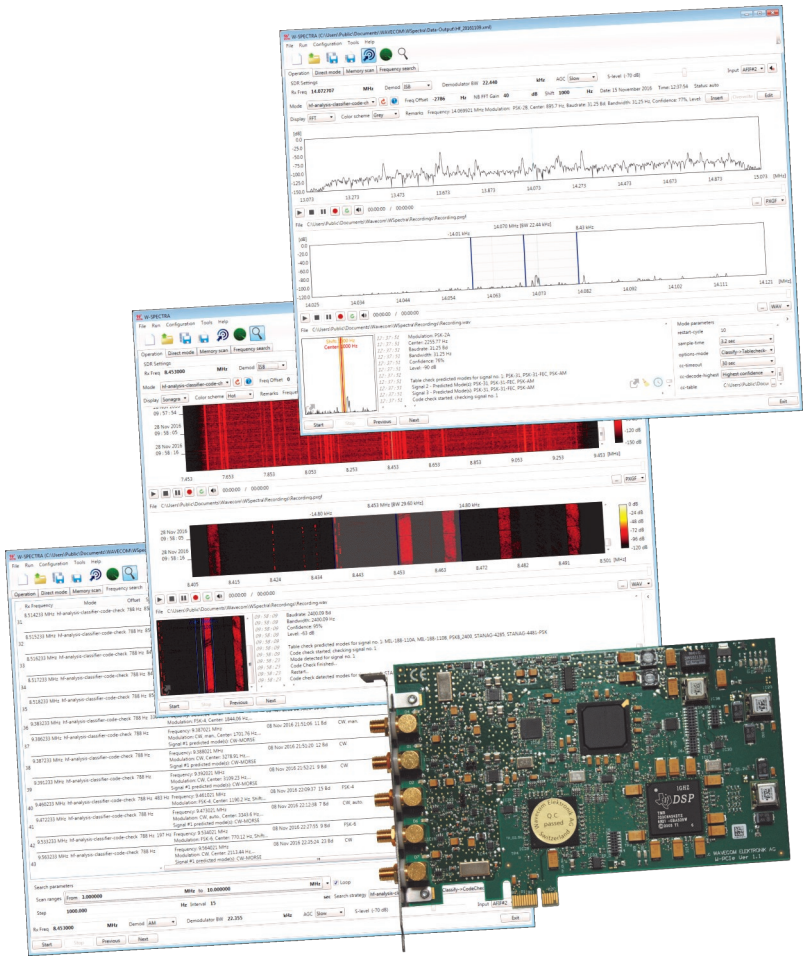
WAVECOM
NACHRICHTENTECHNIK

WAVECOM® W-SPECTRA

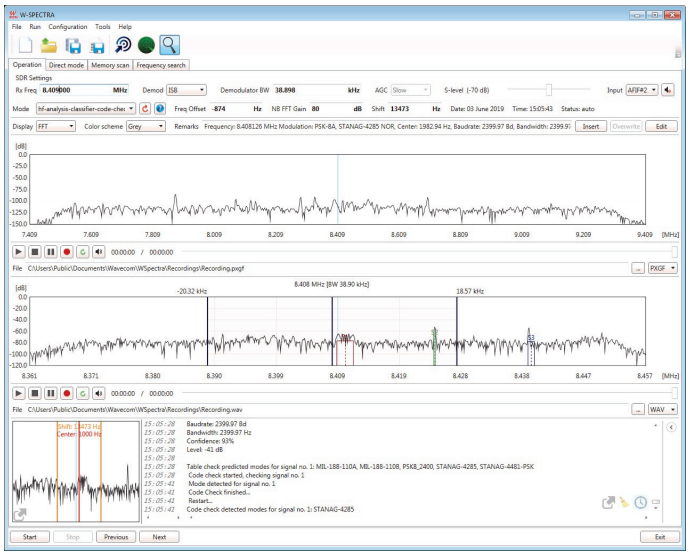


W-SPECTRA is a complete wideband automatic monitoring system running through the entire radio spectrum from ELF to SHF. It provides all monitoring functions such as direct control of the receiver, signal detection, classification, analysis and decoding, wideband IQ signal recording and capturing results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

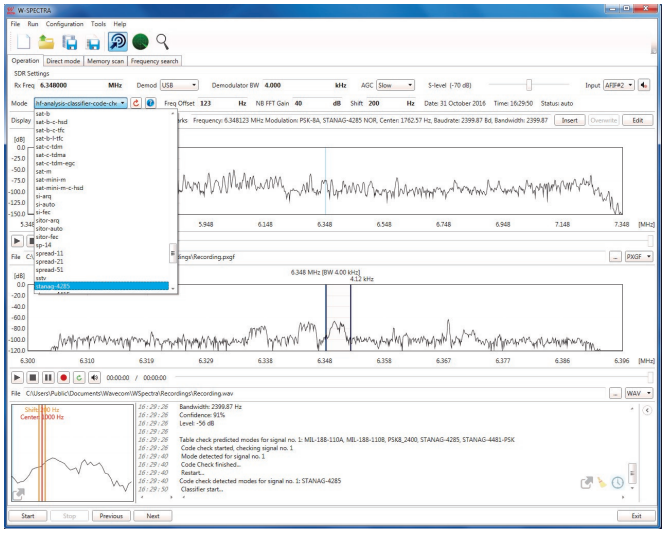
W-SPECTRA Main Features and Facts — I

W-SPECTRA provides:

- Comprehensive real-time radio spectrum monitoring functions.
- Intuitive graphical user interface: main operation tab covers all online monitoring activities.
- Built-in bi-directional control of receivers (W-PCIe receiver and 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 (text, live voice and image etc.) of signals.
- Automatic search, signal detection, classification and code check of signals over a user-defined frequency range and search strategy.
- Automatic or manual capturing of results into a database.
- Signal detection, 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

