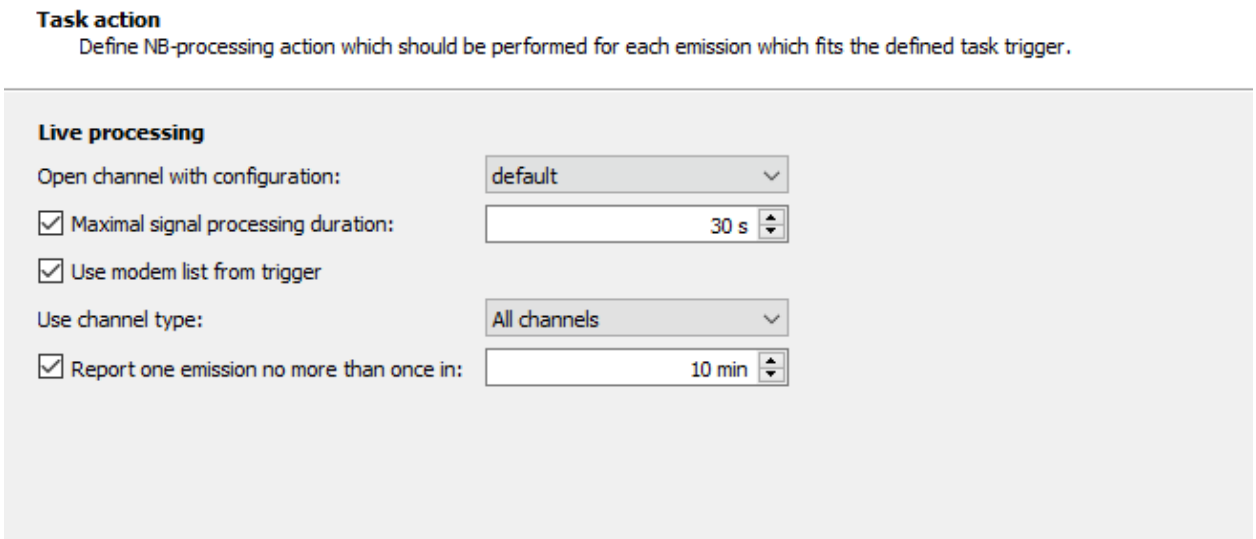


Figure 108.: Task Editing Window - Wideband Signal Search with live Processing

Function	Description
<**Open channel with configuration**>	This option defines which channel configuration should be applied to a GUI channel before opening it to process detected signal. The channel configuration defines its layout and all processing options. See chapter Channels for more information about creating and using channel configurations.
<**Maximal signal processing duration**>	This option defines the maximum processing duration of a narrowband signal in the GUI. If not set (default), the signal will be processed in the GUI channel until user closes the channel manually. If this option is set, the channel will be closed automatically after the specified amount of time.
<**Use modem list from trigger emission**>	This option determines if the possible modem list from the signal detection (typically, emission from the wideband classifier) should be used as a default modem list in the GUI channel. If not set, a modem list stored in the channel configuration will be used. This option makes sense only for "Recognition + Decoding" channel mode because the list in mode "Classification + Recognition + Decoding" is generated automatically. It is always recommended to use this option if you use wideband classifier as a trigger source and if your channel configuration uses "Recognition + Decoding" channel mode.
<**Use channel type**>	This option defines which type of narrowband channels will be used for executing actions defined in this task: DDC channels (i.e. narrowband channels extracted from the wideband signal in software components), NB-receivers (handoff receivers independent of the wideband signal (for details, see chapter Narrowband Receiver Control Option (NRC)) or all available channels regardless the type. This option is especially useful for the use case where action triggering is done directly from the overview scan spectrum. In that case, it does not make sense to use DDCs because there is no continuous wideband signal to extract from and the task would typically use only NB-receivers.
<**Report one emission no more than once in**>	This option can be used to prevent processing of a specific emission too often and starting a new trigger on each emission update report from classifier. The processing of one emission can be blocked for a certain amount of time. It is applicable only if continuous wideband classification is used.

Table 35.: Task Editing Window - Wideband Signal Search with live Processing Functions

For more details about execution procedures for this type of task, see chapter Task Execution Procedure for Search Tasks.

4.10.7.4.8. End Trigger

This part of the task definition determines when the narrowband action of a task will be stopped and which additional system events will be triggered. It is not available for "Wideband signal search with live processing" or "Wideband Recording" tasks.

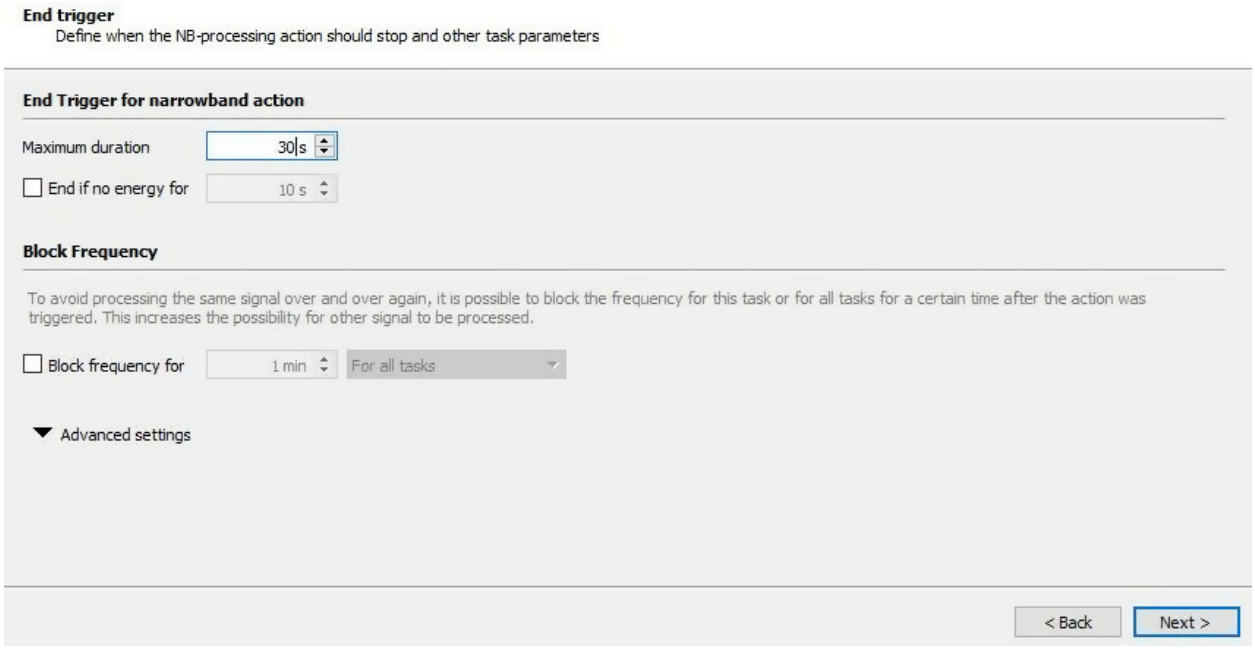


Figure 109.: Task Editing Window - End Trigger

Function	Description
<**Maximum duration**>	In seconds. Overall maximal signal duration for defined action. This specifies PC time and not the signal time. Therefore, it is possible that signal time will be longer due to the fact that processing will use a delay buffer at the beginning of the action to start in the past.
<**End if no energy for**>	In seconds. If there is no energy in the channel for this period of time, the action will be stopped
Block Frequency	The operator can choose to block a signal frequency for this task only, or for all tasks for a certain amount of time after the action has been executed. This setting is used to prevent the system from triggering multiple times on the same signal. The frequency blocking will not be activated for expired actions, only for executed actions. The system will block the frequency and the entire bandwidth of the trigger for this action.

Table 36.: Task Editing Window - End Trigger Functions

4.10.7.4.9. Advanced Settings for End Trigger

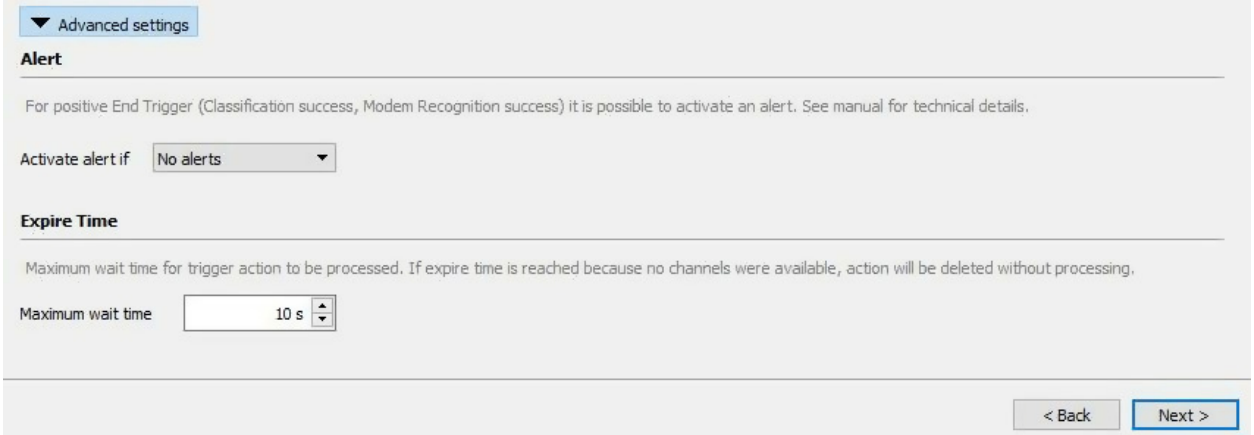


Figure 110.: Task Editing Window - Advanced Settings for End Trigger

Alert

The operator can issue an alert for task-based events (for details, see chapter Alerts). The following options are possible.

Option	Description
<**No alerts**>	There will be no alerts in this task
<**Triggered**>	A signal event is detected in the wideband classifier which matches this task's trigger. The alert will be issued even if there are not enough resources to execute the action.
<**Action executed**>	The action defined in this task has been executed
<**Positive action result**>	Available only if one of the **Modulation type classification** or **Modem recognition and decoding** actions is executed in this task. If the modulation type has been recognized (for the classification action) or if the modem has been recognized (for the modem recognition action), the alert will be issued.

Table 37.: End Trigger - Alert Options

Expire time

The operator defines the maximum time the action can wait for an available NB resource (channel) before the action gets deleted. It will be used in cases where an action should be started but there are no available resources to execute it (all channels are busy).

4.10.7.5. Task Creation Summary

The creation of a new or the editing of an existing task is finalized by displaying the summary holding the related configuration. The amount of information shown depends on the type of task (see chapter Creating and Editing Tasks).

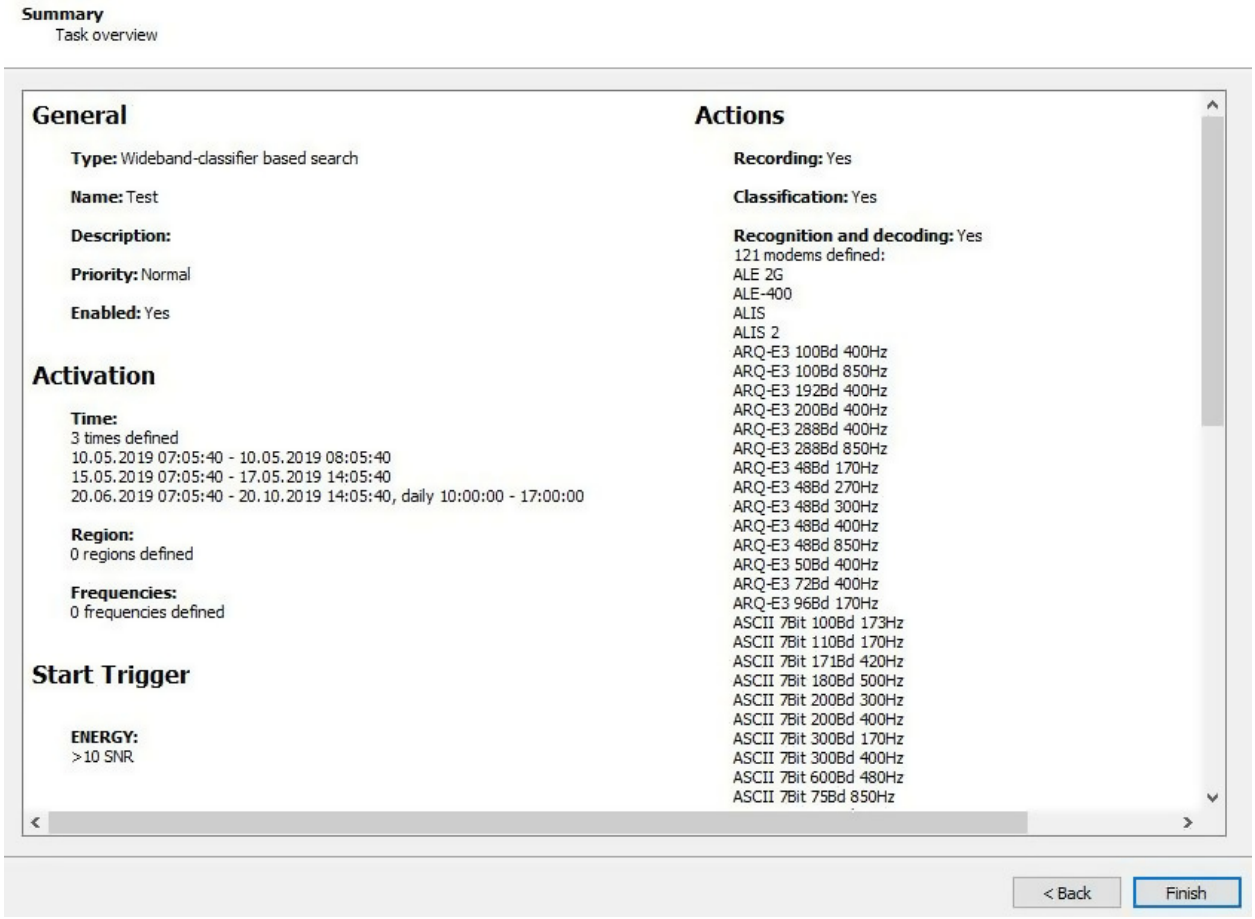


Figure 111.: Task Creation Summary

4.10.8. Task Creation Workflow

Figure 112 describes the process of a task creation for all task types and illustrates the decisions which can be made during the process.

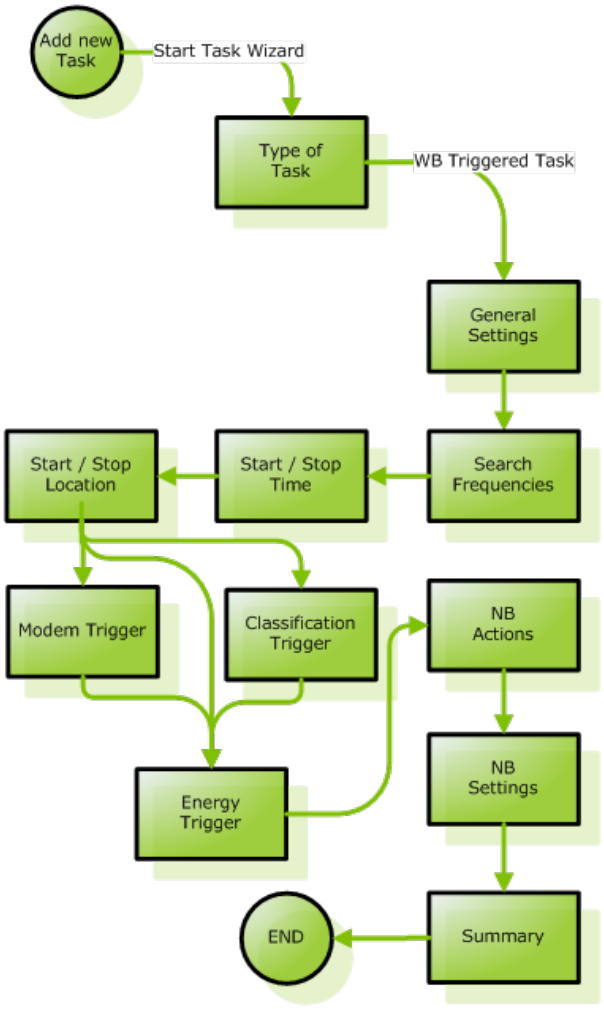


Figure 112.: Task Creation for Wideband Search Tasks

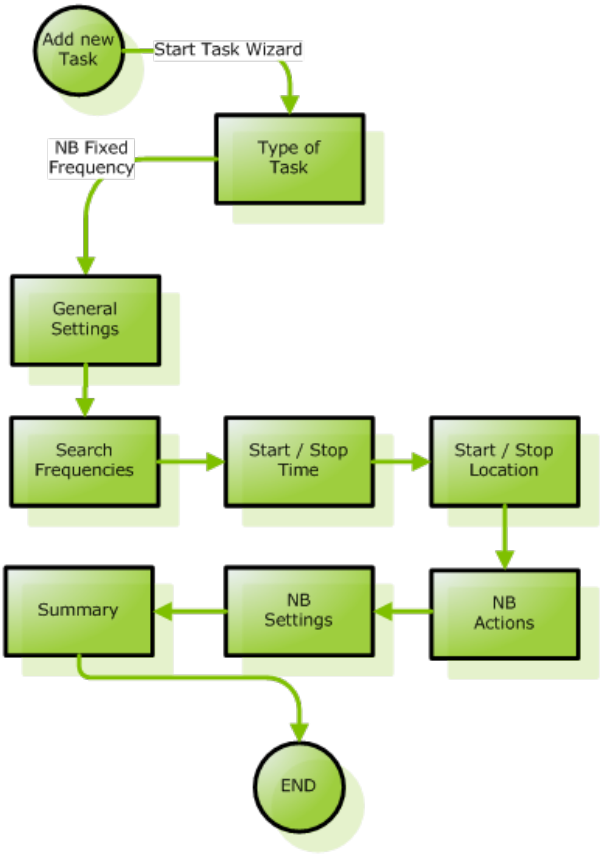


Figure 113.: Task Creation for Narrowband Fixed-frequency Tasks

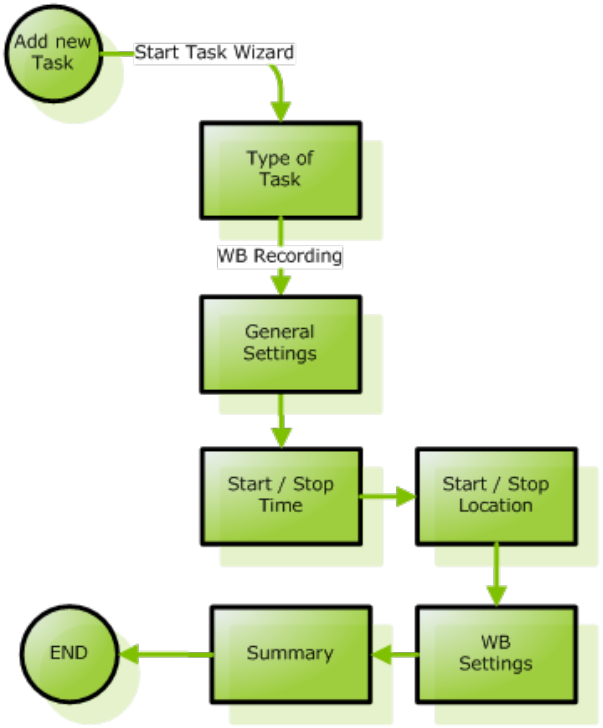


Figure 114.: Task Creation for Wideband Recording Tasks

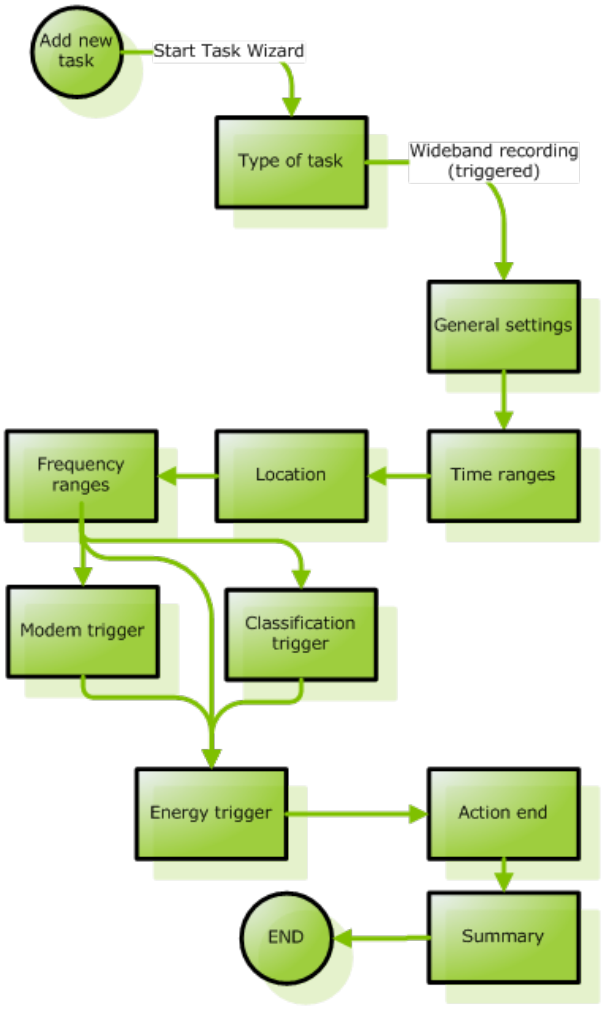


Figure 115.: Task Creation for Triggered Wideband Recording Tasks

4.10.9. Task Execution Procedure for Search Tasks

The following diagrams show simplified procedures for processing tasks which search for emissions in wideband frequency ranges.

4.10.9.1. Wideband Signal Search with Live Processing

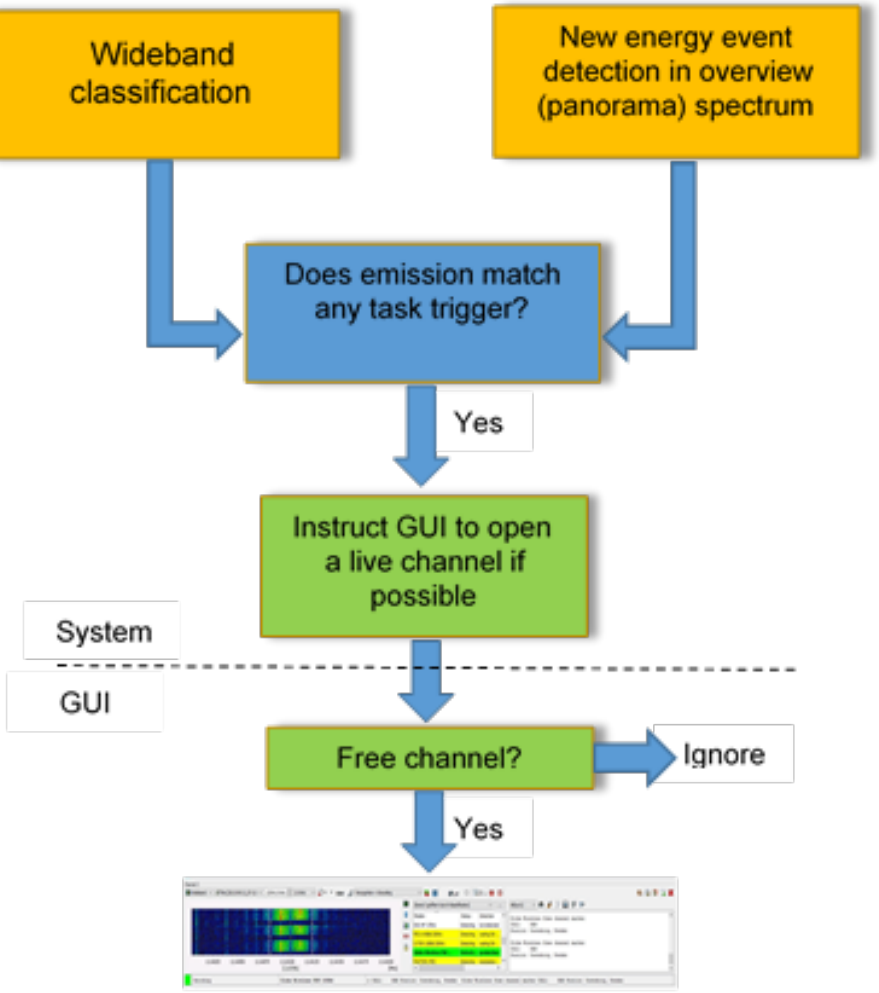


Figure 116.: Task Execution Wideband signal search with live processing

1. go2MONITOR is constantly monitoring the wideband classification results or overview spectrum events of the input signal and matching them to the currently active set of tasks defined by the operator
2. When there is a match between an emission and a task, a request is sent to the GUI to open a channel with requested channel configuration, frequency, bandwidth and a recommended modem list
3. If there are no available channels in the GUI, the request will be ignored
4. If an available channel is available in the GUI, it will be opened as requested, will start processing the signal and will wait for user interaction

4.10.9.2. Wideband Signal Search with Automatic Narrowband Channel Processing

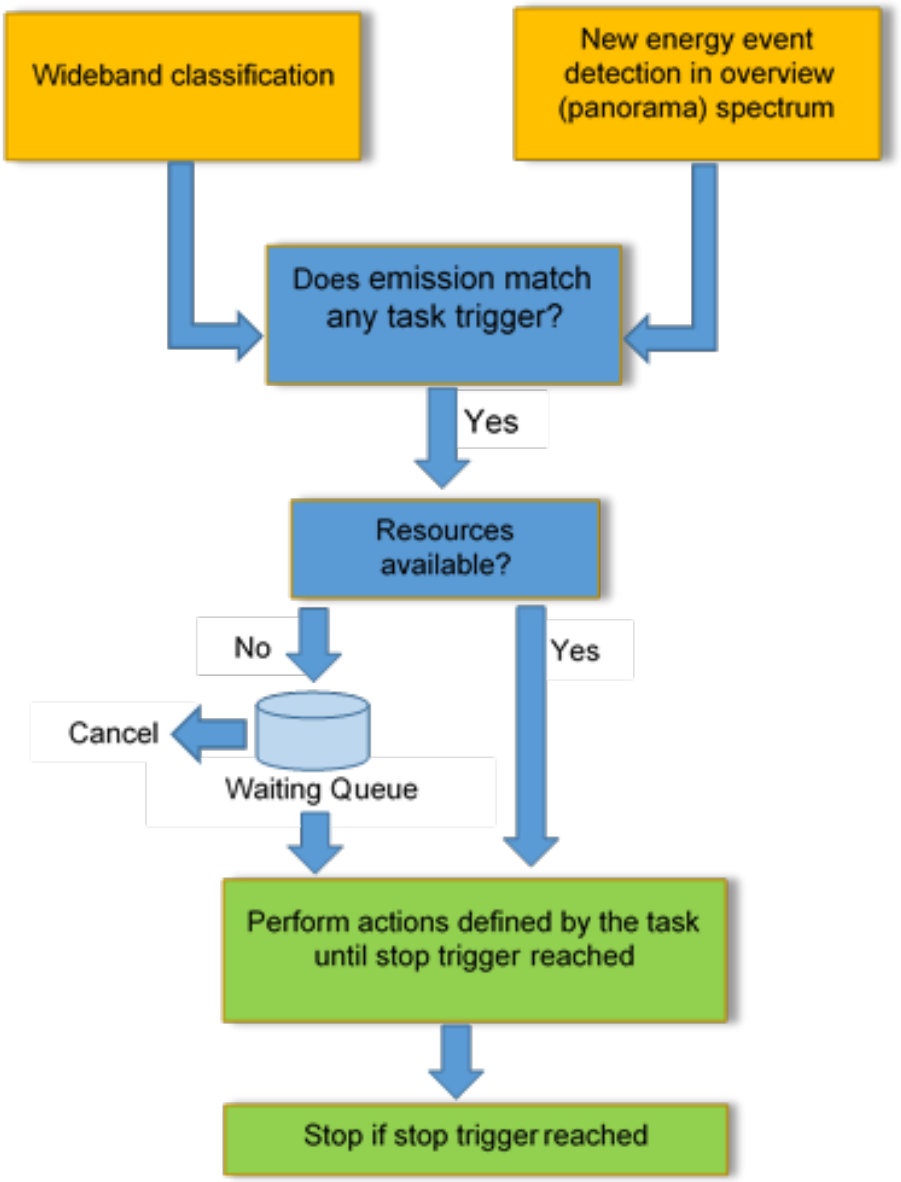
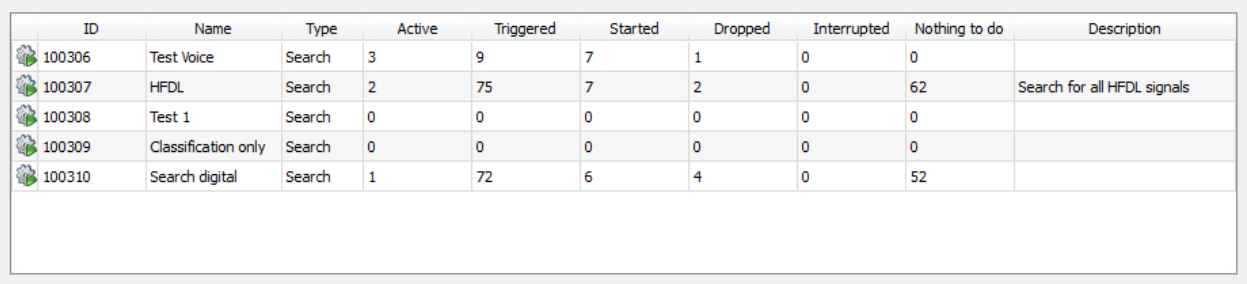


Figure 117.: Task Execution Wideband signal search with automatic narrowband channel processing

1. go2MONITOR is constantly monitoring the wideband classification results or overview spectrum events of the input signal and matching them to the currently active set of tasks defined by the operator
2. When there is a match between an emission and a task, a defined action is executed. For example, a narrowband receiver is parameterized to the emission frequency and its output signal is demodulated and decoded by one of the production channels.
3. If there are not enough resources to execute the action, it waits for a user-defined expiry time. After the expiry-time is reached the action is cancelled without any results.
4. All results produced by automatic tasks are stored in the integrated database and can be retrieved or exported later using the ResultViewer.

4.10.10. Mission Statistics

All currently active tasks (tasks in an active mission with the enabled flag set) will be shown in the **Task Execution** docking window.



ID	Name	Type	Active	Triggered	Started	Dropped	Interrupted	Nothing to do	Description
100306	Test Voice	Search	3	9	7	1	0	0	
100307	HFDL	Search	2	75	7	2	0	62	Search for all HFDL signals
100308	Test 1	Search	0	0	0	0	0	0	
100309	Classification only	Search	0	0	0	0	0	0	
100310	Search digital	Search	1	72	6	4	0	52	

Figure 118.: Task Activity Window

Besides displaying task data such as "ID", "Name" and "Type", this view displays some action execution statistics. The following fields are available:

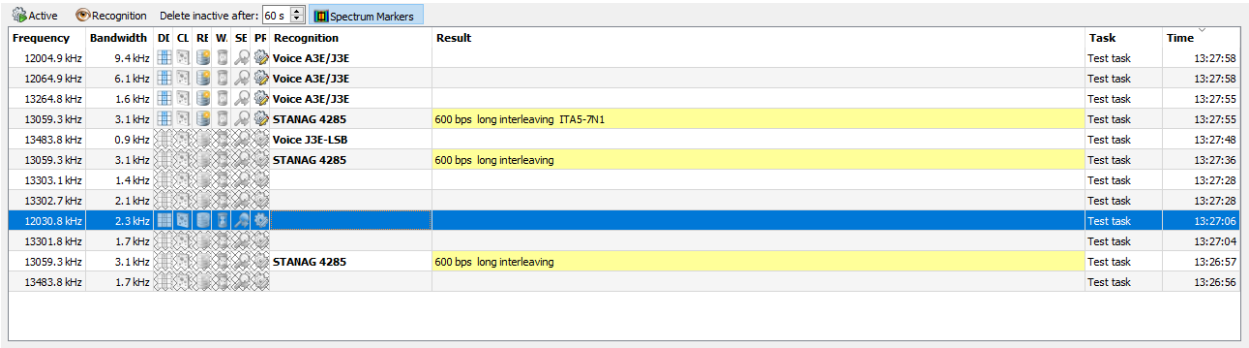
Option	Description
"Active"	Number of active actions for this task. For wideband search tasks, this corresponds to a number of NB-channels currently used by this task
"Triggered"	Number of trigger events matching the criteria of this task. For wideband search tasks, this the number of emissions detected by the wideband classifier matching the task trigger.
"Started"	Total number of actions started by this task
"Dropped"	Total number of actions which could not be executed because there were no resources
"Interrupted"	Number of actions which were started but interrupted because a task with a higher priority required the resource
"Nothing to do"	Number of actions which were triggered but not executed because no further processing was required, e.g. if only the <**Recognition and Decoding**> action was requested but all requested modems were filtered by the classification and removed from the list

Table 38.: Task Activity - Actions

To enable or disable a single task, use the context menu in the task table.

4.10.11. Mission Channels

The <**Mission Channels**> view shows a detailed overview of the current status of actions triggered by active tasks and channels used for automatic processing. It includes information from all task types except Wideband Recordings.



