# WAVECOM® W-SPECTRA

W-SPECTRA is a complete wideband automatic monitoring system running through the entire radio spectrum from ELF to SHF. It provides all monitoring functions such as direct control of the receiver, signal classification, analysis and decoding, wideband IQ signal recording and capturing results into a database.

Together with a spectral editing tool (W-SPEED), it can cut out any signals in frequency and time domains from a recording for further processing.
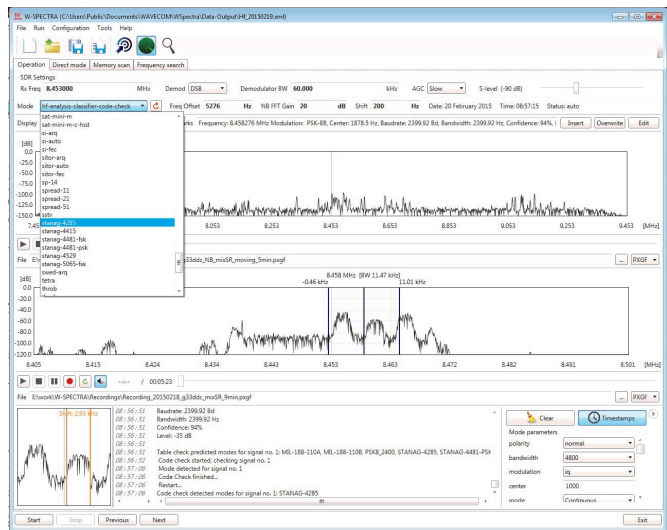
W-SPECTRA

Complete Automatic Spectrum Monitoring System

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W-SPECTRA Main Features and Facts — I

W-SPECTRA provides:

- ♦ Comprehensive real-time monitoring functions
- ♦ Intuitive graphical user interface: main operation tab covers all online monitoring activities
- ♦ Built-in bi-directional control of receivers (WiNRADiO G3xDDC)
- ♦ Three monitoring modes: Direct Mode, Memory Scan and Frequency Search
- ♦ More than 220 mode decoders and protocols over ELF to SHF as in Wavecom standard decoders, e.g., W-CODE
- ♦ Automatic demodulation and decoding to the content level of known signals
- ♦ Automatic search, classification and code check of signals over a user-defined frequency range and search strategy
- ♦ Automatic or manual capturing of results into a database
- ♦ Classification and decoding results can be saved to files
- ♦ User configurable database template
- ♦ Database in XML format, providing easy processing by third-party applications
- ♦ Integrity check of database
- ♦ Wideband (2 MHz) and narrowband (96 kHz) FFT and sonagram display
- ♦ Wideband and narrowband IQ signal recording and playback
- ♦ On-the-fly signal recording with various important side information (meta-data) such as receiver frequency, sampling rate (bandwidth) and timestamp for complete investigation of the whole spectrum
- ♦ Recording in the versatile PXGF format, which allows changes of recording bandwidth and receiver (Rx) frequency
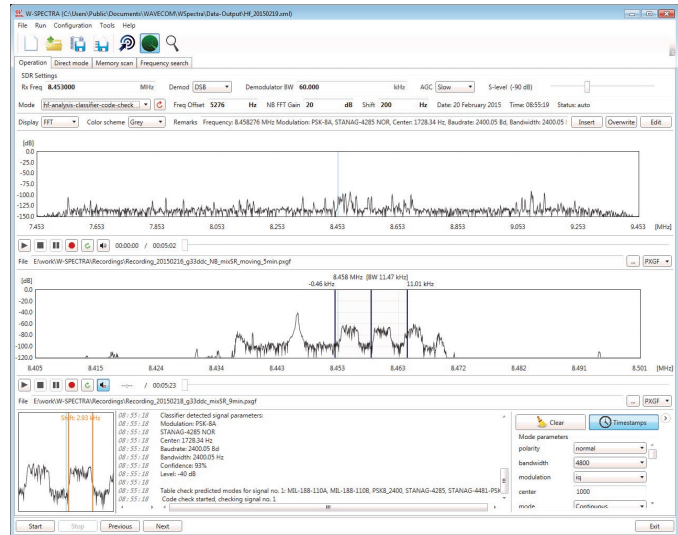

W-SPECTRA GUI Operation tab

Run more than 220 decoders manually or automatically

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W-SPECTRA Main Features and Facts — II

W-SPECTRA provides further:

♦ Instantaneous display of receiver frequency and timestamp. On-the-fly adaptation of the recording bandwidth during playback

♦ Wideband spectrum editing (W-SPEED): sonagram display of a recording, free navigation over the whole sonagram with spot display of spectrum information: absolute receiver frequency and recording timestamp

♦ Detail investigation of a recording: Zoom view into a sonagram. Select a signal anywhere (in time and frequency domains) from a recording for classification and decoding in W-SPECTRA and other Wavecom decoders

♦ A file splitter to divide a big recording into consecutive files with reasonable size

♦ A recording converter to convert a WAV file into PXGF format with on-the-fly metadata
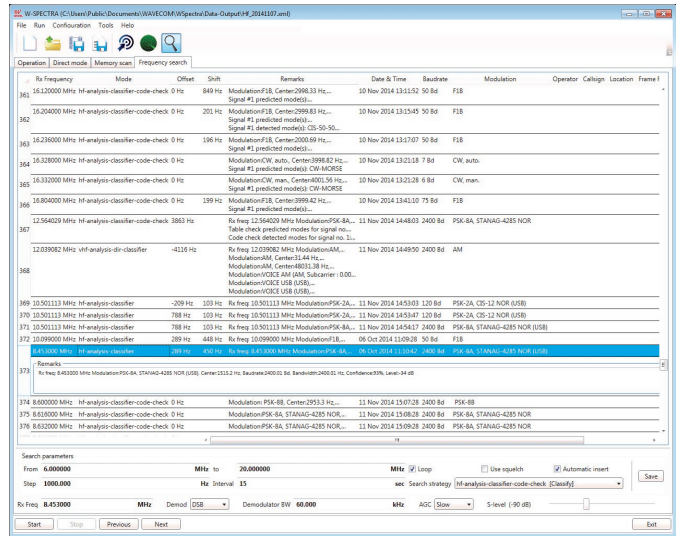


Automatic insertion of results into a database
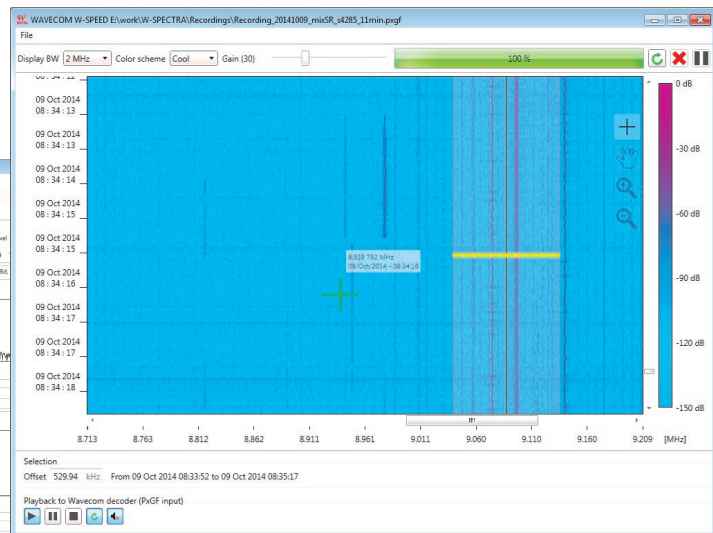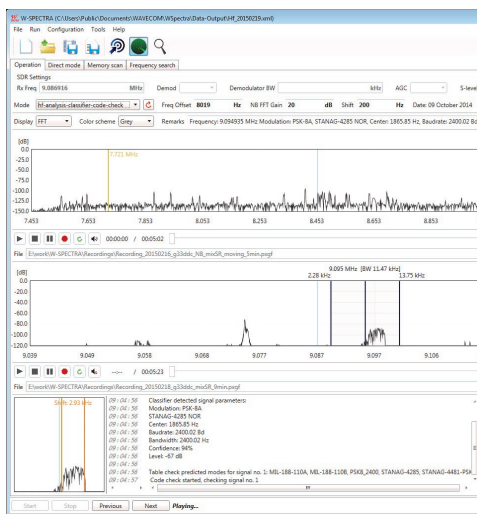
Zoom-in sonagram display of a recording with W-SPEED. Spot display of receiver frequency and recording timestamp. Select a signal and classification in W-SPECTRA

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Typical Configuration

W-SPECTRA connects to a Software Defined Radio (SDR) and takes over its full control.