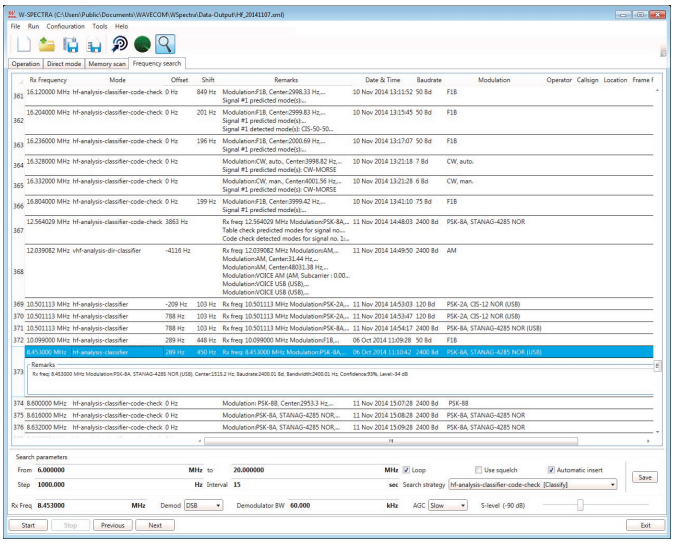


Run more than 220 decoders manually or automatically

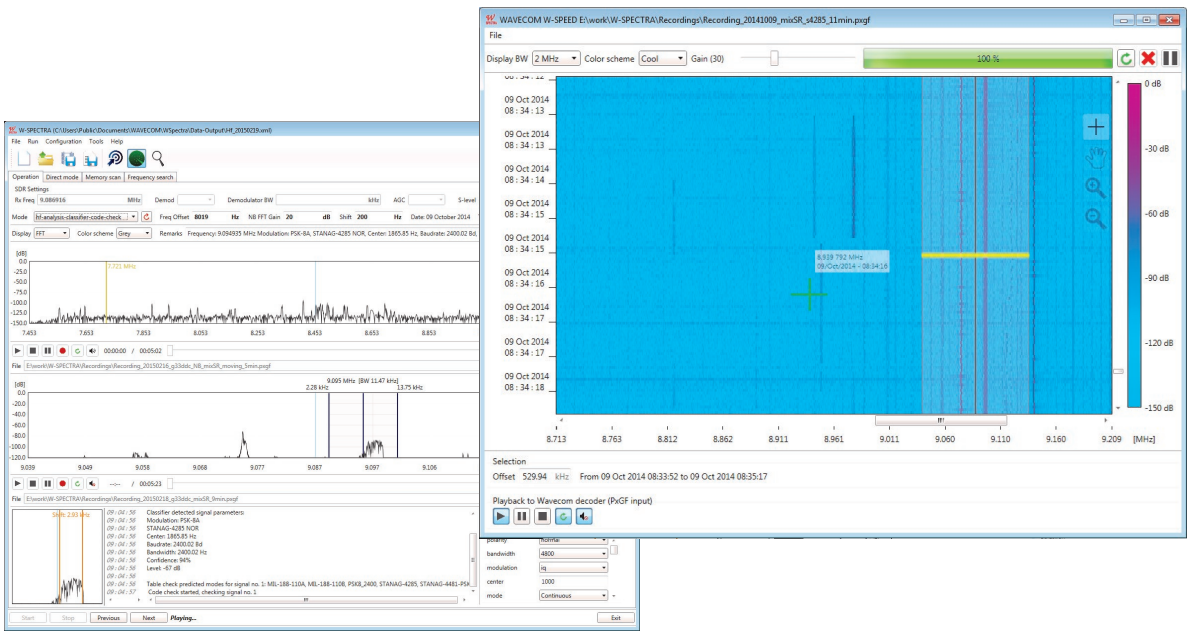
W-SPECTRA Main Features and Facts — II

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

Typical Configuration

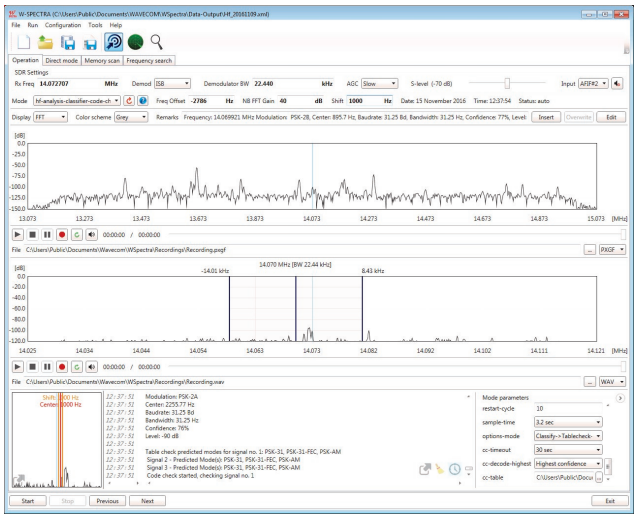
W-SPECTRA connects to Wavecom native W-PCIe receiver or a third-party Software Defined Radio (SDR) and takes over its full control.

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

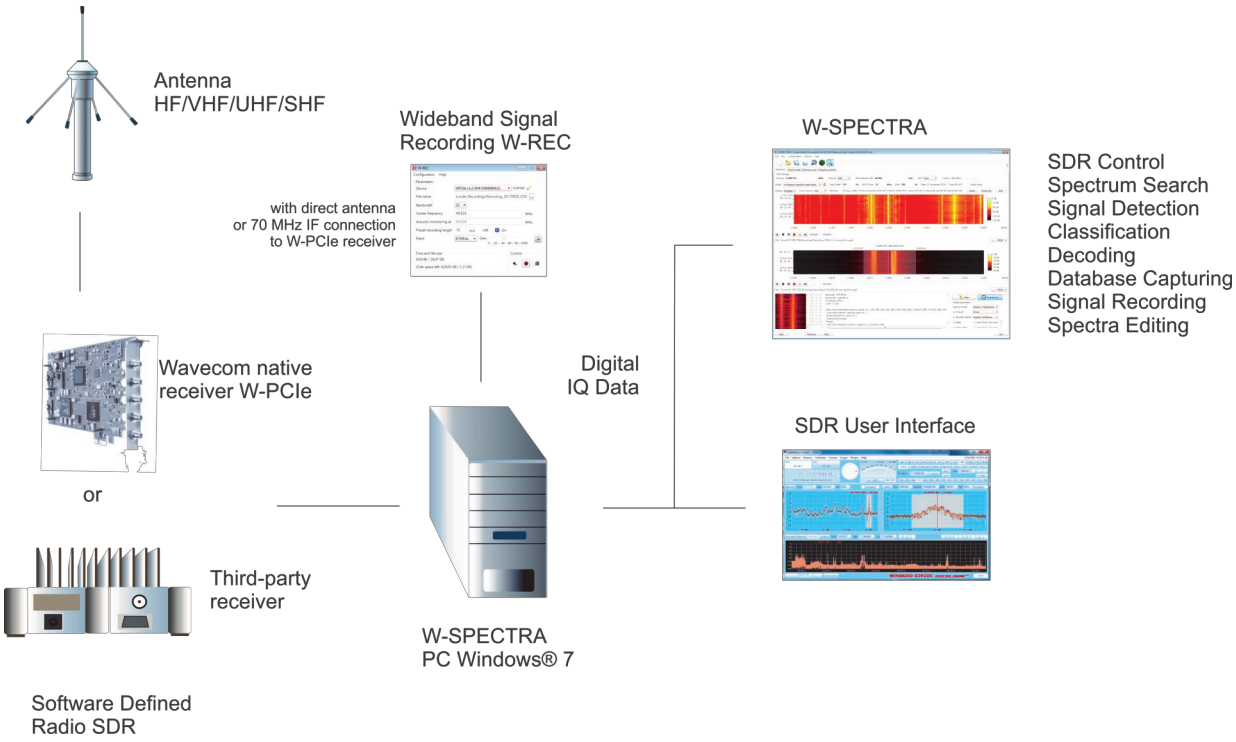
The "Operation" tab in the W-SPECTRA GUI contains *four* parts. All the monitoring activities are covered in this tab.