Frequency	Bandwidth	Recognition	Result	Task	Time
12004.9 kHz	9.4 kHz	Voice A3E/J3E		Test task	13:27:58
12064.9 kHz	6.1 kHz	Voice A3E/J3E		Test task	13:27:58
13264.8 kHz	1.6 kHz	Voice A3E/J3E		Test task	13:27:55
13059.3 kHz	3.1 kHz	STANAG 4285	600 bps long interleaving ITA5-7N1	Test task	13:27:55
13483.8 kHz	0.9 kHz	Voice J3E-LSB		Test task	13:27:48
13059.3 kHz	3.1 kHz	STANAG 4285	600 bps long interleaving	Test task	13:27:36
13303.1 kHz	1.4 kHz			Test task	13:27:28
13302.7 kHz	2.1 kHz			Test task	13:27:28
12030.8 kHz	2.3 kHz			Test task	13:27:06
13301.8 kHz	1.7 kHz			Test task	13:27:04
13059.3 kHz	3.1 kHz	STANAG 4285	600 bps long interleaving	Test task	13:26:57
13483.8 kHz	1.7 kHz			Test task	13:26:56

Figure 119.: Mission Channels View

The frequency and bandwidth of the trigger emissions, classification result, recognized modem or modulation type and possible production result are displayed in a table. Furthermore, the task name that triggered the action and the time of the last status change are displayed. In addition, the current activities of a channel are shown graphically with the following icons:

Button	Description
	Channel is active, i.e narrowband signal is extracted
	Narrowband classification is running
	Narrowband signal is beeing recorded
	Signal waits for production channel
	Production channel is in modem search phase
	Production channels is in decoding phase

Table 39.: Mission Channels Functions

The columns can be arranged by clicking and dragging on the column headings. By clicking on individual column headings, the rows are sorted according to the values in this column. These settings will be saved and reused after go2MONITOR is restarted.

Besides active channels, the view also displays terminated channels for a short time period. The duration of this period can be set in seconds with the parameter "Delete inactive after" in toolbar. Activity icons for inactive channels are displayed with hatched overlay  .

To display only the active channels in the table, use the Active toolbar button  .

To display only channels where modem or modulation type was detected, use Recognition filter button  .

When the Spectrum markers button  is activated, a marker showing the frequency and the status of the active channels is displayed in the corresponding wideband spectrograms. In addition, the channel currently selected in the table is highlighted in the corresponding wideband spectrogram by changing its line width. This does not apply for channels derived from "Live Processing" tasks because they use their own channel marker display in spectrogram.

A context menu with various selectable actions can be opened for a selected table row:

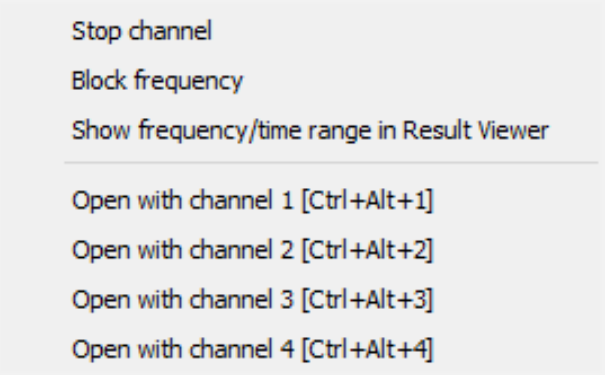


Figure 120.: Mission Channels - Context Menu

Option	Description
<**Stop channel**>	Stop processing of the signal in this channel
<**Block frequency**>	Add channel frequency to the global blocked frequency list. This will prevent future triggers for this frequency.
<**Show frequency/time range in ResultViewer**>	Show frequency/time range of this channel in the ResultViewer
<**Open with channel X**>	Process this frequency with the specified GUI channel

Table 40.: Mission Channels - Actions

4.10.12. Task-Based Filter

This function allows for the filtering of emissions in the list based on their match with the trigger part of selected wideband search tasks.

The tree view display shows all missions/tasks existing in the system (active or inactive). The operator can select single or multiple tasks. If any of the tasks is selected, the mission list will display only emissions matching the activations and trigger parts of any of the selected tasks. Region and time activation will not be considered.

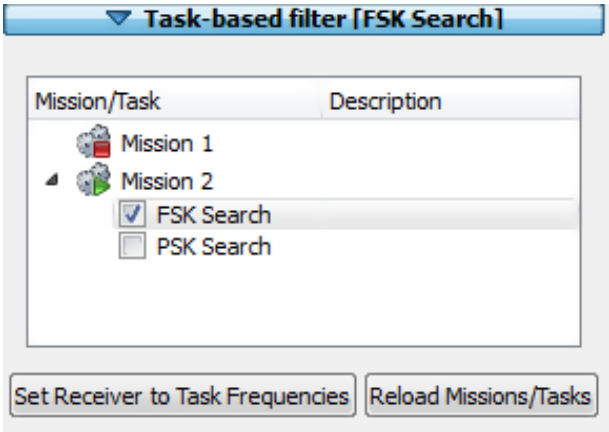


Figure 121.: Task-based Filter Window

If any of the tasks are edited, then the task filter will not be updated automatically. The operator has to select <**Reload Missions/Tasks**> in order to reload the tasks and use the new settings.

By clicking on the <**Set Receiver to Task Frequencies**> button, the following actions will be triggered:

- All tasks that are selected in the <**Task-based filter**> dialog will be queried for their search frequencies
- The current receiver will be set to the optimal frequency and bandwidth to cover all frequencies specified as search frequencies in selected tasks. This function is similar to the operator setting the receiver's frequency and bandwidth manually - the new function deals with determining the optimal values (frequency and bandwidth) and setting them. If it is not possible to cover all or any frequencies by using the current receiver, a message to this effect will be shown.

4.10.13. Alerts

Alert actions can be defined by the operator to report certain task events detected during task execution. The following alert types for a task are possible:

- **Triggered:** A signal event is detected in the wideband classifier which matches this task's trigger. The alert will be issued even if there are not enough resources to execute the action.
- **Action executed:** The action defined in this task has been executed
- **Positive action result:** Available only if one of the actions <**Classification**> or <**Modem Recognition and Decoding**> is selected in this task. If the modulation type has been recognized (for the classification action) or if the modem has been recognized (for the modem recognition action), the alert will be issued.

All alerts are implemented by calling an external command-line application provided by the system integrator. This provides easy integration into existing systems without changing the software.

The actual name and location of the command-line alert application is defined during system integration and stored in the system configuration (alert.exe is used as an example below):

```
alert.exe ALERT_TYPE_SIGNAL <task_name> <frequency> <description>
```

<task name> The name of the task that raised the alert

<frequency> The corresponding frequency

<description> The optional description parameter provides textual information about the event

The following table contains all possible descriptions:

Event	Description
Action started	Action started: [DDC] [+Classification] [+Record] [+Production]
Action result	Modem _ Name recognized Modulation _ Type recognized
Trigger detected	Emission trigger detected

Table 41.: Alert Descriptions

To configure the actual path to the custom alert command-line application, the following line should be added to the as_controller.conf file located in the user settings directory:

```
<add key="SignalAlertAppPath" value="$_APP_PATH_$signal_alert.bat" />
```

Instead of "$_APP_PATH_$signal_alert.bat", the actual full path of the command-line application should be entered. A variable "$_APP_PATH_$" can be used to replace the installation directory path.

4.10.14. Task Priority

Tasks priority defines how the system resources (WB-receiver and NB-channels) are assigned to the active tasks.

All task actions which require an NB-channel are stored (after being triggered) in a Resource Queue. This list is sorted based on task priorities. Tasks which reach expiry are deleted automatically from the Resource Queue. The expiry-time is defined during the task creation.

As soon as one NB-channel becomes available, the first action from the list is started. Actions with the highest priority (critical) are allowed to stop any lower-priority actions running on NB-channel.

The following task priority levels are possible:

- **Critical**. If a task with critical priority requires a NB-channel, it is allowed to stop any current action that was triggered by a non-critical task. This priority should be used only for few very important tasks.
- **Normal**. Actions with normal priority will be positioned before low and idle priority actions in the Resource Queue. They can stop any action running with idle priority.
- **Low**. Actions with low priority will be positioned before idle priority actions in the Resource Queue. They can stop any action running with idle priority.
- **Idle**. Actions with idle priority have the lowest priority in the Resource Queue. This priority level should be used only for unimportant tasks, which should run when system resources are available.

4.10.15. Offline vs. Online Processing

go2MONITOR can use two strategies to perform an action, if an Automatic Wideband Monitoring Task action includes modem recognition and decoding function (APC channels are used):

- **Offline:** Signal is recorded in the signal file first and then processed with the APC channel. The advantage of this strategy is that APC channel can process a signal faster than in real time because the file is already recorded (APC channel speed depends on the product license). This increases the overall system throughput and reduces the number of recognition and production channel licenses needed.

  The disadvantage of this strategy is that the recognition and production results are slightly delayed because the processing has to wait until a file is completely recorded before processing it. Therefore, signal files in narrowband recordings are automatically split into smaller files of configurable size (default 60 s).

  Offline strategy should always be used if the number of DDC channels is higher than the number of APC channels.

  Even if task action does not include recording action but includes recognition and decoding, the signal will be recorded, because it is the only way to get it processed with the APC channel. In that case, after the recording has been processed by the APC channel, recorded files will be deleted but database entry for the recording will remain in the database (files will be displayed as «missing»). If recording action is included in the task, the files will not be deleted.

  Signals which are waiting for processing with the APC channels will form a FIFO queue and will wait for the next available APC channel. After the defined maximum wait time (the

mission settings default is 10 min), and if they are still waiting for an APC channel, these tasks will be deleted to prevent the queue from growing endlessly.

- **Online:** Signal is streamed directly from the DDC channel into the APC. This strategy will work only if the number of DDC channels is the same as the number of APC channels. APC channels process the signal in realtime. Recognition and decoding results are typically delivered with only a few seconds delay.

Offline strategy is used as default in systems with many DDC channels. Online strategy is used in smaller systems (desktop) with the same number of DDC and APC channels. Users can choose between these modes during mission creation.

4.11. Emissions

Snapshot classification performs one search for emissions in all active wideband channels. Every detected emission is classified if possible (modulation type and/or modem type are detected) and the results are displayed in the emission table.

If the AMT option is available and a mission is currently active, the classifier will work in continuous mode tracking all emissions and delivering emission information updates in 3-4s intervals. The results will be displayed in the same way as for snapshot classification.

Figure 122 shows the workflow of the classifier.

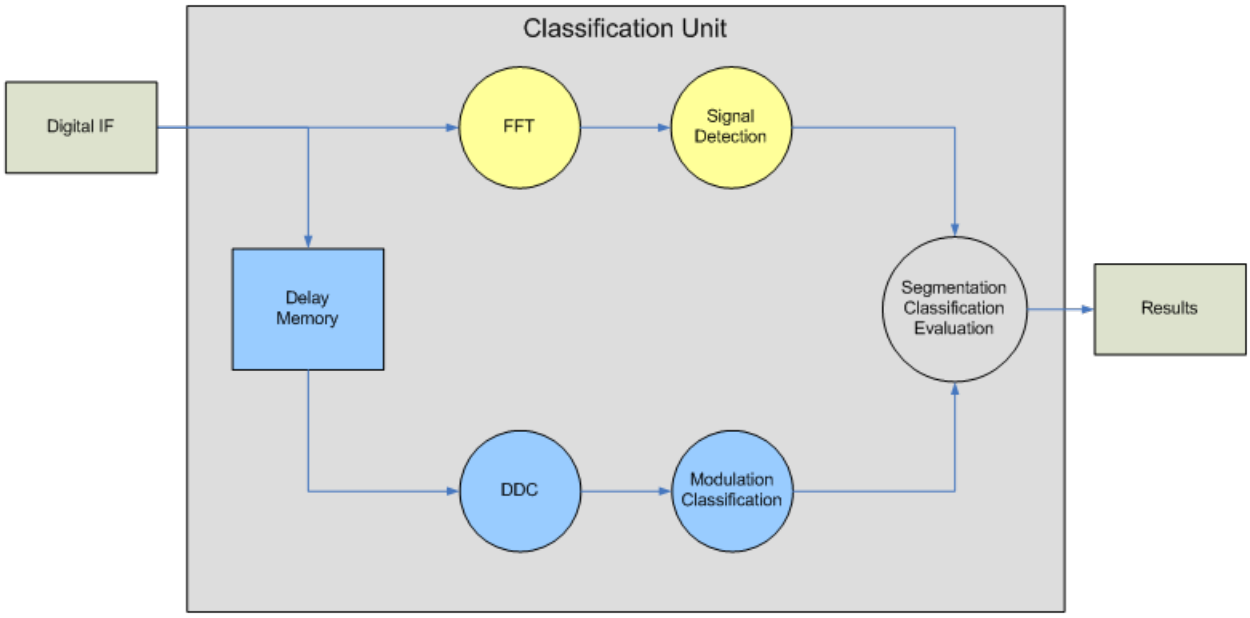


Figure 122.: Classification Unit

4.11.1. Signal Detection and Segmentation

The input signal is transformed into the spectral domain by Fast Fourier Transformation (FFT), which is marked in yellow in Figure 122.

In the spectral domain all emissions and their parameters are determined. The following steps are executed cyclically:

- Noise level curve estimation
- Separation of noise and signal

- Center frequency and bandwidth measurement
- Energy distribution measurement
- Signal start and end time detection
- SNR measurement
- On-Air time and burst behavior measurement
- Detection of wideband interference and elimination of errors in the result
- Time behavior for separation and combination of adjacent signals
- Rule-based merging of measured energy into emissions
- Definition of blocked-frequencies or ranges
- Automatic adaptation of detection parameters to the different frequency ranges (HF/VUHF)

4.11.2. Classification of Modulation

The classification of modulation is marked in blue in Figure 122. The determination of the modulation type or modem is performed for each signal within a wideband input.

Buffering

The input signal is stored in a buffer so that no part of the signal is lost during segmentation or classification.

DDC

All detected emissions within the wideband input are converted to narrow band signals by the Digital Down Converter (DDC) software. This way, wideband input is fragmented into narrower segments.

Classification

In this step, the common modulation type, modulation parameters or modem are detected directly from the signal. Additionally, unmodulated carriers and sweepers are detected based on their energy patterns.

4.11.3. Classifier Results

The emission table consists of the following columns:

- Type
  Contains the modem name of the emission, if it could be identified. If not, the modulation type is entered. If these could not be determined, either “Unknown” or “Not available” will be entered.
- Frequency
- Bandwidth
- Distance (shift / sound / channel)
  (Shift between carriers at FSK or number of tones in a MFSK signal)
- Symbol Rate
- SNR

- Input
  Reference to the wideband channel in which the issue was detected
- List (count) of matching frequencies from the <**Frequencies**> view.
  It will be filled with data only if the table row has been selected.

A typical <**Results**> window is shown in Figure 123.

Type	Frequency	Bandwidth	Distance (Shift/Tone/Ch)	Symbol rate	SNR	Input	Time	Frequencies
PSK8A	8303.8 kHz	3125 Hz		2400.0 Bd	24 dB	File ...	14:09:22	
PSK8A	8326.9 kHz	3013 Hz		2400.0 Bd	21 dB	File ...	14:09:22	
Morse	8424.0 kHz	188 Hz		60.0 Bd	23 dB	File ...	14:09:22	
PSK8A	8430.0 kHz	3125 Hz		2400.0 Bd	29 dB	File ...	14:09:22	
FSK2	8439.0 kHz	1250 Hz	876.3 Hz	75.0 Bd	48 dB	File ...	14:09:22	
PSK8A	8450.0 kHz	3125 Hz		2400.0 Bd	14 dB	File ...	14:09:22	
PSK8A	8454.8 kHz	3125 Hz		2400.0 Bd	33 dB	File ...	14:09:22	
PSK8A	8465.0 kHz	3125 Hz		2400.0 Bd	20 dB	File ...	14:09:22	
PSK8A	8470.0 kHz	3038 Hz		2400.0 Bd	11 dB	File ...	14:09:21	
FSK2	8489.0 kHz	438 Hz	203.1 Hz	99.6 Bd	26 dB	File ...	14:09:21	
PSK8A	8494.5 kHz	3125 Hz		2400.0 Bd	15 dB	File ...	14:09:22	
PSK8A	8507.5 kHz	3125 Hz		2400.0 Bd	31 dB	File ...	14:09:22	
PSK8A	8514.1 kHz	3125 Hz		2400.0 Bd	30 dB	File ...	14:09:22	
FSK2	8565.1 kHz	1188 Hz	830.2 Hz	50.0 Bd	52 dB	File ...	14:09:22	
FSK2	8591.0 kHz	438 Hz	190.7 Hz	100.1 Bd	27 dB	File ...	14:09:22	
PSK8A	8614.8 kHz	3125 Hz		2400.0 Bd	11 dB	File ...	14:09:22	
PSK8A	8620.0 kHz	3063 Hz		2400.0 Bd	17 dB	File ...	14:09:22	

Find emissions | Clear all emissions

Filter & display options

Task-based filter

Figure 123.: Classifier Result

The classifier is started by clicking on the <**Find emissions**> button.

During classification, the classifier draws a rectangle onto each signal in the spectrogram. The length of the rectangle is an indicator for the signal time which has been analyzed during classification. The width is equal to the bandwidth which has been classified. The color of the rectangle identifies which signals have been recognized. The type of classified modulation is written to each rectangle.

The color is defined in the display and filter options of the classifier. They can be set to any color available on the computer.

The spectrogram with these rectangles is shown in Figure 124.

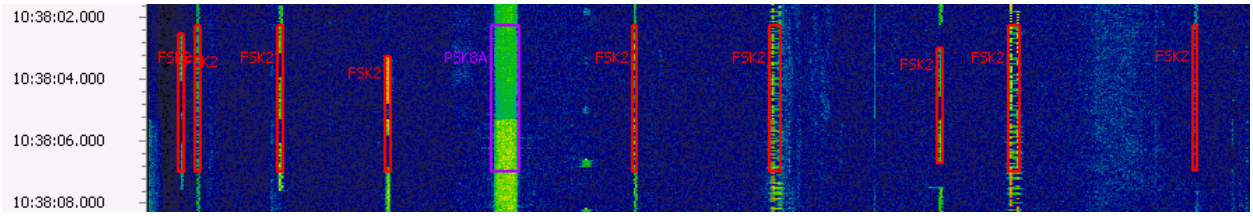


Figure 124.: Classifier Result Display in Spectrogram

The results in the classifier list and in the spectrogram are deleted by clicking on the <**Clear all emissions**> button.

4.11.3.1. Processing Emissions in a Narrowband Channel

After some Emission Of Interest is found by using snapshot classification, it can easily be processed further by using one of available narrowband channels.

Drag-and-drop

The easiest way to transfer emission information to the channel is to simply drag the corresponding row from the emissions table onto the channel. The channel will be set to the emission's frequency and the snapshot classification result will be taken as initial classification result in the channel.

Context menu and keyboard shortcuts

Another method to transfer emission information into a narrowband channel is via the context menu in the emissions table.

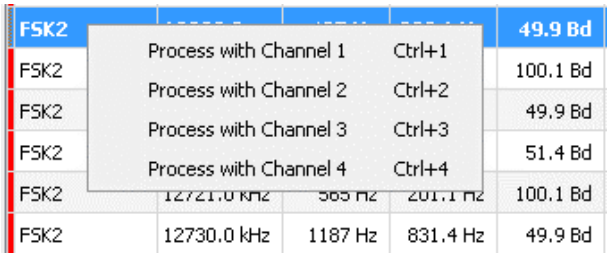


Figure 125.: Emissions View - Context Menu

<**Ctrl**>+<**channel number**> keyboard shortcuts can also be used.

4.11.4. Tuning the Receiver from the Classifier Result

The results in the list can be used to tune a channel to the frequency of a classification result. Left-click and hold the record, and then drag it to a channel window and release the mouse button. The center frequency of the channel spectrum or spectrogram will be set to the selected frequency.

A right-click will also open a context menu, which shows all channels available in the software. From this list, one channel can be selected. The center frequency of the selected channel spectrum or spectrogram will be set to the selected frequency.

4.11.5. Filter and Display Options

The following options are available for filtering and displaying classification results, as Figure 126 shows.

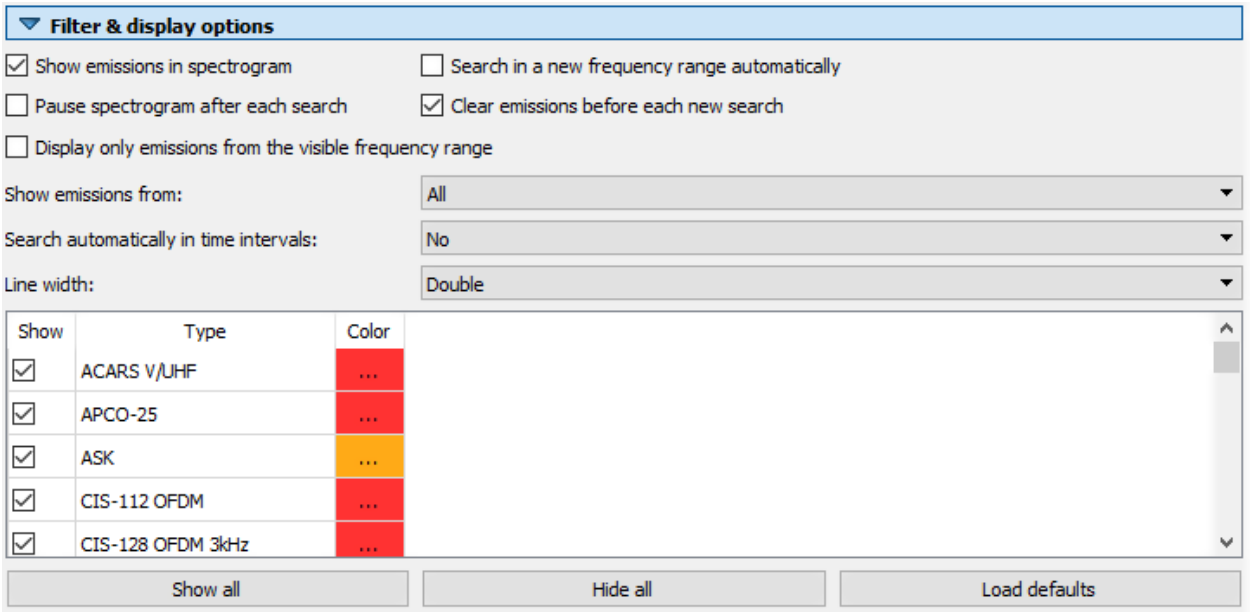


Figure 126.: Classifier Options

The table displays all the modulation/modem types that can be classified by the BCU. All entries whose "Show" column has a check mark will be displayed in the wideband diagram if a corresponding emission has been detected. Using the "Color" column, it is possible to select for each type of modulation or the respective method in which color the respective emissions are to be displayed.

The buttons described below for the manipulation of the table described.

- <**Show all**> Switches on the display of all modulation type
- <**Hide all**> Turns off the display of all types of modulation
- <**Load Defaults**> Overwrites all color changes with the factory default color scheme

The following additional options for adjusting the display and filtering emissions are available:

- <**Show emission in spectrogram**> Classification will be started automatically when the receiver is tuned to a new center frequency
- <**Search in a new frequency range automatically**> The classification should start automatically if the receiver center frequency is changed
- <**Pause spectrogram after each search**> The spectrogram display will be stopped after the classification is finished
- <**Clear emissions before each new search**> The result list is cleared before a new classification is started
- <**Display only emissions from the visible frequency range**> Show only the results from frequencies visible in the spectrogram
- <**Show emissions from**> Show emissions only from selected signal input
- <**Search automatically in time intervals**> Classifications can be done automatically in 10 s, 20 s or 30 s. Select <**No**> to disable this function.
- <**Line width**> Set to single, double or triple

4.12. Results

This chapter describes functions and concepts related to the storage and retrieval of the monitoring results.

4.12.1. Storage Concept and Settings

The following result types are available:

- Demodulated audio results for detected signals
- Decoder text results for detected signals
- Modem recognition
- Classification results (narrowband or wideband)
- Recorded IF-signals (narrowband or wideband)

There is no need for the user to explicitly save results. All results are stored automatically in a result library consisting of a database and a file storage system.

All meta-information about results (e.g. classification results, modem recognition, etc.) are stored in the database. File-based results (e.g. audio files, recordings, decoder output, etc.) are stored as files in a file-based storage. The references to these files are also stored into database.

Each result item in the database represents only one specific result type. For example, if the system generates a recording and then generates a classification result from that recording following the modem recognition and decoder result, this will generate three result items in the database: one Recording, one Classification and one Decoder-text result.

The relation between these results can be established by filtering based on the emission ID. When navigating results in the ResultViewer, the relation between results and recordings will be established automatically based on the same emission ID or their time/frequency overlap.

4.12.1.1. Storage Location of the Result-Files

In the standard installation, all file-based results are stored in the "results" subdirectory of the application's user directory. For example:

- on Windows®

  %USERPROFILE%\go2SIGNALS\ go2MONITOR\results\...

- on Linux®

  $HOME/go2SIGNALS/go2MONITOR/results/...

Files and database should be accessed or modified only by using the ResultViewer GUI (see chapter Results Storage Settings).

4.12.1.2. Application Database

The application stores all database specific results in a PostgreSQL database. On the first launch of the application after installation, the program initializes and configures a database instance. Through database initialization, all related files and directories are copied into the database storage location. The database storage location differs for technical reasons depending on the operating system used.

- Windows®

  ```
  %USERPROFILE%\go2SIGNALS\ go2MONITOR\database
  ```

- Linux®
  For security reasons it is, by design, not permitted to create an instance of a PostgreSQL database if you are logged in as a root user. If the application is executed by a root user, the directory is used as database storage location.

  ```
  /home/pro_postgres/pro_database/
  ```

  For other users, the database is stored in the directory:

  ```
  $HOME/pro_database/
  ```

4.12.1.3. Automatic Result Deletion

If the storage hard disk has less than 2 % free space available, the oldest files from the result storage will be deleted automatically to release some space for new results.

Also, it is possible to limit the storage to a specific duration, i.e. number of days (see chapter Results Storage Settings).

4.12.2. ResultViewer

For navigation through system results, a ResultViewer GUI is provided. Access is via the <**Views**><**Results**> main menu option or as separate application.

The ResultViewer opens a separate window containing components for filtering and navigating, display and export (see Figure 127.

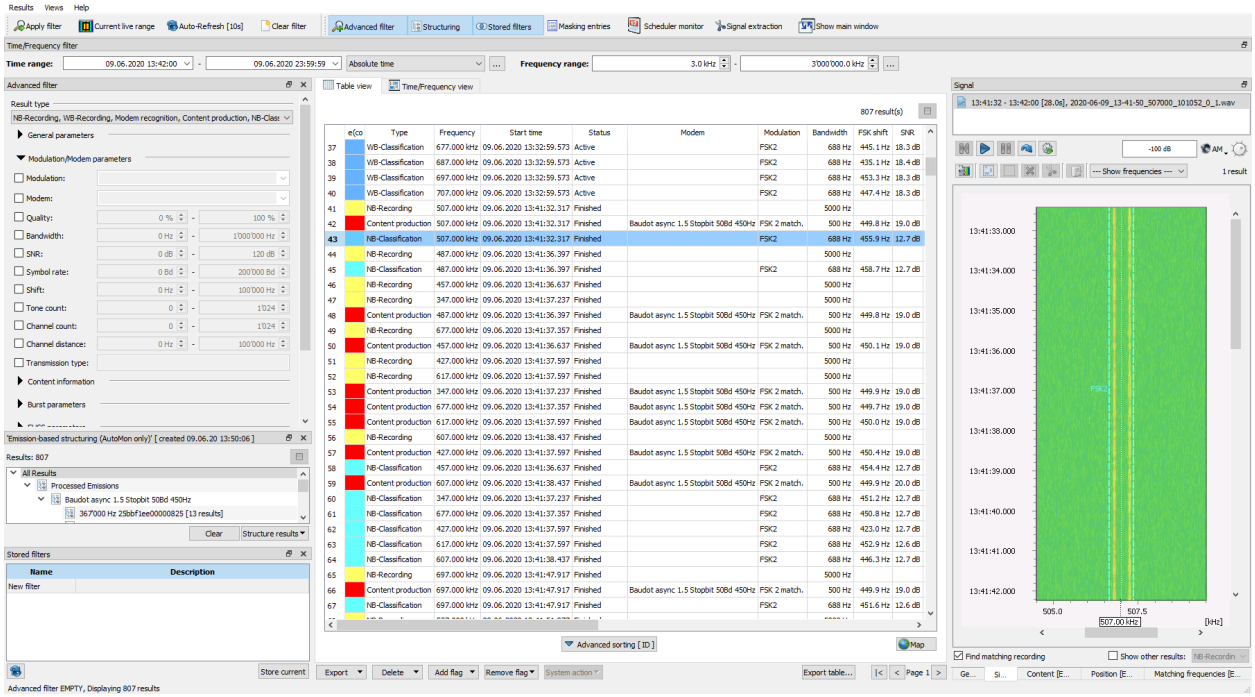


Figure 127.: ResultViewer Window

All views are implemented as docking windows and can be freely positioned or dragged out of the ResultViewer as floating windows. Configuration of views will be stored and reused in the next session.

4.12.3. Menu & Toolbar

The ResultViewer menu and toolbar include items corresponding to all important functions. The following items are available in the menu only:

Function	Description
<**Export filter**>	Stores current filter in a file
<**Import filter**>	Loads current filter from file
<**Delete lookups**>	Deletes lookups used for fast selection in advanced filter and detail views (modem and modulation fields)
<**Refresh lookups**>	Reads used lookup values for fast selection in advanced filter and detail views (modem andmodulation fields). These values are refreshed automatically each few minutes.
<**Shortcuts**>	Opens the Shortcuts view for defining user defined keyboard shortcuts
<**Close**>	Closes ResultViewer window

Table 42.: ResultViewer Menu Functions

The following items are available from both the menu and toolbar:

Figure 128.: ResultViewer Toolbar

The ResultViewer toolbar provides a fast access to some of the available functions.

Function	Description
<**Apply filter**>	Provides a refresh function. It reads data from the database by using the currently selected filter settings. The same function can be performed by pressing <**F5**>.
<**Current live range**>	When clicking on this button , a time/frequency filter is set to the time and frequency range of the wideband signal currently processed in go2MONITOR (+/- 5 minutes of the current signal time).
<**Auto-Refresh [10 s]**>	This option can be turned on or off. If the option is turned on, data will be read from the database automatically in regular intervals. The interval length can be set between 10 s and 10 minutes via the <**Auto-refresh interval**> item on the ResultViewer menu.
<**Clear filter**>	Deletes all values currently set in the Advanced Filter
<**Advanced filter**>	Turns the display of the Advanced filter on or off (for details, see chapter Advanced Filter)
<**Structuring**>	Opens the <**Structuring**> view for a script-based result structuring (for details, see chapter Structuring View)
<**Stored filters**>	Opens the Stored Filters view for saving and reusing filters (for details, see chapter Stored Filters View)
<**Masking entries**>	Opens the <**Masking Entries**> view (for details, see chapter Masking Entries View)
<**Scheduler monitor**>	Opens the <**Scheduler monitor**> view. Only available if the "Planning" option is active.
<**Signal extraction**>	Opens the <**Signal Extraction**> view (for details, see chapter Signal Extraction View)
<**Show main window**>	Minimizes the ResultViewer window and shows the main application window.

Table 43.: ResultViewer Toolbar Functions

4.12.4. Time/Frequency Filter

The time/frequency filter defines a time and frequency range for the results displayed. The range defined by from-to values for both time and frequency can be changed manually or several predefined ranges can be selected by using the <**...**> button. The time range can be configured in three different ways.

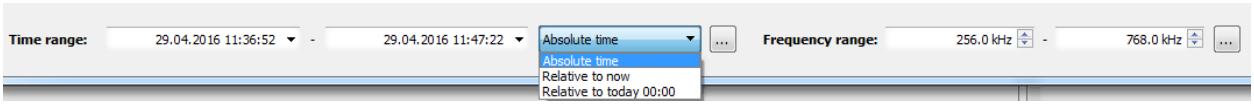


Figure 129.: Time/Frequency Filter

Function	Description
<**Absolute time**>	Fixed time range configuration. Both the from and to values are entered and displayed in date time format.
<**Relative to now**>	Relative time range configuration. The from and to values are durations in the format *+/- <days> <hours>:<minutes >:<seconds*. The durations are relative to the point in time at which the <**Apply filter**> button is clicked. Example: "-0 01:00:00" – "-0 00:00:00" will show the results of the hour before <**Apply filter**> was clicked.
<**Relative to today 00:00**>	Relative time range configuration. The from and to values are durations in the format *+/- <days> <hours>:<minutes>: <seconds*. The durations are relative to midnight. Example: *"-0 01:00:00" – "-0 00:00:00"* will always show yesterday's results from 11:00 p.m. until midnight (UTC time).

Table 44.: Time/Frequency Filter Functions

Click <**Apply filter**> to apply the new filter settings and display the matching results in the result list display.

4.12.5. Advanced Filter

The Advanced Filter allows detailed result filtering based on result type or various result parameters. Almost all available meta-data or signal parameters can be specified in the filter in order to filter displayed results or to find some specific result based on its properties.