A built-in mass storage device (e.g., an SSD) can be used by W-SPECTRA for wideband IQ signal recording.

The "Operation" tab in the W-SPECTRA GUI contains four parts. All the monitoring activities are covered in this tab.

♦ Receiver control: allows the setting of receiver frequency, demodulator and bandwidth etc.

♦ Wideband spectrum display (2 MHz) with IQ signal recording and playback

♦ Narrowband spectrum display (96 kHz) with IQ signal recording and playback

♦ Classification and decoding result display

W-SPECTRA can work in three modes: *Direct Mode*, *Memory Scan* and *Frequency Search*.
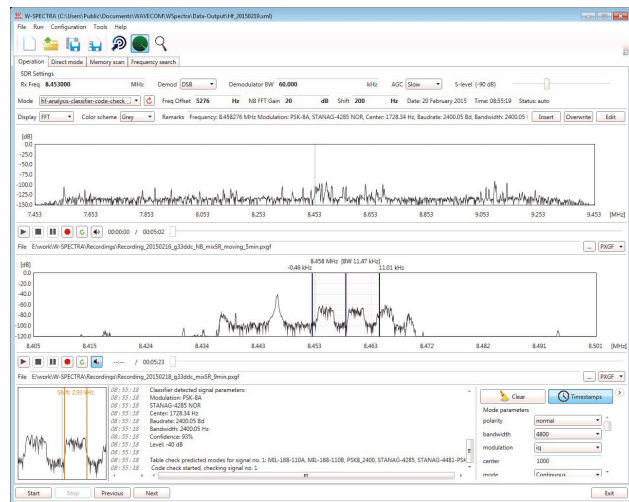
W-SPECTRA Operation GUI contains four parts
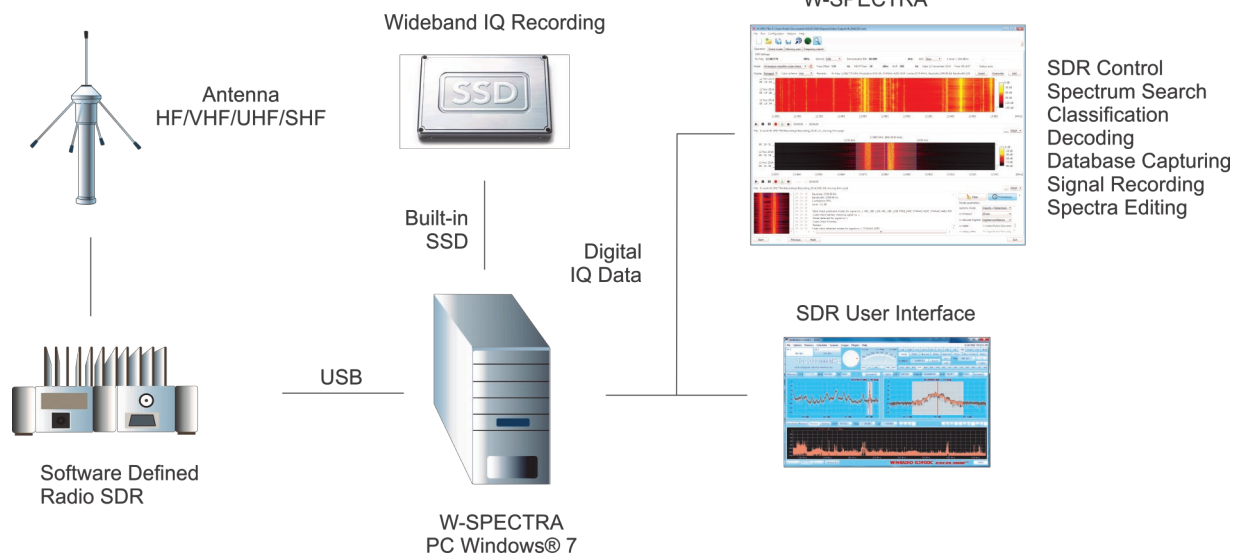
Example setup of a monitoring system with W-SPECTRA

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Direct (Built-in) Receiver Control

At start-up W-SPECTRA connects to a WiNRADiO G3xDDC receiver and assumes full control.
The connection is bi-directional. Users may set the receiver frequency, demodulator, demodulator bandwidth, AGC and squelch level directly in the W-SPECTRA GUI. This will then reflect to the SDR GUI and vice-versa.
The Demodulator BW determines the bandwidth of the narrowband spectrum display.
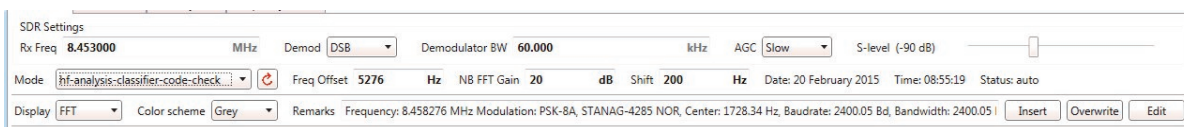
Bi-directional receiver (SDR) control

With an "SDR settings" GUI W-SPECTRA can
- configure the connection behavior to a receiver at start: preset the receiver frequency, demodulator bandwidth, AGC and squelch level
- recheck if a receiver is still online by Rescan and
- connect and disconnect a receiver during running
Three color indicators mean
- Yellow: the receiver is running properly and ready for connection to W-SPECTRA
- Green: the receiver is now connected to W-SPECTRA and works properly or
- Black: the receiver is not running (offline)

SDR settings GUI

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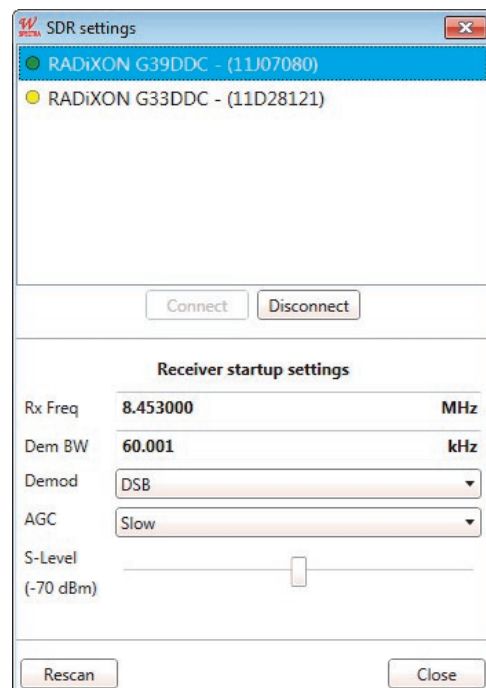
Wideband (WB) and Narrowband (NB) Spectrum Display and Media Player/Recorder

There are two spectrum displays in W-SPECTRA: wideband and narrowband. They have the following characteristics and capabilities:

♦ The wideband display is 2 MHz wide. It corresponds to the DDC1 of the G3xDDC SDR.

♦ A wideband recording of the DDC1 IQ signal in PXGF format with on-the-fly side information such as receiver frequency, bandwidth and timestamp.

♦ The narrowband spectrum display corresponds to the DDC2 of the G3xDDC SDR. Its bandwidth can be 24, 48 or 96 kHz and is coupled with the SDR demodulator BW.

♦ A narrowband recording of the DDC2 IQ signal (96 kHz) in PXGF or .wav format.

♦ Playback of a recording in both Media Play-

ers. The Signal is streamed to the classifier or decoder for processing.

♦ The wideband display enables the selection of any 96 kHz band from a WB recording for classification and decoding.

♦ Playback is made in real-time.

♦ The recorded side information (Rx Freq and timestamp) is displayed instantaneously in the main GUI Operation tab.

♦ The playback progress cursor can be moved to any position of the recording, providing forward and backward traversing of the signal.