- 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*.



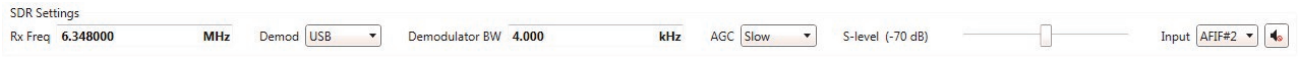
W-SPECTRA Operation GUI contains four parts



Example setup of a monitoring system with W-SPECTRA

Direct (Built-in) Receiver Control

At start-up W-SPECTRA connects to the Wavecom native W-PCIe receiver and a third-party receiver (e.g., WiNRADiO G3xDDC) and assumes full control.
The connection is bi-directional. Users may set the receiver frequency, demodulator, demodulator bandwidth, AGC, squelch level and antenna input directly in the W-SPECTRA GUI. This will then reflect to the SDR GUI and vice-versa.
With the speaker button the user can output the demodulated signal to the speaker for acoustic monitoring purpose.
The Demodulator BW determines the bandwidth of the narrowband spectrum display.



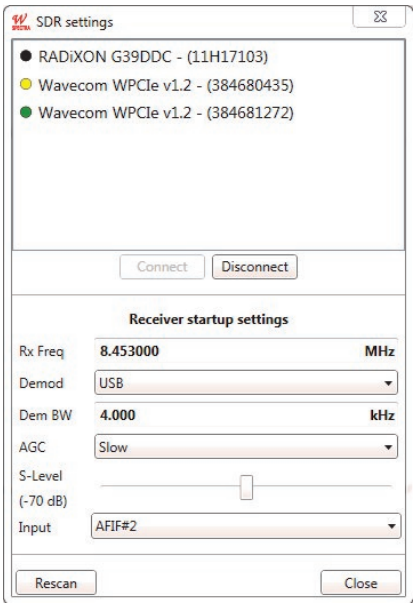
Bi-directional receiver (SDR) control

With the "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)

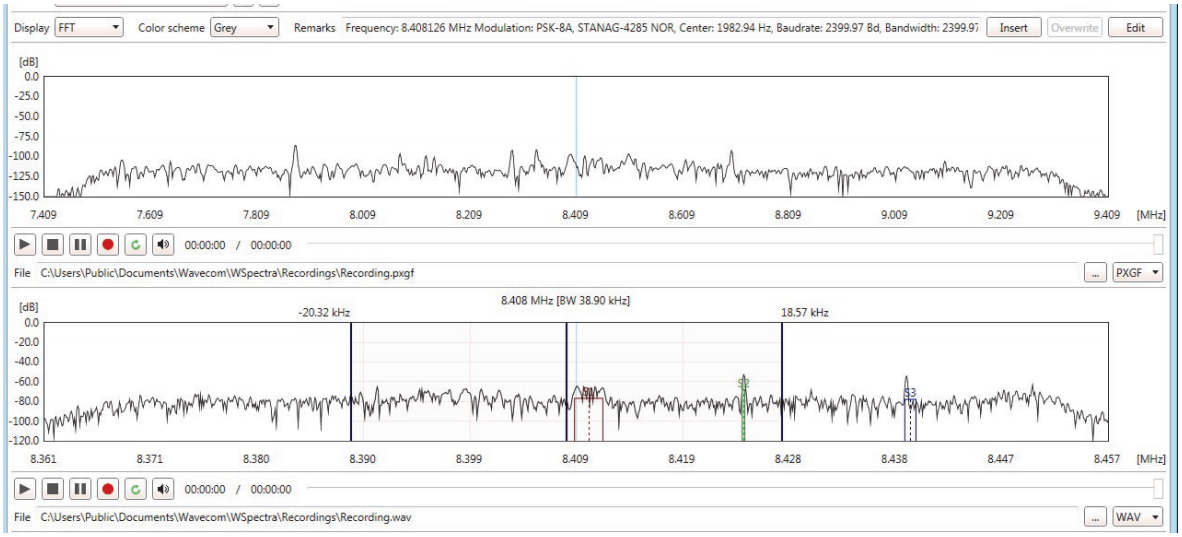


SDR settings GUI

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 receiver.
- 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 receiver. Its bandwidth can be 24, 48 or 96 kHz and is coupled with the SDR demodulator BW.
- The narrowband spectrum display contains a Spectrum Analysis (W-SA) function, which will detect and mark all signals in this band.
- A narrowband recording of the DDC2 IQ signal (96 kHz) in PXGF or .wav format.
- Playback of a recording in both Media Players. The signal is classified or decoded in W-SPECTRA.
- The wideband display enables the selection of any 96 kHz band from a WB recording for classification and decoding.
- Playback is running 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.