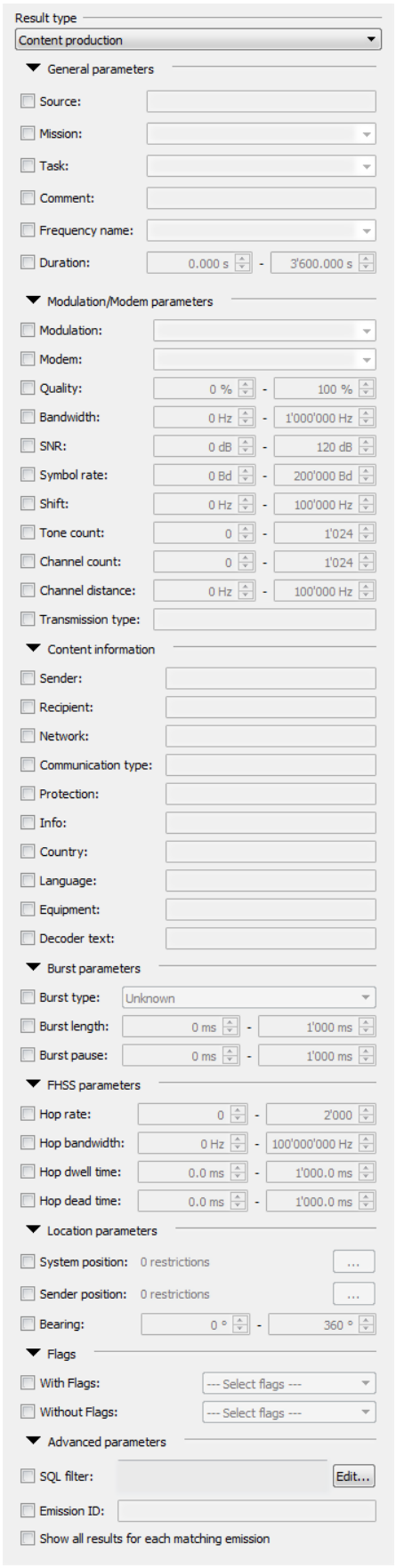


Figure 130.: ResultViewer - Advanced Filter

For detailed description of the different result parameters, see chapter Result Detail Display.

Filter fields are grouped in several collapsible field groups. If a field is in use, the name of its group will be displayed as bold text.

For all text fields (e.g. "Modem", "Modulation",...), filtering is performed by using the **exact** values entered by the operator.

For example, if the operator enters "Voice" in the modulation field, "Voice USB" or "Voice LSB" results will not match the filter. To search for a part of a string, wildcards can be used, for example "Voice*". As a wildcard character, both "*" and "%" can be used. These wildcards substitute any number of any characters in the string. For example, "Voice*" will match "Voice USB" and "Voice LSB" but not "My Voice USB".

"*Voice*" will match all string having "Voice" inside. All string comparisons are case-sensitive. Also, for all text fields, it is possible to perform negative search by preceeding filter string with "NOT", for example "NOT Voice" in the modem filter field.

For filtering results based on flags, two search fields are provided: <**With Flags**> for positive search and <**Without Flags**> for negative search. If "New" and "Important" flags are selected in the first instance and "Processed" in the second, the resulting query will include all results **with** "New" or "Important" flags set but **without** the "Processed" flag.

<**Show all results for each matching emissions**> provides a way to select specific results by using their properties (e.g. only modem recognitions for specific modem), but to keep all results belonging to the same emission as well. For example, without this option, selecting modem recognitions for a specific modem will remove all recording or classification results because they don't have any value in the modem field. With this option set, all recordings and classifications belonging to the same emission as displayed modem recognitions will be displayed as well.

4.12.5.1. SQL Filter

Advanced filter can be extended by using standard SQL (Structured Query Language) expressions. This enables the operator to define more complex filter expressions than possible with the standard advanced filter capabilities. For example, arbitrary combinations of AND/OR operators or multiple expressions for one field can be used.

An SQL filter expression is always combined with the remainder of the advanced filter. I.e. an existing query defined for other advanced filters is extended with the SQL filter expression.

An SQL expression can be edited in the **SQL Editor** dialog.

Figure 131.: SQL Editor

SQL Editor contains the following components:

Editor: Text editor where an SQL expression can be edited. The expression is always a combination of field names and operators, for example:

(Bandwidth > 2000 and Modem LIKE 'Voice%') OR Bandwidth > 5000 OR FlagNew IS NOT NULL

An expression uses database field names, which are sometimes slightly different than the visible field names in, for example, the **Detail** view.

<**Combine this query with other filter options by using and>:**> This combo-box defines whether the SQL expression will be combined with the remainder of advanced filter by using either the AND or the OR operator.

Field list: The yellow table on the right side of the dialog contains all fields which can be used in SQL expressions. A field can be dragged and dropped into the editor in order to use it. Field names which are used in expressions are database column names and therefore sometimes different than descriptive field names visible in other parts of the ResultViewer. The field list contains both: database name and descriptive name as well as short field description.

<**Apply**> button: This feature can be used to apply current SQL expression and to execute the filter.

If an SQL expression contains any syntax errors, for example wrong field names, an error message will be displayed if the filter is executed.

4.12.5.2. System and Sender Position Filter

Results can be filtered by system and/or sender positions by using the Advanced Filter. The position filters are defined by using a map. There are separate maps for defining the system and sender positions, which can be opened by clicking on the corresponding buttons in the Advanced Filter.

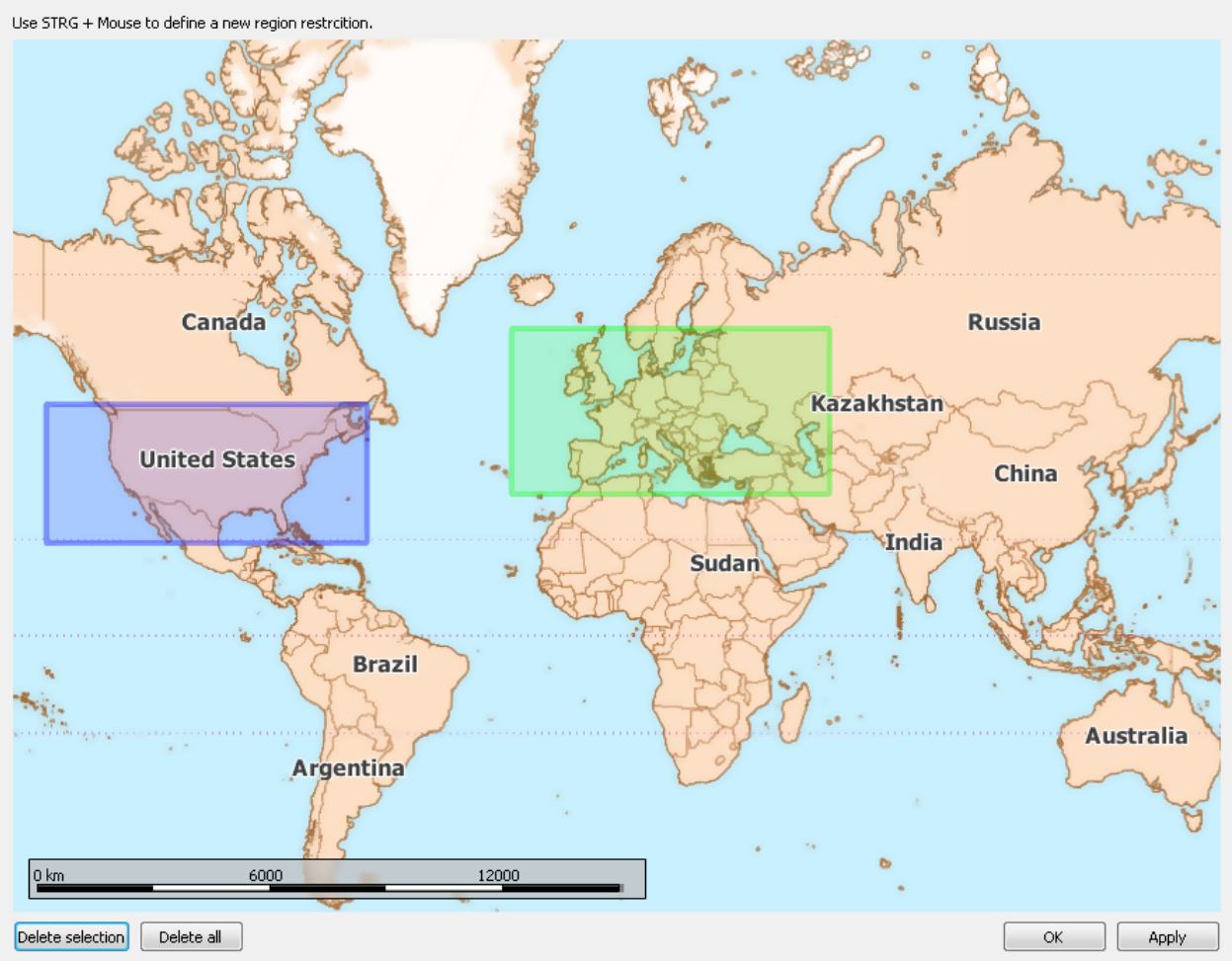


Figure 132.: Map View for Defining Region Restrictions

The map can be moved with the mouse and zoomed with the mouse wheel. This can also be achieved by using the navigation functions at the bottom right of the map. If <**CTRL**> is pressed and held, the cursor shape will change to a cross cursor. Rectangular position restrictions can be drawn afterwards using the mouse. If the advanced filter is executed, the result list will only show results whose system and/or sender positions are located within the defined restriction rectangles. The single restrictions of a position will be linked by an OR operator. But, the system and sender filters will be linked by using an AND operator. For the example restrictions in Figure 98, this means that all results will be displayed whose system position is located either in Central Europe **or** in the USA.

The defined region rectangles can be selected with the mouse. Selected rectangles will be painted blue and can be deleted by clicking <**Delete selection**>. In addition, all defined rectangles can be deleted with <**Delete all**>. Clicking on the <**OK**> button adds all restrictions to the advanced filter. As in the SQL Filter dialog, the Advanced Filter can be executed directly by clicking <**Apply**>.

The currently active restrictions are displayed in the Advanced Filter as well.

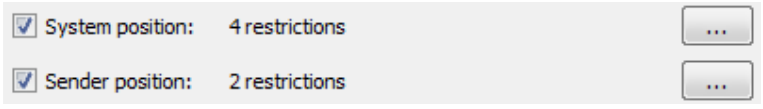


Figure 133.: Display of Active Region Restrictions in the Advanced Filter

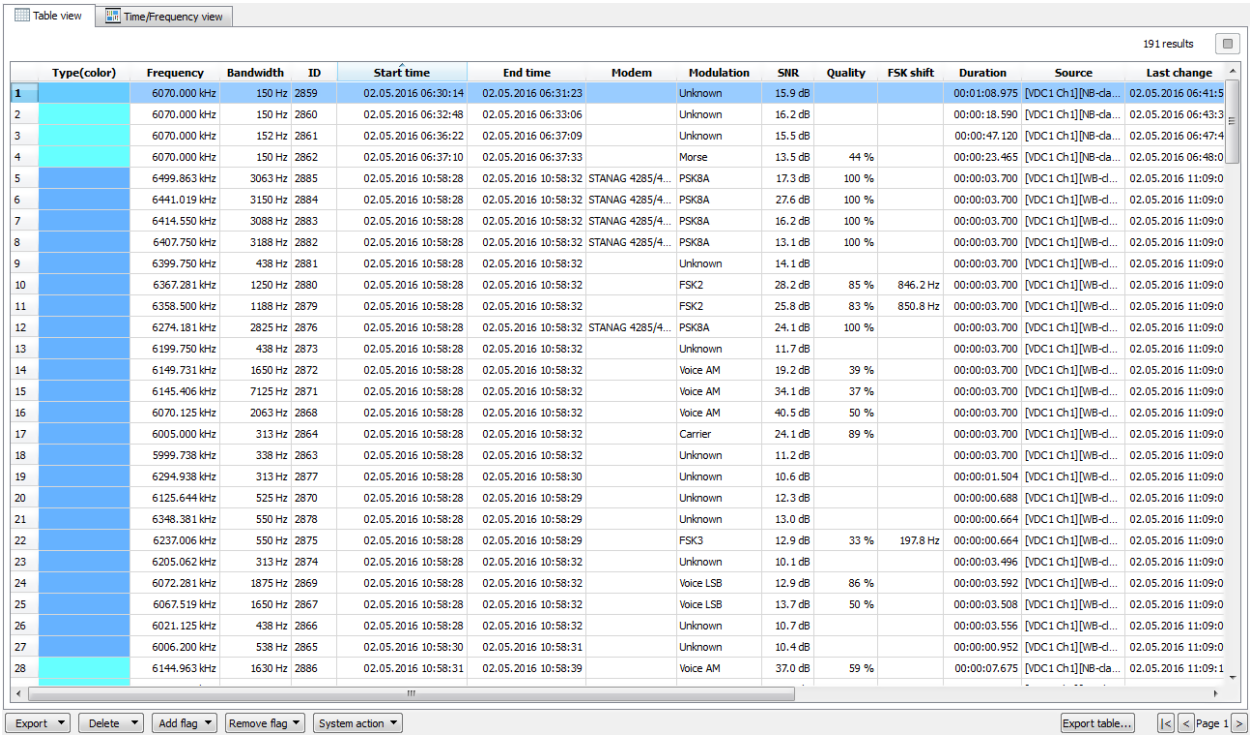
4.12.6. Result List Display

Two different views are provided for showing the list of results. The <**Table view**> shows the results as a list, the graphical <**Time/Frequency view**> visualizes the results on a time-frequency plane. The user can switch between them by selecting one of two tab views. Both views always show the same set of results.

Figure 134.: ResultViewer - Display Selector

4.12.6.1. Table View

The <**Table view**> shows the results filtered in accordance with the current filter settings in form of a table. Each row represents a single result, i.e. Demodulation/decoder result, Classification or Recording.



	Type(color)	Frequency	Bandwidth	ID	Start time	End time	Modem	Modulation	SNR	Quality	FSK shift	Duration	Source	Last change
1		6070.000 kHz	150 Hz	2859	02.05.2016 06:30:14	02.05.2016 06:31:23		Unknown	15.9 dB			00:01:08.975	[VDC1 Ch1][NB-da...	02.05.2016 06:41:5
2		6070.000 kHz	150 Hz	2860	02.05.2016 06:32:48	02.05.2016 06:33:06		Unknown	16.2 dB			00:00:18.590	[VDC1 Ch1][NB-da...	02.05.2016 06:43:3
3		6070.000 kHz	152 Hz	2861	02.05.2016 06:36:22	02.05.2016 06:37:09		Unknown	15.5 dB			00:00:47.120	[VDC1 Ch1][NB-da...	02.05.2016 06:47:4
4		6070.000 kHz	150 Hz	2862	02.05.2016 06:37:10	02.05.2016 06:37:33		Morse	13.5 dB	44 %		00:00:23.465	[VDC1 Ch1][NB-da...	02.05.2016 06:48:0
5		6499.863 kHz	3063 Hz	2885	02.05.2016 10:58:28	02.05.2016 10:58:32	STANAG 4285/4...	PSK8A	17.3 dB	100 %		00:00:03.700	[VDC1 Ch1][WB-d...	02.05.2016 11:09:0
6		6441.019 kHz	3150 Hz	2884	02.05.2016 10:58:28	02.05.2016 10:58:32	STANAG 4285/4...	PSK8A	27.6 dB	100 %		00:00:03.700	[VDC1 Ch1][WB-d...	02.05.2016 11:09:0
7		6414.550 kHz	3088 Hz	2883	02.05.2016 10:58:28	02.05.2016 10:58:32	STANAG 4285/4...	PSK8A	16.2 dB	100 %		00:00:03.700	[VDC1 Ch1][WB-d...	02.05.2016 11:09:0
8		6407.750 kHz	3188 Hz	2882	02.05.2016 10:58:28	02.05.2016 10:58:32	STANAG 4285/4...	PSK8A	13.1 dB	100 %		00:00:03.700	[VDC1 Ch1][WB-d...	02.05.2016 11:09:0
9		6399.750 kHz	438 Hz	2881	02.05.2016 10:58:28	02.05.2016 10:58:32		Unknown	14.1 dB			00:00:03.700	[VDC1 Ch1][WB-d...	02.05.2016 11:09:0
10		6367.281 kHz	1250 Hz	2880	02.05.2016 10:58:28	02.05.2016 10:58:32		FSK2	28.2 dB	85 %	846.2 Hz	00:00:03.700	[VDC1 Ch1][WB-d...	02.05.2016 11:09:0
11		6358.500 kHz	1188 Hz	2879	02.05.2016 10:58:28	02.05.2016 10:58:32		FSK2	25.8 dB	83 %	850.8 Hz	00:00:03.700	[VDC1 Ch1][WB-d...	02.05.2016 11:09:0
12		6274.181 kHz	2825 Hz	2876	02.05.2016 10:58:28	02.05.2016 10:58:32	STANAG 4285/4...	PSK8A	24.1 dB	100 %		00:00:03.700	[VDC1 Ch1][WB-d...	02.05.2016 11:09:0
13		6199.750 kHz	438 Hz	2873	02.05.2016 10:58:28	02.05.2016 10:58:32		Unknown	11.7 dB			00:00:03.700	[VDC1 Ch1][WB-d...	02.05.2016 11:09:0
14		6149.731 kHz	1650 Hz	2872	02.05.2016 10:58:28	02.05.2016 10:58:32		Voice AM	19.2 dB	39 %		00:00:03.700	[VDC1 Ch1][WB-d...	02.05.2016 11:09:0
15		6145.406 kHz	7125 Hz	2871	02.05.2016 10:58:28	02.05.2016 10:58:32		Voice AM	34.1 dB	37 %		00:00:03.700	[VDC1 Ch1][WB-d...	02.05.2016 11:09:0
16		6070.125 kHz	2063 Hz	2868	02.05.2016 10:58:28	02.05.2016 10:58:32		Voice AM	40.5 dB	50 %		00:00:03.700	[VDC1 Ch1][WB-d...	02.05.2016 11:09:0
17		6005.000 kHz	313 Hz	2864	02.05.2016 10:58:28	02.05.2016 10:58:32		Carrier	24.1 dB	89 %		00:00:03.700	[VDC1 Ch1][WB-d...	02.05.2016 11:09:0
18		5999.738 kHz	338 Hz	2863	02.05.2016 10:58:28	02.05.2016 10:58:32		Unknown	11.2 dB			00:00:03.700	[VDC1 Ch1][WB-d...	02.05.2016 11:09:0
19		6294.938 kHz	313 Hz	2877	02.05.2016 10:58:28	02.05.2016 10:58:30		Unknown	10.6 dB			00:00:01.504	[VDC1 Ch1][WB-d...	02.05.2016 11:09:0
20		6125.644 kHz	525 Hz	2870	02.05.2016 10:58:28	02.05.2016 10:58:29		Unknown	12.3 dB			00:00:00.688	[VDC1 Ch1][WB-d...	02.05.2016 11:09:0
21		6348.381 kHz	550 Hz	2878	02.05.2016 10:58:28	02.05.2016 10:58:29		Unknown	13.0 dB			00:00:00.664	[VDC1 Ch1][WB-d...	02.05.2016 11:09:0
22		6237.006 kHz	550 Hz	2875	02.05.2016 10:58:28	02.05.2016 10:58:29		FSK3	12.9 dB	33 %	197.8 Hz	00:00:00.664	[VDC1 Ch1][WB-d...	02.05.2016 11:09:0
23		6205.062 kHz	313 Hz	2874	02.05.2016 10:58:28	02.05.2016 10:58:32		Unknown	10.1 dB			00:00:03.496	[VDC1 Ch1][WB-d...	02.05.2016 11:09:0
24		6072.281 kHz	1875 Hz	2869	02.05.2016 10:58:28	02.05.2016 10:58:32		Voice LSB	12.9 dB	86 %		00:00:03.592	[VDC1 Ch1][WB-d...	02.05.2016 11:09:0
25		6067.519 kHz	1650 Hz	2867	02.05.2016 10:58:28	02.05.2016 10:58:32		Voice LSB	13.7 dB	50 %		00:00:03.508	[VDC1 Ch1][WB-d...	02.05.2016 11:09:0
26		6021.125 kHz	438 Hz	2866	02.05.2016 10:58:28	02.05.2016 10:58:32		Unknown	10.7 dB			00:00:03.556	[VDC1 Ch1][WB-d...	02.05.2016 11:09:0
27		6006.200 kHz	538 Hz	2865	02.05.2016 10:58:30	02.05.2016 10:58:31		Unknown	10.4 dB			00:00:00.952	[VDC1 Ch1][WB-d...	02.05.2016 11:09:0
28		6144.963 kHz	1630 Hz	2886	02.05.2016 10:58:31	02.05.2016 10:58:39		Voice AM	37.0 dB	59 %		00:00:07.675	[VDC1 Ch1][NB-da...	02.05.2016 11:09:1

Figure 135.: ResultViewer - Table View

The column selection can be freely changed by right-clicking a table header and selecting columns from the context menu. The exact list of supported columns depends on the system settings and can vary. The "Type" column will always contain the result type, i.e. *Production* for demodulation/decoding results or *Recording* for IF-recording results.

The order of the columns can be changed by dragging the respective column header with the mouse. The column order and selection will be automatically stored and reused next time the application is started.

If a specific table row is selected, the detailed view for single results will show further details of the selected result (see chapter Result Detail Display).

The table can show up to 1,000 rows at once. If there are more rows in the database, the table with be displayed over multiple pages. The user can switch between pages using by arrow buttons in the lower right corner. The <**Export table...**> function exports the visible table contents as a CSV file.

The buttons below both result views provide general operations on results, e.g. export and deletion. Each button opens a popup menu to select which results will be used for the operation.

Figure 136.: ResultViewer - Buttons

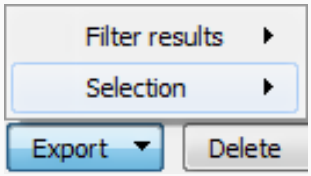
Function	Description
<**Export**>	Exports the results as files in a directory. Along with the standard export there is an additional function for result export into the Inno Metascope CIM format available.  *Figure 137.: Export Popup Menu* <**Filter results**> All results that match the current filter will be used. This includes all visible results and those on further table pages. <**Selection**> The currently selected results will be used. During this process, the following files can be created for each result row: • <result_id>_meta_data.xml containing all information about the result entry (mandatory) • <result_id>_xxxxxxx.dec containing decoder output in case of decoder result (optionally, if available) • <result_id>_xxxxxxx.wav containing IF-storage or audio output in case of audio result (optionally, if available)
<**Delete**>	Deletes the results from the database. Note: Deleted results cannot be restored!
<**Add flag**>	Allows the selection of a result flag that will be set on the results.
<**Remove flag**>	Removes the specified result flag from the results.
<**System action**> (optional)	Script-based system functions can be called for current results in the ResultViewer. These functions are executed in the system and not in the GUI.

Table 45.: ResultViewer Functions

All these operations are also available in the context menu of the <**Table view**> (see Figure 138). With a right-click in the <**Table view**>, this menu appears and the selected results can be exported, deleted, etc.

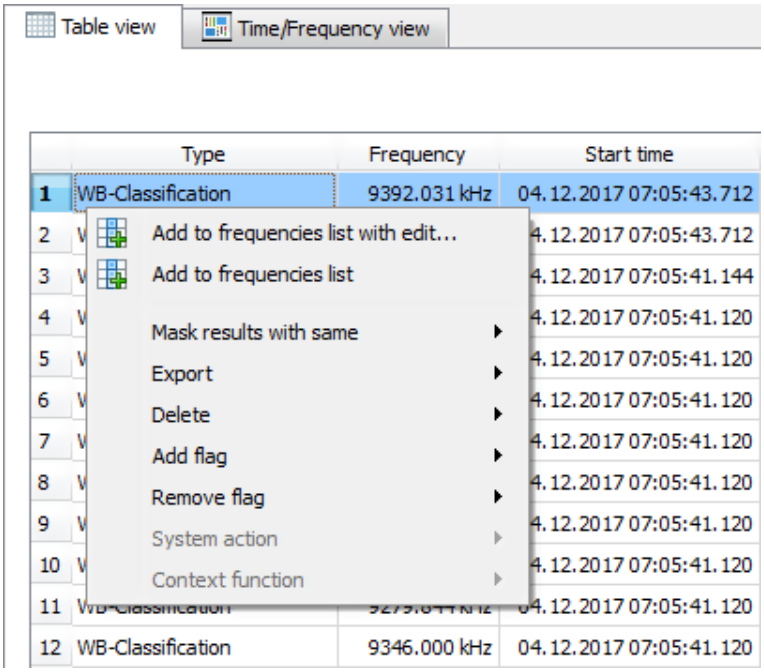


Figure 138.: Table View Context Menu

Function	Description
<**Add to frequencies list with edit...**>	Appends the selected results to the frequency list and allows the editing of the group membership properties for appended entries (see chapter Frequencies)
<**Add to frequencies list**>	Appends the selected results to the frequency list (see chapter Frequencies)
<**Mask results with same**>	Temporarily masks out table results (for details, see chapter Masking Entries View)
<**Context function**>	Is an optional feature (for details, see chapter GUI Scripting Option)

Table 46.: Table View Functions

4.12.6.2. Advanced Sorting

With the advanced sorting feature, the <**Table view**> can be sorted for multiple columns. To view the advanced sort view, click <**Advanced sorting**> located below the result table.

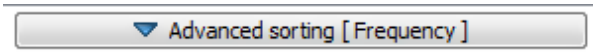


Figure 139.: Advanced Sorting

Now a column header can be clicked and dragged from the <**Table view**> and can be dropped onto the <**Advanced sorting**> bar. Repeat for sorting by multiple columns. Alternatively, drag-and-drop can be used to add columns to the <**Advanced sorting**> bar by pressing <**Shift**> and simultaneously selecting a column header by a left-click. If the clicked column header is already inserted in the <**Advanced sorting**> bar, the sort order will be changed for this column.

Note: Each column can only be added once during advanced sorting.

An ascending sorting is represented by an upward pointing arrow, a descending sorting by a downward pointing arrow. To change between ascending and descending sorting, simply click on a column on the <**Advanced sorting**> bar.

The positions of the columns in the <**Advanced sorting**> bar represent the multi-column sorting order. The leftmost column is the most significant sorting criterion, the rightmost the least significant sorting criterion. The multi-column sorting order can be changed by clicking on a column on the <**Advanced sorting**> bar and dragging it to the desired position.

To remove a single column or all columns from sorting, open the context menu of the <**Advanced sorting**> bar and select the desired action.

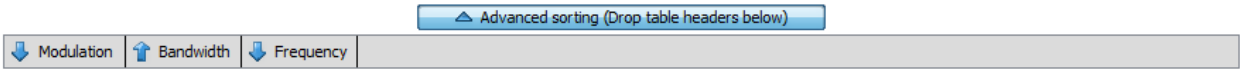


Figure 140.: Advanced Sorting Bar

The image above shows an advanced sorting with three columns. The primary sorting criterion is *Modulation* (descending), the secondary criterion *Bandwidth* (ascending) and the tertiary is *Frequency* (descending).

Click <**Advanced sorting**> again to hide the <**Advanced sorting**> bar. If the <**Advanced sorting**> bar is collapsed, the selected column headers are shown within square brackets on the button itself as seen in Figure 139.

Note: A left-click of the column in the <**Table view**> without holding down <**Shift**> will clear the current advanced sort and add only this row to the advanced sorting.

4.12.6.3. Time/Frequency View

The <**Time/Frequency view**> displays the same results as the list view, but in a graphical way on a time/frequency plane.

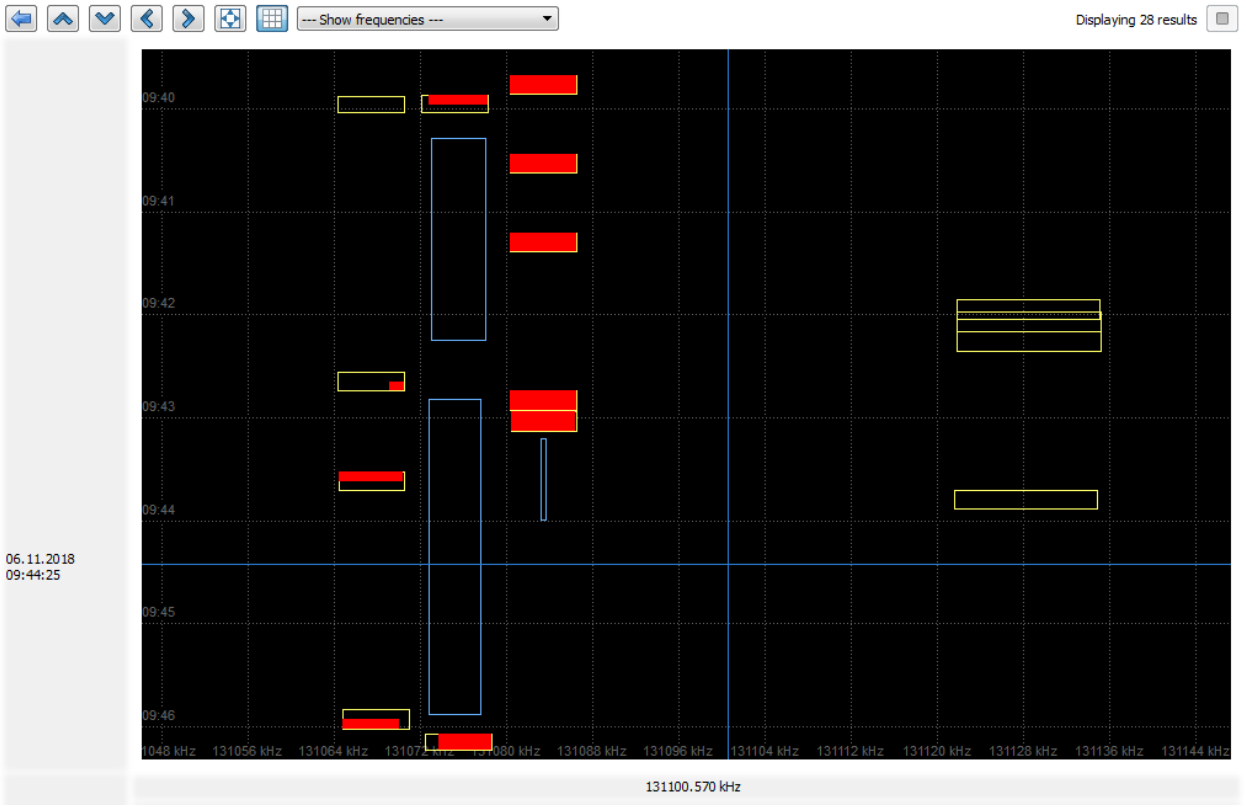


Figure 141.: ResultViewer - Time/Frequency View

	Description
Axes	The Y-Axis of the Graphical view represents the time (ascending toward screen bottom), and the X-Axis represents the frequency (from left to right). The Graphical view always shows the time and frequency ranges currently selected in the Time/Frequency filter. Consequently, zooming in or out in the Graphical view also changes the current time and frequency ranges in the Time/Frequency filter. Use the <**Axis**> button to toggle the axes' grid visibility.
Results	The results are shown as rectangles or dots of different colors on a background. Each rectangle represents one demodulation/recording result, classification or recording result. Different colors represent different result types: Red — Production-channel result (decoder result or demodulated audio) Blue — NB-Classification results Cyan — WB-classification results Yellow — IF-Recordings White — Only modem recognition without produced text or audio

	Description
Zooming and navigating	In the Graphical view, zooming in is done by selecting a new rectangle with the mouse. After releasing the mouse button, the view will zoom in to show the selected rectangle only. To go back to the last zoom level, the <**Back**> button can be used. To simply zoom out, the <**Center**> button can be used. To navigate through the frequency/time domain, arrow keys available in the upper part of the graphical view can be used: For fast graphical zooming in and zooming out, a mouse wheel control can be used. This fast zoom method will only result in a graphical zoom without retrieving database data each time the visible range has changed. Time/frequency filtering will not be affected.
Cursor	While the mouse pointer is moved over the Graphical view, a crosshair cursor will be shown. It can be used for selection of single results (via mouse click) or for fast preview of result contents by hovering over it. In the latter case, some information about the result will be shown in the lower pane of the Graphical view (e.g. found modem/classification, time, bandwidth, frequency). Clicking the mouse on a single result has the same effect as selecting the corresponding row in the <**Table view**>.
Currently selected result	The currently selected result is highlighted graphically with a transparent blue marker  *Figure 142.: Selected Result*
Monitoring/stopping data retrieval from the database	Depending on the current time/frequency range, this view can contain thousands of results. The display of so many results can last very long. The retrieving of results is done in background and new results are added to the display several times per second. In the upper-right part, the number of retrieved results is shown. The <**Stop**> button can be used to stop data retrieval.

Table 47.: Time/Frequency View Functions

4.12.6.4. Map View

The system and sender positions of the results within the <**Table view**> can be displayed on a map. To open the Map view, click <**Map**>. The map will be automatically zoomed and aligned so that all positions can be seen right after the map is displayed or when a result in the <**Table view**> has been selected. This feature can be deactivated by disabling the <**Zoom and position automatically**> checkbox at the bottom of the map.