♦ The signal can be output to the speaker for sound monitoring purpose.
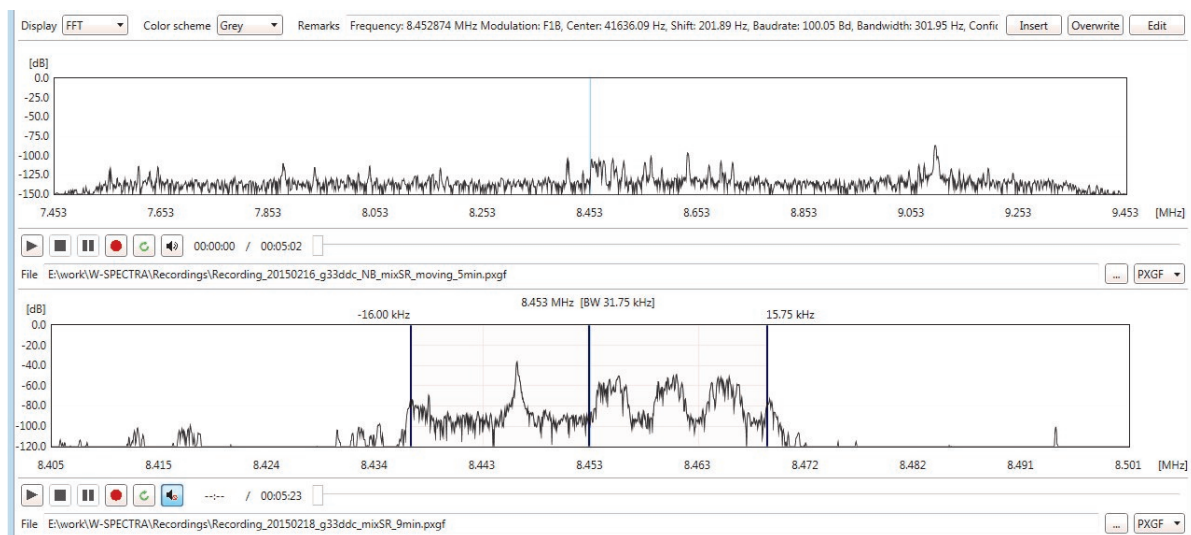
Wideband and narrowband spectrum and media player/recorder

⚠ Only make recordings on a built-in storage medium (e.g., built-in harddisk or SSD). Don't use external USB harddisk, nor over the network, because the max. speed of external devices may be insufficient for the wideband recording.

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Three Operation Modes: Direct Mode, Memory Scan and Frequency Search

W-SPECTRA works in three operation modes: Direct Mode, Memory Scan and Frequency Search.

♦ A decoder or classifier can be set manually or automatically to process the signal selected by the middle cursor of the NB spectrum display. Results are displayed in the lower part of the GUI.

♦ All the three modes can work in a manual or automatic way. Four buttons (Start, Stop, Previous and Next) control the work flow.

♦ In each mode W-SPECTRA opens a database with a user defined template to record classification and decoding results.

♦ A small tuning FFT at the lower left corner can be used to measure the signal width.
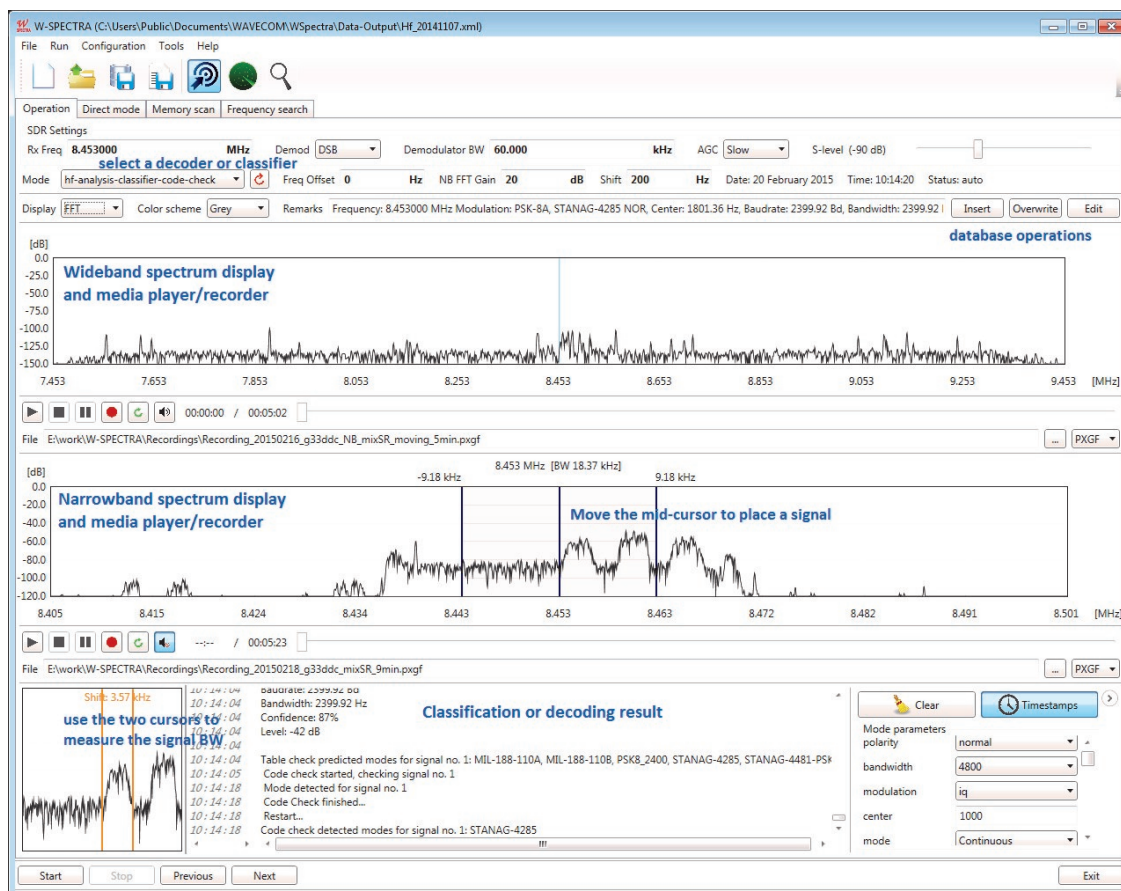
W-SPECTRA GUI Operation tab (with comment)

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Direct Mode: First Things First to Begin Spectrum Monitoring

W-SPECTRA Direct Mode is designed for a user to begin the spectrum monitoring in a manual way.

- ◆ The user can set the receiver frequency manually and turn on the classifier or a decoder to monitor and decode a signal.
- ◆ The user can open a database in the "Direct Mode" tab and manually insert results.
- ◆ Direct Mode can also run automatically to sweep the spectrum in a small range so that a signal can be fine tuned to the spectrum middle.

There are four buttons in the last line of the GUI which have the following function:

- ◆ Start button: starts the sweep function. The receiver will jump to the next frequency according to the Step size and Dwell period.
- ◆ Stop button: stops the sweep function.
- ◆ Previous and Next buttons: jump manually to the previous and next frequency respectively according to the Step size.

Direct Mode tab with database and sweep parameters setting

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Memory Scan: Spectrum Monitoring and Verification

W-SPECTRA runs in Memory Scan mode over an existing database. Each database entry sets the receiver (SDR) and the decoder or classifier accordingly. In this way the spectrum is revisited and verified. The user may insert a new entry into the database or just overwrite the old one.

The four buttons in the last line of the GUI have the following functions:

♦ Start button: starts the memory scan from the first database entry and jump to the next one after an Interval period.
♦ Stop button: stops the memory scan function.
♦ Previous and Next buttons: manually jump to the previous and next database entry respectively.
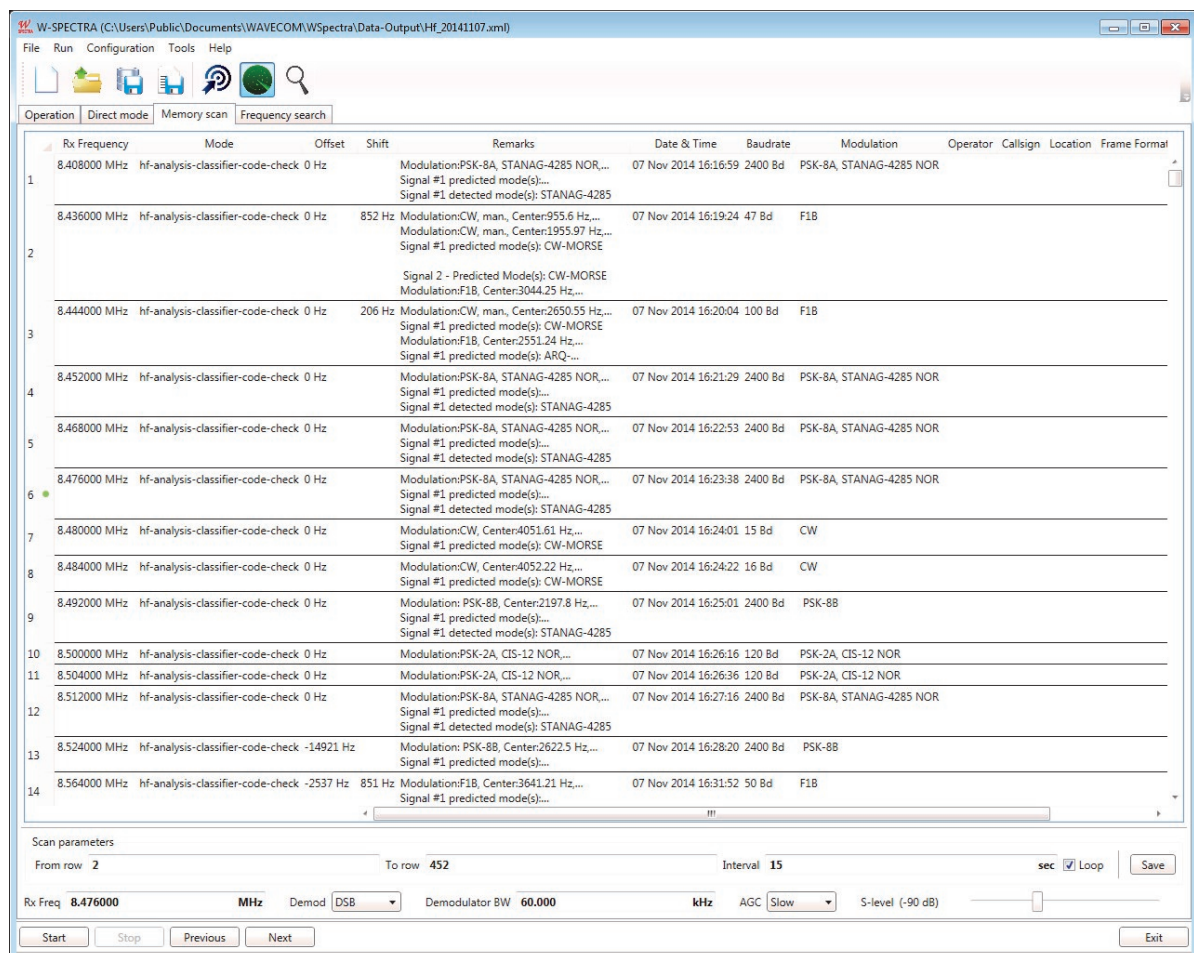
Memory Scan mode with a database and scan parameters setting