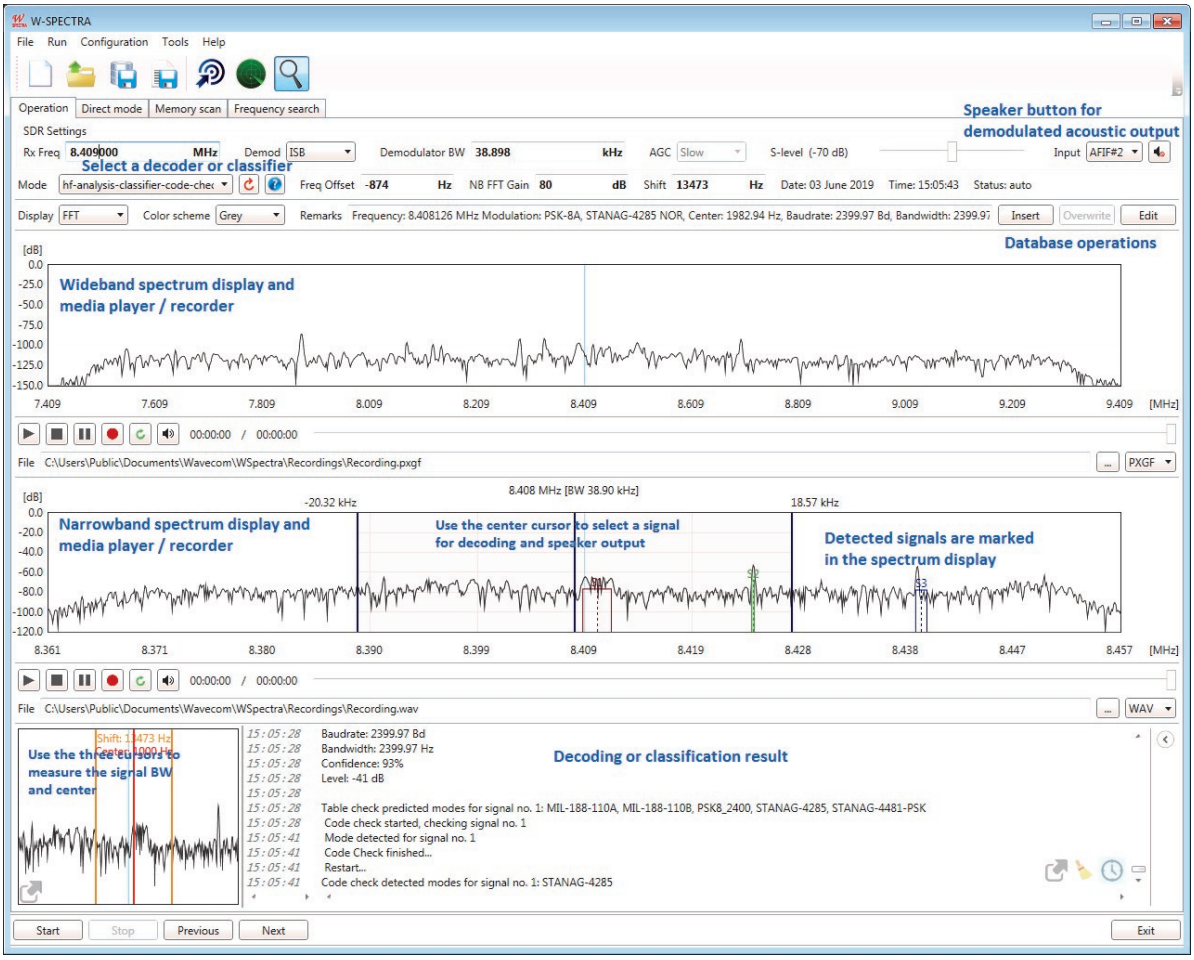
Wideband (2 MHz) and narrowband (96 kHz) spectrum and media player/recorder. Spectrum Analysis (W-SA) detects and marks all signals in the narrowband spectrum and display the signal details in the text output window below.

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.

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)

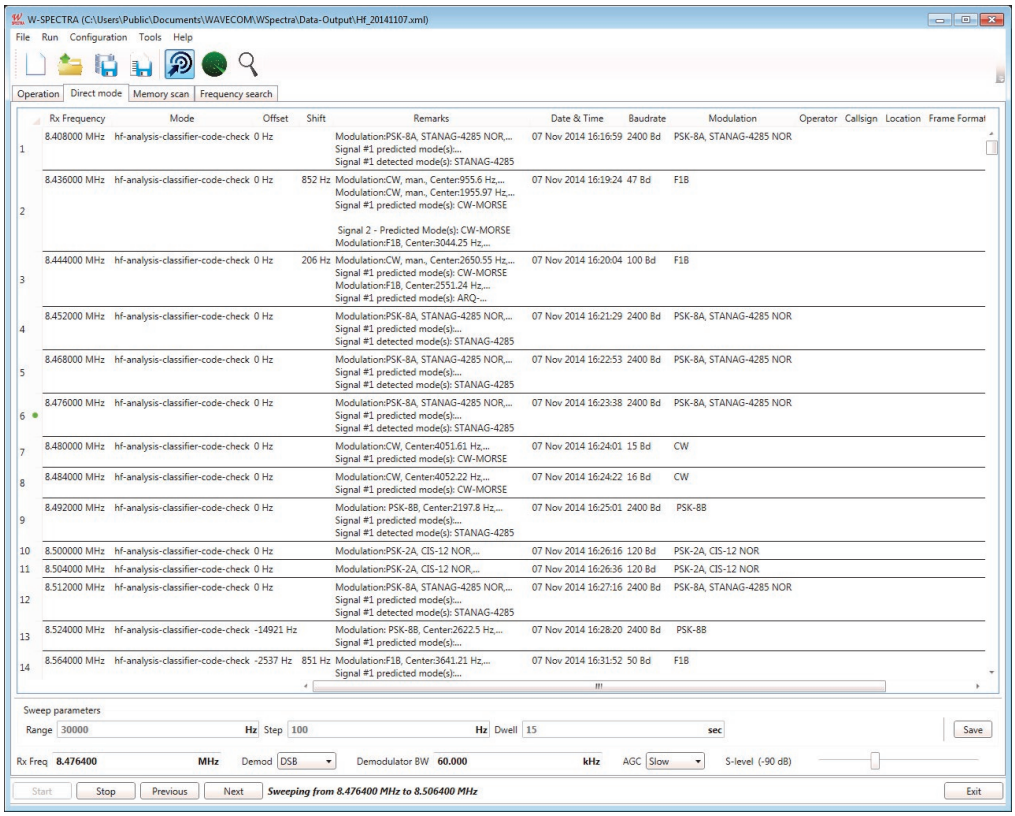
Direct Mode: First Things First to Begin Spectrum Monitoring

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.