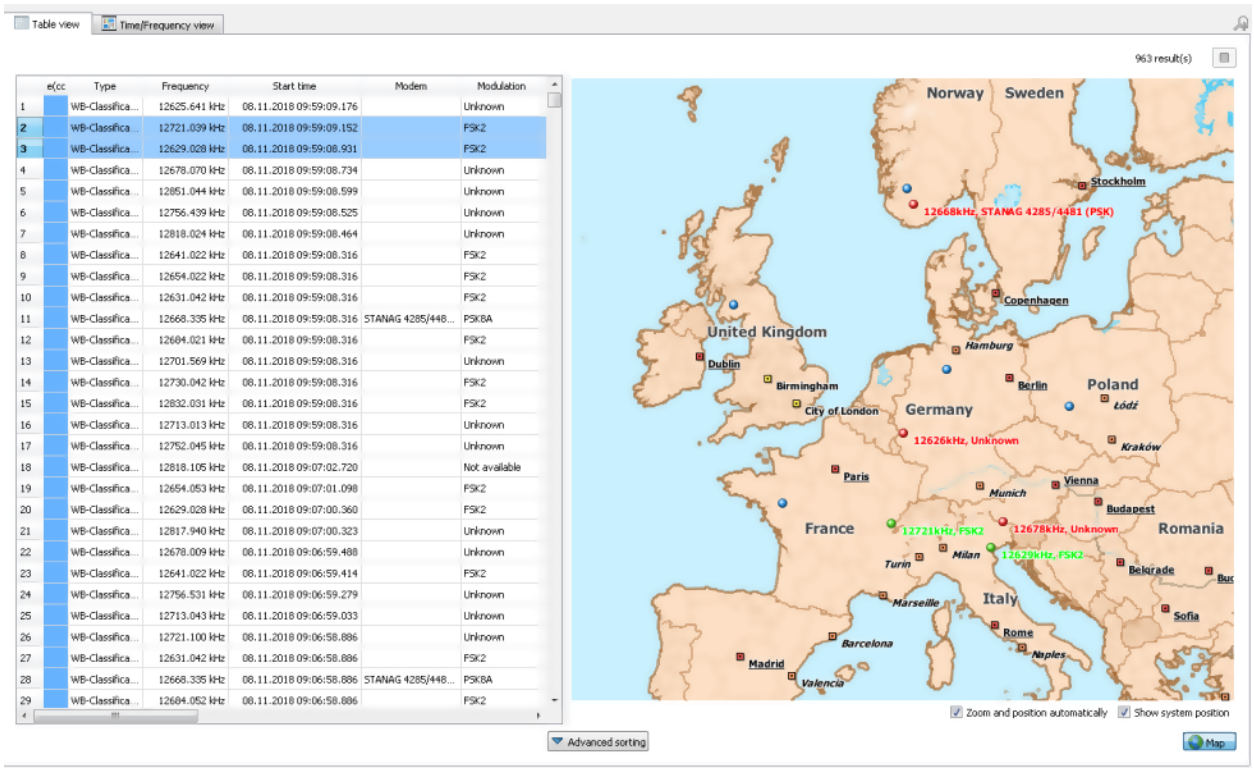


Figure 143.: Map view of System and Sender Positions of the Results

The system position of the results will be displayed on the map by blue markers and the sender position by red markers. The sender positions hold a description that contains the frequency in kHz and the modulation type of the result. The positions of selected results in the <**Table view**> will be highlighted green on the map. The system positions on the map can be hidden by disabling the <**Show system position**> checkbox at the bottom of the map.

4.12.7. Result Detail Display

Having selected a single row in the <**Table view**> or a result in the Graphical view, all available information for that result will be shown in a detailed view on the right of the result list display. The detailed view features three different docking windows initially arranged as tabs. Depending on the result type, some of these views may be empty. For example, a classification result contains only a meta data and no IF-recording or signal content.

4.12.7.1. General View

This view shows all meta-information available in this result in form of a table. It is available for all result types. The exact list of supported columns and their order depends on the system settings and can vary.

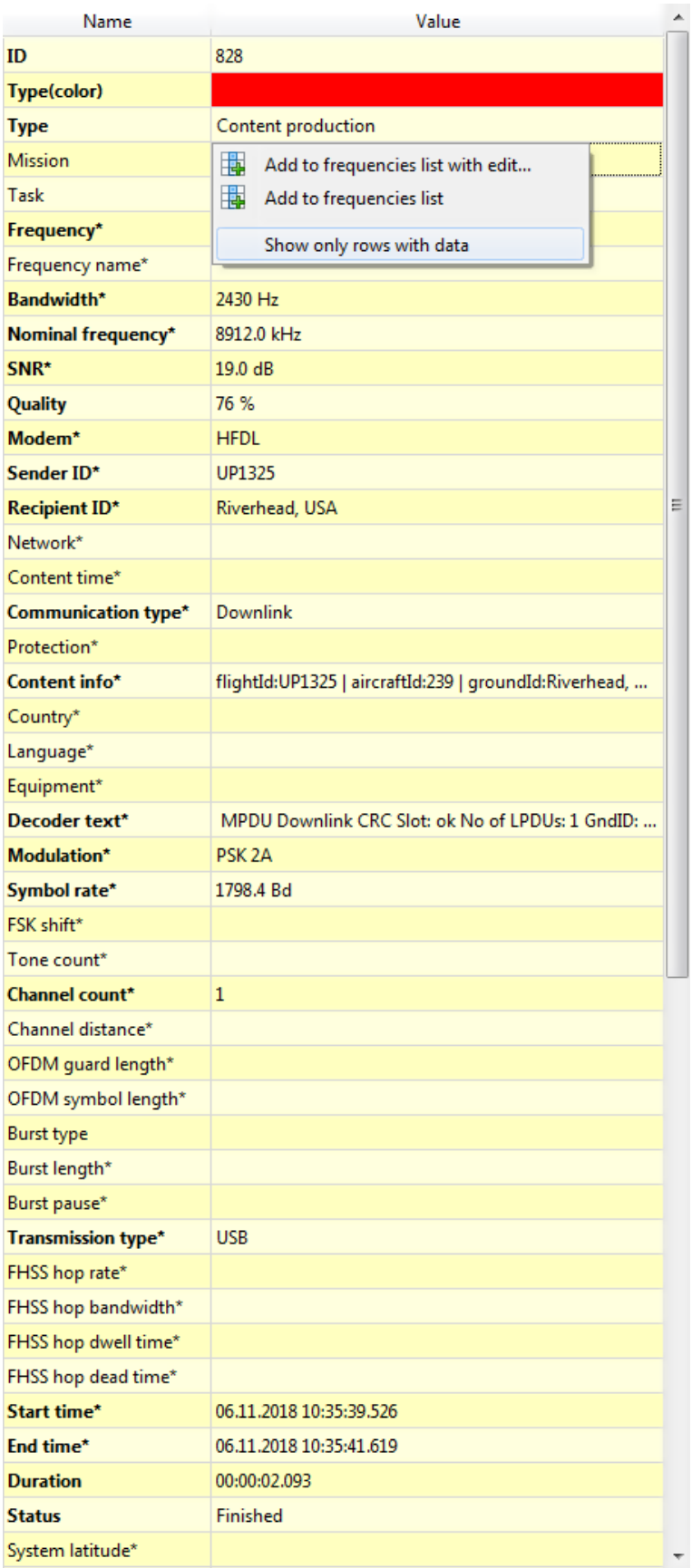


Figure 144.: ResultViewer - General View

All fields marked with "*" after the field name can be edited directly in the table (i.e. "Frequency" or "Bandwith" in Figure 144). Field names for fields contain some information will be displayed as bold text.

Function	Description
<**Add to frequencies list with edit...**>	For details, see chapter Table View
<**Add to frequencies list**>	For details, see chapter Table View
<**Show only rows with data**>	When checked, will hide all empty rows. This option can improve the readability of the result values; however, it may complicate the comparison of different result entries.

Table 48.: ResultViewer General View Functions

The following table contains the list of available fields in the basic configuration.

Field name	Description
ID	Unique ID of this result
Type(color)	Color field matching the color for this result type in the Graphical view
Type	Result type (NB/WB-recording, NB/WB classification, content production, modem recognition)
Mission/Task	Name of of Automatic Wideband Monitoring mission and task which created this result
Frequency	Center-frequency of the result
Frequency name	Name of the matching frequency for the current result, or rather the name of the frequency range from the of Automatic Wideband Monitoring task
Bandwidth	Bandwidth of the result
Nominal frequency	Nominal frequency of the signal if available (some classification and production results only)
SNR	Signal-to-Noise ratio
Quality	Recognition quality between 0 % and 100 %
Modem	Modem name (if available)
Sender ID	Provides emission sender identification, e.g. callsign, participant ID, etc. (for details, see chapter Result Post-Processor)
Recipient ID	Provides emission recipient identification, e.g. callsign, participant ID etc. (for details, see chapter Result Post-Processor)
Network	Provides identification for network where data transmission occurred (for details, see chapter Result Post-Processor)
Content time	Timestamp of data transmission as retrieved from the decoder result (for details, see chapter Result Post-Processor)
Communication type	Provides a description for communication type, e.g. broadcast, squitter, etc. (for details, see chapter Result Post-Processor)
Protection	Description for the type of protection/encryption used on the communication channel (for details, see chapter Result Post-Processor)

Field name	Description
Content info	May hold some common information from the decoder production result file which does not fit other fields (for details, see chapter Result Post-Processor)
Country	Provides some identifier about a country where the data transmission occurred (for details, see chapter Result Post-Processor)
Language	Provides information about language used on the communication channel (for details, see chapter Result Post-Processor)
Equipment	Provides information about equipment used to send the corresponding emission (for details, see chapter Result Post-Processor)
Decoder text	Decoder text from production channels. Text storage in the database is limited to the first 265 characters (can be changed during integration).
Modulation	Modulation type (if available)
Symbol rate	Symbol rate of the signal (if available)
FSK-Shift	Shift for FSK modulation type
Tone count	Tone count (if available)
Channel count	Channel count (if available)
Channel distance	Channel distance in Hz for multichannel signals
OFDM guard length /OFDM symbol length	Parameters specific for OFDM modulation recognition
Burst type/length/pause	Burst type and parameters (if available)
FHSS hop rate	For FHSS signals, number of hops/s
FHSS hop bandwidth	For FHSS signals, mean bandwidth of single hops
FHSS hop dwell time	For FHSS signals, mean duration of single hops
FHSS hop dead time	For FHSS signals, mean pause between hops
Start time	Start time of the result
End time	End time of the result
Transmission type	Transmission type for this emission, e.g. USB, LSB, AM or FHSS
Duration	Result duration
Status	Active or Finished
System latitude/longitude	Position of the system during the creation of the result
Sender latitude/longitude	Position of the sender during the detection and creation of the result
Bearing	Bearing delivered from external direction finding system (reserved for future use)
Last change	Date/time of the last update
Source	Signal source where this result was found. Usually of the form [signal][component].
Antenna	The antenna used for the creation of the result

Field name	Description
Comment	Result description (editable)
Emission ID	In of Automatic Wideband Monitoring, all results triggered by a specific emission will contain its unique emission ID in this field
Flags (New, Old, Process, Processed)	Various flags (boolean values) which can be freely used to support a specific operation procedure. I.e., for all processed results, the user can set the <**Processed**> flag to prevent processing the same result again. The flags can be set directly from the detail view and used as a filter parameter in the advanced filter. The set of available flags is customizable and can be changed during integration process to support specific customer needs.

Table 49.: Fields of Basic Configuration

4.12.7.2. Signal View

This view shows the recorded IF-signal as a spectrogram preview. In the case of a recording result, it will show the IF-signal of the result itself. For other result types which do not contain a recorded signal (e.g. classification, production, etc.), this view will search the database for any other recorded signal containing the time/frequency area of this result (but only if the <**Find matching recording**> option is selected).

For a faster display of wideband recordings, the precalculated spectrum option is used. The option can be disabled in the Signal view toolbar (see chapter Toolbar). There is no precalculated spectrum available for narrowband recordings.

The signal view option <**Show Other Results**> allows the loading and display of further results from the database that lie in the same time and frequency range as the displayed IF-signal. The Signal view also allows the selection of time and frequency ranges, and extraction of their content into separate narrowband recordings. Alternatively, the time and frequency can be added as user results. This allows signals in a recording to be selected manually and be labeled.

The integrated offline audio demodulator can demodulate signal data from a recording into an audio signal. The modulation type of the signal data can be set manually or automatically detected.

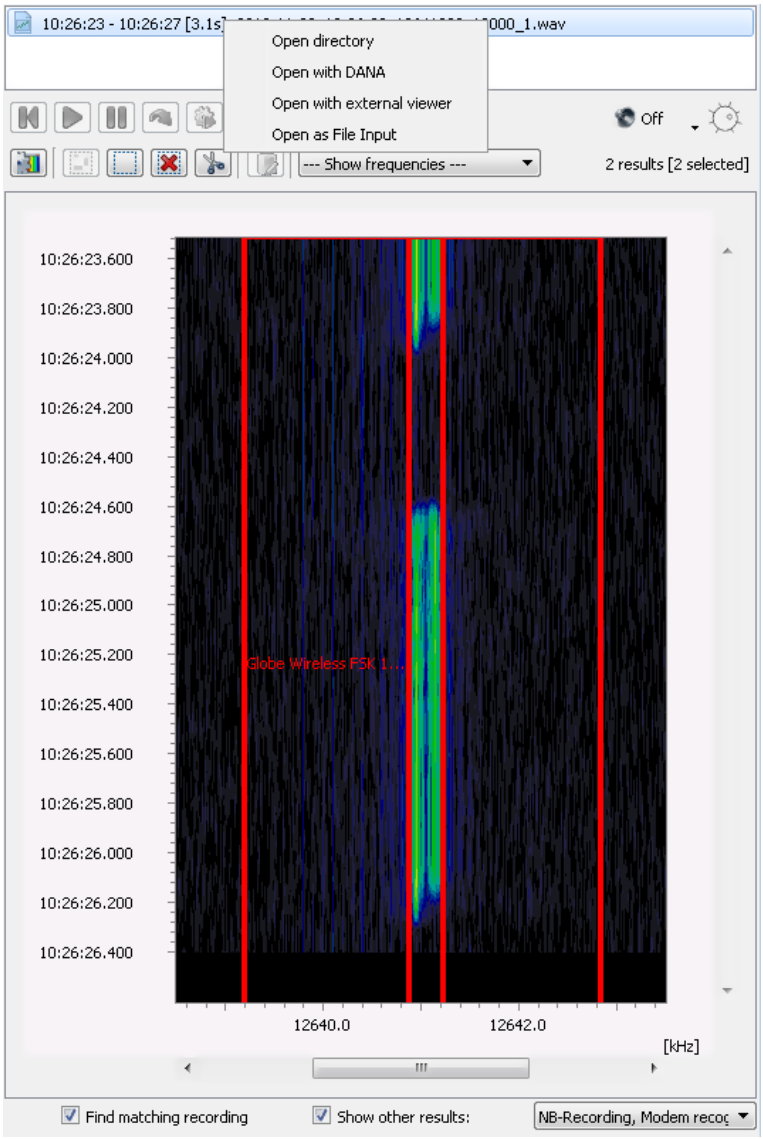


Figure 145.: ResultViewer - Signal View

The upper part of the view shows a list of signal files related to this result. Clicking on a file will show it in the spectrogram preview. In case of large files (for example from a WB-recording), the file may be listed in form of multiple segments with consecutive from/to time ranges for performance reasons. The context menu on each file item provides several functions

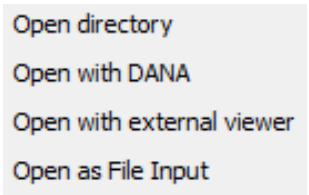


Figure 146.: ResultViewer - Signal View, Context Menu

Function	Description
<**Open directory**>	Used to open the file location directory directly with the file manager of the operating system
<**Open with external viewer**>	Click to open this file with the default OS viewer
<**Open as File Input**>	Will open the currently displayed file as a file input in the main GUI
<**Open with DANA**>	The presence of this context menu item depends on the current configuration of the application. Open this file with the DANA converter module from the go2DECODE software suite. This requires a go2DECODE installation.

Table 50.: ResultViewer Signal View Functions

4.12.7.2.1. Find Matching Recording

If this option is turned on and the current result is not a signal recording, the view will search the database for the best matching recording result which contains the time/frequency area of this result and show it in the spectrogram preview. A link to the matching recording for the result will be stored in the database. From now on, the matching recording for this result will always be displayed in the Signal view (even if the <**Find matching recording**> option is turned off).

The <**Find matching recording**> option works globally across all results and is enabled by default after the program is started. If it is activated, an appropriate recording will be searched for every displayed result. If this is not desired, the option can be globally deactivated in the signal window of any result available.

4.12.7.2.2. Show Other Results

Activate this option to see all other results which fit to the currently displayed time/frequency range as overlay rectangles in the spectrogram preview. There has to be a recording for the current selected result, otherwise no other results can be loaded and displayed. It is possible to define which result types should be displayed by using the associated filter. Activate the option check box and use the dropdown list to select the visible result types.

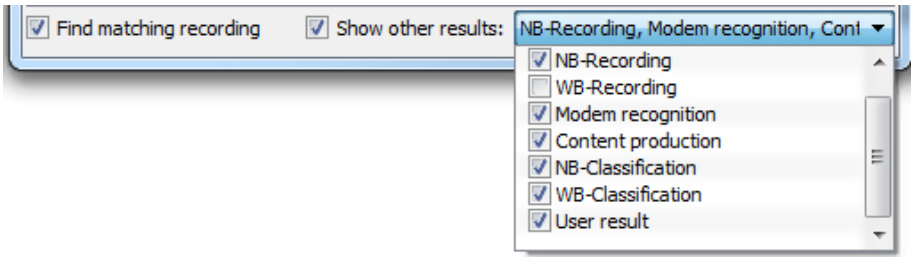


Figure 147.: Result Type Filter for Displaying Additional Results in the Spectrogram

The number of the currently displayed results in the spectrogram will be displayed next to the toolbar of the Signal view (see Figure 145 and Figure 149).

The <**Show other results**> option has a global effect across all results. If it is activated, the application will always try to find all matching results in the database for a displayed result and show them in the spectrogram as well. After the start of the program, the option is deactivated and all result types, except wideband recording, are selected by default in the filter.

4.12.7.2.3. Audio Demodulator

For narrow or wideband recordings, an offline audio demodulator is available for demodulation of signal data into an audio signal. Through selection of a signal file in the file list, the audio player and demodulator interfaces will be accessible in the GUI. A similar demodulation function is also available with the narrowband channels in manual mode. See chapter Audio Demodulation and Playback for all details regarding modulation types, volume control and squelch options.

Button	Description
	Rewinds the audio playback to the beginning of file
	Starts the playback on selected file
	Pauses playback
	Toggles the playback loop function
	Toggles the auto play function. Enables the playback to start immediately when either rewound or another file is selected. This allows a quick audio analysis when switching between several signals.

Table 51.: Audio Player Functions

The current playback time is displayed by the audio time marker. The change of the current playback position is possible by a left mouse double-click on the desired position.

The audio player will use only the currently selected file for demodulation and replay. To demodulate another file from the signal files list, the user has to select it manually in the Signal view.

Automatic demodulator settings

The <**Automatic demodulator settings**> option in the offline audio demodulator is turned off by default. In addition to using classifier results for automatic parameter settings (as in manual mode channels), the offline audio demodulator will also use modem recognition results to determine the correct audio demodulator and its nominal frequency. For further description of this option, see chapter Automatic Demodulator Settings.

4.12.7.2.4. Toolbar

On top of the spectrogram, a toolbar with various buttons provide quick access to important Signal view functions.

Button	Description
	Opens the spectrogram setting window (see chapter Settings)
	Selects all displayed results in the spectrogram. Results that are not in the visible range of the spectrogram are also selected. Selected results in the spectrogram are shown in bold and they will also be selected in the <**Table view**> of the ResultViewer (see chapter Selection of Results in the Spectrogram).
	Deselects all currently selected in the spectrogram and the table view
	Deletes all currently selected results in the spectrogram from the database
	Extracts the signal range of all selected results into separate narrowband records and adds these new results to the database (see chapter Extract Recordings)

Button	Description
	If precalculated spectra are available for a wideband recording, the precalculated spectra can be displayed in the spectrogram by clicking this button. This allows the viewing and editing of the entire recording across all file segments. This option is activated by default after program startup and is not available for narrowband recordings.

Table 52.: Signal View Toolbar Buttons

4.12.7.2.5. Spectrogram Settings

In this window, the parameters of the spectrogram can be changed. The parameters, cursors and extras tabs correspond to those of the spectrogram settings of the Channel window (see chapter Spectrogram Settings). The <**FFT-length**> and <**Windowing**> parameters in the Parameter tab of the window are only available if no precalculated spectrum is used.

4.12.7.2.6. Spectrogram Context Menu

The context menu of the spectrogram can be opened by clicking the right mouse button in the spectrogram.

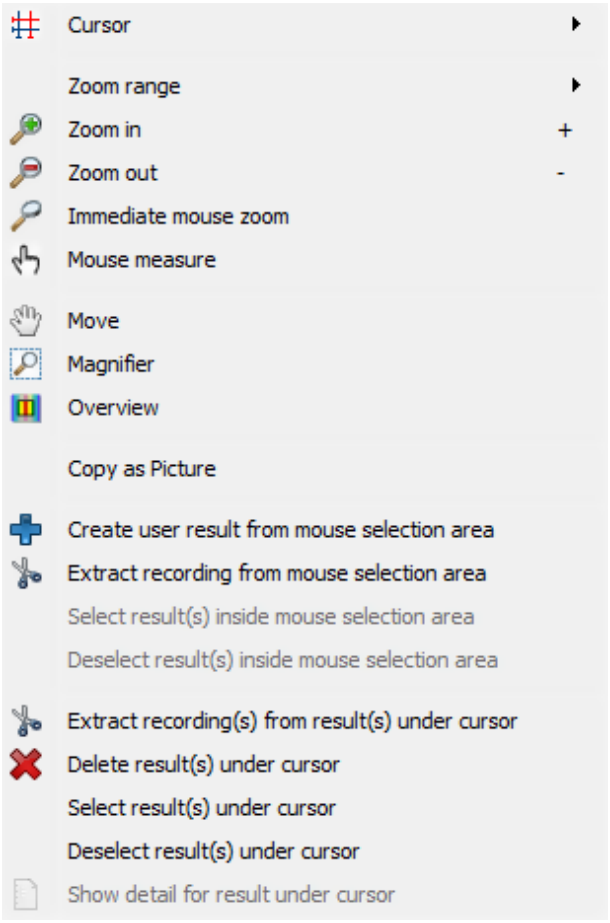


Figure 148.: Signal View - Spectrogram Context Menu

The first four sections of the context menu are identical to the spectrogram settings in chapter Spectrogram Settings. The last two sections contain functions specific for this Spectrogram view. The penultimate

section enables actions on areas selected by the user. These selection areas are time/frequency ranges in the spectrogram which the user has selected using the mouse cursor.

Icon	Context menu item	Description
	<**Create user result from mouse selection area**>	A user result is generated from the mouse selection area and stored in the database (see chapter Create User Results)
	<**Extract recording from mouse selection area**>	A narrowband recording is extracted from the mouse selection
	<**Select result(s) inside mouse selection area**>	All results that are completely contained within a mouse selection area will be selected and shown in bold in the spectrogram (see chapter Selection of Results in the Spectrogram)
	<**Deselect result(s) under mouse selection area**>	All selected results within a mouse selection area will be deselected in the spectrogram and the ResultViewer <**Table view**> (see chapter Selection of Results in the Spectrogram)

Table 53.: Spectrogram Context Functions for Selection Areas

The menu items in the last section of the context menu allow actions to be applied to one or more results within the spectrogram. All results that lie under the mouse cursor when opening the context menu will be considered. Overlapping results under the mouse cursor are also taken into account when executing the actions.

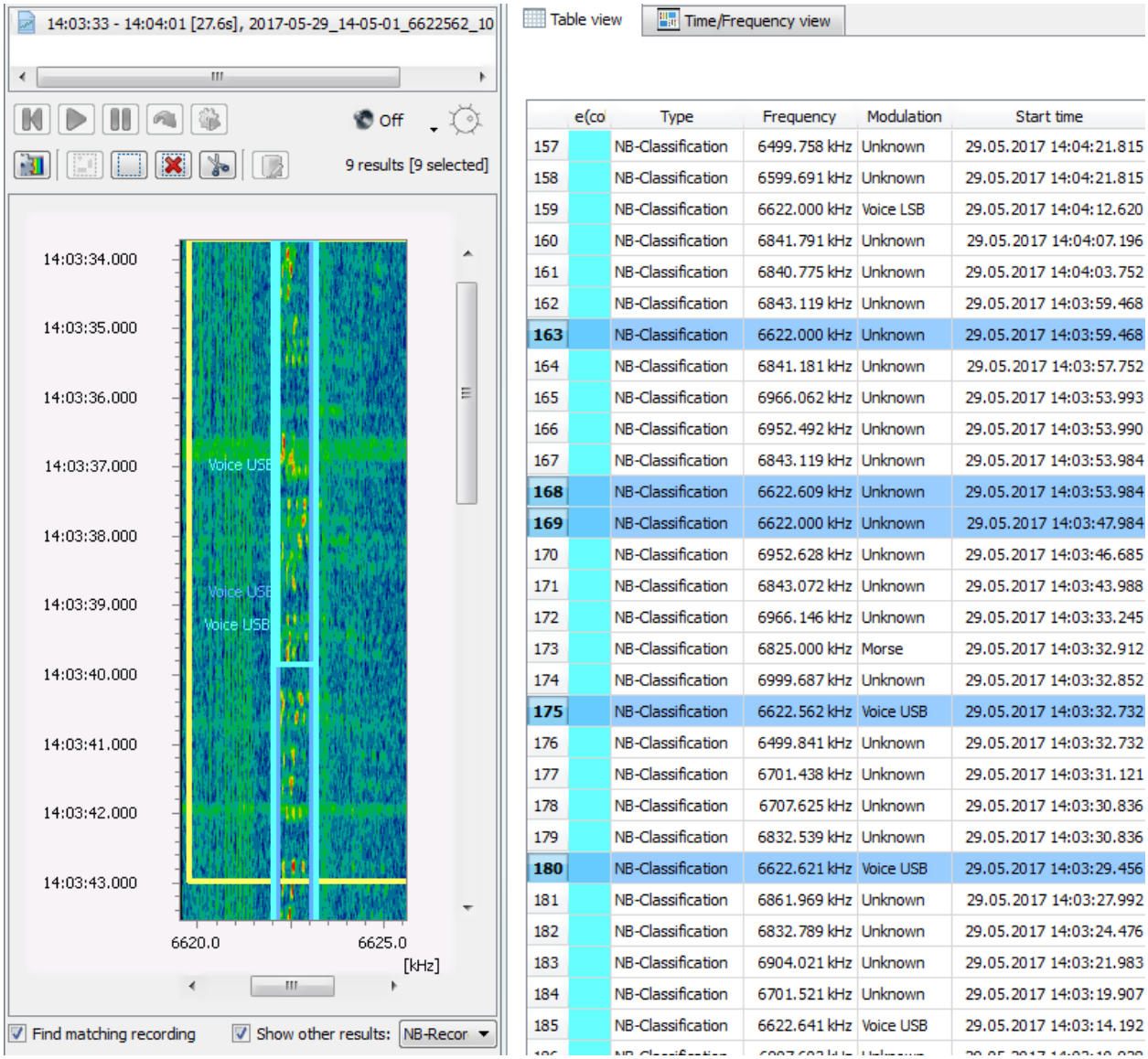
Icon	Context menu item	Description
	<**Extract recording(s) from result(s) under cursor**>	For each result under the mouse cursor, a narrowband recording is extracted and stored as a new result in the database (see chapter Extract Recordings)
	<**Select result(s) under cursor**>	All the results under the mouse cursor will be selected and shown in bold in the spectrogram. The corresponding table view rows of the results will also be selected.
	<**Deselect result(s) under cursor**>	All selected results under the mouse cursor will be deselected. The corresponding table view rows of the results will be deselected as well.
	<**Deselect result(s) under mouse selection area**>	All selected results within a mouse selection area will be deselected in the spectrogram and the ResultViewer <**Table view**> (see chapter Selection of Results in the Spectrogram)
	<**Show detail for result under cursor**>	The properties for exactly one result under the mouse cursor will be displayed. If more than one result is lying under the mouse cursor, the option is disabled.

Table 54.: Spectrogram Context Functions for Results Under Mouse Cursor

4.12.7.2.7. Selection of Results in the Spectrogram

By clicking on a result or within its time/frequency range, this result can be selected. Selected results are shown in bold in the spectrogram. If the result is within the signal range of another result, this other result will be also selected. Multiple results can be selected by pressing and holding <**Shift**> or <**Ctrl**>. A selected result can be deselected with a click and <**Shift**> or <**Ctrl**> pressed down. The results selected

in the spectrogram will also be selected in the <**Table view**> of the ResultViewer and highlighted in blue there.



	e(co	Type	Frequency	Modulation	Start time
157		NB-Classification	6499.758 kHz	Unknown	29.05.2017 14:04:21.815
158		NB-Classification	6599.691 kHz	Unknown	29.05.2017 14:04:21.815
159		NB-Classification	6622.000 kHz	Voice LSB	29.05.2017 14:04:12.620
160		NB-Classification	6841.791 kHz	Unknown	29.05.2017 14:04:07.196
161		NB-Classification	6840.775 kHz	Unknown	29.05.2017 14:04:03.752
162		NB-Classification	6843.119 kHz	Unknown	29.05.2017 14:03:59.468
163		NB-Classification	6622.000 kHz	Unknown	29.05.2017 14:03:59.468
164		NB-Classification	6841.181 kHz	Unknown	29.05.2017 14:03:57.752
165		NB-Classification	6966.062 kHz	Unknown	29.05.2017 14:03:53.993
166		NB-Classification	6952.492 kHz	Unknown	29.05.2017 14:03:53.990
167		NB-Classification	6843.119 kHz	Unknown	29.05.2017 14:03:53.984
168		NB-Classification	6622.609 kHz	Unknown	29.05.2017 14:03:53.984
169		NB-Classification	6622.000 kHz	Unknown	29.05.2017 14:03:47.984
170		NB-Classification	6952.628 kHz	Unknown	29.05.2017 14:03:46.685
171		NB-Classification	6843.072 kHz	Unknown	29.05.2017 14:03:43.988
172		NB-Classification	6966.146 kHz	Unknown	29.05.2017 14:03:33.245
173		NB-Classification	6825.000 kHz	Morse	29.05.2017 14:03:32.912
174		NB-Classification	6999.687 kHz	Unknown	29.05.2017 14:03:32.852
175		NB-Classification	6622.562 kHz	Voice USB	29.05.2017 14:03:32.732
176		NB-Classification	6499.841 kHz	Unknown	29.05.2017 14:03:32.732
177		NB-Classification	6701.438 kHz	Unknown	29.05.2017 14:03:31.121
178		NB-Classification	6707.625 kHz	Unknown	29.05.2017 14:03:30.836
179		NB-Classification	6832.539 kHz	Unknown	29.05.2017 14:03:30.836
180		NB-Classification	6622.621 kHz	Voice USB	29.05.2017 14:03:29.456
181		NB-Classification	6861.969 kHz	Unknown	29.05.2017 14:03:27.992
182		NB-Classification	6832.789 kHz	Unknown	29.05.2017 14:03:24.476
183		NB-Classification	6904.021 kHz	Unknown	29.05.2017 14:03:21.983
184		NB-Classification	6701.521 kHz	Unknown	29.05.2017 14:03:19.907
185		NB-Classification	6622.641 kHz	Voice USB	29.05.2017 14:03:14.192

Figure 149.: Selection of Results in Spectrogram and ResultViewer

The number of results in the spectrogram and the results that have been selected are displayed in the Signal view to the right of the toolbar. All available results in the recording can be selected by clicking on the <**Select**> button on the toolbar. In this case, the results which are in a non-visible part of the spectrogram will also be selected. If the <**Deselect**> button is clicked, all currently selected results are deselected in the spectrogram and in the <**Table view**>.

It is also possible to select one or more results within a mouse selection area in the spectrogram. For this purpose, the results in the spectrogram must be completely surrounded with a mouse selection area. The <**Select result(s) inside mouse selection area**> action must then be executed from the context menu of the spectrogram (see chapter Spectrogram Context Menu and Figure 148).