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## Frequency Search: Automatic Spectrum Monitoring and Database Capturing

With the Frequency Search mode W-SPECTRA can scan over an entire frequency band, e.g., the HF band (3 — 30 MHz), run a classifier and code check (with different search strategies), search for signals and record the classification results into the database automatically.

The four buttons in the last line of the GUI have the following function:

♦ Start button: starts the frequency search from the first frequency defined and jump to the next frequency (+ Step) after an Interval period.

♦ Stop button: stops the frequency search function.

♦ Previous and Next buttons: manually jump to the previous and next frequency respectively according to the Step size.
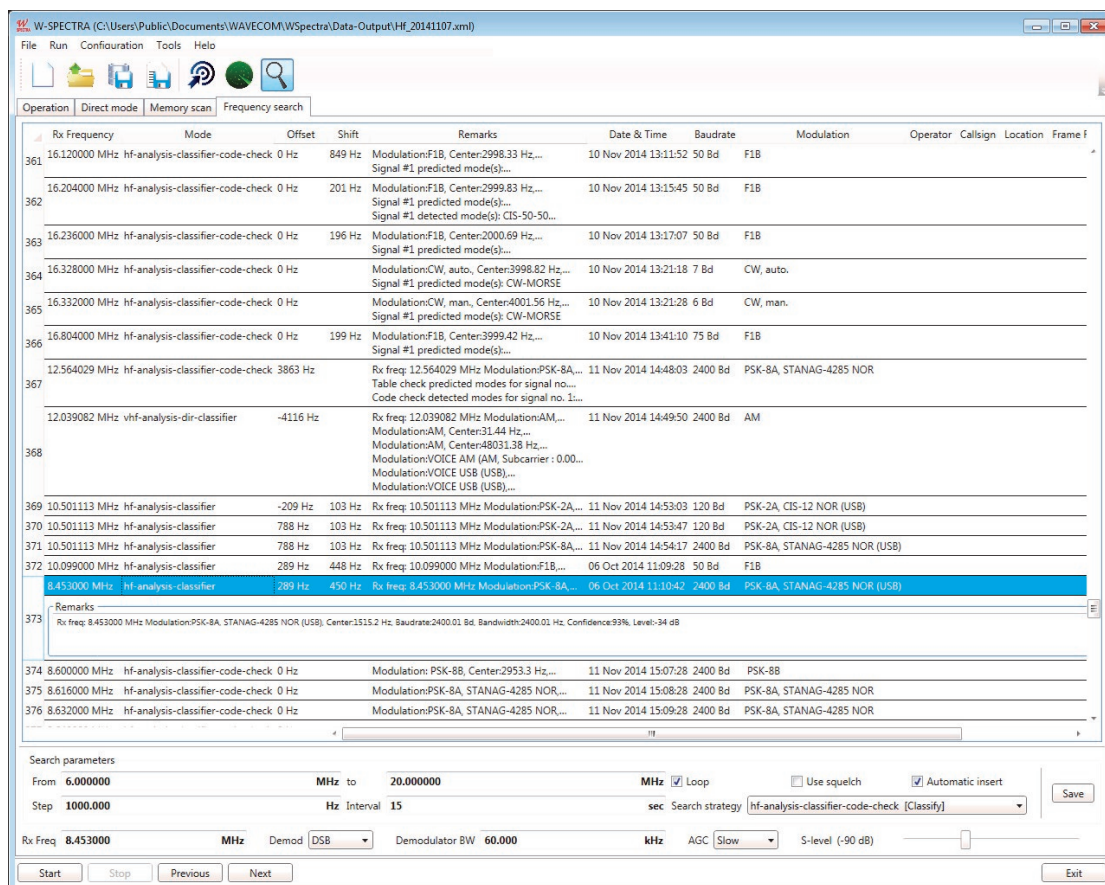
Frequency Search mode with a database and search parameters setting

Recommended configuration and typical search results on page 21.

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Scan Delay in Automatic Modes

W-SPECTRA adopts a "scan delay" method when running in an automatic mode. When the classifier and code check find a signal at a frequency the automatic jump to the next frequency / memory entry is hold on until the complete classifier code check result is delivered. In this way W-SPECTRA delivers more precise, stable and reliable monitoring results.

This method applies to all three operation modes: Direct Mode, Memory Scan and Frequency Search.

Automatic Classification and Decoding

Powerful classification unit — The brain of W-SPECTRA

The automation of the signal classification process relieves the operator from manual evaluation, which otherwise requires considerable skill and experience.

W-Classifier detects and measures the following signal parameters automatically:

♦ Modulation type
♦ Baud rate or symbol rate
♦ Signal center frequency
♦ Number of carriers
♦ Frequency shift or signal bandwidth

Multiple signal classification and code check

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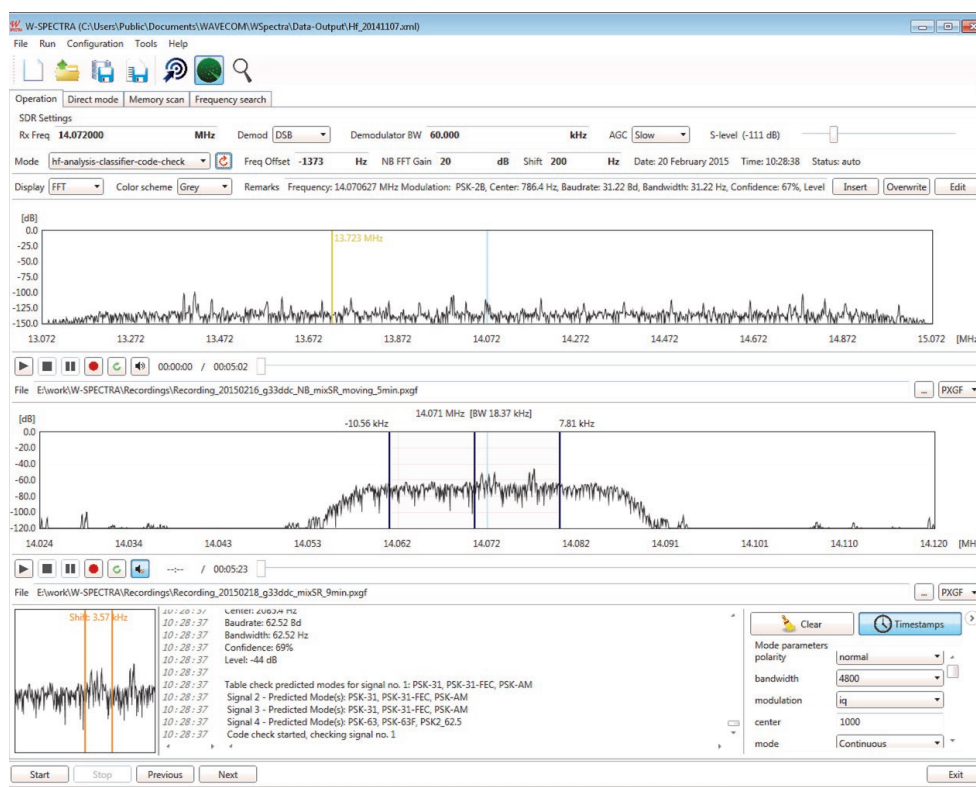
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Automatic Classification and Decoding

♦ Carrier spacing or distance
♦ CW-Morse detection

All signals within the classifier bandwidth are detected in one shot — multiple signal classification.