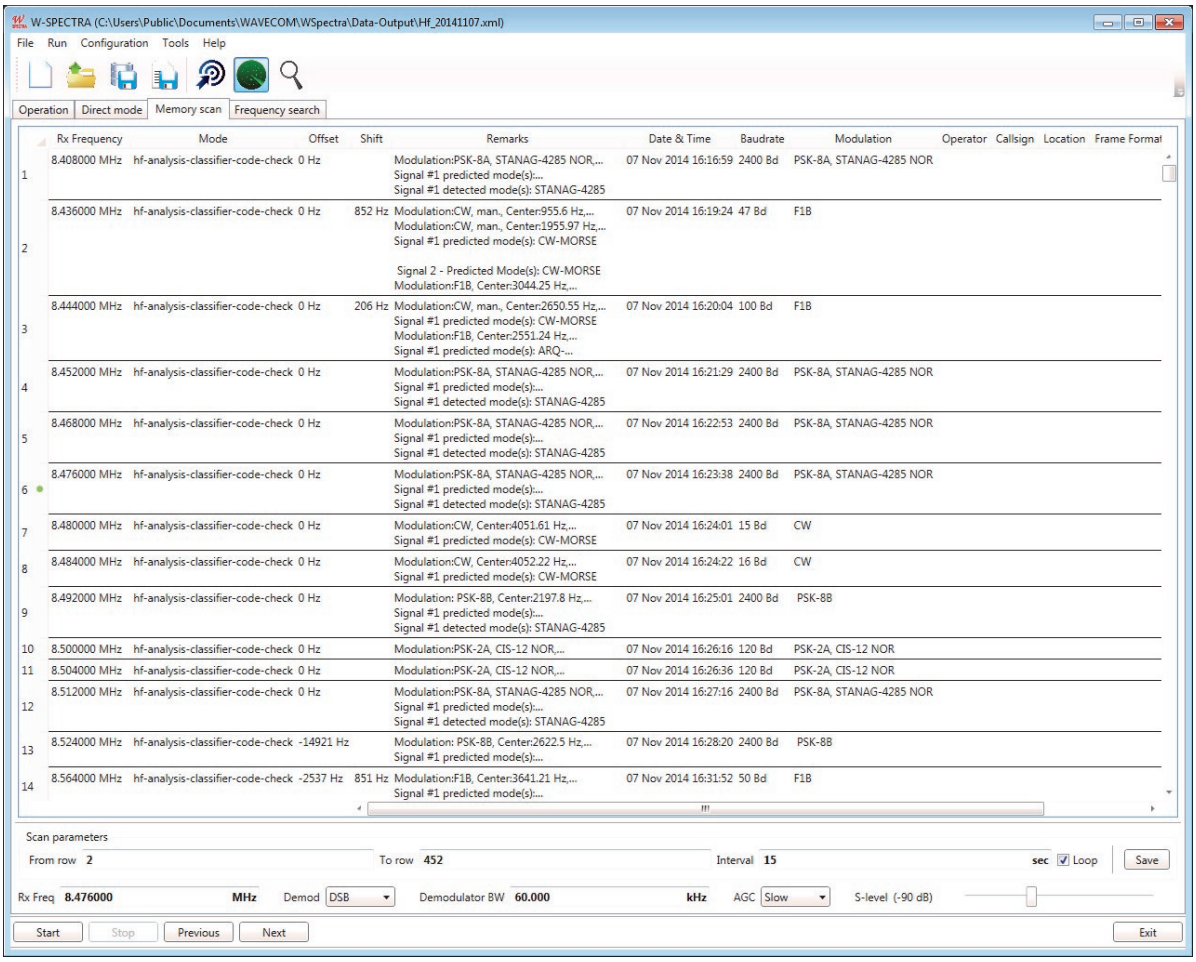


Direct Mode tab with database and sweep parameters setting

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.



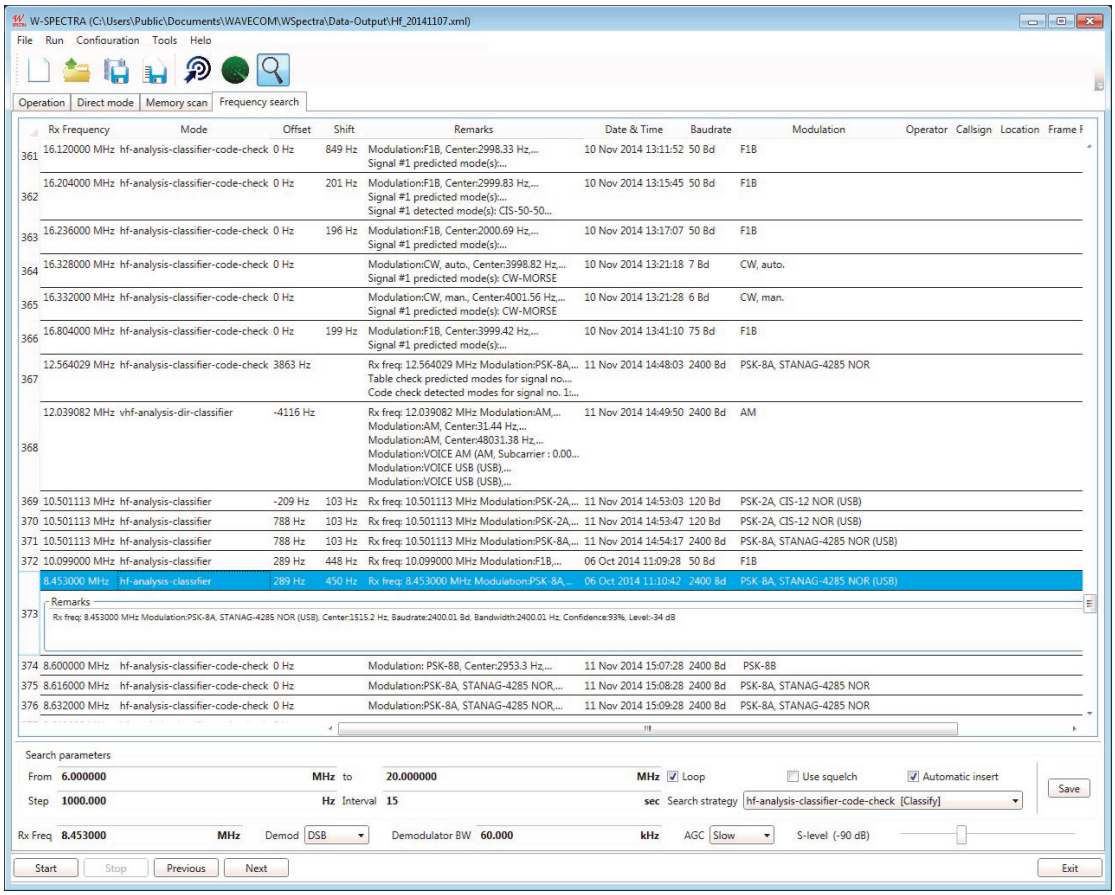
Memory Scan mode with a database and scan parameters setting

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.