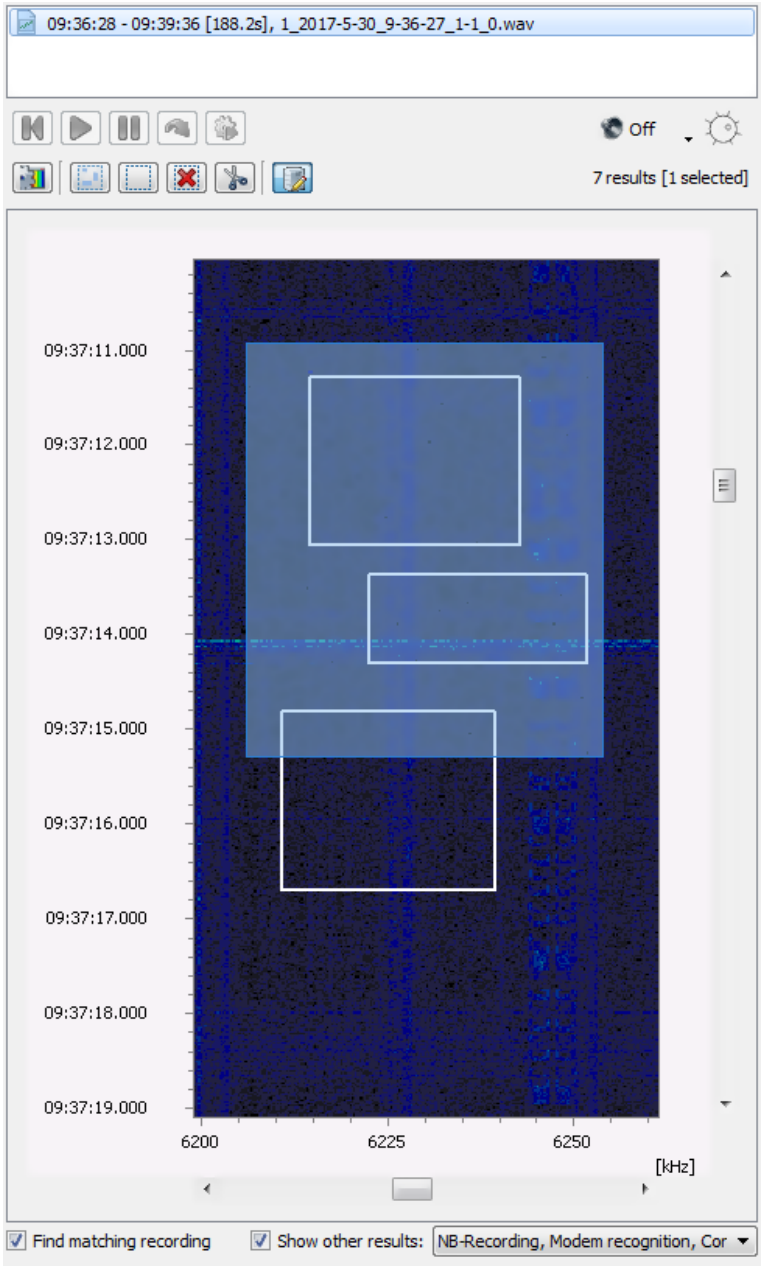


Figure 150.: Selection of Results Using a Selection Area in the Spectrogram

Only results that are completely surrounded by the selection area will be selected. For example, in Figure 150, only the first two upper results would be selected. Selected results can be deselected with the same procedure by using the <**Reset result selection within the selected range**> context menu item instead.

4.12.7.2.8. Shortcuts

Keyboard shortcuts can be assigned for many actions within the Signal view by using the shortcut manager, e.g. keyboard shortcuts for the audio demodulator and for actions on results in the spectrogram. The configuration of keyboard shortcuts is described in chapter Cached Shortcuts.

4.12.7.2.9. Create User Results

Time/frequency ranges in the spectrogram of a recording result can be defined as user results, e.g. for labeling emissions in recordings.

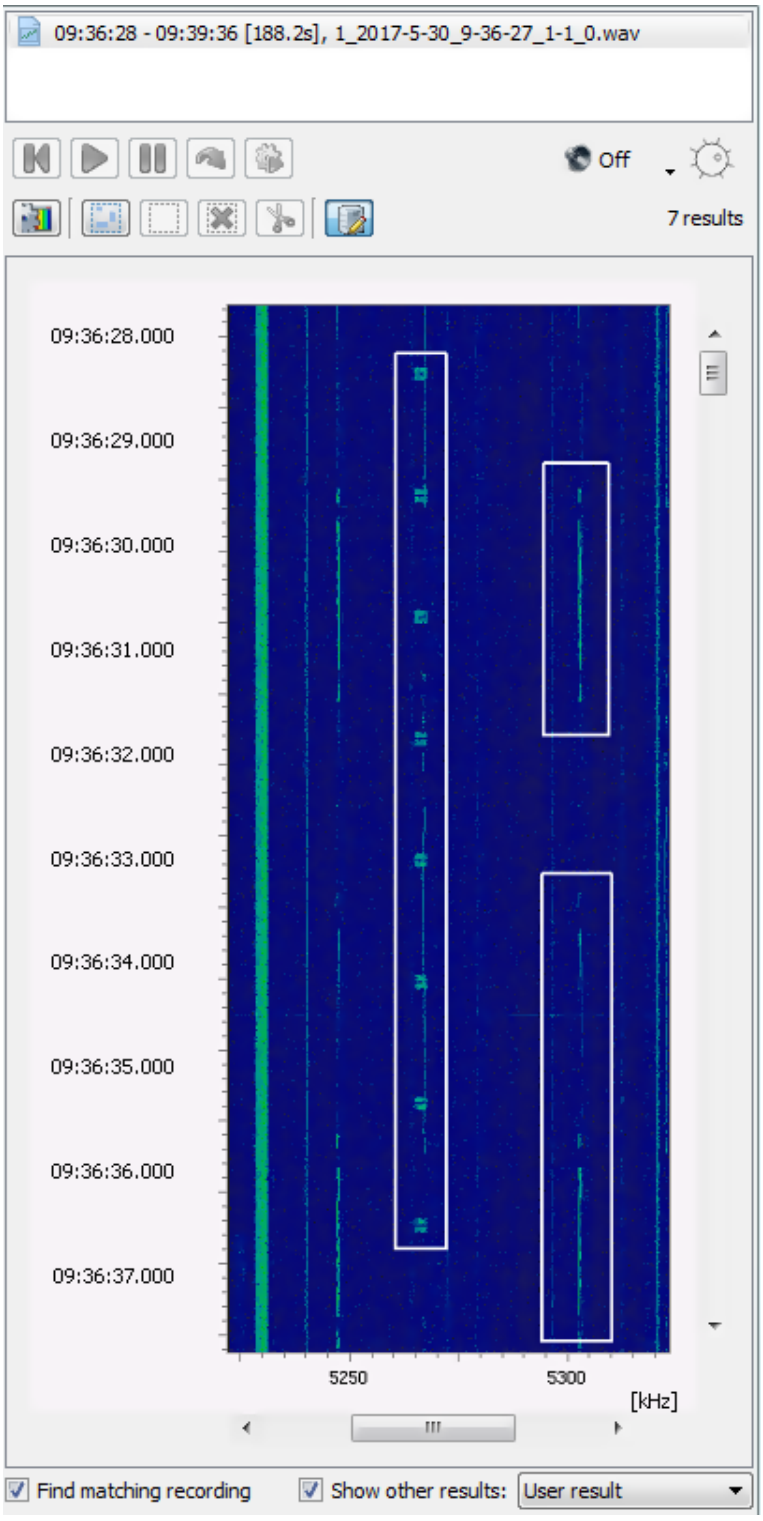


Figure 151.: User Results in Signal View

A user result is generated from a selected time and frequency range in the spectrogram. To create a user result, hold down the left mouse button and move the mouse until the desired range of the selection area is

reached. Then release the mouse button to confirm the selection area. The user result can now be created from the spectrogram context menu item (see Table 53). The context menu can be opened by right-clicking in the created selection area. After the user result is created, a dialog opens automatically in which the properties of the user results can be edited. The cursor is automatically positioned in the "Comment" field of the dialog, so that the generated result can be directly annotated. The first 20 characters of the comment will be displayed next to the user result in the spectrogram. User results are displayed as a box with white orders in the spectrogram.

With user results, a new result type was introduced. Hence, all actions which can be applied on the previous result types can also be applied on user results. Accordingly, user results can be selected with the methods already described, extracted into narrowband recordings and deleted.

Note: If the <**Show Other Results**> option is deselected, created user results will not be displayed in the spectrogram. A popup message above the option's checkbox will show a warning. For this reason, user results have to be active in the filter.

4.12.7.2.10. Extract Recordings

Recordings can be extracted in the spectrogram of the Signal view for selected time/frequency ranges and for results. The time/frequency ranges of mouse selection areas and of results are extracted into a new narrowband recording, with either the wideband or narrowband recording being used as the source of extraction. The extracted recordings will be added to the database as new results. After completion of the extraction, the new results can be viewed in the Signal view spectrogram as well as in the <**Table view**> of the ResultViewer.

Note: After the completion of extractions, it is necessary to apply the ResultViewer filter. For example the <**Apply Filter**> button in the ResultViewer can be used to achieve this (see chapter Menu & Toolbar). This process updates the views and visualizes the new records and results.

Extraction from time/frequency selection areas

A recording can be extracted from a time/frequency selection area in the spectrogram. To extract a recording from a selection area, hold down the left mouse button and move the mouse until the desired size of the selection area is reached. Then release the mouse button to confirm the selection area. The extraction can now be created from the corresponding spectrogram context menu item (see Table 53). The context menu can be opened by right-clicking in the created selection area. The status of the extraction can be traced in the <**Signal Extraction**> view (see chapter Signal Extraction View).

Extraction from result

Every result type can be used to create a new narrowband recording. Multiple results can be extracted in one step. The selection of multiple results is described in the chapter Selection of Results in the Spectrogram.

One or more selected results in the spectrogram can be extracted by clicking on the <**Extraction**> button  on the Signal view toolbar (see Table 52). Alternatively, the extraction can be executed with the corresponding spectrogram context menu entry (see Table 54). In this case, the selection of results is irrelevant. Only the results, which are under the mouse cursor when the context menu is called, are extracted. The status of the extraction can be traced in the <**Signal Extraction**> view (see chapter Signal Extraction View).

Note: For technical reasons, the bandwidth of the signal under extraction must remain under the threshold of ca. 70 % the sampling rate of the source signal.

4.12.7.2.11. Displaying Frequencies as Overlay

By using a frequency group selection combo-box, it is possible to show frequencies from the <**Frequencies**> view as overlay markers in the spectrogram (for details, see chapter Displaying Frequencies as Spectrogram Overlay).

4.12.7.3. Content View

This view shows signal content for production results (e.g. decoder text, audio, binary data). All available content types retrieved from one signal will be shown combined in this view (see Figure 152). The following content types are available.

Function	Description
Decoder output	Text-based output from a production channel decoder saved in XML-format
Audio	Demodulated audio saved as a WAV file
Binary content	Any other content retrieved from the signal in form of binary files. In the case of decoder output, all functions available in the processing channel in the channel GUI will also available in this view (e.g display type selecting, search, printing, etc.)

Table 55.: Content Types

For each content type, a list of produced files (e.g. decoder text files, WAV files, etc.) is shown. Clicking on a specific file will show its content in the integrated viewer. The context menu on each file item provides two functions:

Function	Description
Open with external viewer	To open this file with the default OS viewer
Open directory	To open the file location directory directly with the with the file manager of the operating system

Table 56.: Content Menu - Functions

In the below example, additionally to the decoder text result, a demodulated audio content is also displayed (Morse modem) on the right. The integrated audio player provides basic functions to play and navigate through audio.

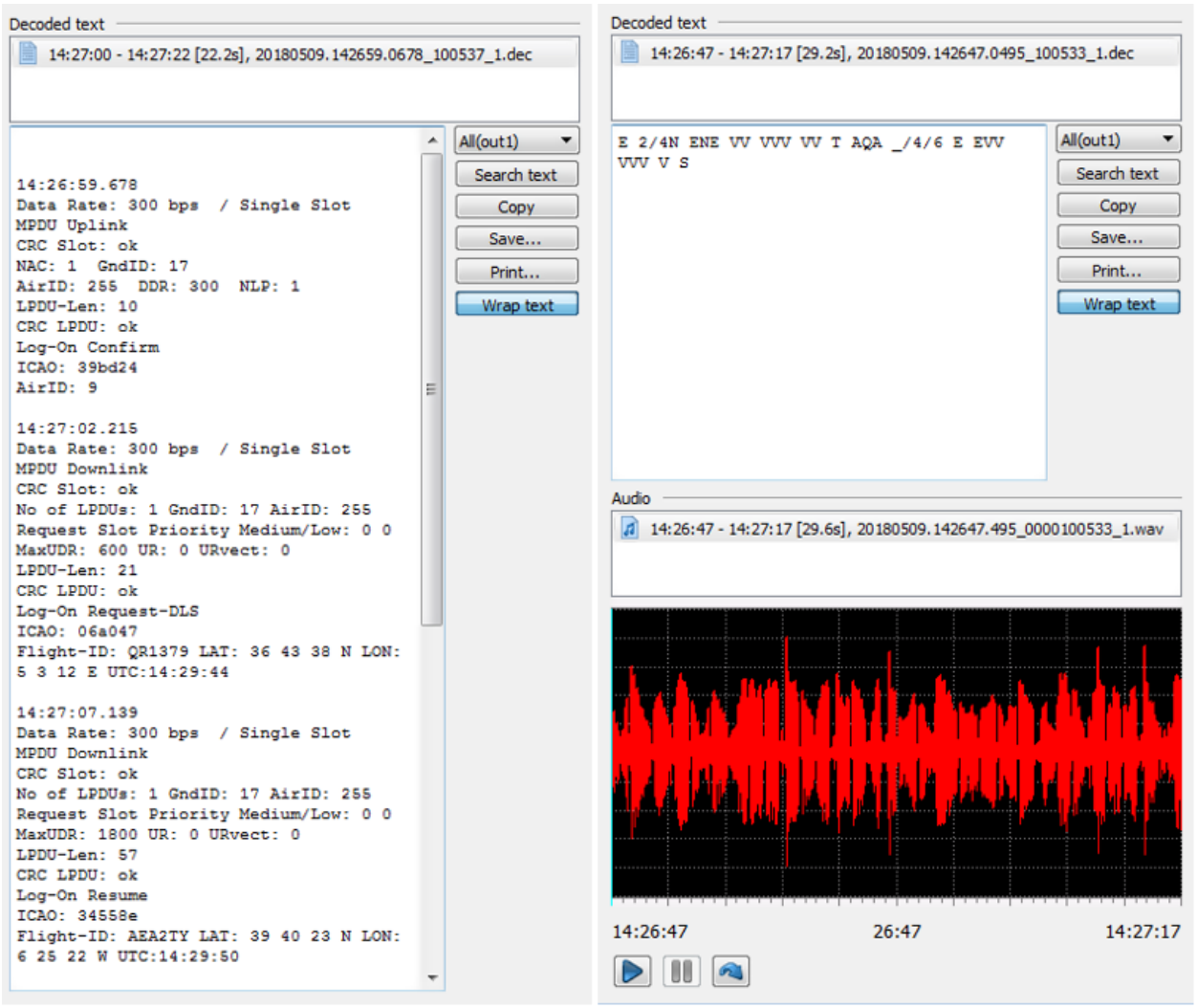


Figure 152.: ResultViewer - Content View

4.12.7.4. Position View

Figure 153 shows the system and sender position of a result. After the selection of a result in the <**Table view**>, the position map will be automatically zoomed and aligned so that the system and sender positions can be seen. This feature can be deactivated by disabling the <**Zoom and position automatically**> option at the bottom of the map.

Figure 153.: System and Sender Position Display of a Result

The map can be moved with the mouse and zoomed with the mouse wheel. If <**CTRL**> is pressed and held, the cursor shape will change to a cross cursor. Now a new sender position can be set by clicking on the desired place on the map. If a result does not have a system and sender position, the map will be empty.

4.12.7.4.1. Delete System and Sender Position

The system and sender position of a result can be deleted in the General view. This can be achieved by emptying the latitude and longitude fields of the positions.

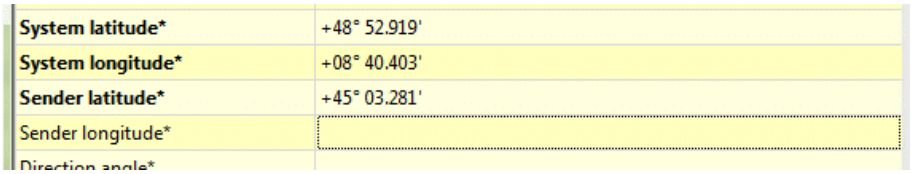


Figure 154.: System and Sender Position in the General View

Note: The latitude and longitude of a position can be deleted independently. This can lead to invalid positions which won't be recognized by the system and therefore cannot be displayed by the map dialogs.

4.12.7.5. Matching Frequencies View

This view shows all frequencies (from the <**Frequency**> view) matching the currently displayed result. The frequency is considered to "match" a result if it is inside the result's bandwidth.

No matching frequencies will be displayed for wideband or narrowband recordings.

The frequencies which fit perfectly to the current result (i.e. where the center frequency difference is less than 10 % of the result bandwidth) will be shown with a green background.

All frequency list entries or frequency groups can be edited directly from this view.

By clicking on the <**Reload**> button, new frequency information can be loaded from the database (important only in multi-user systems).

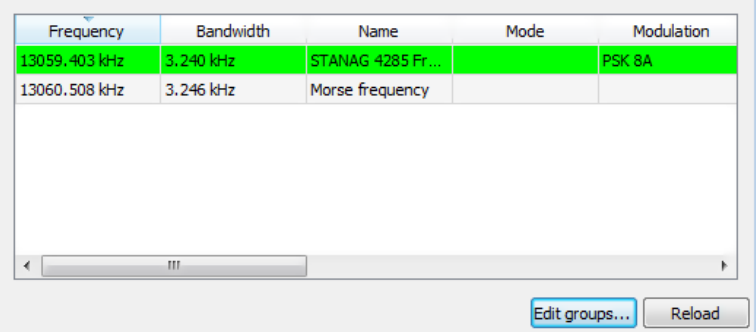


Figure 155.: Matching Frequencies View

4.12.8. Structuring View

The result structuring function enables the user to organize results into custom groups with unlimited hierarchy and complex structuring algorithms implemented as Python scripts.

For more information regarding script creation, see chapter GUI Scripting Option. Several simple script examples are already included in the standard product setup and can be used without creating own custom scripts.

The structuring view can be turned on by using the main menu or toolbar button. It appears as a docking view inside ResultViewer.

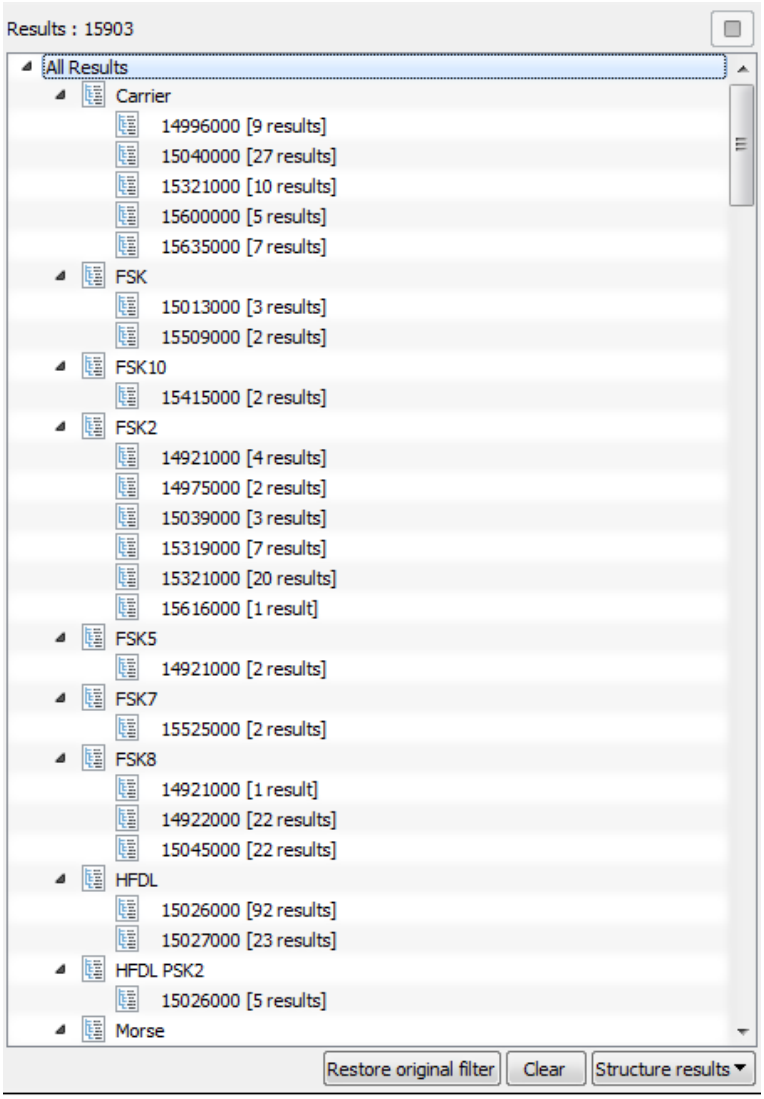


Figure 156.: Structuring View

To perform the result structuring, simply select an entry from the <**Structure results**> dropdown and the execution of the associated structuring script will be started immediately.

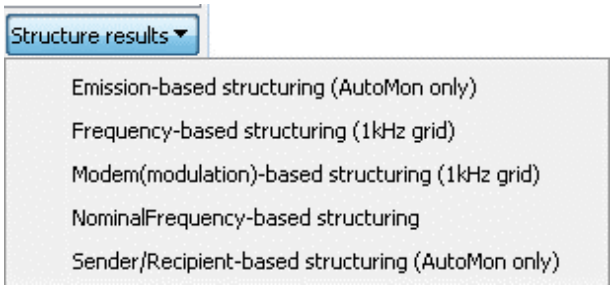


Figure 157.: Structure Results Context Menu

The script goes through all results matching your current filter (e.g. time/frequency range and advanced filter settings) and groups those according to its rules.

Depending on the complexity of the underlying algorithm and the result set matching the current filter, the execution can take some time until completed. The number of results retrieved from the database so far

is displayed in the upper part of the view. On execution completion, the view will display calculated result groups as a tree structure.

Selecting a group in the created tree structure works as a filter for the Table view and Time/Frequency view, restricting the display only to the results from the selected group. Of course, this will work only if the results are still contained in your current result filter. If the filter is changed after structuring your results, for example by moving to a different time/frequency range, the results from created groups will probably not be visible anymore. See <**Restore original filter**> button information below for more information.

To turn the result filtering based on the selected group off, simply select the <**All Results**> item at the top of the tree structure (see Figure 156) or simply hide the structuring view by using the main menu or toolbar button.

Multiple selection of groups (tree structure items) is also possible. In this case, all results from all selected groups will be displayed in a table or frequency/time display.

The tree's items may either contain further group nodes or result nodes or both. A result item will show the number of contained results next to its name.

Function	Description
<**Clear**>	Used to clear all created groups
<**Restore original filter**>	Displayed only if filter settings are changed in the ResultViewer after structuring your results. By clicking this button, it will be possible to restore the original filter settings used for the group creation.

Table 57.: Structuring View Functions

4.12.9. Stored Filters View

To query the database for a certain set of results, various filtering possibilities are available as a combination of the time/frequency filter and the advanced filter (see chapters Time/Frequency Filter and Advanced Filter). The Stored Filters view provides functions for saving and reusing such filters (see Figure 158).

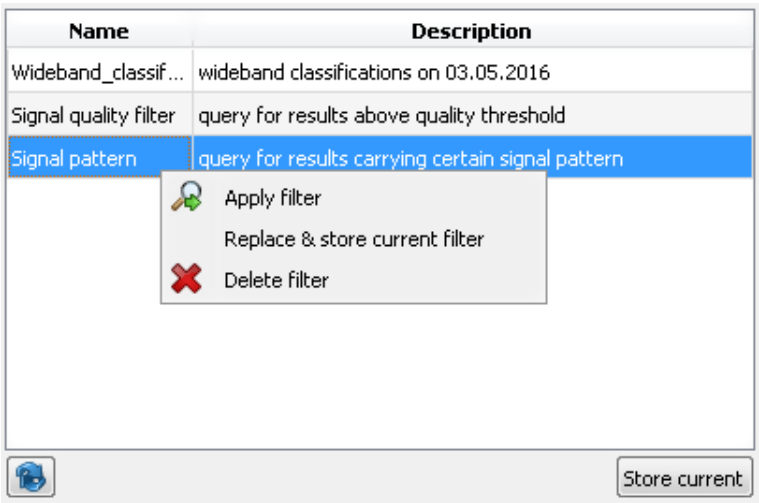


Figure 158.: ResultViewer Stored Filters

Function	Description
<**Apply filter**>	Applies the selected filter. Alternatively, double-clicking with the left mouse button can be used to apply the selected filter.
<**Replace & store current filter**>	Replaces the filter of selected entry by the current ResultViewer filter
<**Delete filter**>	Deletes the selected filter
	<**Refresh filters**> synchronizes the table contents with the database (for multiuser environments)
<**Store current**>	Stores the current ResultViewer filter

Table 58.: Stored Filters View Functions

4.12.10. Masking Entries View

Masking entries provide an extension for filtering, which may improve the clarity in the Result Table view. By definition of a masking rule with criteria defined either by the "Emission ID", the "Frequency" or the "Nominal Frequency" value of selected results, the matching result entries are removed temporarily for a specified duration from the Result Table (for details, see Figure 159). The creation of masking rule is possible only when the value of specified criteria is not empty.

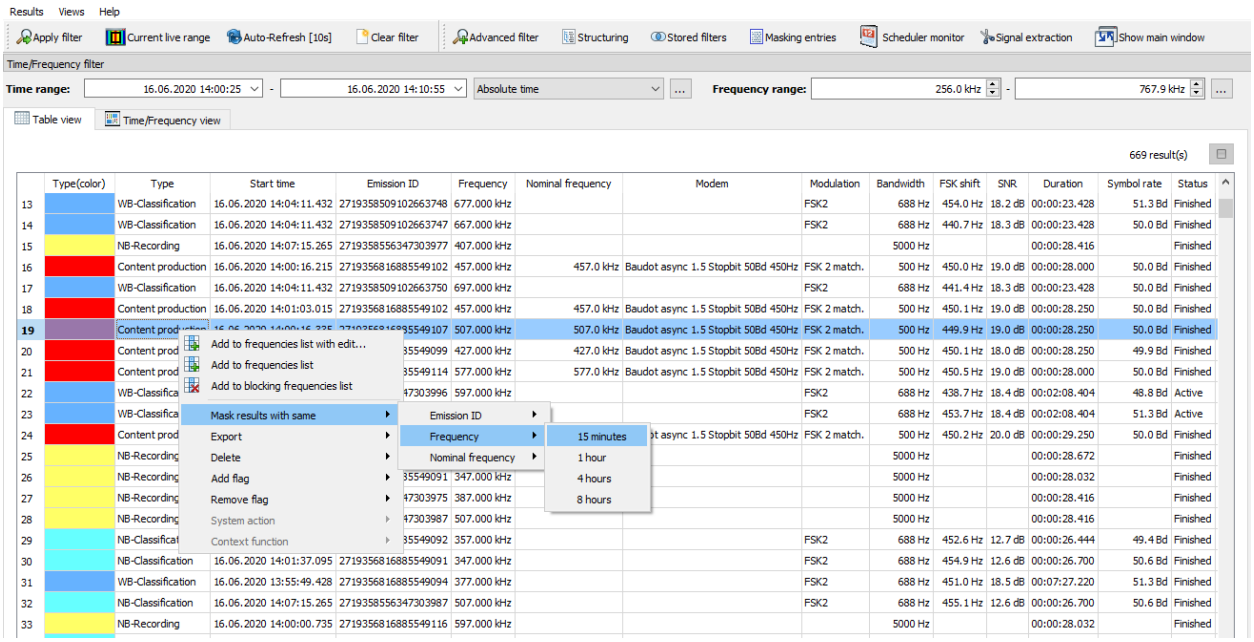


Figure 159.: Context Menu for Masking Entries

Masking rule

By activation of a context menu option, a masking rule is created and placed in the in the <**Masking entries**> view. The created masking rule immediately applies to the result entries on the visible table page causing the affected results to be removed for a specified duration from the Result Table.

Every masking rule is described by the information in the following table.

Column name	Description
Active	Shows the activity state of a masking rule and allows the activation/deactivation of the masking rule
Masked results	Provides the number of results actually masked out by this rule
Emission ID	Holds the masking criteria value used for masking results. The value "---" indicates the criteria are not relevant for this rule.
Frequency	Holds the masking criteria value used for masking results. The value "---" indicates the criteria are not relevant for this rule.
Nominal frequency	Holds the masking criteria value used for masking results. The value "---" indicates the criteria are not relevant for this rule.
Duration	Holds the duration value as specified on masking rule creation
End time	Describes the maximum validity of this masking rule as a UTC time stamp
Validity	Holds the countdown for the validity value

Table 59.: Masking Rule Fields

Note: Expired masking rules do not affect the Result Table content until the filter is applied.

Masking rules are presented in a table form. The number of entries actually masked out by active masking rules is displayed in the status output above the Result Table (see Figure 160).

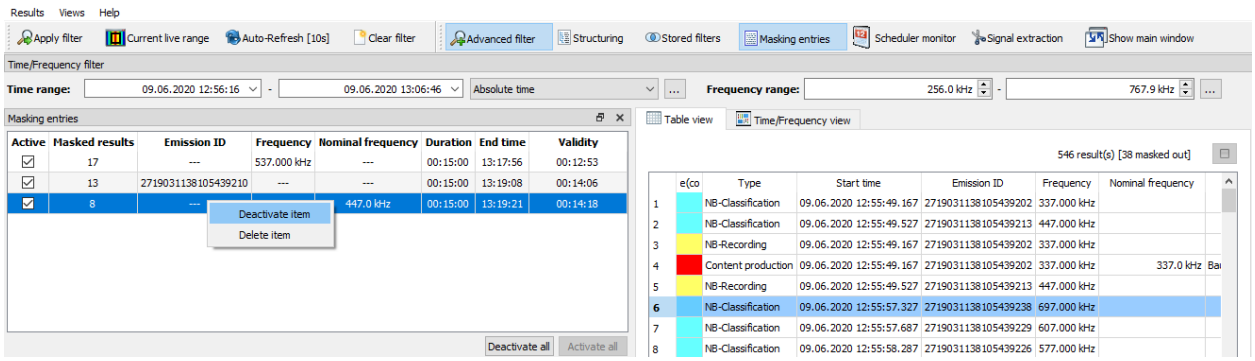


Figure 160.: Masking Entries View

Administrating Masking Rules

In the Masking Rules view, either the context menu or the push buttons can be used for the administration of masking rules. Every change applied to a masking rule immediately affects the contents of the Result Table.

The actions accessible from within the context menu are sensitive to the activity state as well as to the amount of selected rules, allowing the activation, deactivation and deletion of selected entries.

The buttons at the bottom of the Masking Rules view provide quick access to all masking rules.

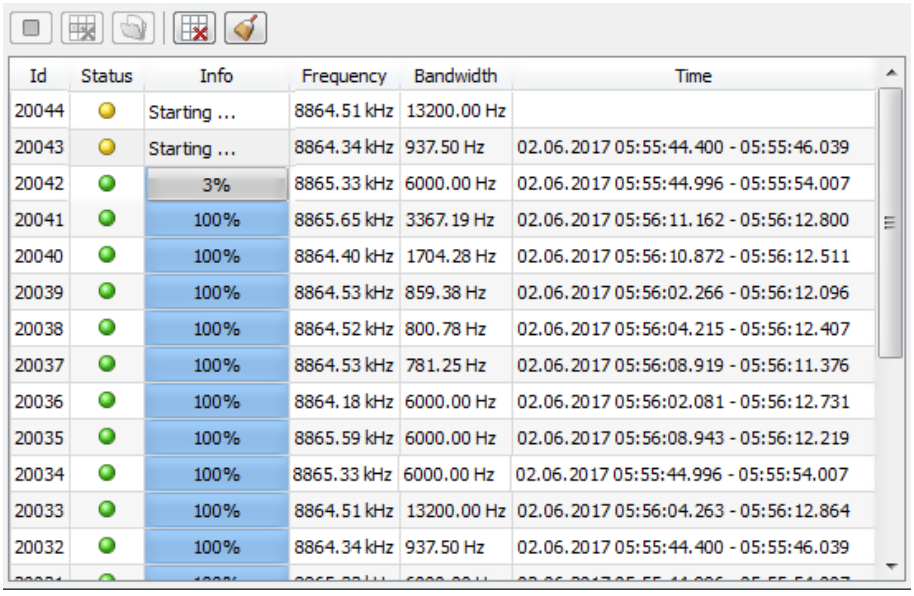
Function	Description
<**Deactivate all**>	Deactivates all active masking rules
<**Activate all**>	Activates all inactive masking rules. Expired rules are activated again for the original duration. Rules with running countdown are just activated, the remaining duration is retained.

Table 60.: Masking Rules Functions

4.12.11. Signal Extraction View

The state of signal extractions can be traced in the <**Signal Extraction**> view. The extraction of signals from selection areas and results is described in chapter Extract Recordings.

The <**Signal Extraction**> view can be opened either by using the Signal extraction button on the toolbar of the results display (see Figure 128 respectively Table 43) or via the <**Views**> menu item in the menu bar of the ResultViewer window.



Id	Status	Info	Frequency	Bandwidth	Time
20044		Starting ...	8864.51 kHz	13200.00 Hz	
20043		Starting ...	8864.34 kHz	937.50 Hz	02.06.2017 05:55:44.400 - 05:55:46.039
20042		3%	8865.33 kHz	6000.00 Hz	02.06.2017 05:55:44.996 - 05:55:54.007
20041		100%	8865.65 kHz	3367.19 Hz	02.06.2017 05:56:11.162 - 05:56:12.800
20040		100%	8864.40 kHz	1704.28 Hz	02.06.2017 05:56:10.872 - 05:56:12.511
20039		100%	8864.53 kHz	859.38 Hz	02.06.2017 05:56:02.266 - 05:56:12.096
20038		100%	8864.52 kHz	800.78 Hz	02.06.2017 05:56:04.215 - 05:56:12.407
20037		100%	8864.53 kHz	781.25 Hz	02.06.2017 05:56:08.919 - 05:56:11.376
20036		100%	8864.18 kHz	6000.00 Hz	02.06.2017 05:56:02.081 - 05:56:12.731
20035		100%	8865.59 kHz	6000.00 Hz	02.06.2017 05:56:08.943 - 05:56:12.219
20034		100%	8865.33 kHz	6000.00 Hz	02.06.2017 05:55:44.996 - 05:55:54.007
20033		100%	8864.51 kHz	13200.00 Hz	02.06.2017 05:56:04.263 - 05:56:12.864
20032		100%	8864.34 kHz	937.50 Hz	02.06.2017 05:55:44.400 - 05:55:46.039

Figure 161.: Signal Extraction View

The state of started extractions is displayed in tabular form. Each line in the table corresponds to an extraction of a time/frequency range. Depending on their current status, several functions can be applied on selected extraction entries by using the available toolbar buttons in the view.