The narrowband classifier is of 8 kHz bandwidth.

Additional functions for the wideband classifier (W-Classifier-WB)

♦ Bandwidth up to 96 kHz
♦ Voice detection AM, FM, USB and LSB
♦ Baud rates up to 60 kBd

The Classifier-Code-Check (CCC) is a versatile analysis tool for the classification of known and unknown signals and the determination of the mode in use. The CCC attempts to process all signals within the bandwidth of the classifier. The classifier attempts to classify the input signals according to their modulation formats. The table check will check the signal against the entries of the selected mode list. The code check attempts to synchronize against classified modes, finally the signal will be forwarded to a decoder for output.

A CCC Table Editor (under the menu Addons) allows extending, modifying or deleting records in the table used for mode look-up. An input template containing all important parameters is available for each modulation type. All parameters, the record name and the file name are user selectable.

Name	Decoder	Modulation	Subcarrier	Baud / Symbol...	Shift	Bandwidth	No. of Tones	No. of Carriers	Spacing	Pilot Frequency	Coded
FSK_800_500	no-mode	FSK		800	500	*	2				
FSK_81.9_145	no-mode	FSK		81.9	136	*	2				
FSK_81.9_145	no-mode	FSK		81.9	145	*	2				
G-TOR	g-tor	FSK		100	170	*	2				2
G-TOR	g-tor	FSK		100	200	*	2				2
G-TOR	g-tor	FSK		200	170	*	2				2
G-TOR	g-tor	FSK		200	200	*	2				2
G-TOR	g-tor	FSK		300	200	*	2				2
G-TOR	g-tor	FSK		300	170	*	2				2
GMDSS/DSC-HF	dsc-hf	FSK		100	170	*	2				1
GW-FSK	gw-fsk	FSK		100	200	*	2				5
GW-FSK	gw-fsk	FSK		200	200	*	2				5
GW-OFDM	gw-ofdm	OFDM	PSK-4	62.5				12 (min. 11)	62.5		5
GW-OFDM	gw-ofdm	OFDM	PSK-4	62.5				14 (min. 13)	62.5		5
GW-OFDM	gw-ofdm	OFDM	PSK-4	62.5				16 (min. 15)	62.5		5
GW-OFDM	gw-ofdm	OFDM	PSK-4	62.5				18 (min. 17)	62.5		5
GW-OFDM	gw-ofdm	OFDM	PSK-4	62.5				20 (min. 19)	62.5		5
GW-OFDM	gw-ofdm	OFDM	PSK-4	62.5				22 (min. 21)	62.5		5
GW-OFDM	gw-ofdm	OFDM	PSK-4	62.5				24 (min. 23)	62.5		5
GW-OFDM	gw-ofdm	OFDM	PSK-4	62.5				26 (min. 25)	62.5		5
GW-OFDM	gw-ofdm	OFDM	PSK-4	62.5				28 (min. 27)	62.5		5
GW-OFDM	gw-ofdm	OFDM	PSK-4	62.5				30 (min. 29)	62.5		5
GW-OFDM	gw-ofdm	OFDM	PSK-4	62.5				32 (min. 31)	62.5		5
GW-PSK	gw-psk	PSK-4		200							5
GW-PSK	gw-psk	PSK-8		200							5
HC-ARQ	hc-arq	FSK		240	200	*	2				5
HELL-80	fm-hell	FSK		245	490	*	2				1
HF-ACARS	hf-acars	PSK-2		1800							2
HF-ACARS	hf-acars	PSK-4		1800							2
HF-ACARS	hf-acars	PSK-8		1800							2

Classifier Code Check table editor

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Database Define and Check

W-SPECTRA records classification and decoding results into a database. The database is in XML format, which allows easy access by a third-party program. The user can define a database template according to his needs. Each database template contains 6 mandatory fields:

♦ Rx Frequency
♦ Mode: decoder, classifier or code check running in W-SPECTRA
♦ Offset: offset of the middle cursor in the NB spectrum display, used to place a signal in the bandwidth
♦ Shift: bandwidth or shift of a signal
♦ Remarks: classification code check result

automatically filled or free text manually editable
♦ Date & Time: date and time when the record is inserted into the database

All the mandatory fields are accessible in the main GUI "Operation" tab.

The user can extend the template by choosing up to 23 predefined optional fields and defining up to 3 custom fields.

W-SPECTRA can verify the database integrity by

♦ removing empty entries and
♦ removing duplicate entries when all data fields have the identical content.
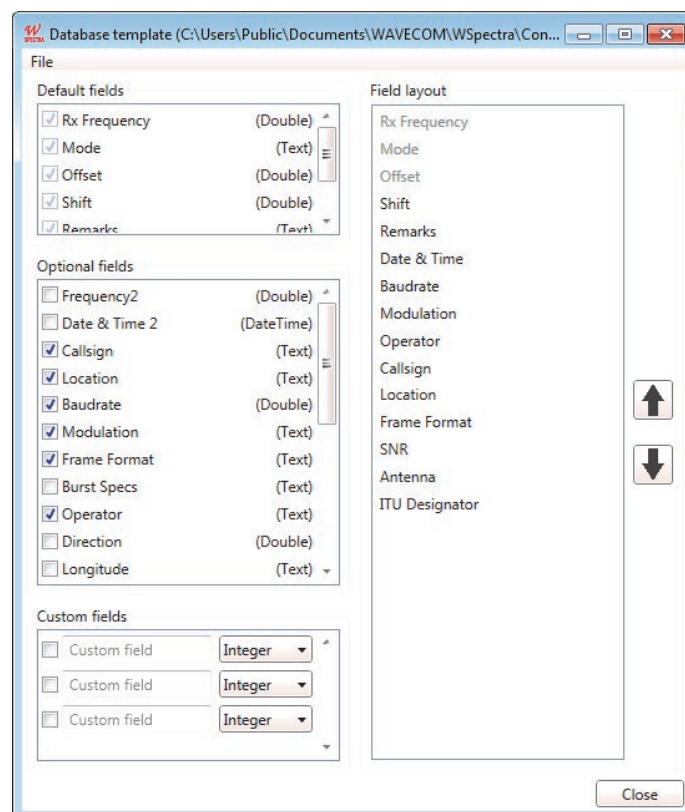
Customize a database template

13

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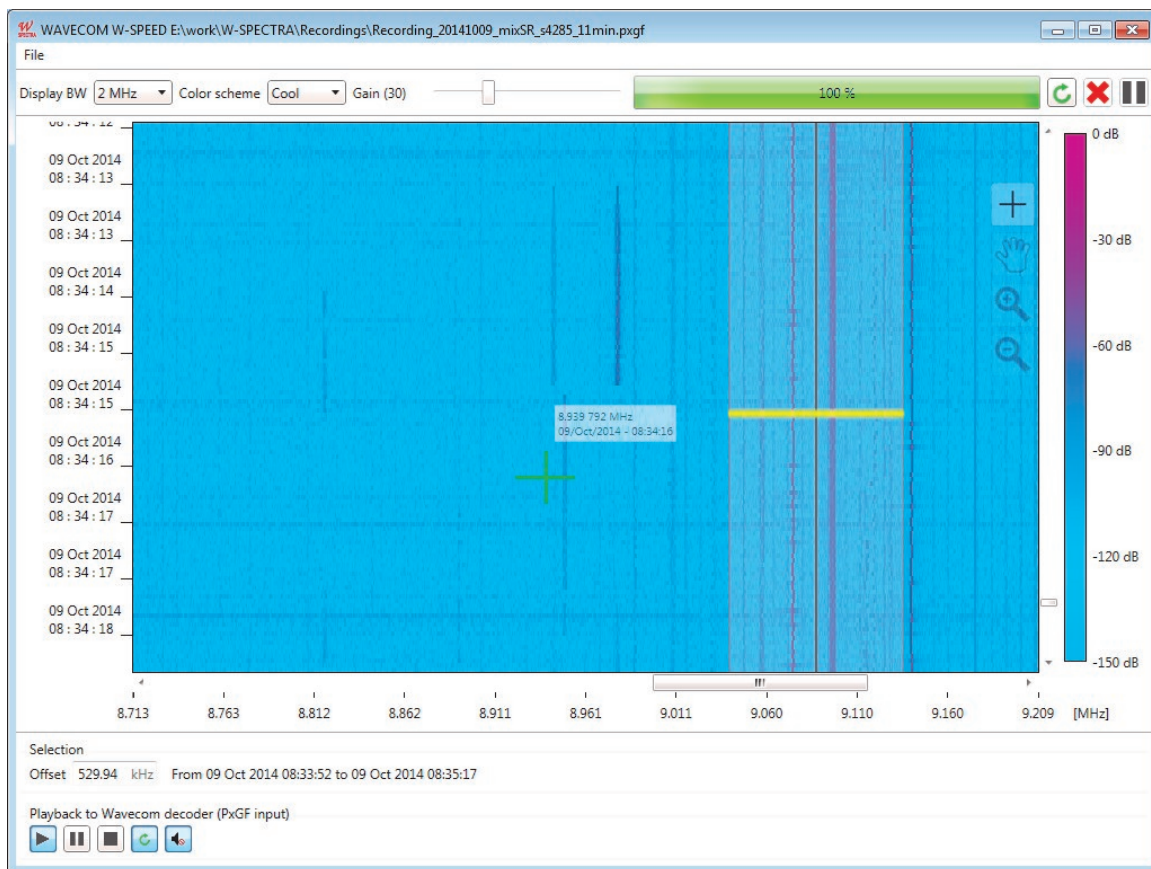
Spectra Editing (W-SPEED) — I