Scan Delay in Automatic Modes

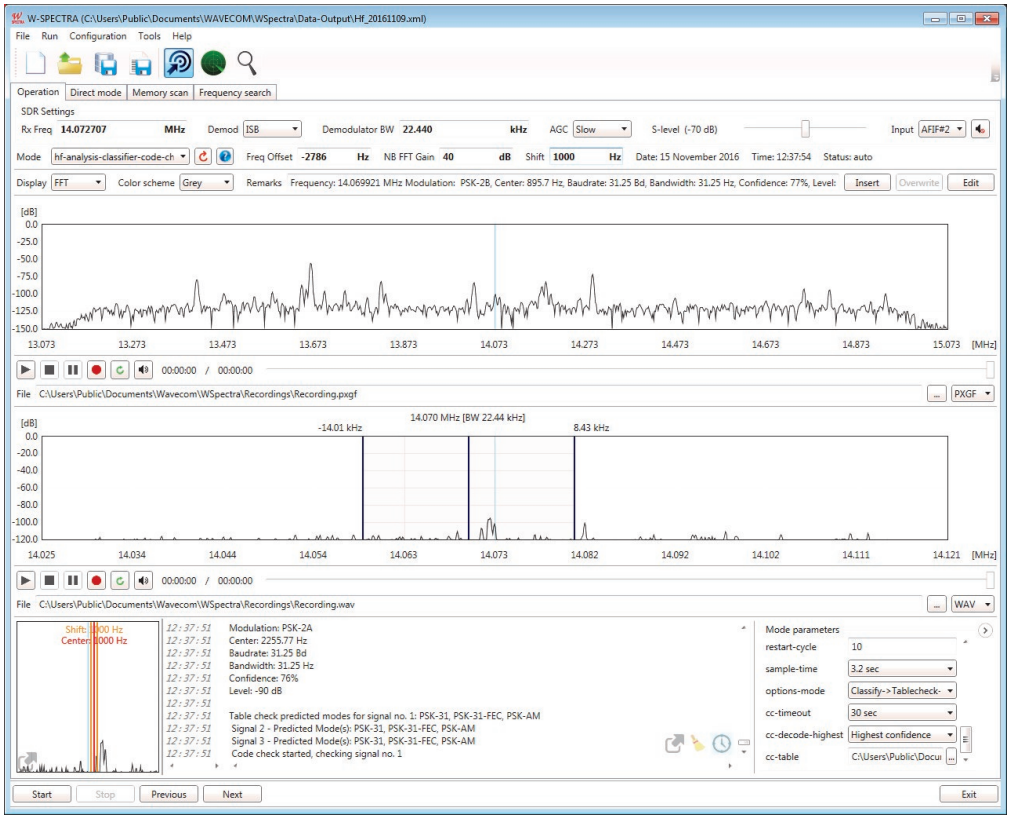
W-SPECTRA adopts a “scan delay” method when running in an automatic mode. When the classifier and code check find a signal at a frequency, the automatic jump to the next frequency / memory entry is hold on until the complete classifier code check result is delivered. In this way W-SPECTRA delivers more precise, stable and reliable monitoring results. This method applies to all three operation modes: Direct Mode, Memory Scan and Frequency Search.

Automatic Signal Detection, Classification and Decoding

Powerful spectrum analysis and classification unit — The brain of W-SPECTRA

The automation of the signal detection and classification process relieves the operator from manual evaluation, which otherwise requires considerable skill and experience.
W-Spectrum Analysis (W-SA) W-Classifier (W-CL) detects and measures the following signal parameters automatically:

- Modulation type
- Baud rate or symbol rate, up to 60 kBd
- Signal center frequency
- Number of carriers



Multiple signal classification and code check

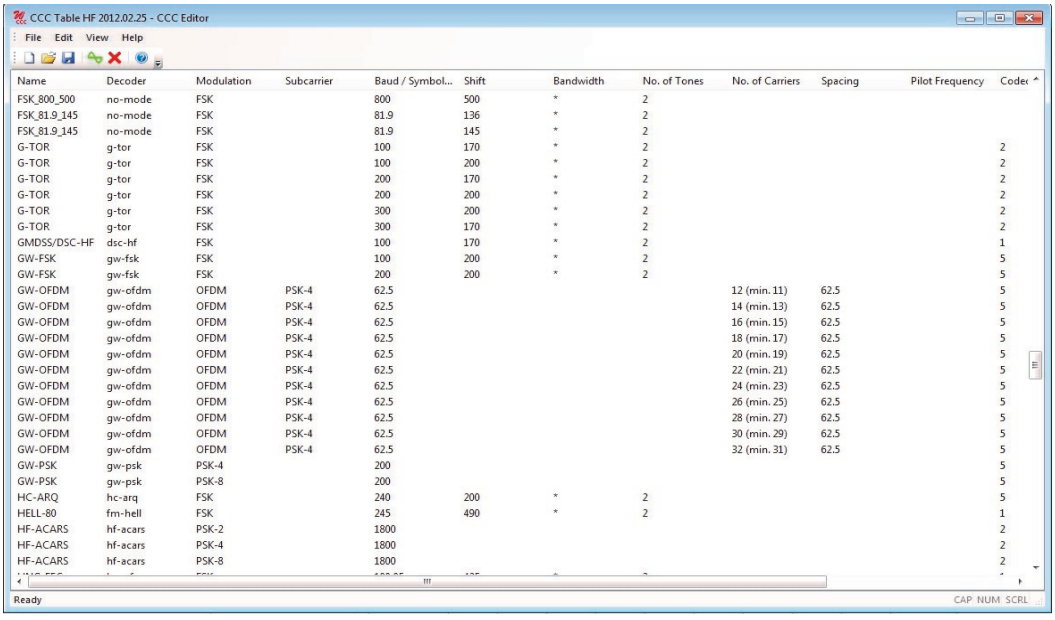
Automatic Signal Detection, Classification and Decoding

- Frequency shift or signal bandwidth
- Carrier spacing or distance
- CW-Morse detection
- Voice detection AM, FM, USB and LSB

All signals within the analysis bandwidth (up to 96 kHz) are detected and analyzed in one shot — multiple signal classification.

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	Code
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

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 8 mandatory fields:

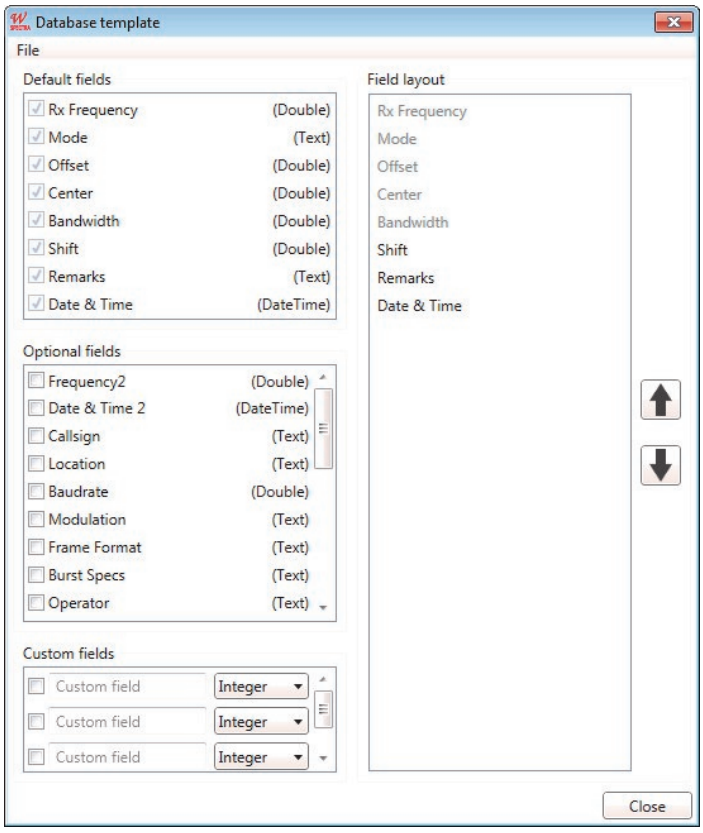
- Rx Frequency
- Mode: decoder, classifier or code check running in W-SPECTRA
- Offset: offset of the middle cursor in the NB spectrum display, used to place a signal in the bandwidth
- Center: center of a signal, relative to the center of the narrowband spectrum display
- Bandwidth: bandwidth of a signal
- Shift: shift of a signal, equals to bandwidth in most case
- 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.