4.12.11.1. Status Notification

The current state of an extraction is visible in the "Status" column. The possible states are described below.

Icon	State description
	Extraction is either running or has already been successfully finished
	The extraction task is waiting until the required system resource is available
	The extraction has been aborted due to errors. The "Info" column does hold the description for the cause of failure (see Figure 161)

Table 61.: Extraction States Overview

4.12.11.2. Troubleshooting

The extraction is aborted on failure. The cause of most common failures along with possible solutions are described below.

Error message	Error description	Possible solution
Bandwidth XY extraction failed	The parametrized bandwidth XY of the signal under extraction exceeds the maximum DDC channel bandwidth of the Signal Server	Reduce the bandwidth to comply with the Signal Server capabilities
Bandwidth XY extraction failed	The bandwidth of the signal under extraction is too high (see chapter Extract Recordings)	Adopt the bandwidth to comply with the technical limitation
Frequency/Bandwidth out of range	The frequency range of the signal under extraction exceeds the frequency range of source recording	Ensure the frequency range is within those of the source recording
Signal is shorter than limit (XY ms)	The minimum duration of the signal under extraction is below limit, which is by default 1000 ms	Extend the minimum duration beyond limit

Table 62.: Failures and Possible Solutions

4.12.11.3. Toolbar

The toolbar provides several buttons for quick access to important functions in the Signal Extraction view.

Button	Description
	Stops a pending or ongoing extraction. This option is not available when extractions are completed. When stopping pending extractions, there is no valid time range available, this is indicated by the "Not available" message in the table column.
	Removes a selected status entry from the table. This has no effect on the generated extraction result in the database. The result can still be viewed in the ResultViewer.
	Opens the directory containing the recording file of the selected extraction

Button	Description
	Removes all status entries from the table. This has no effect on the generated extractions in the database. The results are still visible through the ResultViewer <**Table view**>.
	Removes all completed status entries from the table. Pending and not yet completed extractions remain.

Table 63.: Signal Extraction View - Functions

4.12.11.4. Context Menu

By right-clicking on a status entry in the table, the context menu for the selected entry will be shows.

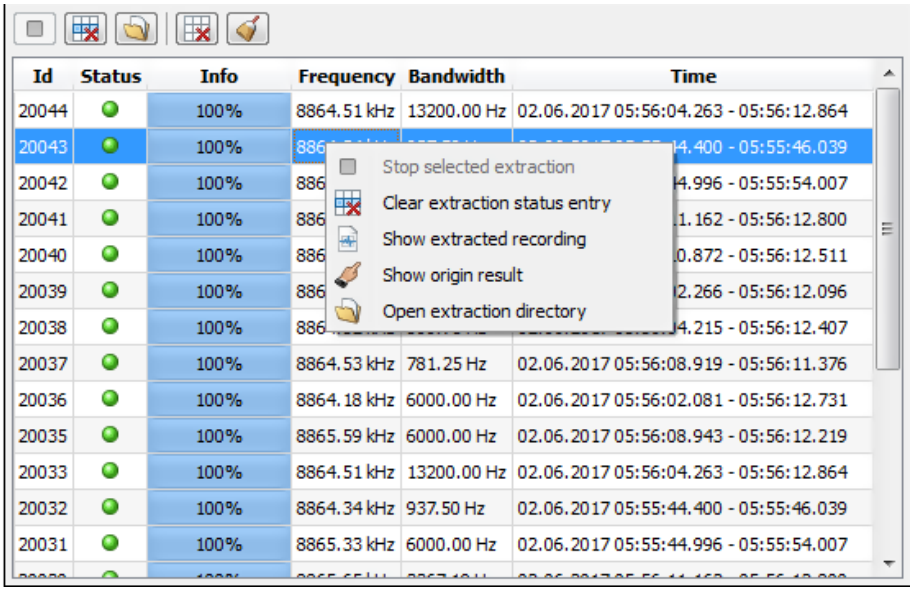


Figure 162.: Context Menu for a Status Entry in the Signal Extraction View

It contains the following functions for the selected status entry:

Icon	Context menu	Possible solutionDescription
	<**Stop selected extraction**>	Stops a pending or ongoing extraction. This option is not available when extractions are completed. When stopping pending extractions, there is no valid time range available, this is indicated by the "Not available" message in the table column.
	<**Clear extraction status entry**>	Removes a selected status entry from the table. This has no effect on the generated extraction result in the database. The result can still be viewed in the ResultViewer.
	<**Show extracted recording**>	Opens the General view and shows the meta-information of the extracted result
	<**Show origin result**>	If the extraction was created from a result (for example, a classification or user result), the meta-information of the original result is opened when this context menu item is selected. If the extraction was created from a selected time/frequency selection area instead, this context menu entry is deactivated.

Icon	Context menu	Possible solutionDescription
	<**Open extraction directory**>	Opens the directory containing the recording file of the selected extraction

Table 64.: Signal Extraction View - Status Context Menu

4.12.12. Shortcuts

Several options in the ResultViewer provide keyboard shortcuts, such as the execution of the <**Apply filter**> or <**Current live range**> functions. These shortcuts can be assigned and deleted with a shortcut edit dialog via <**ResultViewer**><**Viewer**><**Shortcuts**>.

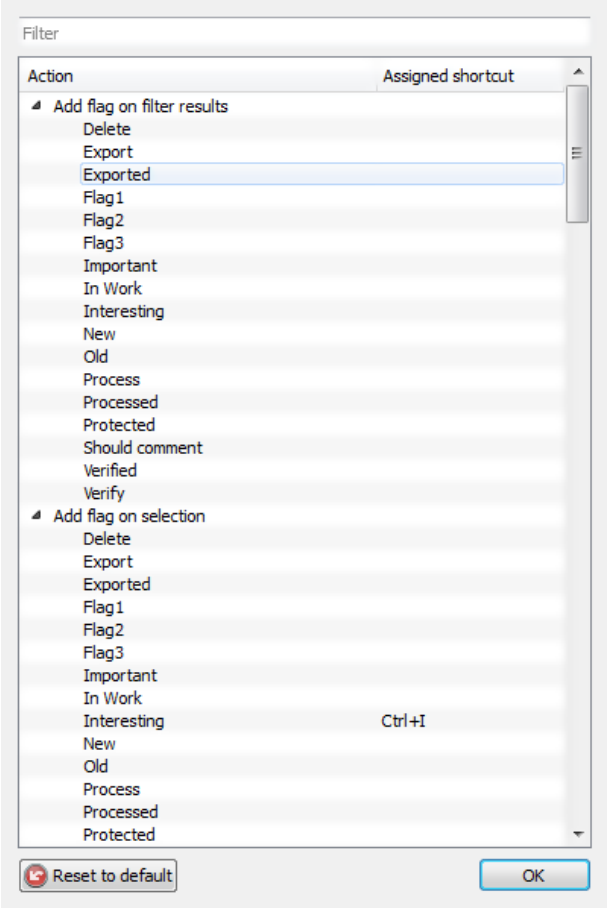


Figure 163.: Shortcut Edit Dialog

The <**Shortcuts**> dialog shows all actions with assignable shortcuts. The actions are grouped by name, e.g. "Add flag on filter results" or "Add flag on selection". By double-clicking on the group name, the group can be expended or contracted.

The action can be searched by name from the <**Filter**> text box.

To assign a shortcut, double-click on the shortcut name or the column next to it. A dialog as seen in Figure 164 will be displayed.

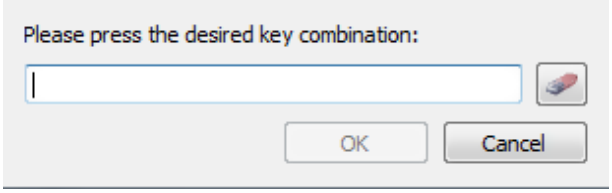


Figure 164.: Assignment of a Shortcut

If the shortcut is already taken by another action, you will receive a warning next to the <**OK**> button, as seen in Figure 165.

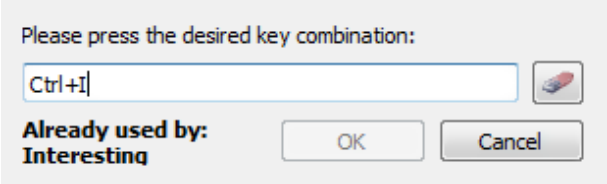


Figure 165.: Already Used Shortcut

If the entered shortcut is valid, the <**OK**> button will be enabled. Apply your choice by clicking <**OK**> or undo any changes by clicking <**Cancel**>.

To delete an already assigned shortcut, click the button with the <**Rubber**> icon next to the text edit field.

It is possible the undo all assignments by clicking on the <**Reset to default**> button. Be aware that this step cannot be undone; all assigned shortcuts will be lost and must be reassigned again.

4.12.12.1. Cached Shortcuts

If your system has an interactive actions feature (optional), actions may be added and deleted dynamically (see chapter Action Editor. If a shortcut is assigned to an interactive action which does not exist anymore, the action is displayed in red italics in the <**Shortcuts**> dialog (see Figure 166).

If the action is added again, the last assigned shortcut will be automatically be assigned to the action (caching).

A cached item can be deleted by selecting an item, opening the context menu with a right-click and then selecting <**Delete cached entry**>.

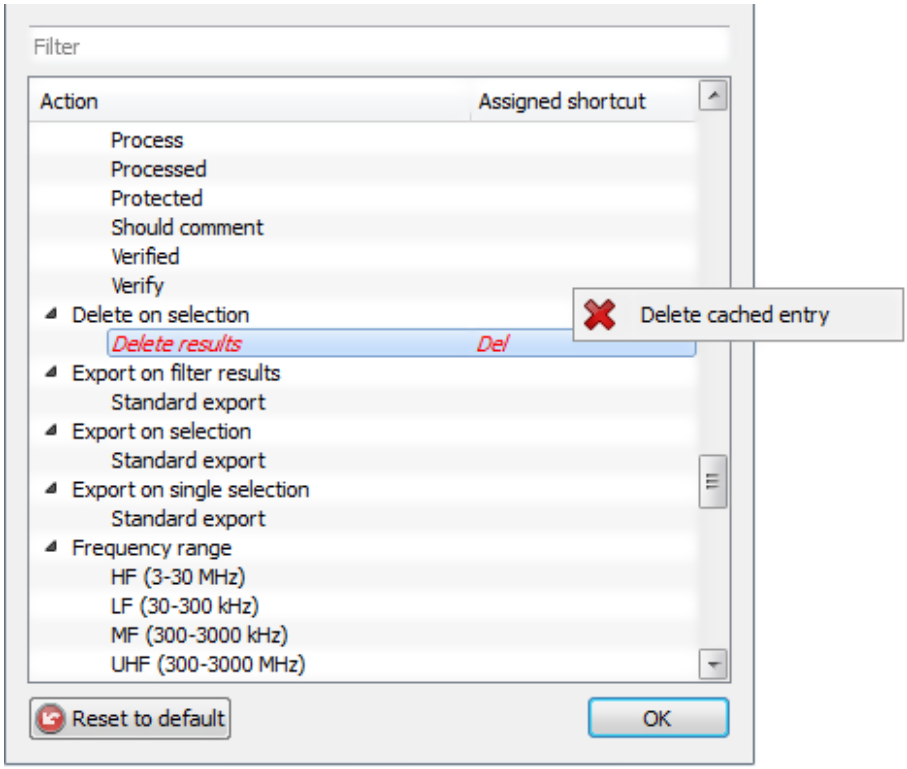


Figure 166.: Cached Actions

4.13. Frequencies

The <**Frequencies**> window offers functionality for organizing and maintaining frequencies and frequency ranges. It allows the operator to store frequency ranges or single frequencies, which can later be used during task creation.

As all other docking windows, it can be started from <**Views**><**Frequencies**> in the main menu. It is available in both automatic and manual mode (see Figure 167).

For the purpose of clarity, the management for fixed frequencies and frequency ranges has been separated into different tables, with each table row containing a frequency entry. The fields of an entry can be edited after a double-click on the corresponding table cell. Once a value has been edited, the <**TAB**> key can be used to edit the next or the <**Alt**>+<**TAB**> key combination to edit the previous value. The entered frequency entries are validated when the <**Next**> button is clicked, an error message is displayed on table lines with invalid entries. After correcting all invalid entries, the task configuration can proceed to the next page. To save the changes, press the <**Enter**> key or click outside the table cell being edited. The new value is then persistently stored. A left-click on the table header sorts the values in the associated table column.

Note: The semicolon and vertical line are both used by data export as separator characters, so their usage for editing frequency entry is not permitted.

The filter widgets at the top of the dialog allow the table entries to be filtered by <**Name**>, <**Remark**>, <**Frequency**> range (from ... to) and the <**Group name**>. The filtering of the Group membership can be done via the drop-down menu or by free text entry.

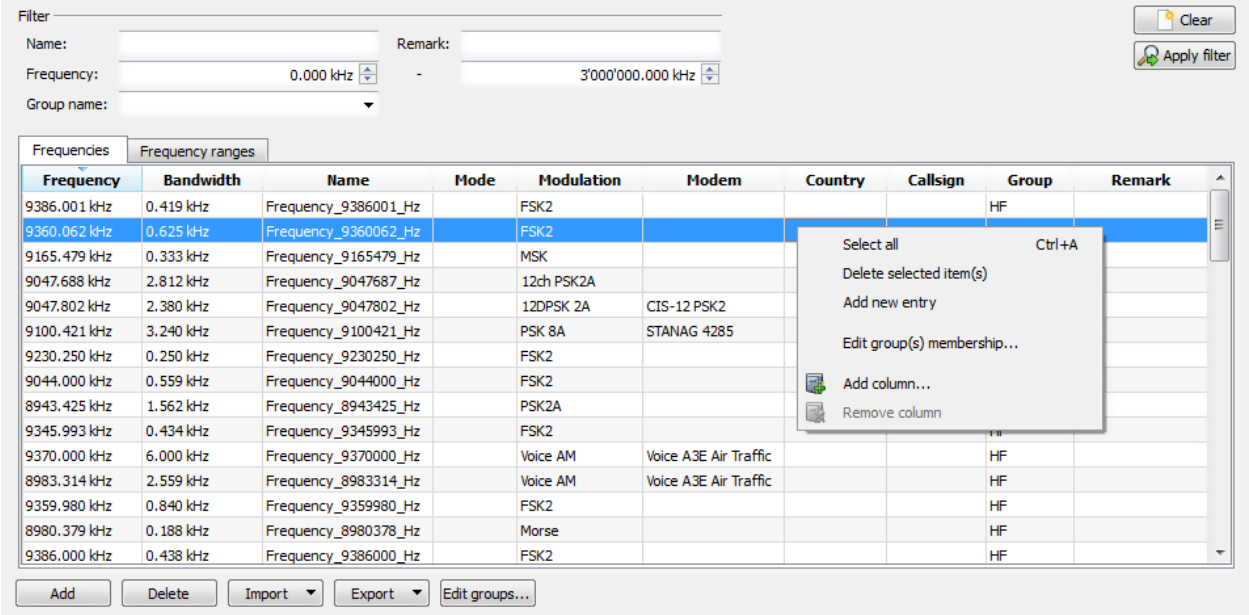


Figure 167.: Frequencies Window

Parameter	Description
<**Clear**>	Clear all filter fields
<**Apply filter**>	Apply current filter values
<**Add**>	Add a new frequency entry
<**Delete**>	Delete selected entry
<**Import**>	Import either fixed frequencies or frequency ranges from a CSV file (see chapter CSV Export/Import of Frequencies)
<**Export**>	Export either fixed frequencies or frequency ranges to a CSV file (see chapter CSV Export/Import of Frequencies)
<**Edit groups...**>	Open an Edit dialog for frequency groups (for details, see chapter Frequency Groups

Table 65.: Frequencies Window - Parameters

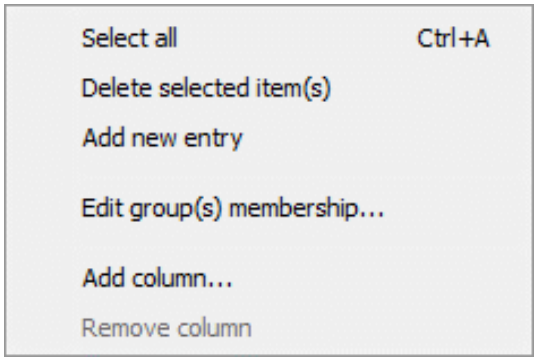


Figure 168.: Frequencies Window - Context Menu

The context menu above provides further actions, depending on the frequency entry type.

Parameter	Description
<**Select all**>	Select all table entries
<**Delete selected item(s)**>	Delete selected frequency entries
<**Add new entry**>	Add a new table entry
<**Edit group(s) membership...**>	Show a dialog for editing the group membership of the selected table entries (for details, see chapter Grouping Frequency Entries)
<**Add column...**>	Add a new table column with the name and data type as specified by user (for details, see chapter User Data). This context menu entry is available for fixed frequency entries only.
<**Remove column**>	Remove the table column under the mouse cursor. The removal of predefined columns is not allowed. This context menu entry is available for fixed frequency entries only.

Table 66.: Frequencies Window - Context Menu

4.13.1. Frequency Groups

Frequency groups enable the simplification of frequencies management and provide a better overview of available frequency entries through group membership. For example, the contents of the frequencies table may be restricted to entries belonging to one or more specified groups. The grouping of entries has been realized as an "n-to-m" relationship, i.e. several frequency entries may participate in one or more groups (for details, see chapter Grouping Frequency Entries).

The Edit dialog (see Figure 169) provides functions for adding new groups, and editing or deleting existing ones. Group properties can be edited with a double click on an associated table cell. The group name must not be empty or already used. Check any messages at the bottom left corner of the dialog.

Note: The semicolon and vertical line are both used by data export as separator characters, so their usage for editing frequency entry is not permitted.

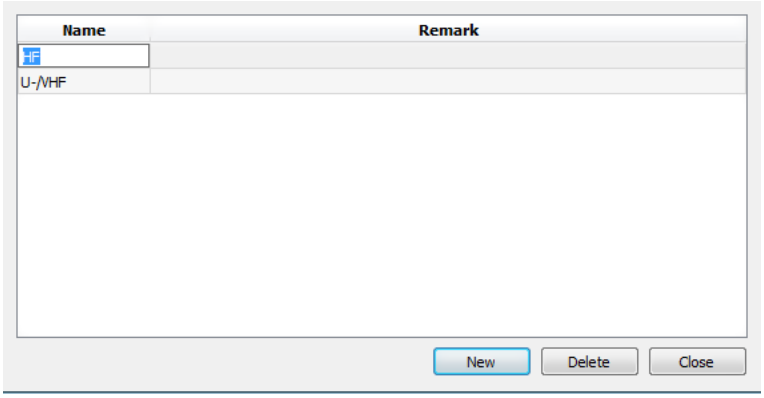


Figure 169.: Edit Groups

Parameter	Description
<**New**>	Add new group entry with some default properties

Parameter	Description
<**Delete**>	Delete the selected entry
<**Close**>	Close the dialog (unfinished editing will be aborted)

Table 67.: Edit Groups - Parameters

4.13.2. Grouping Frequency Entries

The assignment of a single frequency entry to one or more defined groups is possible by editing the group membership property in the Frequency table.

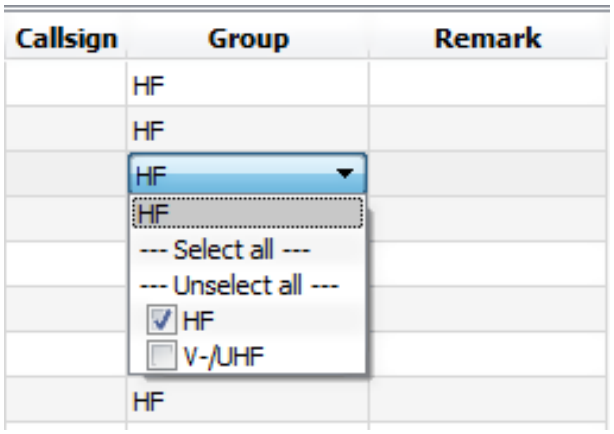


Figure 170.: Group Membership Edit for Frequency Entry

To edit several entries of group membership, the use of the <**Groups**> dialog as shown in Figure 171 is a more convenient option.

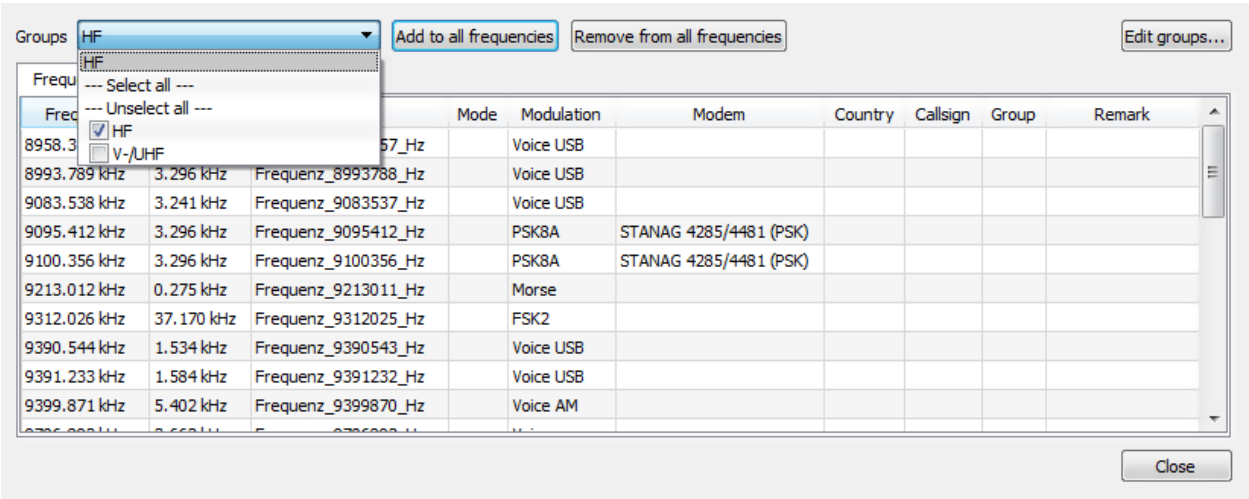


Figure 171.: Group Membership Editing for multiple Frequency Entries

Parameter	Description
<**Add to all frequencies**>	Add all frequency entries in selected group(s)
<**Remove from all frequencies**>	Remove all frequency entries from selected group(s)
<**Edit groups...**>	Open an Edit dialog for frequency groups (see chapter Frequency Groups)

Table 68.: Group Membership Editing - Parameters

To change frequency entry's properties, double-click on the associated table cell (for details, see chapter Frequencies).

4.13.3. Channel Raster /-Bandwidth

For frequency ranges and blocked frequency ranges, channel raster and channel bandwidth can be entered. By specifying channel raster and channel bandwidth, a frequency range can be divided into adjacent channels. These settings take effect when using the frequency range with the automatic processing (see chapter Automatic Wideband Monitoring).

4.13.4. User Data

Frequency entries allow the addition of new properties by adding new table columns and assigning user-defined data to them.

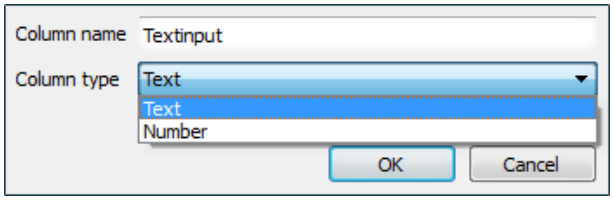


Figure 172.: Add New Column

The specification for column name and data type, either text or floating point number, is required. Column naming must follow the rules below.

- Column name must be unique
- Column name must not only consists of digits
- Column name must not be empty

Check any messages at the bottom left corner of the dialog.

Note: The semicolon and vertical line are both used by data export as separator characters, so their usage for editing frequency entry is not permitted.

To remove user defined table columns (which will also remove the associated user data), right-click the mouse cursor on a column, open the context menu and then click the entry to be removed. The table column will be deleted after confirming the query prompt.

4.13.5. CSV Export/Import of Frequencies

Both fixed frequency and frequency ranges can be exported/imported by using simple CSV-formatted text files.

The export formats for fixed frequency and frequency ranges do differ regarding the data fields used and are incompatible with each other. However, both export formats have a common structure. The first line holds the data field names and is followed by some rows, each holding one frequency entry.

All frequency/bandwidth values are in [Hz].

The fix frequency export has the following format:

```
FrequencyName;FrequencyRemark;Fixed;Bandwidth;Mode; Modulation;Modem;Country;Callsign;Group
```

When a fixed frequency entry has been extended with user data, then the user data column name will appear after the "Group" column.

In the following example, the export data for a fixed frequency entry is presented (see Figure 173):

Frequency_1;My remark;9100422;718.5;0;0;PSK 8A;STANAG 4285;;;HF;My entry

Frequencies | Frequency ranges

Frequency	Bandwidth	Name	Mode	Modulation	Modem	Country	Callsign	Group	Remark	Userentry
9100.422 kHz	0.719 kHz	Frequency_1		PSK 8A	STANAG 4285			HF	My remark	My entry

Figure 173.: Entry for export example

The frequency range export has the following format:

```
FrequencyName;FrequencyRemark;FrequencyFrom;FrequencyTo
```

With v17.2, frequency entries are exported in a new data format. The import function does however support the previous data format. To integrate the available frequencies entries (exported before v17.2), proceed as follows:

- Start the previous go2MONITOR version
- Export frequency entries to a CSV file
- Close the application and start the new go2MONITOR version
- Import frequencies data from a CSV file

Errors detected through the data import process are written to a log file located in the user directory (after data import has completed, the information dialog offers to open the log file so you can view any errors). After the data import process is complete, a dialog for grouping imported frequency entries will be displayed (see chapter Grouping Frequency Entries).

For the data to be imported, in the first line data import function expects a header, holding semicolon separated names of the data fields. The following lines each contain a new frequency entry per line whose fields are also separated by a semicolon analogous to the header.

As of v20.1, the import function supports the import of optional data fields. This reduces the re-quired data fields in the data to be imported for single frequency entries to "Fixed" and "Bandwidth", as well as for frequency ranges to "FreqencyFrom" and "FrequencyTo". The remaining data fields are treated as optional and, if not available, occupied with default values. The data fields are accepted in any order.

Figure 174 shows an example of a data record for import with the optional data field "modulation".

```
1  modulation,fixed;bandwidth
2  CW;8437000;3000
3  DIG;8439000;3000
4  DIG;8442000;3000
5  DIG;8443000;3000
6  FAX;8444100;3000
7  SSB;8445000;3000
8  DIG;8446000;3000
9  DIG;8448800;3000
```

Figure 174.: Dateset with Optional Data Field

Figure 175 shows the contents of the frequency table after import.

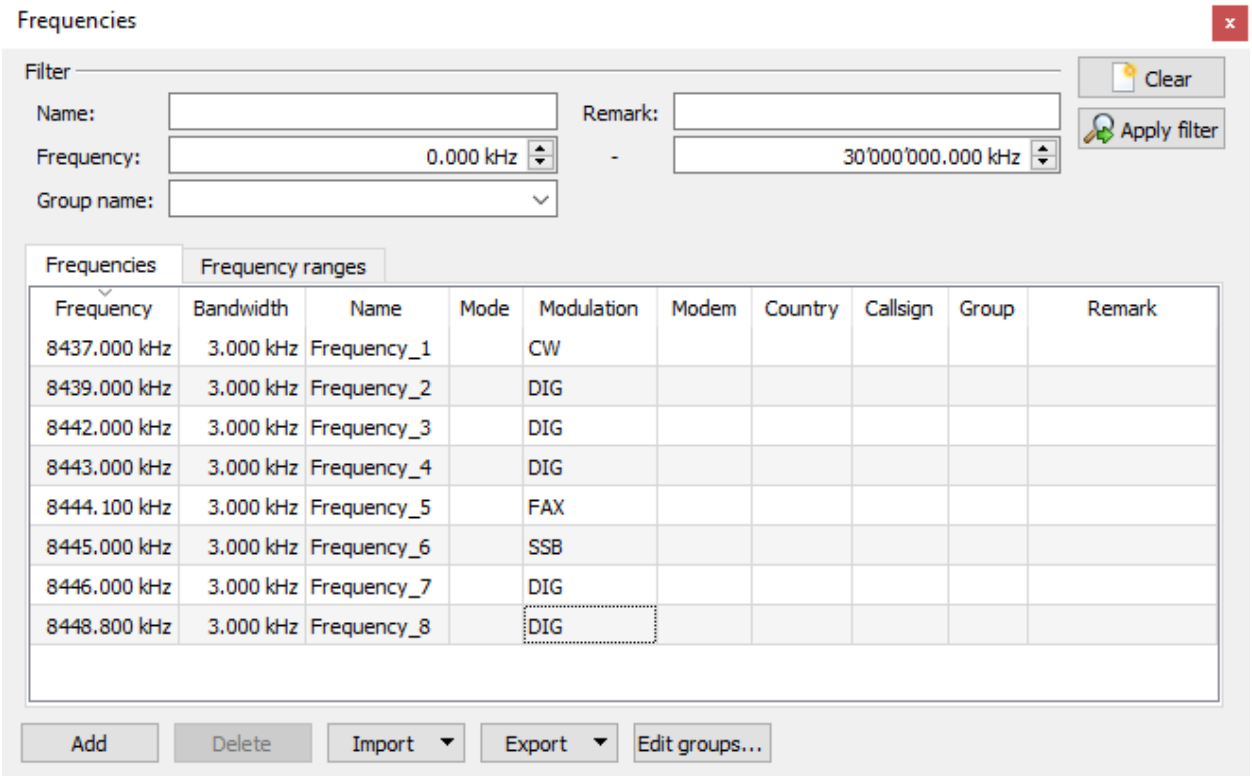


Figure 175.: Frequencies Table after Import

4.13.6. Blocked Frequencies Window

The frequency ranges defined in the <**Blocked frequencies**> window are excluded from the emission detection in wideband classifier, for example for triggering in Automatic Wideband Monitoring tasks. This feature can be used to prevent the processing of well-known permanent emissions and therefore save resources.

The management of blocked frequencies is similar to those described in chapter Frequencies. The window can be opened from <**Views**><**Blocked frequencies**> in the main menu.

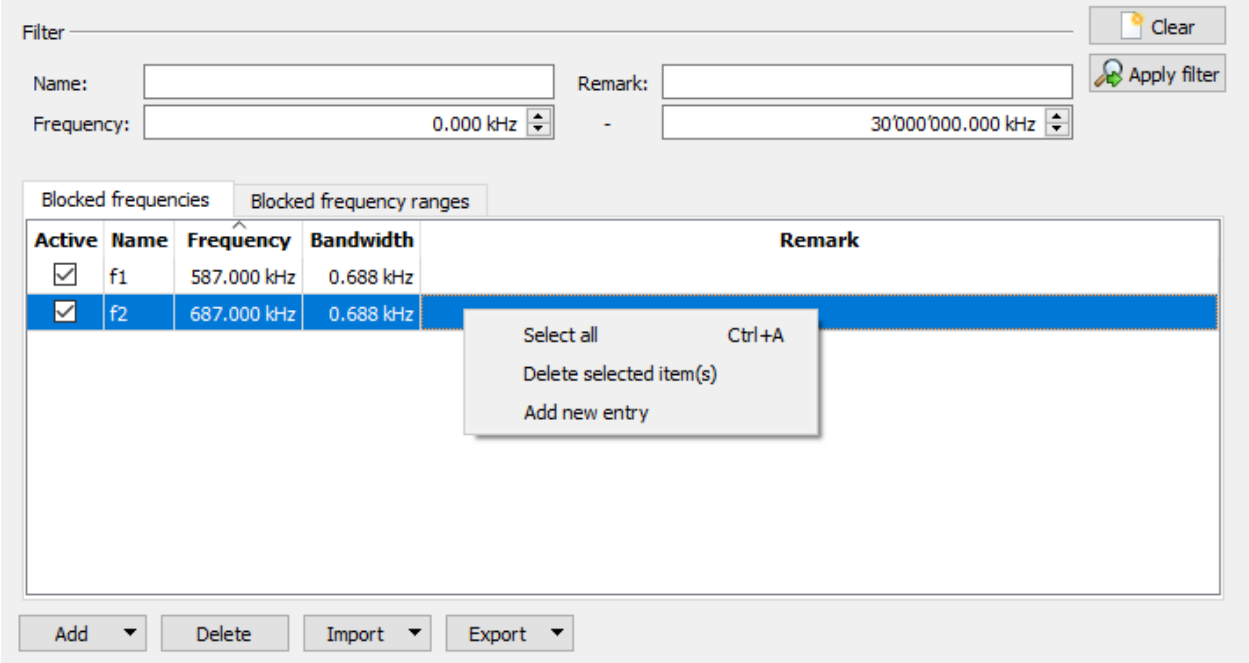


Figure 176.: Blocked Frequencies Window

Parameter	Description
<**Clear**>	Clear all filter fields
<**Apply filter**>	Apply current filter values
<**Add**>	Add a new frequency entry or allows adding entries from the frequency window
<**Delete**>	Delete selected entry
<**Import**>	Import either fixed frequencies or frequency ranges from a CSV file (see chapter CSV Export/Import of Frequencies)
<**Export**>	Export either fixed frequencies or frequency ranges to a CSV file (see chapter CSV Export/Import of Frequencies)

Table 69.: Blocked Frequencies Window - Parameters

4.13.7. Insert Selected Blocking Frequency Ranges

From the receiver spectrum overview, the selected frequency range can be added to the blocking frequency list. To do this, mark the desired frequency range in the receiver spectrum overview area and select the entry <**Block selected frequency range**> in the context menu (see chapter Toolbar).