W-SPECTRA performs online monitoring of signals within a 96 kHz bandwidth of the receiver frequency. For spectrum outside this bandwidth the user can make a wideband (2 MHz) IQ signal recording with various side information. The recording is made in PXGF format.

The entire recorded spectrum can be displayed as a sonagram and analysed (classified and decoded) using the wideband Spectra Editing (W-SPEED) tool. The main features of W-SPEED are:

♦ It displays an IQ recording in a 2-dimensional sonagram (frequency and time domains) with selectable display bandwidths from 250 kHz to 24 MHz, with 2 MHz as default. The X-axis

is labeled with the absolute receiver frequency when it is not changed through the whole recording; otherwise it is labeled with the relative frequency of +/- half of the display bandwidth. The Y-axis is labeled with the recording timestamp.

♦ A spot display (a cross cursor) shows the absolute receiver frequency and the recording timestamp anywhere in the sonagram.

♦ Zoom-in (max. 32 times) displays the sonagram with the max. resolution of 60 Hz each FFT point (pixel).

Display a recording in the Spectra Editing Tool (W-SPEED). The X and Y-axis are labeled with the absolute Rx frequency and the recording timestamp, respectively. Spot display, zoom-in function and free navigation of the entire sonagram

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Spectra Editing (W-SPEED) — II

With W-SPEED the user can perform detail analysis and investigation on interesting signals.

♦ Two dimensional free navigation and positioning over the entire sonagram.

♦ The user can choose an interesting signal by marking it with a rectangular stripe (width 96 kHz) in time and frequency domains.

♦ The user can playback the selected signal to W-SPECTRA or other Wavecom decoders for afterwards classification and decoding.

♦ The playback displays the instantaneous side information (receiver frequency and recording timestamp) in the W-SPECTRA main GUI "Operation" tab.

♦ During the playback W-SPEED outputs the signal to the speaker for acoustic monitoring purpose.
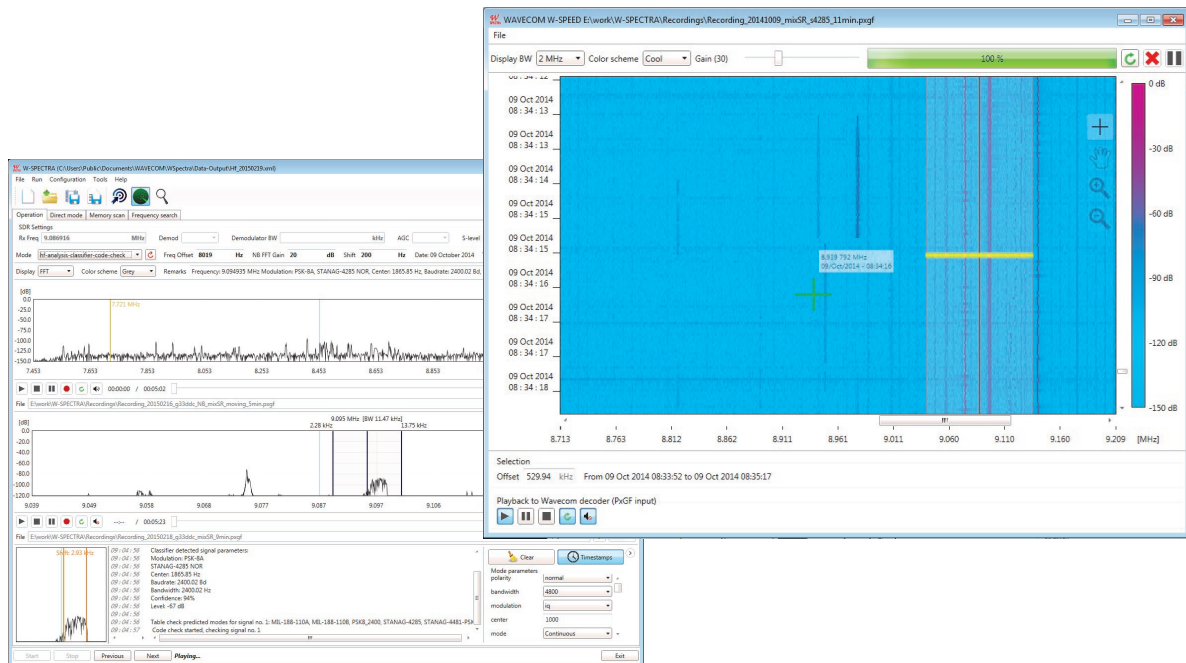
Use W-SPEED to cut out an interesting signal for detail processing in W-SPECTRA

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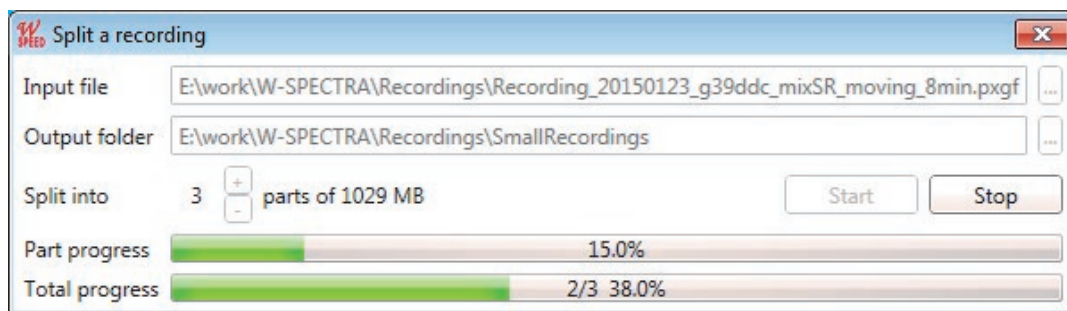
Recording Splitter Tool

Nowadays wideband recordings can get huge. The wideband recording made by W-SPECTRA is 2 MHz wide, in I/Q, each I and Q parts are 16 bits. This makes a one-minute recording 0.5 GB; one hour 30 GB and for 24 hours the recording will be 720 GB. Although the capacity of modern storage media can easily accommodate these huge files, it may be inconvenient to view and analyze a huge recording at one time.

Using the Recording Splitter Tool (from W-SPEED under the File menu or from W-SPECTRA under the Tools menu) a big recording file can be divided into part recordings of reasonable size.

Because the recording format PXGF allows intrinsic side-information (meta-data is recorded periodically throughout the whole file), the recordings after split can be processed by W-SPECTRA and W-SPEED as the original file.

The scheme of file splitting is:

♦ A recording bigger than 10 GB can be split into max. 10 equal size files;

♦ A recording between 9 GB and 10 GB can be split into max. 9 equal size files;

♦ The minimum size of a recording which can be split is 2 GB. It can be split into max. 2 files.