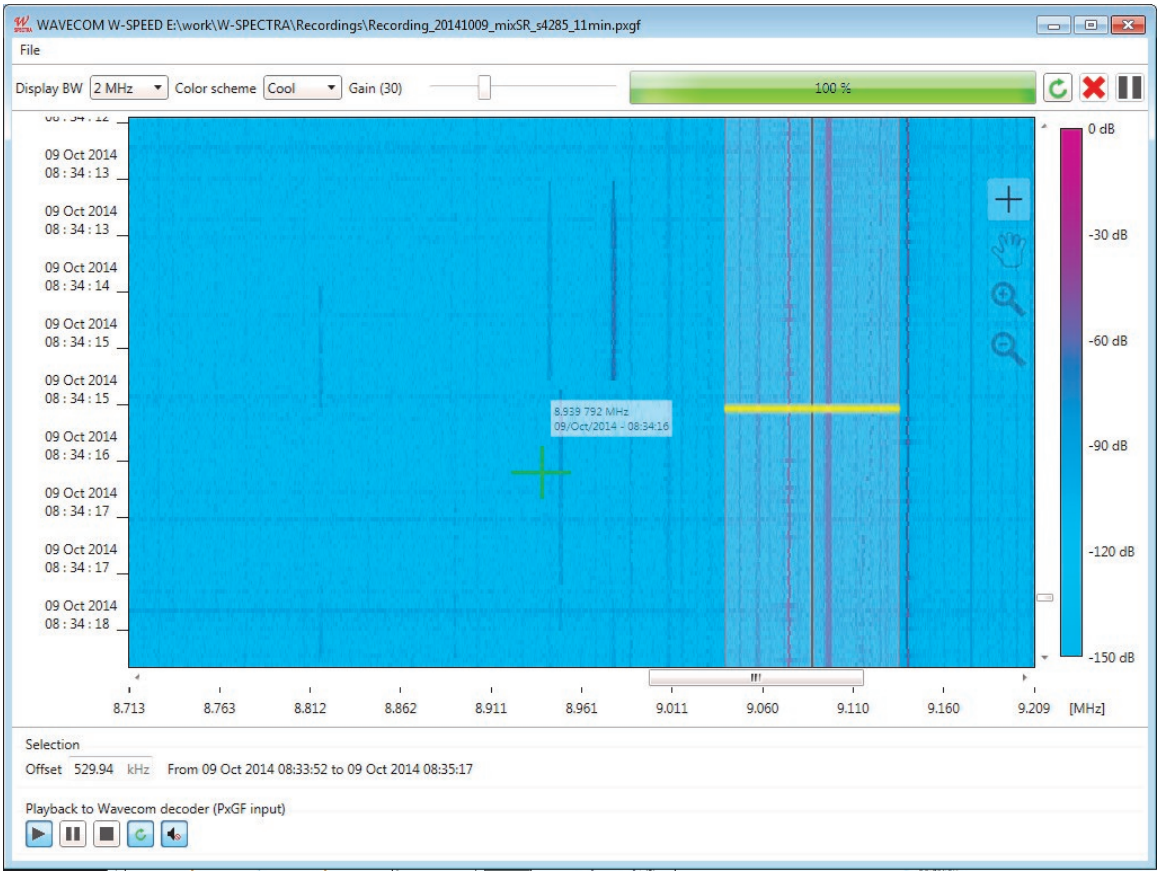
Customize a database template

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 30 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).

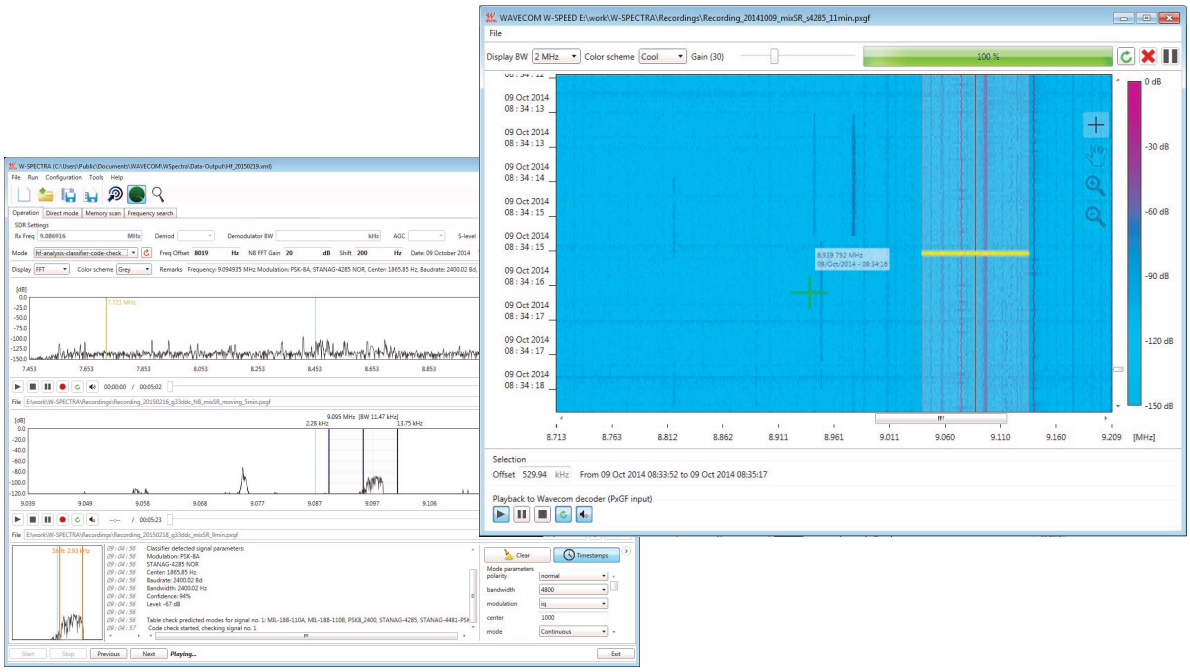


Display a recording in the Spectra Editing Tool (W-SPEED). The X and Y-axis are labeled with the absolute Rx frequency and the recording timestamp, respectively. Spot display, zoom-in function and free navigation of the entire sonagram