4.13.8. Displaying Frequencies as Spectrogram Overlay

In both wideband input spectrogram and in the recording result spectrogram in ResultViewer, it is possible to display frequencies as overlay markers. A Frequency group selection combo-box allows the selection of the frequency group(s) which should be displayed in the spectrogram.

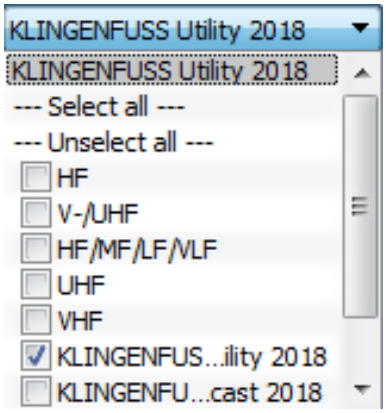


Figure 177.: Frequency Overlay Group Selection

The selected frequencies are displayed in the spectrogram as dashed orange lines at the center frequency position along with the frequency name information. Frequency names will be displayed only if there are not too many frequencies in the visible part of the spectrogram. Otherwise, only frequency lines will be displayed.

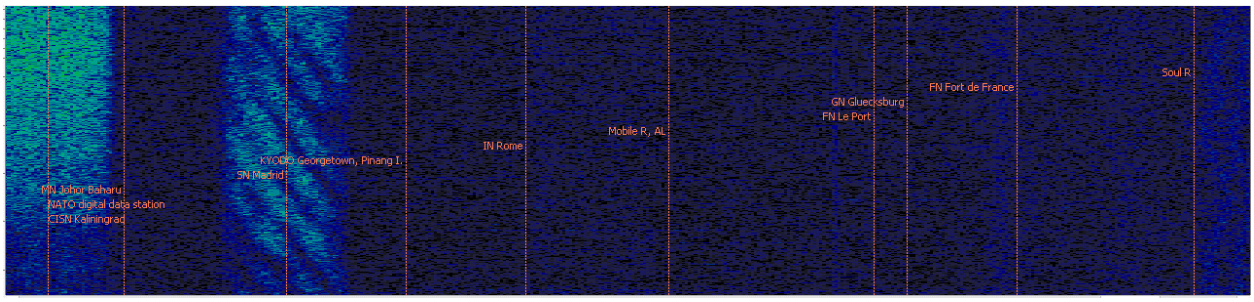


Figure 178.: Frequencies Displayed in the Spectrogram

4.14. Bulk File Processing

Bulk File Processing is a function to automatically process signal files with available narrow or wideband channels (see chapter Channels and chapter Wideband Signal Input). The user defines directories whose signal files are processed. Files that are created in the respective directories after the batch processing is started, are also processed.

Bulk File Processing currently supports the following file formats:

- Complex WAV files with optional Procitec extensions (see chapter Signal Sources)
- Blackbird TCI CAP format (only complex signals)

Warning: Read/write permissions for all processed files/folders must be provided. Files without write permission will be ignored.

Processing is done by playing back the signal files in a narrowband or a wideband channel. The actual processing of the signals contained in the files is parameterized as follows:

- A channel configuration must be selected for processing in narrowband channels
- When processing through wideband channels, an Automatic Wideband Monitoring mission must be active

Bulk File Processing can be configured, started / stopped and monitored via a view. This view can be shown or hidden in the <**Views**><**Bulk File Processing**> menu. The view consists of two tabs:

- Settings
- Status

The Settings tab is used to configure the Bulk File Processing. The Status tab shows statistics about all relevant information about Bulk File Processing and there is a text field in which events are logged.

4.14.1. Configuration of Bulk File Processing

There are three settings that the user must make before starting Bulk File Processing (see Figure 179).

- In which directories should be searched for files (1)
- How the files should be processed (2)
- What to do with a file after processing (3)

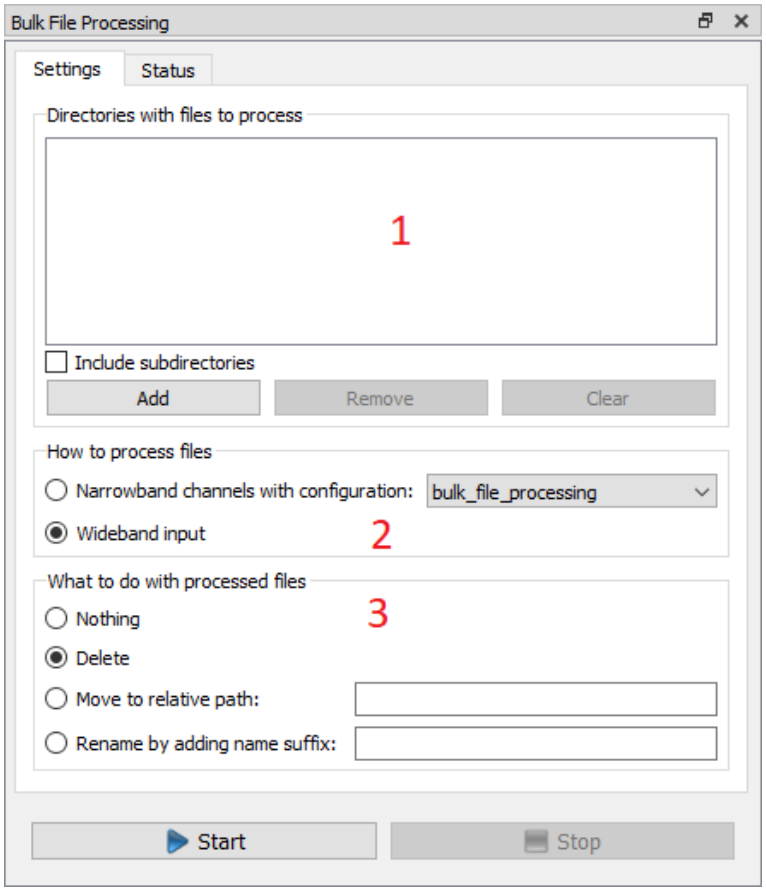


Figure 179.: Dialog with settings of Bulk File Processing

4.14.1.1. Directories with Files to be Processed

Directories to be searched for signal files by Bulk File Processing are shown in the list at (1) in Figure 179. Click the <**Add**> button to add directories to the list. Individual entries can be marked by clicking in the list and deleted from the list by clicking the <**Remove**> button. Clicking the <**Delete All**> button removes all entries from the list.

By selecting the <**Include subdirectories**> checkbox, all subdirectories from each entry in the list are also searched for signal files.

4.14.1.2. Processing Methods for Signal Files

To process the signal files, they are played-back using the go2MONITOR file playback function (see chapter File Playback Toolbar). There are two ways in which files can be played:

- Playback in a narrowband channel
  In order to play the signal files in narrowband channels, the option <**Narrowband channels with configuration**> (2) in Figure 179 must be selected. If Bulk File Processing is started with this option, all open narrowband channels will be closed first.

  Warning: All ongoing actions in narrowband channels are interrupted. Results which are not saved will be lost.

  Then, all available narrowband channels are restarted with the selected configuration. You can choose from all available narrowband configurations. The *bulk_file_processing* configuration is selected by default. This configuration is specially designed for Bulk File Processing, so it is recommended to use it. It is possible to create your own channel configurations and use them for Bulk File Processing (see chapter Channel Configuration).

  Warning: not all channel configurations are suitable for using with Bulk File Processing. In order to use a channel configuration for Bulk File Processing, the signal input must be set to "File" and "Play in loop" option has to be deactivated.

- To play signal files with wideband inputs, the "Wideband input" option has to be selected. When starting Bulk File Processing, the signal inputs of all available broadband channels are set to "File". Automatic wideband monitoring is normally used for further processing of the signals contained in the files (see chapter Automatic Wideband Monitoring).

4.14.1.3. Action for Signal Files after Processing

After processing for a file is complete, there are four ways to proceed with the file (see (3) in Figure 179):

- **Nothing**: The file remains unchanged. As a result, this file is processed again after restarting go2MONITOR or Bulk File Processing
- **Clear**: The file is deleted after processing
- **Move in a subdirectory relative to the path**: The name of a directory into which the files will be moved after processing must be specified in the text field behind this option. Only the name of the directory relative to the file should be specified, not an absolute path. This directory refers to the location of each file at the time of processing. If the directory does not exist, it will be created automatically.
  Directories with this name are ignored when searching for signal files if the "Include subdirectories" option is activated.

  Note: if a file with the same name already exists in the directory to which the file is to be moved, an index is added to the file name. A file Example.wav then becomes Example_1.wav. Example_1.wav becomes Example_2.wav.

- Rename by adding a name suffix
  The file suffix to be added must be specified in the textbox behind the option. After processing, a file example.wav is renamed to example.wav_done if the suffix specified by the user is "done".

Note: If a file already exists with the name into which the file should be renamed, the procedure is the same as for moving files.

4.14.1.4. Start and stop Bulk File Processing

After all settings have been made, Bulk File Processing can be started by clicking on the <**Start**> button. This automatically switches the view to the <**Status**> tab. To stop Bulk File Processing, click the <**Stop**> button.

4.14.2. Monitoring Bulk File Processing

To monitor the status of Bulk File Processing, there is a <**Status**> tab in the Bulk File Processing view. The tab consists of two elements:

- Statistics (1)
- Log (2)

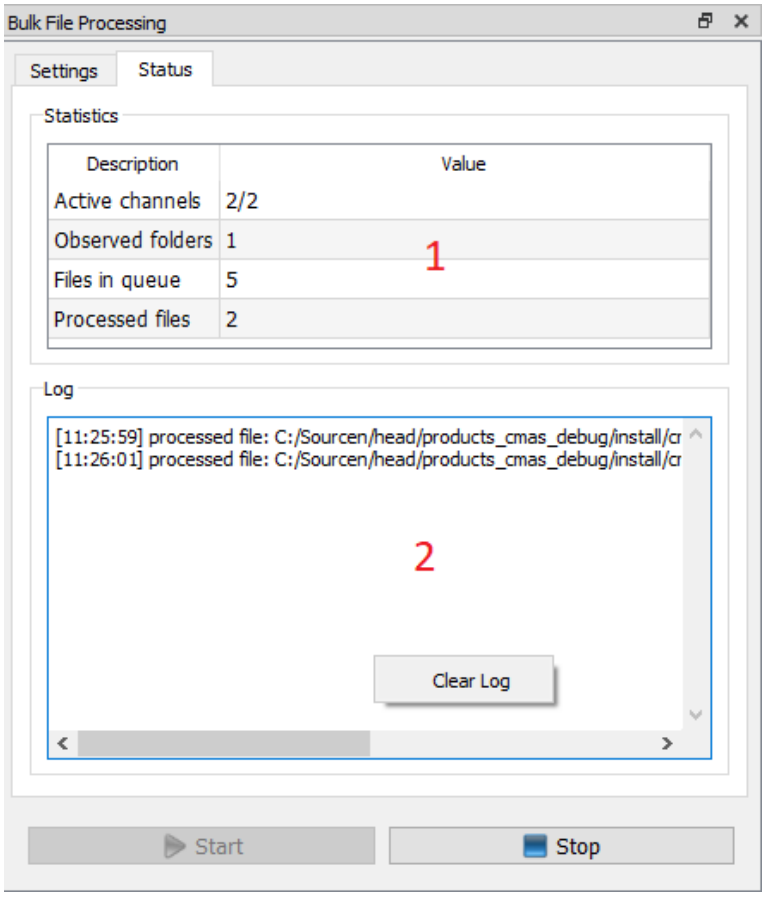


Figure 180.: Status tab of the Bulk File Processing statistics dialog

4.14.2.1. Statistics

The statistics are represented by a table (1). It contains the following values:

- **Active channels**: This value represents the number of channels which are currently processing a signal file. This contrasts with the value of the total number of available channels.
- **Observed folders**: This value specifies in how many directories Bulk File Processing is searching for signal files. If the "Include subdirectories" option is active, the directories below the folders specified in "Directories with files to be processed" are also counted.
- **Files in queue**: Indicates the number of signal files that Bulk File Processing has already discovered but not yet processed
- **Processed files**: The number of signal files that have already been processed

4.14.2.2. Log

The log consists of a text field (2) in which events related to Bulk File Processing are entered. An event is either an error or the finishing of a file procession. The following errors can occur:

- A file was not found at the time when it should be processed
- A file cannot be played back because its bandwidth violates the license restrictions

A context menu can be opened by right-clicking in the text field of the log. This menu contains a button to delete the contents of the log.

5. Options

5.1. Narrowband Receiver Control Option (NRC)

This option allows the usage of external narrowband receivers as a signal input for processing channels (in parallel with the software DDC). All receiver types supported for the wideband input can also be used for this. The maximum bandwidth of a channel used as a part of a NRC is limited to 500 kHz (see Figure 20).

The advantage of a narrowband receiver-based channel over standard software DDC channels is that they are independent of the wideband input frequency range and offer in many cases higher sensitivity.

5.1.1. Narrowband Receiver Configuration

For detailed information about the configuration, see chapter Narrowband Receivers.

5.1.2. Using Narrowband Receiver Channels

After setting up the narrowband receivers and starting the application, each processing channel will show an additional combo-box for selecting its signal source.

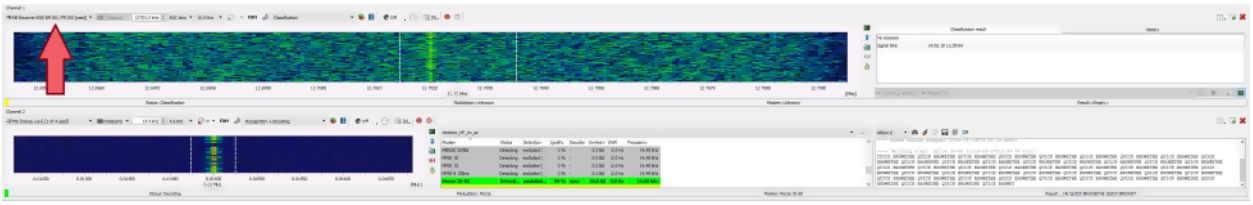


Figure 181.: Narrowband Receiver Control

For example, if the name of the added narrowband receiver is "Receiver #1", each combo-box will include the following items:

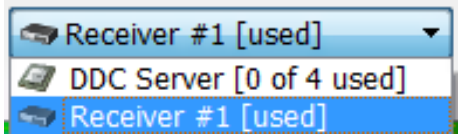


Figure 182.: Narrowband Receiver Selector

5.1.2.1. NB Server [x of y used]

Selecting this item selects the internal software narrowband signal server to extract the narrowband channel from the current wideband input. The channel depends on the current wideband input, i.e. if the frequency of the wideband signal is changed, the narrowband signal may disappear if its frequency is outside of that range. The maximum number of channels depends on the product license.

5.1.2.2. Narrowband Receiver Name [free/used]

Selecting this item selects the narrowband receiver as input. The channel is independent of the current wideband input. The choice of bandwidths and the allowed frequency range depends on the currently selected narrowband receiver. If the receiver's status is [free] (i.e. it s available), it can be selected and used in the channel. If the receiver is already in use in another channel, the [used] status will be displayed. It can, nevertheless, be chosen in the second processing channel as well, but it will not deliver the signal for it.

5.2. 20 MHz Wideband Recording Option

This option extends the signal input and recording bandwidth up to 20 MHz effective bandwidth.

5.2.1. Requirements

Because of high performance requirements, this option is usually not available in a standard desktop or laptop environment. At least one separate server-grade computer is needed to run this option.

To work with the maximal supported bandwidth of 20 MHz (24 MHz sampling rate), a receiver capable of delivering the signal (for example IZT R3xxx or SIR 21xx) and a GBit network infrastructure is required.

If higher recording bandwidth is required, it can be configured by using Multiple Wideband Signal Inputs with multiple recording components.

5.2.2. Setup

In order to set up the system for the usage of separate recording hardware and the receiver with high signal bandwidth, some changes in the system configuration files are needed. The entire system including the server is usually delivered ready-to-run. Alternatively, the configuration instructions can be provided by the system integrator to upgrade an existing system with this option.

5.3. 20 MHz Wideband Classifier Option

This option extends the signal input bandwidth and the classifier up to 20 MHz.

5.3.1. Requirements

Because of high performance requirements, this option is usually not available in a standard desktop or laptop environment. At least one separate server-grade computer is needed to run the wideband option.

To work with the maximal supported bandwidth of 20 MHz (24 MHz sampling rate), a receiver capable of delivering the signal (for example IZT R3xxx or SIR 21xx) and a GBit network infrastructure is required.

5.3.2. Setup

In order to set up the system for the usage of separate classification hardware and the IZT receiver with high bandwidth, some changes in the system configuration files are needed. The entire system including the server is delivered ready-to-run. The instructions for these changes can be provided by the system integrator if needed. Alternatively, the system integrator can set up the whole system as a ready-to-run solution.

5.3.3. Limitations

If the signal input bandwidth is higher than a standard product bandwidth (1 MHz), then the software-DDC will not be available for performance reasons. Because of this limitation, if NB-channels are needed, the narrowband receivers (NRC) option is required. It is also recommended to use the "20 MHz Wideband Recording Option together with the 20 MHz Wideband Classifier Option.

5.3.4. Usage

There are no special considerations or changes regarding the GUI and handling. All functions will remain the same additionally providing the support for higher signal input bandwidth. It is recommended to use this option together with the 20 MHz Wideband Recording Option.

5.4. GUI Scripting Option

This option extends the go2MONITOR GUI with functions for creating user-defined automation scripts written in the Python programming language.

5.4.1. Requirements

Basic level of software development and Python language know-how is required.

5.4.2. Setup

All components are installed with the go2MONITOR setup. No special setup considerations are necessary.

5.4.3. Usage

Scripts can be created and tested by using the built-in Scripting Editor. They can be started from the <**Views**><**Scripting editor**> option on the main menu. The following chapter describes the usage of the Scripting Editor. Additional information regarding available objects and functions which can be used in the scripts can be accessed directly from the Scripting Editor.

5.4.4. Script Types and Contexts

Each script created in the Scripting Editor must have a defined script type which implicitly defines the context where the script can be executed. When creating a new script, a dialog is displayed where operator can choose the script type by selecting its context.

When a new script is created, a dialog is displayed in which the user can select the type of script by selecting the context.

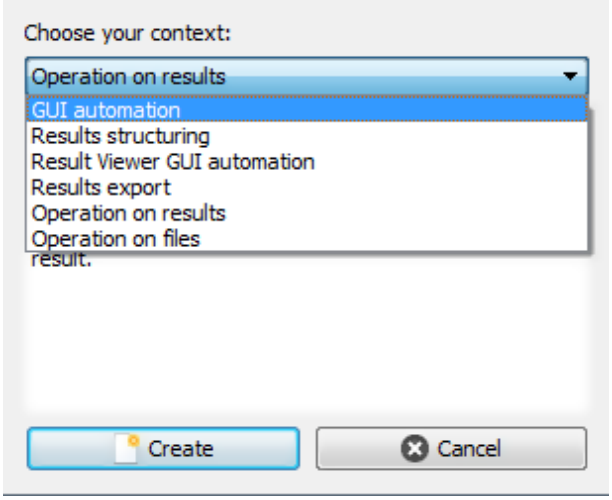


Figure 183.: Script Context Choice

Several types of scripts can be created using the Scripting Editor:

- **GUI automation** scripts have access to all GUI elements and can be used to automate all GUI functions.
- **Result structuring** scripts are used for result structuring in the Structuring View in the ResultViewer.
- **ResultViewer GUI automation** scripts are similar to GUI automation scripts but have limited access only to GUI elements inside the ResultViewer.
- **Results export** scripts are used to export the results. They should be used to define custom export formats (for details, see chapter Results).
- **Operation on results** scripts are used to perform operations on results within the ResultViewer, for example, <**Open result with...**> (for details, see chapter Results).
- **Operation on files** scripts are used to perform operations on files within the ResultViewer, for example <**Open file with...**> (for details, see chapter Results).

A script determines the context for the script execution, i.e. which objects/functions can be used in the script and how the script can be used in the GUI.

The same dialog will be displayed if a script created outside the Script Editor is loaded for the first time. Script context information is stored in a *.py file and reused later.

5.4.5. Scripting Editor

With the Scripting Editor, most functionality for go2MONITOR GUI applications can be scripted. The scripting language is Python. The basic functionality and features of the Scripting Editor are described in this chapter. For help with specific scripting functions check the Python Scripting documentation.

Figure 184 shows a screenshot of the Scripting Editor for an analysis and monitoring application:

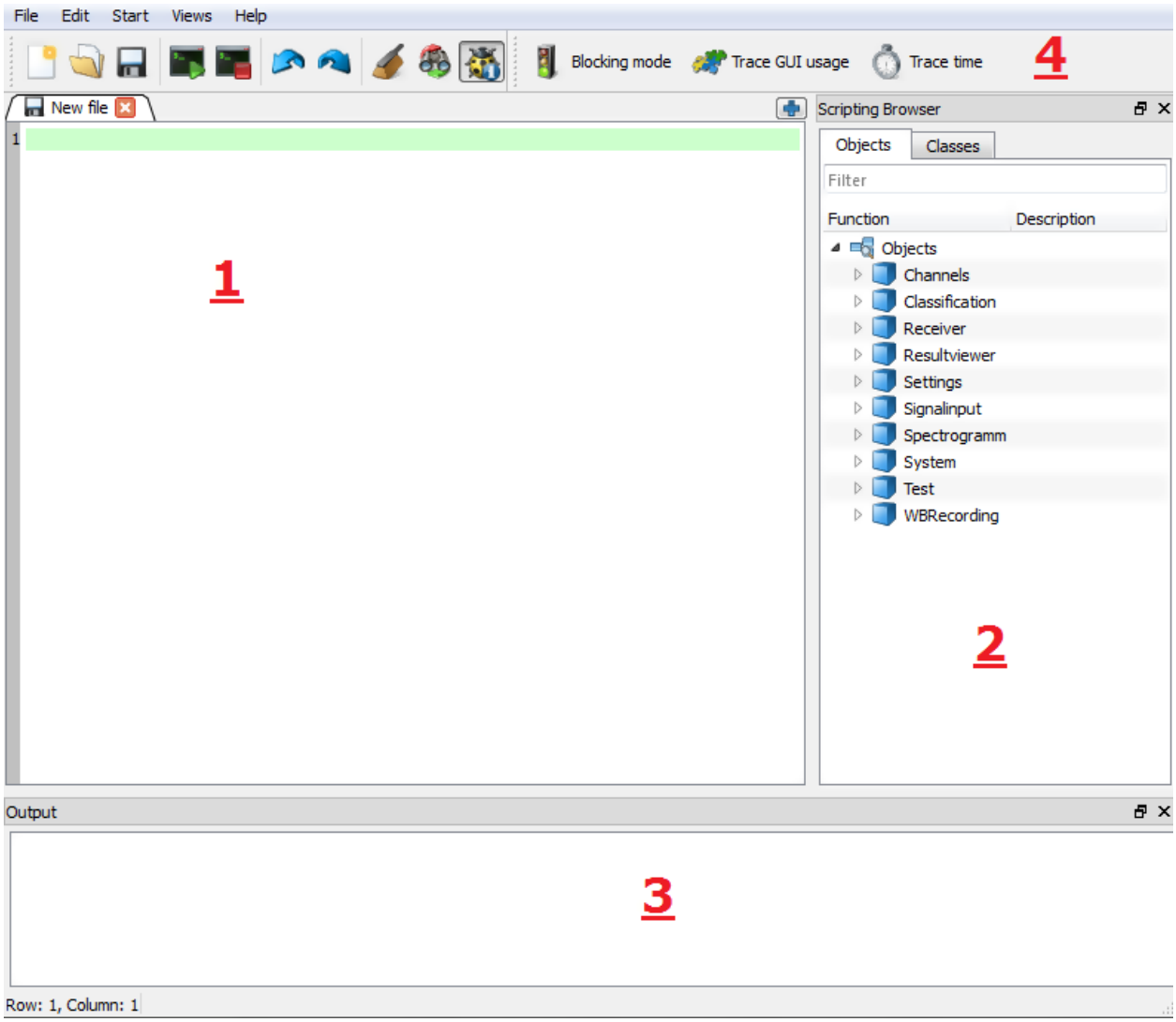


Figure 184.: Scripting Editor

1. The Editor
   The script content is created with the help of the editor.
   The current selected row has a green background, as seen in Figure 184.
   The row numbers are displayed on the left of the editor and in the current row and column is displayed in the status bar of the Scripting Editor.
   Files can be opened via the <**File**> menu and the toolbar. Multiple files can be opened at the same time and activated by selecting the file from the <**Tab**> view. The filename is used as tab name; you can see the full path of the file by hovering the tab and looking at the tooltip.
   The editing of the script content is supported by syntax highlighting and a completion code. The completion code can be triggered with the shortcut <**CTRL**>+<**SPACE**>. Figure 185 shows the completion code and syntax highlighting of an example file.

```
27 if ( Test.verifyInt( Spectrogramm.hasSignal(), True, 'ReceiverTest: Has Signal' ) ):
28   Receiver.setReceiverFrequency_MHz( 20 );
29   System.wait( 3000 );
30   currentFreq = Receiver.signalFrequency();
31   Test.verifyInt(currentFreq, 20000000, 'ReceiverTest: Set Frequency 20MHz')
32   Receiver.si
33   Receiver.                                                    0 );
34   System.wa
35   currentFr                                                    cy();
36   Test.veri                                                    , 'ReceiverTest: Set Frequency 10MHz')
37
38   # select first bandwidth in combobox
```

Receiver.signalFrequency()
Receiver.signalFrequency_kHz()
Receiver.signalFrequency_MHz()
Receiver.signalBandwidth()
Receiver.signalBandwidth_kHz()
Receiver.signalBandwidth_MHz()

Figure 185.: Code Completion

Unsaved files are distinguished from already saved files through a red loppy disc icon in the <**Tab**> view.

2. Scripting Browser
   The Scripting Browser displays all available scripting objects and scripting classes (depending on the script context).

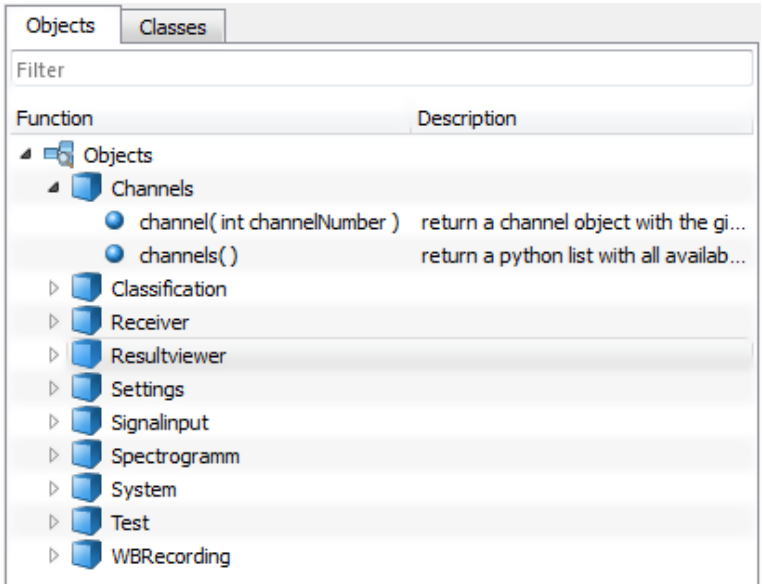


Figure 186.: Scripting Browser

You can view the available functions of the scripting object by expanding the object entry. A short description will be given for each function in the "Description" column. For further information and a short usage example, take a look at the scripting documentation. Specific object chapters of the scripting documentation can be opened directly by selecting a scripting object in the scripting browser and pressing <**F1**>. By double-clicking a function, the function name and its parameters are copied to the Scripting Editor.

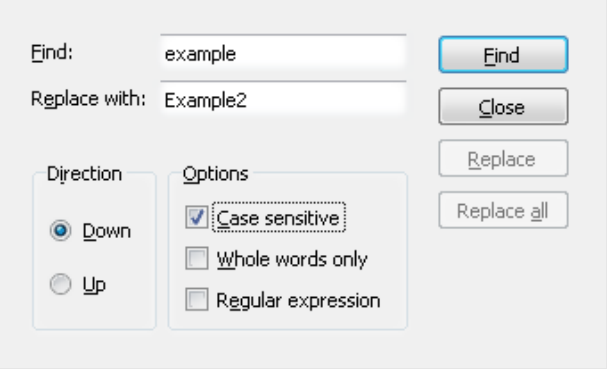
The displayed objects and functions can be filtered by starting to type in the **Filter** field. The content is updated as you type. Individual content filters for the <**Objects**> and <**Classes**> tabs can be set.

A set filter can be deleted by clicking on the <**Delete**> button in the **Filter** field.

3. Output
   The output console shows all output of your script and the scripting objects. The log output can be

cleared by clicking on the <**Delete**> button on the toolbar, or by opening the context menu with a right-click and selecting <**Clear output**>.

4. Toolbar

Button	Description
	Creates a new empty scripting file in your editor. A context selection dialog will be displayed first.
	Open a scripting file. Scripting files have the extention **.py**. If an already opened file is selected, the tab with the file is selected, so it is not possible to open the same file twice.
	Saves to current file. If no filename was saved yet, a <**Save As**> dialog will be displayed and prompt you to select the file location and the file name.
	Executes the current opened file. It is not possible to execute multiple files at once.
	Stops the current script execution
	Undo the last change in the Editor
	Redo the last change in the Editor
	Clears the output console. This cannot be undone.
	Opens the <**Find and Replace**> dialog  *Figure 187.: Find and Replace Dialog* <**Case sensitive**>, <**Whole words only**> or <**Regular expression**> can be searched. The search and replacements only occur in the current active tab. It is not possible to search in all opened files.
	By activating this button, additional output for each function will be shown in the Scripting Browser. Turn this off to reduce the output in the output console to a minimum.
	Toggle between blocking and unblocking mode. By using **Unblocking** mode , script execution occurs parallel to the execution of your analysis and monitoring application. This is recommended for execution without graphical elements. In **Blocking** mode ,the execution of your analysis and monitoring application is blocked until the script execution is finished. This mode must be used to start scripts with graphical elements.

Button	Description
	By activating this button, user interaction can be tracked with the GUI of the analysis and monitoring application. Each interaction is translated in the corresponding scripting function, if available. By activating the <**Trace time**>  button, the waiting time between each interaction is measured and also tracked. With the help of this function, macros for your common tasks can easily be created.
	Activates/deactivates the time measurement for the tracking of user interactions with the <**Trace GUI usage**>  button. Activating this button without activating the trace button has no effect.

Table 70.: Scripting Editor Functions

Run Multiple Times

A script can be executed multiple times by open the dialog <**Run**><**Run multiple times**>.

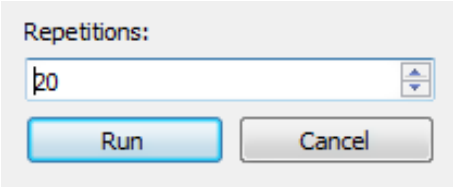


Figure 188.: Run Multiple Times Dialog

If a script execution is started multiple times, an indicator on the toolbar shows how many repetitions are still remaining until the execution is finished. This indicator can be seen in Figure 189 where 20 executions are still remaining.

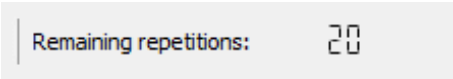


Figure 189.: Remaining Repetitions

Multiple executions of scripts can be stopped by clicking on the <**Stop Script**>  button.

5.4.6. Saving Scripts as Plugins

Created scripts can be saved as plugins to be integrated into the GUI. This kind of integration depends on the script context.

- **GUI automation** scripts will be integrated to the toolbar in the main window
- **ResultViewer GUI automation** scripts will be integrated into the ResultViewer toolbar
- **Results structuring, Results export, Operation on results and Operation on files** will be available in the ResultViewer

To save the current editor script as a plugin, select the <**File**><**Save as Plugin**> menu option. The Export Script dialog will be displayed.

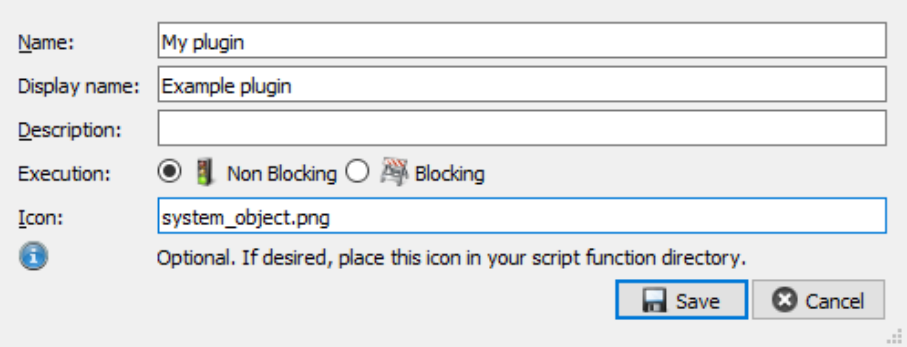


Figure 190.: Export Script Dialog

A <**Name**> for the plugin has to be entered in the dialog. This corresponds to the file name on the hard disk. The <**Display name**> appears as a label in the GUI.