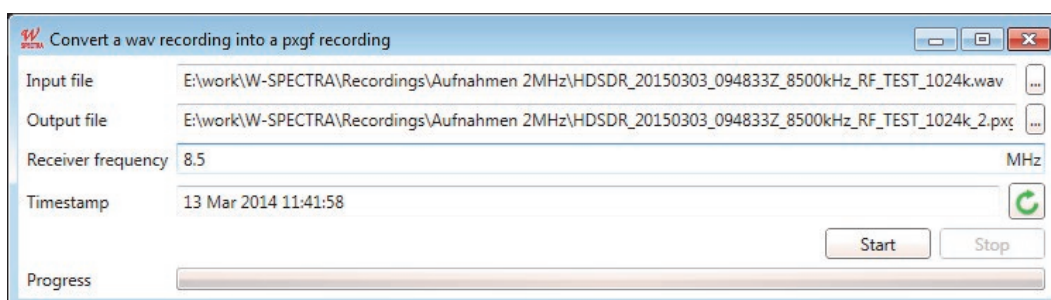*A recording splitter tool divides a big PXGF recording into several equal size recordings*

Convert a WAV Recording

The user can convert a WAV recording into PXGF format using the "Convert a WAV recording" tool. The user can set the receiver frequency and

beginning timestamp so that these meta-data can be implanted into the PXGF file.

A tool converts a WAV recording into PXGF format with receiver frequency and timestamp

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Technical Data and Overall Software Characteristics

Receiver Control

♦ Support WiNRADiO G3xDDC (e.g., G33DDC and G39DDC)

♦ Bi-directional control of the receiver

♦ Spectrum display wideband (up to 2 MHz) and narrowband (96 kHz) signals and process of them

W-SPECTRA Operation Modes

	Direct Mode	Memory Scan	Frequency Search
Description	Classify and decode a signal by setting a receiver frequency manually. Use „Sweep" mode to catch a signal in a small range	Rescan and verify signals according to database entries. New result can be inserted into the database	Automatic search signals (classify and code check) over a predefined frequency band according to a search strategy. Results automatically inserted into a database
Start button	Start to sweep over a defined frequency range	Start to rescan the spectrum according to the database entries	Start to search signals in a wide range of frequency
Stop button	Stop sweeping	Stop rescan	Stop searching signals
Previous button	Jump to the previous frequency according to the step size	Jump to the previous database entry	Jump to the previous frequency according to the step size
Next button	Jump to the next frequency according to the step size	Jump to the next database entry	Jump to the next frequency according to the step size
Default (recommended) values	Sweep range: 3000 Hz Step size: 100 Hz Dwell period: 1 sec	Time interval: 15 sec	Step size: 1000 Hz Time interval: 15 sec

Decoder Modes in W-SPECTRA

All HF, VHF/UHF, SHF and SATELLITE modes as in W-CODE (see modes list on pages 22 and 23)

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Signal Recording and Playback

Media Player / Recorder	Wideband	Narrowband
Recording format	IQ PXGF	IQ PXGF and WAV
Bandwidth	Up to 2 MHz	96 kHz
Bits per sample	16 bits each I and Q	32 bits each I and Q
On the fly side information	Receiver frequency (Rx Freq), recording bandwidth and timestamp	Receiver frequency (Rx Freq), recording bandwidth and timestamp in PXGF format
Playback	♦ WB spectrum display with side information ♦ A selected 96 kHz band displayed in NB spectrum and processed by the classifier or decoder ♦ Signal output to speaker for acoustic monitoring	♦ Signal displayed in NB spectrum with side information ♦ Selected signal processed by the classifier or decoder ♦ Signal output to speaker for acoustic monitoring
Typical recording size	♦ 0.5 Gigabytes for 1 minute ♦ 30 Gigabytes for 1 hour ♦ 720 Gigabytes for 1 day (24 hours)	♦ 46 MB for 1 minute ♦ 2.7 Gigabytes for 1 hour ♦ 64 Gigabytes for 1 day (24 hours)

Spectra Editing Tool (W-SPEED)

Sonagram bandwidth	250 kHz, 500 kHz, 1 MHz, 1.5 MHz, 2 MHz, 4 MHz, 8 MHz, 10 MHz, 12 MHz, 16 MHz or 24 MHz. Default 2 MHz
Axis label	X-axis labeled as the absolute receiver (Rx) frequency when it is not changed in the whole recording, otherwise it is labeled as the relative frequency +/- half of the display bandwidth Y-axis labeled with the recording timestamp
Spot display	Instantaneous display of the Rx frequency and recording timestamp when a cross cursor is moved over the entire sonagram
Zoom-in	Maximum zoom-in of 32 times maks the max. visible frequency resolution of 60 Hz.
Free navigation	Two-dimensional free navigation and positioning over the entire sonagram
Select a signal and process	Mark a 96 kHz wide stripe over an interesting signal and send it to W-SPECTRA or other Wavecom decoders for detail processing

Recording Splitter Tool

♦ Split a PXGF recording into max. 10 equal size recording files

♦ The minimum size of recordings after split is 1 GB

♦ The minimum size of a recording which can be split is 2 GB

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W-Classifier-NB Technical Data

Bandwidth HF	4 kHz or 8 kHz (complex: 9.6 kHz)
Sampling interval (Ts)	1.6 sec or 3.2 sec
FSK	30 to 3000 Bd, Shift ≤ 3500 Hz Modulation index: 0.5-20 Signal must be continuously present during sampling interval
FSK-4 (F7B)	30 to 300 Bd, Shift ≤ 3500 Hz
MFSK	4-36 tones
PSK 2/4 Variant A/B	30 to 3000 Bd
PSK 8/16 Variant A/B	30 to 3000 Bd
MIL/STANAG	Classified to protocol
CIS-12	120 Bd, classified as one signal
OFDM	25-512 carriers Tg/Tu = 1/1 to 1/8 ≥ 25 Bd
OQPSK	25 Bd to 30 kBd
CW-Morse	Ts = 1.6 s: 6 to 60 Bd Ts = 3.2 s: 3 to 60 Bd
Voice	No
Operation	FFT display of classified signals Continuous and single-pass mode Classifier Code Check with look-up table

W-Classifier-NB Quality of Modulation Classification

FSK	m = 0.8: 100-2400 Bd m = 0.8: 50 Bd m ≥ 2: 100-2400 Bd m ≥ 2: 50 Bd	12 dB (Eb/N0) 15 dB (Eb/N0) 14 dB (Eb/N0) 16 dB (Eb/N0)
PSK 2/4 Variant A/B	100-2400 Bd	14 dB (Eb/N0)
PSK 8/16 Variant A/B	100-2400 Bd	16 dB (Eb/N0)
CW-Morse	8-50 Bd	18 dB (Eb/N0)

W-Classifier-NB Accuracy of Measured Parameters

FSK	baud rate center frequency	0.3 % 2 % of baud rate
PSK	baud rate center frequency	0.2 % 0.15 % of baud rate
CW-Morse	baud rate	5 %

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W-Classifier-WB Technical Data

Bandwidth HF/VHF/UHF/SHF	500 Hz to 96 kHz (complex: 160 kHz)
Sampling interval (Ts)	1.6 sec or 3.2 sec
FSK	30 Bd to 60 kBd, Shift ≤ 30 kHz Modulation index: m = 0.5-20 Signal must be continuously present during sampling interval
4-FSK (F7B)	30 to 300 Bd, Shift ≤ 3500 Hz
MFSK	4-36 tones
PSK 2/4 Variant A/B	30 Bd to 60 kBd
PSK 8/16 Variant A/B	30 Bd to 60 kBd
MIL/STANAG	Classified to protocol
CIS-12	120 Bd, classified as one signal
OFDM	25 - 512 carriers Tg/Tu = 1/1 to 1/8 ≥ 25 Bd
OQPSK	25 Bd to 30 kBd
CW-Morse	Ts = 1.6 s: 6 to 60 Bd Ts = 3.2 s: 3 to 60 Bd
Voice	AM, FM, USB, LSB
Operation	FFT display of classified signals Continuous and single-pass mode Classifier Code Check with look-up table

W-Classifier-WB Quality of Modulation Classification

FSK	m = 0.8: 100-2400 Bd m = 0.8: 50 Bd m ≥ 2: 100-2400 Bd m ≥ 2: 50 Bd	12 dB (Eb/N0) 15 dB (Eb/N0) 14 dB (Eb/N0) 16 dB (Eb/N0)
PSK 2/4 Variant A/B	100-2400 Bd	14 dB (Eb/N0)
PSK 8/16 Variant A/B	100-2400 Bd	16 dB (Eb/N0)
CW-Morse	8-50 Bd	18 dB (Eb/N0)

W-Classifier-WB Accuracy of Measured Parameters

FSK 100 - 60 kBd	baud rate center frequency	0.3 % 2 % of baud rate
PSK 100 - 60 kBd	baud rate center frequency	0.2 % 0.15 % of baud rate
CW-Morse 6 - 50 Bd	baud rate	5 %

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Classifier Code Check (CCC) with look-up table and XML-editor for all modulation variants

Process steps	P1	Only classification is performed, but no decoding
	P2	Classification and table check are performed, but no decoding
	P3	Classification, table check and code check are performed, but no decoding
	P4	Classification and table check are performed and finally the signal is decoded if a mode with an associated, valid detector was found
	P5	Classification, table check and code check are performed and finally the signal is decoded if a mode with an associated, valid detector was found
Scan Delay		When CCC gets the first result, the automatic scan will hold on until the entire result is delivered.