An additional <**Description**> for the plugin can be defined. The description is used as a toolbar tooltip.

Similar to the Scripting Editor, the <**Execution**> type can be chosen. Use <**Non Blocking**> mode for scripts without GUIs and <**Blocking**> mode for script with GUI components.

An individual <**Icon**> can be selected for each exported script function. Pass the file name of the icon and place the icon in the destination folder for your exported scripts. Depending on the destination of your export, exported functions are located in your user directory in different directories.

Plugin scripts are stored in the "CustomFunctions" directory in your user directory.

Plugin scripts can easily be copied between different installations of your analysis and monitoring application by copying the *.py files in your "CustomFunctions" directory.

After clicking on the <**Save**> button, a script will be integrated as a plugin. For example, GUI automation script will be displayed in your toolbar, as seen in Figure 191.

Figure 191.: Export Toolbar

A script can be executed by clicking the item on the toolbar. The execution can be stopped by clicking <**Stop Script**> on the toolbar.

Plugin scripts can be deleted by using the menu entry <**File**><**Delete plugin**> and selecting the script which should be deleted. The selection of the script occurs by script name.

5.5. GUI Remote Control

go2MONITOR GUI provides two command-line parameters for the remote execution of Python scripts. This feature can be used effectively as a remote control interface for the go2MONITOR GUI.

5.5.1. Python Command-Line Parameters

The GUI accepts two command-line parameters. One parameter for Python script files and another parameter for single Python commands which can be executed in the GUI.

To execute a file containing Python-Script:

```
go2monitor.exe --execscript=<file name>

e.g.:
go2monitor.exe --execscript=script1.py
```

This command-line call will start the go2MONITOR GUI (if it is not yet running), wait until the system is started, and then execute the script. After the script finishes, the GUI will close automatically. This can be avoided by using the following command line argument:

```
go2monitor.exe --execscript=<file name> --no_close
```

By using the following command-line parameter, Python strings can be directly executed in the GUI (parameter "--no_close" applies here as well):

```
go2monitor.exe --execscriptcontent=<script_command1;script _command2;...>

e.g.
go2monitor.exe --
execscriptcontent=Classification.clearEmissions(); Classification.classifySnapshot();
--no_close
```

5.5.2. Using Python Command-Line Parameters for a Running Instance

If an instance of the go2MONITOR GUI is already running, commanded script-file or script-commands will be forwarded to that instance and executed.

Example:

```
no go2MONITOR GUI running
go2monitor.exe --execscript=test1.py --no_close
...
go2MONITOR GUI starts
wait until system starts
test1.py is executed
...
go2monitor.exe --
execscriptcontent=Classification.clearEmissions(); Classification.classifySnapshot();
--no_close
...
existing go2MONITOR GUI instance performs classification
...
```

Note: During execution of a Python-Script in a GUI, all command-line calls containing script execution parameters will be ignored. There is no queue for Python script command-line calls!

Each command-line call, including calls forwarded to the running go2MONITOR GUI instance, must contain "--no_close" parameter in order to prevent the GUI from closing after script execution.

Text output from parametrized Python scripts can be monitored in the Scripting Editor Log view in the go2MONITOR GUI.

5.5.3. Path in Arguments

Keep in mind that the syntax for any paths in arguments depends on your operating system. For Windows® OS, replace all backslashes "\" with a double back slash "\\" as seen in the following example:

```
go2monitor.exe --
execscriptcontent="Signalinput.startFilePlayback ('c:\\tetra.wav');"
--no_close
```

For Unix OS, the use of a standard forward slash "/" is sufficient.

5.6. Scheduling (optional)

With the Scheduling option, the application can be extended by scheduling tasks which execute Python scripts at a specific time with an optional execution interval.

The parameters for these tasks can be defined by the system integrator.

A scheduling task consists of two parts:

- An action which defines what the scheduling task is about to do
- Scheduling information which defines at which time the action should run and on which data the task should be executed

The GUI for scheduling includes an <**Action Editor**> to define actions and a <**Scheduler Editor**> to define execution constraints.

Actions can also be executed interactively by the system operator. These are so-called "Interactive Actions". They can be executed by context menu entry or by clicking a button in the ResultViewer. The execution states of interactive actions are shown in the Scheduling Editor and in ResultViewer in the so-called Scheduler Monitor.

5.6.1. Action Editor

The Action Editor is the GUI for managing scheduling actions. The type of available actions is defined by your system integrator.

Different kind of actions can be filtered via the <**Show**> dropdown. To add a new action, click <**Add**> and select the desired action type.

If any values in the <**Edit**> tab are changed, the label of the changed value will turn to red. This indicates that these values are not stored persistently yet. Click <**Apply**> to store these values.

If your actions have a checkbox called <**Interactive**>, these actions can be added to the ResultViewer as Interactive actions. These actions can be executed by the user from in ResultViewer on the currently selected result or all visible results.

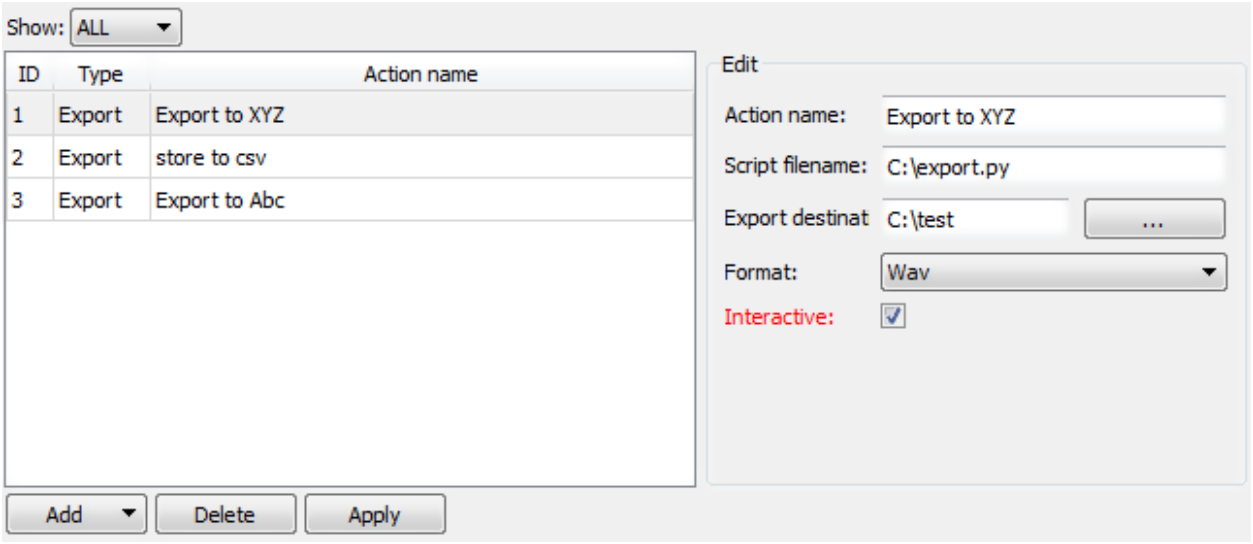


Figure 192.: Action Editor

The path to the script filename can either be absolute or relative. If a relative path is passed, the base directory is extended by "CustomFunctions".

5.6.2. Scheduler Editor

The <**Scheduler Editor**> is the GUI for managing scheduling items. The <**Show**>, <**Add**>, <**Delete**> and <**Apply**> buttons work in the same manner as in the <**Action Editor**>.

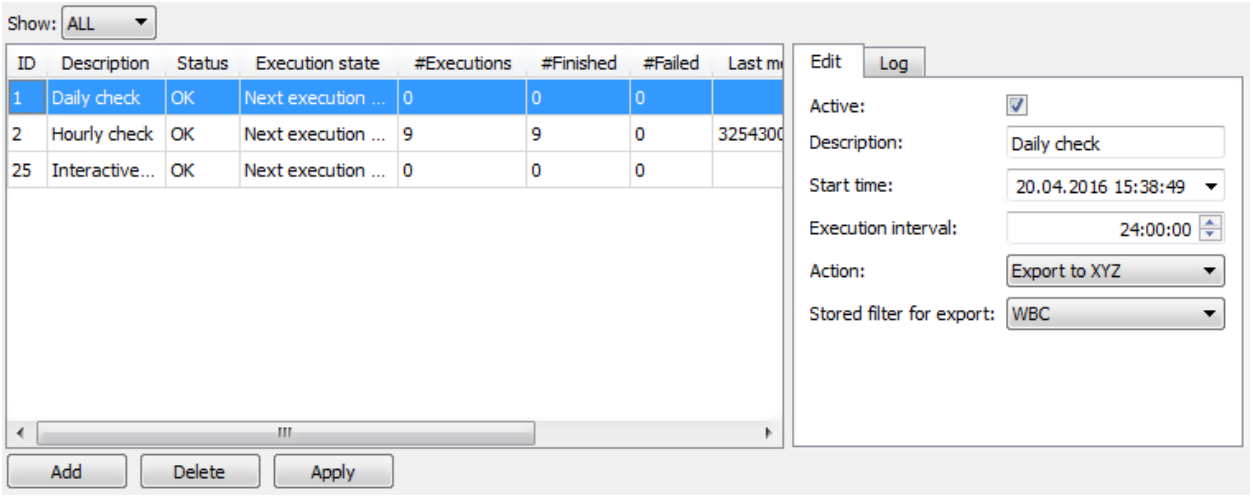


Figure 193.: Scheduling Editor

The <**Scheduling Editor**> shows status information for the following scheduling items:

- Total number of item executions
- Number of finished executions
- Number of failed executions

In addition, the last output messages of the script can be seen in the "Last message" column. Every field use the full column content as a tooltip.

The last 12.500 characters of log information of the items are stored in the <**Log**> tab.

The <**Scheduler Editor**> has a context menu. Right-click an entry to open it.

Selecting <**Clear statistics**> from the context menu will set all status information about started, finished and failed executions to 0.

A process can be killed with the context menu entry <**Kill process**>.

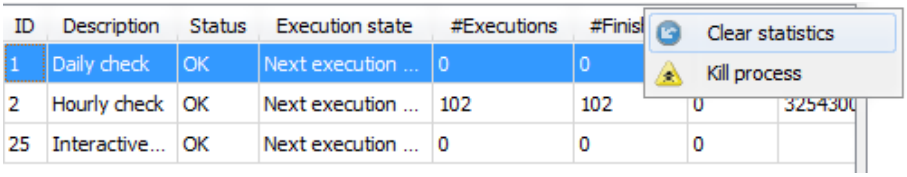


Figure 194.: Context Menu in Scheduling Editor

5.7. FHSS Detection - HDU Option

This option enables the detection of FHSS (Frequency Hopping Spread Spectrum) signals. If this option is included, two new backend components, "Hop detection" and "FHSS detection", will be visible in the <**Resource**> view (see chapter Resources.

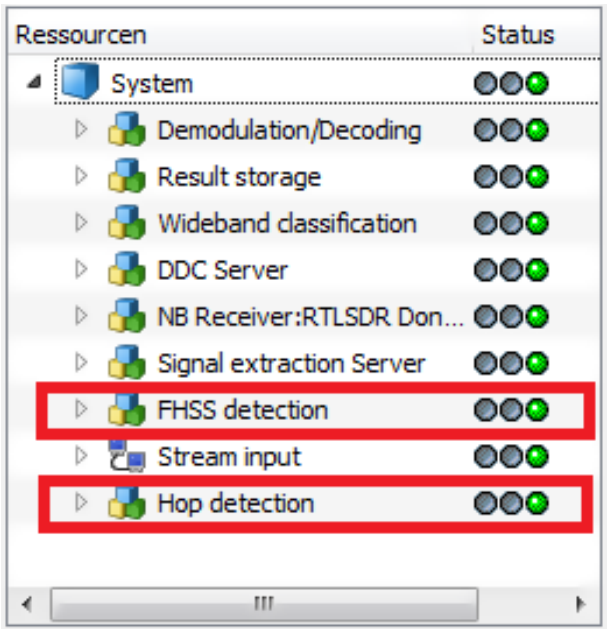


Figure 195.: HDU Components

The "Hop detection" component can have multiple instances, one for each wideband signal input. This component detects short signal bursts and reports them to the "FHSS detection" component.

The "FHSS detection" component gathers all information from single hop detectors and detects possible FHSS signals including the most important parameters such as hop rate, dwell time, bandwidth, etc.

The components for FHSS detection can work only if an Automatic Wideband Monitoring mission is being executed (see chapter Automatic Wideband Monitoring). If that is not the case, the status of "Hop detection" components will be "Waiting" (yellow). If a new mission is activated, the components will start working automatically, processing the input signal and displaying detected emissions in the <**Emission**> view and in the wideband spectrogram.

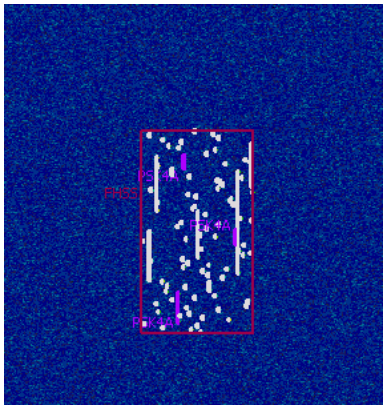


Figure 196.: FHSS Emission Display in Wideband Spectrogram

Intercepted FHSS emissions are stored in the result database and can be opened as any other classification result by using the ResultViewer. In addition to the FHSS signal parameter such as frequency, hop rate, hop bandwidth etc., each FHSS result will also include an entire list of single detected hops as a CSV file with the following format:

ID;FrequencyFrom;FrequencyTo;TimeFrom;TimeTo

Both time fields contain a number of seconds since 1.1.1970 00:00 (including the fractional part).

These CSV files can be opened with any text editor and processed further.

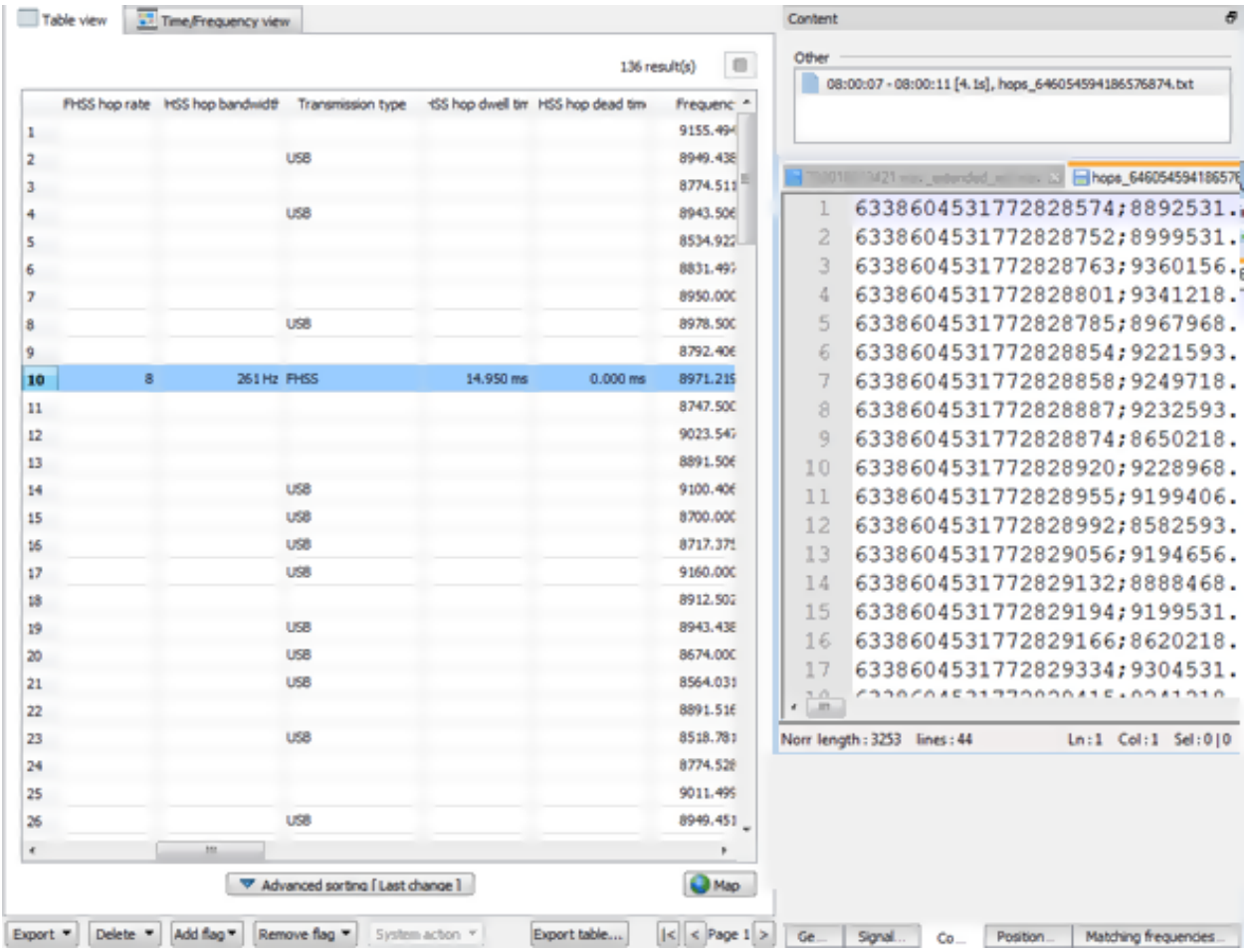


Figure 197.: Example of an FHSS Emission Display in ResultViewer

The Advanced Filter in ResultViewer also includes new filtering fields related to the FHSS emissions.

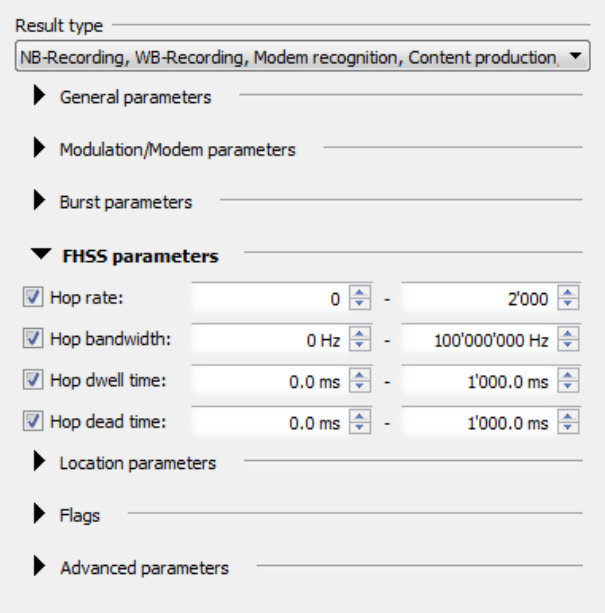


Figure 198.: FHSS Filtering Options in ResultViewer

The most important application for the HDU option is the usage of detected FHSS emissions as a trigger in Automatic Wideband Monitoring. In each Automatic Wideband Monitoring task, the FHSS emission type can be used as a trigger criterion, just like any included modulation type. The most common task type for the usage with FHSS trigger would be "Triggered Wideband recording". It would allow the entire detected FHSS signal to be recorded (for details, see chapter Automatic Wideband Monitoring).

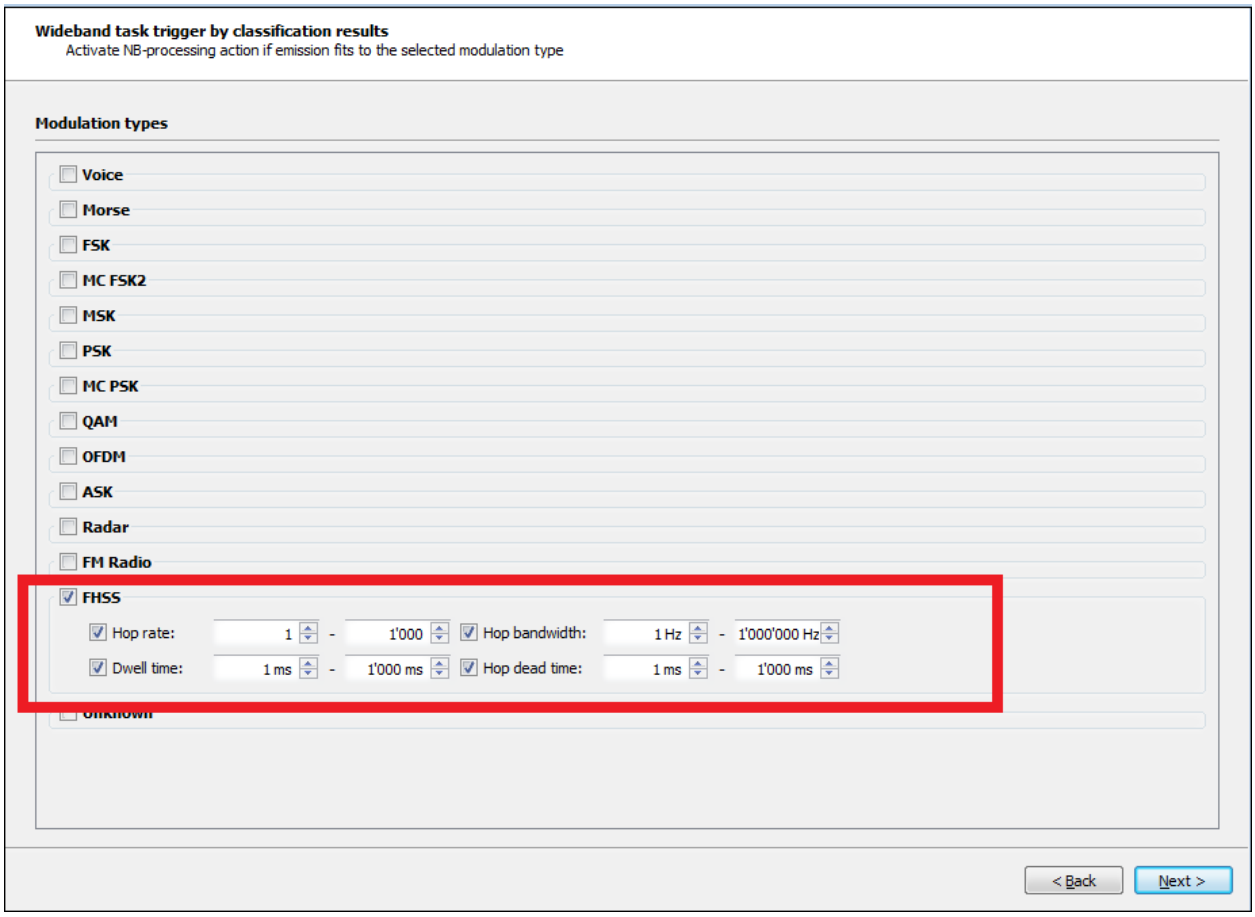


Figure 199.: FHSS Triggering Options in the Automatic Wideband Monitoring Task Wizard

Narrowband processing (recording or modem detection) with FHSS signal as a trigger would generally make no sense.

5.8. Antenna Information (optional)

This option enables the use of information about the antenna connected to the system. This information can be stored with each produced system result and can be used for triggering actions in Automatic Wideband Monitoring . Antenna information can be parametrized only from an external system or application by using remote control interface (for example from antenna switch control). There is no GUI available for the direct parametrization by the operator. Therefore, this option is available only in custom project setups.

5.9. Result Post-Processor

Various decoders deliver complex, modem-specific, meta-data which sometimes has to be mapped to standard meta-data categories like Sender, Recipient etc.

The Result Post-Processor provides functionality for extracting certain meta-data from decoder result files (.DEC), the preparation and mapping of the extracted data to specified categories, and the extension of production results with the meta-data. For extracting meta-data, the Post-Processor launches internal Python scripts which attempt to parse the specified result file and extract meta-data based on rules which are specific for each decoder type. If the extraction of meta-data was successful, the Post-Processor will

extend the associated content production result with information retrieved through parsing. Otherwise, the result entry will remain unchanged (see chapter General View).

The whole process is completely automated; the extracted fields are stored in the database and will be visible in the RV just as other result fields.

The functionality is available only for the following modems: ACARS, ALE-2G, AIS, DSC-HF/VHF, HFDL, VDL2 and TETRA.

Note: This functionality should be regarded as preliminary and will probably change in future versions.

6. FAQ / Troubleshooting

Question:
I have an older version of the software. If I install a new one, how can I keep my data (results, frequencies, etc.)?

Answer:
Your data will be automatically updated and used by the new version. After the first GUI start, a message is displayed offering a database upgrade. This automatic migration includes the following data:

- Results (including all files, recordings, etc.)
- Missions/Tasks
- Frequencies and frequency lists
- Stored filters
- Scheduler actions
- System position

Other application settings or your custom modems/decoders will not be transferred automatically to a new version. Contact our customer support if a transfer to the new version is necessary.

Question:
After starting the software, the main window stays gray and I cannot work with it.

Answer:
The Splash screen can be closed by clicking on it. Open the <**Resources**> view via the <**Views**> menu and check if any components are in a red/yellow state. If yes, check if there are any error messages shown as items under that component in the tree-view.

For example, the Result storage component will be in the error state if there is less than 1 % free space on the hard disk.

Try closing the software and starting again.

Contact our customer support if none of the above helps.

Question:
I've added my receiver but get no signal from it.

Answer:
In the case of a network receiver not being recognized, double-check the IP-addresses and ports you've entered in the Receiver Configuration Tool. Try deactivating your firewall. Check if Jumbo-Frames are activated on your network card (needed for IZT/narda receivers).

If you have multiple receivers in your configuration, delete them and add them again one-by-one.

Question:
I cannot find my results in the ResultViewer. What should I do?

Answer:
There may be filter settings preventing the results from appearing. To solve this, click <**Clear filter**> on

the toolbar and increase the frequency/time range to the maximum. If frequency information was missing in the signal, your results may be stored with frequency = 0 Hz.

Also, old results will by default be automatically deleted after one week from the database (this setting can be changed in application settings).

If your hard disk is almost full, your oldest data will also be automatically deleted.

Question:
I've created an Automatic Wideband Monitoring mission and a corresponding task but no task is shown within Task Activity.

Answer:
In the **Task Activity** view, tasks are only displayed for missions which are currently active. Make sure the corresponding mission for the task you would like to see has been activated.

Question:
I've created an Automatic Wideband Monitoring task but get no expected results. What am I doing wrong?

Answer:
Check in the **Task Activity** view if there are any triggers and/or started/dropped actions for your task. Use the task-based filter in the <**Emissions**> view to interactively monitor if there are any live emissions which fit your task trigger.

Question:
I am trying to use the task-based filter in the <Emissions> view, but it does not work correctly. Why?

Answer:
If a mission or task has changed, they won't be reloaded/updated automatically in a task-based filter. You have to manually update using the <**Reload Missions/Tasks**> button.

Question:
The <Find emissions> button in the Emissions view seems to be missing. What can that be?

Answer:
An Automatic Wideband Monitoring mission is probably currently active in your system. You can check this in the **Missions** view. After you activate the mission, wideband classification switches into continuous mode. Therefore, snapshot classification is not available. After you deactivate your active mission, the <**Find emissions**> button will appear automatically.

Question:
I've created an offline Automatic Wideband Monitoring mission with a task containing only "Recognition + Decoding" narrowband channel action. I see many recording results in database but the WAV files are missing. Why?

Answer:
Since it is an offline mission, the software has to store narrowband recordings in order to perform recognition & decoding. The files are deleted afterwards (because recording action was not selected in a task), but the recording information stays visible in the database.

Question:
How can I change the language of the GUI after installation?

Answer:
To do this, it is necessary to open and modify the prolang.cfg file in the installation folder with a text editor. Valid entries are "de" for German and "en" for English. go2MONITOR must be restarted after the change.

Question:
How can I use go2MONITOR on a PC without a network card?

Answer:
If there are problems in starting go2MONITOR when no LAN is activated, add the Microsoft Loopback Adapter.

- In the Device Manager, select <**Add legacy hardware**>
- In the **Add Hardware** wizard, select <**Install the hardware that I manually select from a list (Advanced)**>
- In the **Common hardware types** list, click <**Network adapters**> and then click <**Next**>
- In the **Manufacturer** list, click <**Microsoft**>
- In the **Network Adapter** list, click <**Microsoft Loopback Adapter**> and then click <**Next**> twice.
- If a message about driver signing appears, click <**Continue Anyway**>.
- In the **Completing the Add Hardware Wizard** dialog box, click <**Finish**>, and then click <**OK**>

Question:
How can I add my own modems/decoders in go2MONITOR?

Answer:
You will need go2DECODE to create your modem and decoder first. From there, you should save your modem as a *.ver file and your decoder to a *.bin file. VER file should be copied to your <**USER_DIR**>**/modems**> directory and your BIN file to the <**USER_DIR**>/decoders directory. After that, select the <**File/Reload modems from disk...**> menu option to load new modems and decoders.

The location of the <**USER_DIR**> is:

- Windows®

```
%USERPROFILE%\go2SIGNALS\go2MONITOR x.y
```

- Linux®

```
$HOME/go2SIGNALS/go2MONITOR x.y
```

Question:
Some modems in the modem list in narrowband channel are deactivated / grayed-out. Why?

Answer:
Some modems are not suitable for automatic modem recognition, so they will be deactivated if you are in search mode. Which modems are suitable for automatic search can be seen in the **Auto-recognition** column in the Modem List Editor.

Also, if a modem list contains more than 200 modems, all modem will be disabled and appropriate message will be displayed indicating that you have to select a shorter modem list.

Question:
The layout of my GUI is messed up - I would like to bring it in the default state. How can I do it?

Answer:
Click <**Perspective**> on the toolbar and select the **Default** perspective.

Question:
I have a problem with the software and the support team would like me to send log files for the analysis. Where do I find these?

Answer:
You will find log files in the <**USER_DIR**>/log directory. Simply compress all files you find in that directory and send them to support. It would also help if you could report the exact time when the problem occurred and the steps to reproduce it.

The location of the <**USER_DIR**> is:

- Windows®

  ```
  %USERPROFILE%\go2SIGNALS\go2MONITOR x.y
  ```

- Linux®

  ```
  $HOME/go2SIGNALS/go2MONITOR x.y
  ```

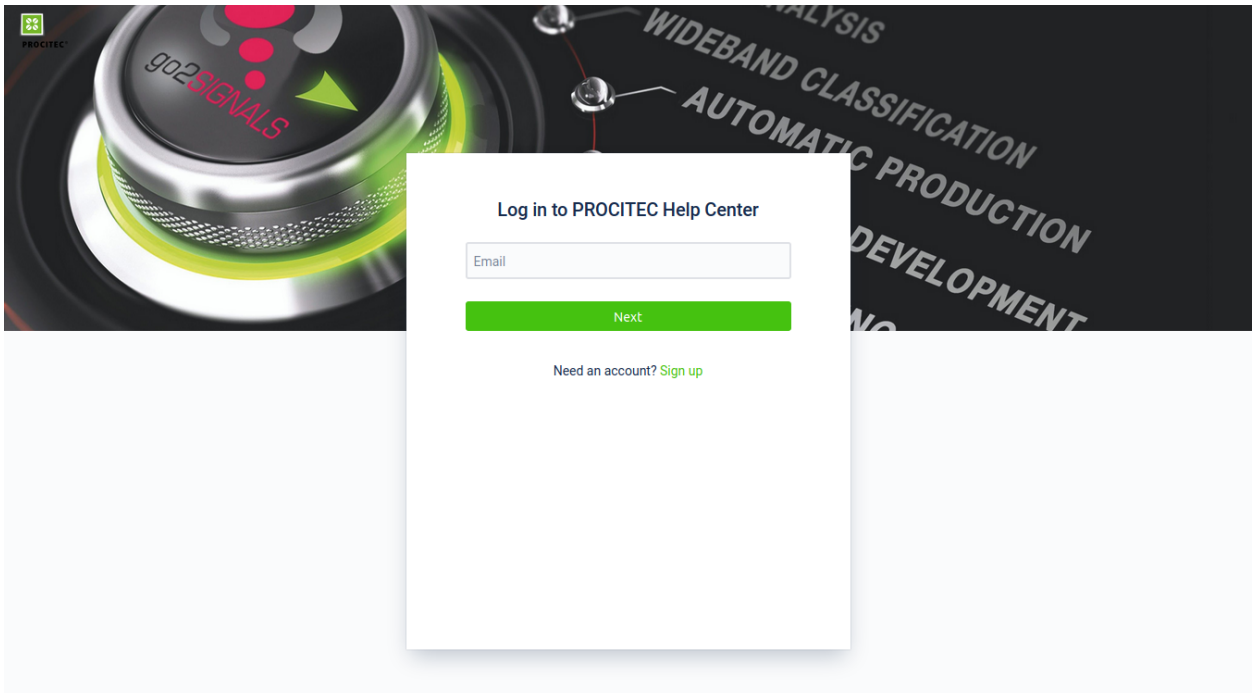
A. Support

Requests and suggestions?

All requests or suggestions regarding our go2SIGNALS product-range are very much appreciated; we would be delighted to hear from you.

Any questions? We are happy to assist you!

If you have any further questions, please do not hesitate to contact our Support Team for rapid assistance – just raise a service request at: **http://servicedesk.procitec.com**.



PROCITEC GmbH
Rastatter Straße 41
D-75179 Pforzheim
Phone: +49 7231 15561 0
Web: www.procitec.com
Email: service@procitec.com

List of Figures

List of Tables