User Configurable Database

Database in XML format	Location	ITU Designator
Six mandatory fields	Baudrate	Remote Name
Rx Frequency (receiver frequency)	Modulation	Polarisation
Mode (decode or classifier running)	Frame Format	Satellite Name
Offset (middle cursor of the NB spectrum display)	Burst Specs	Satellite Position
Shift	Operator	Links to Templates
Remarks	Direction	Links to Files
Date & Time	Longitude	Links to Internet
23 optional fields	Latitude	**Three custom fields free editable**
Frequency 2	SNR	
Date & Time 2	Antenna	
Callsign	Elevation	

Recommended Configuration for Automatic Frequency Search and Typical Result

From ... to	4 MHz to 20 MHz (for HF band)
Step	1000 Hz
Interval	15 seconds
Search strategy	HF Classifier Code Check (Classify — Tablecheck — Codecheck)
Typical result	Round 250 automatically captured results (database entries) per day (24 hours)

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HF - Protocols

ALE-400	FEC-A	PSK-10
ALF-RDS	FELDHELL	PSK-125 (BPSK, QPSK) with FLARC
ALIS	FM-HELL	PSK-125F
ALIS-2	GMDSS/DSC-HF	PSK-220F
ARQ6-90	G-TOR	PSK-250 (BPSK, QPSK) with FLARC
ARQ6-98	GW-FSK	PSK-31 (BPSK, QPSK)
ARQ-E	GW-OFDM	PSK-31-FEC
ARQ-E3	GW-PSK	PSK-63 (BPSK, QPSK) with FLARC
ARQ-M2-242	HC-ARQ	PSK-63F
ARQ-M2-342	HF-ACARS (HF-DL)	PSK-AM
ARQ-M4-242	HNG-FEC	ROBUST-PACKET
ARQ-M4-342	ICAO-SELCAL (ANNEX 10)	RUM-FEC
ARQ-N	LINK-11 (CLEW)	SI-ARQ
ASCII	MD-674	SI-AUTO
AUM-13	MFSK-16	SI-FEC
AUTOSPEC	MFSK-20	SITOR-ARQ
BAUDOT	MFSK-8	SITOR-AUTO
BR-6028 (ITA-2 and ITA-5)	MIL-188-110-16TONE (-110A/B App. A)	SITOR-FEC
BULG-ASCII	MIL-188-110-39TONE (-110A/B App. B)	SP-14
CHN 4+4	MIL-188-110A Serial Tones, 75-4800 bps	SPREAD-11, 21, 51
CHU	MIL-188-110A-MOD	SSTV Automatic
CIS-11	MIL-188-110B (App. C) STANAG 4539	SSTV Martin 1, 2, 3, 4
CIS-12 (HEX output)	MIL-188-110B 3200-12800 bps	SSTV Robot 8s, 12s, 24s ,36s
CIS-14	MIL-188-141A (ALE)	SSTV SC-1 16, 32s
CIS-36	MIL-188-141B (BW0, BW1, BW4 data)	SSTV SC-1 8s, 16s, 32s
CIS-36-50	MIL-188-141B (BW2, BW3 ID)	SSTV Scottie 1, 2, 3, 4
CIS-50-50	MIL-M-55529 NB/WB	SSTV Wraase SC-1 24s - 96s
CLOVER-2 (ARQ, all CRCs)	OLIVIA	SSTV Wraase SC-2 20s - 180s
CLOVER-2000 (ARQ, all CRCs)	PACKET-300/600	STANAG 4285 75-3600 bps
CLOVER-2500 (ARQ, all CRCs)	PACTOR (all CRCs)	STANAG 4415 75 bps (NATO ROBUST)
CODAN-SELCAL	PACTOR-FEC (all CRCs)	STANAG 4481-FSK (KG-84)
CODAN-9001	PACTOR-II (all CRCs)	STANAG 4481-PSK
COQUELET-8	PACTOR-II-AUTO (all CRCs)	STANAG 4529 75-1800 bps
COQUELET-13	PACTOR-II-FEC (all CRCs)	STANAG 4539 3200-12800 bps
COQUELET-80	PACTOR-III (all CRCs)	STANAG 5065-FSK
CV-786	PICCOLO-MK12	SWED-ARQ
CW-MORSE	PICCOLO-MK6	THROB
DCS SELCAL	POL-ARQ	THROBX
DGPS	PRESS-FAX	TWINPLEX
DUP-ARQ		VISEL
DUP-ARQ-2		WEATHER-FAX
DUP-FEC-2		
EFR		

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VHF/UHF - Protocols

ACARS	DZVEI (Selcal analog)	NXDN (with live voice)
AIS	EEA (Selcal analog)	PACKET-1200
APCO-25 (P25)	EIA (Selcal analog)	PACKET-9600
ASCII	ERMES	PCCIR (Selcal analog)
ATIS (Selcal digital)	EURO (Selcal analog)	PDZVEI (Selcal analog)
BIIS	FLEX	POCSAG
CCIR-1 (Selcal analog)	FMS-BOS (Selcal digital)	PZVEI (Selcal analog)
CCIR-2 (Selcal analog)	GMDSS/DSC-VHF	SKYPER (POCSAG)
CCIR-7 (Selcal analog)	GOLAY/GSC	TETRA (with live voice)
CCITT (Selcal analog)	MOBITEX-1200 (with OVLS)	VDEW (Selcal analog)
CTCSS	MOBITEX-8000	VDL-M2
DCS-SELCAL	MODAT (Selcal analog)	X.25
DGPS	MPT-1327 (with ITA-5)	ZVEI-1 (Selcal analog)
DMR (with live voice)	NATEL (Selcal analog)	ZVEI-2 (Selcal analog)
dPMR (with live voice)	NMT-450	ZVEI-3 (Selcal analog)
DTMF (Selcal analog)	NWR-SAME	ZVEI-VDEW (Selcal digital)

SATELLITE - Protocols

AMSAT-P3-D	INMARSAT-B-TELEX-SM (forward)	INMARSAT-mM-DATA (forward)
INMARSAT-AERO-P, C, R and T	INMARSAT-C-EGC (Enhanced Group Call)	INMARSAT-mM-FAX (forward)
INMARSAT-B-C-TFC (return)	INMARSAT-C-TDM	INMARSAT-mM-TEL (forward)
INMARSAT-B-Data (forward)	INMARSAT-C-TDM-EGC	INMARSAT-mM-HSD (High Speed Data)
INMARSAT-B-FAX (forward)	INMARSAT-C-TDMA	INMARSAT-mM-C-HSD (C band High Speed Data)
INMARSAT-B-HSD (forward, high speed data)	INMARSAT-M-DATA (forward)	NOAA-GEO SAT
INMARSAT-B-TEL (forward, with live voice)	INMARSAT-M-FAX (forward)	ORBCOMM
INMARSAT-B-TELEX-MM (forward)	INMARSAT-M-TEL (forward, with live voice)	

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Since thirty years Wavecom Elektronik AG has developed, manufactured and distributed high quality devices and software for the decoding and retrieval of information from wireless data communication in all frequency bands. The nature of the data communication may be arbitrary, but commonly contains text, images and voice. The company is internationally established within this industry and maintains a longstanding, world-wide network of distributors and business partners.

Product Information

Products	http://www.wavecom.ch/product-summary.php
Datasheets	http://www.wavecom.ch/brochures.php
Specifications	http://www.wavecom.ch/product-specifications.php
Documentation	http://www.wavecom.ch/manuals.php
Online help	http://www.wavecom.ch/content/ext/decoder-online-help/default.htm
Software warranty	One year free releases and bug fixes, update by DVD
Hardware warranty	Two years hardware warranty
Prices	http://www.wavecom.ch/contact-us.php

System Requirements

	Minimum	Recommended
CPU	Core i5 2.8 GHz	Core i7 3.2 GHz
Memory	4 GB RAM	12 GB RAM
OS	Windows 7 32-bit or Windows 7 64-bit	Windows 7 32-bit or Windows 7 64-bit
Monitor resolution	1024 x 768	1280 x 1024

Distributors and Regional Contacts

You will find a list of distributors and regional contacts at http://www.wavecom.ch/distributors.php

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