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

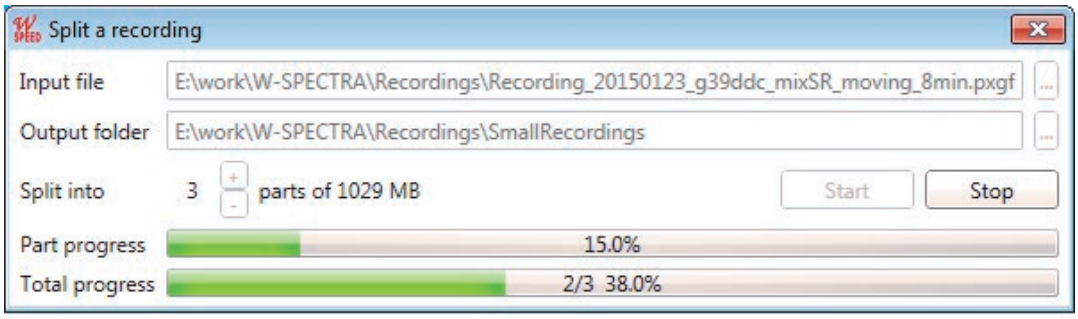
Recording Splitter Tool

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:

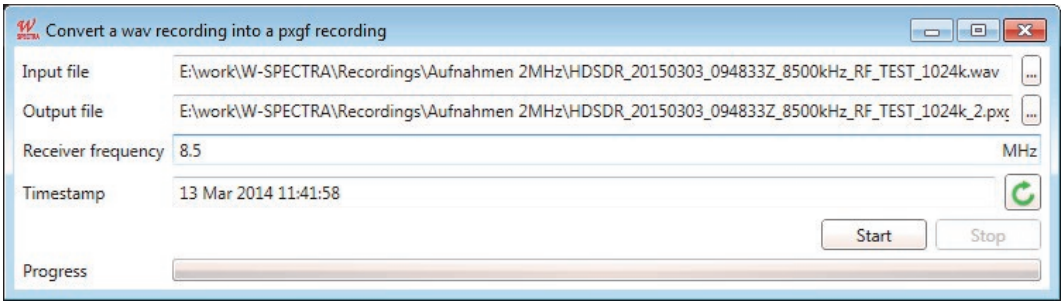
- A recording bigger than 10 GB can be split into max. 10 equal size files;
- A recording between 9 GB and 10 GB can be split into max. 9 equal size files;
- The minimum size of a recording which can be split is 2 GB. It can be split into max. 2 files.



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

Technical Data and Overall Software Characteristics

Receiver Control

Support Wavecom W-PCIe receiver and 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 Wavecom decoders (see modes list on pages 21 and 22).

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 ♦ 66 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, 24 MHz or 30 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

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 %

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

Process steps	P0	Spectrum analysis is running, no detail classification
	P1	Signal 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	Date & Time 2	Antenna
Eight mandatory fields	Callsign	Elevation
Rx Frequency (receiver frequency)	Location	ITU Designator
Mode (decode or classifier running)	Baudrate	Remote Name
Offset (middle cursor of the NB spectrum display)	Modulation	Polarisation
Center	Frame Format	Satellite Name
Bandwidth	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	

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)

HF - Protocols

- ALE-400
- ALF-RDS
- ALIS
- ALIS-2
- ARQ6-90
- ARQ6-98
- ARQ-E
- ARQ-E3
- ARQ-M2-242
- ARQ-M2-342
- ARQ-M4-242
- ARQ-M4-342
- ARQ-N
- ASCII
- AUM-13
- AUTOSPEC
- BAUDOT
- BR-6028 (ITA-2 and ITA-5)
- BULG-ASCII
- CHN 4+4
- CHU
- CIS-11
- CIS-12 (HEX output)
- CIS-14
- CIS-36
- CIS-36-50
- CIS-50-50
- CLOVER-2 (ARQ, all CRCs)
- CLOVER-2000 (ARQ, all CRCs)
- CLOVER-2500 (ARQ, all CRCs)
- CODAN-CHIRP
- CODAN-SELCAL
- CODAN-3212
- CODAN-9001
- COQUELET-8
- COQUELET-13
- COQUELET-80
- CV-786
- CW-MORSE
- DCS SELCAL
- DGPS
- DUP-ARQ
- DUP-ARQ-2
- DUP-FEC-2
- EFR
- FEC-A
- FELDHELL
- FM-HELL
- FT8
- GMDSS/DSC-HF
- G-TOR
- GW-FSK
- GW-OFDM
- GW-PSK
- HC-ARQ
- HF-ACARS (HF-DL)
- HNG-FEC
- ICAO-SELCAL (ANNEX 10)
- LINK-11 (CLEW)
- MD-674
- MFSK-16
- MFSK-20
- MFSK-8
- MIL-188-110-16TONE (-110A/B App. A)
- MIL-188-110-39TONE (-110A/B App. B)
- MIL-188-110A Serial Tones, 75-4800 bps
- MIL-188-110A-MOD
- MIL-188-110B (App. C) STANAG 4539
- MIL-188-110B 3200-12800 bps
- MIL-188-141A (ALE)
- MIL-188-141B (BW0, BW1, BW4 data)
- MIL-188-141B (BW2, BW3 ID)
- MIL-M-55529 NB/WB
- OLIVIA
- PACKET-300/600
- PACTOR (all CRCs)
- PACTOR-4
- PACTOR-FEC (all CRCs)
- PACTOR-II (all CRCs)
- PACTOR-II-AUTO (all CRCs)
- PACTOR-II-FEC (all CRCs)
- PACTOR-III (all CRCs)
- PICCOLO-MK12
- PICCOLO-MK6
- POL-ARQ
- PRESS-FAX
- PSK-10
- PSK-125 (BPSK, QPSK) with FLARC
- PSK-125F
- PSK-220F
- PSK-250 (BPSK, QPSK) with FLARC
- PSK-31 (BPSK, QPSK)
- PSK-31-FEC
- PSK-63 (BPSK, QPSK) with FLARC
- PSK-63F
- PSK-AM
- ROBUST-PACKET
- RUM-FEC
- SI-ARQ
- SI-AUTO
- SI-FEC
- SITOR-ARQ
- SITOR-AUTO
- SITOR-FEC
- SP-14
- SPREAD-11, 21, 51
- SSTV Automatic
- SSTV Martin 1, 2, 3, 4
- SSTV Robot 8s, 12s, 24s, 36s
- SSTV SC-1 16, 32s
- SSTV SC-1 8s, 16s, 32s
- SSTV Scottie 1, 2, 3, 4
- SSTV Wraase SC-1 24s - 96s
- SSTV Wraase SC-2 20s - 180s
- STANAG 4285 75-3600 bps
- STANAG 4415 75 bps (NATO ROBUST)
- STANAG 4481-FSK (KG-84)
- STANAG 4481-PSK
- STANAG 4529 75-1800 bps
- STANAG 4539 3200-12800 bps
- STANAG 5065-FSK
- SWED-ARQ
- THROB
- THROBX
- TWINPLEX
- VISEL
- WEATHER-FAX

VHF/UHF - Protocols

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

SATELLITE - Protocols

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

W-PCIe Receiver Card Specifications and Technical Data

Inputs	AFIF#1 and AFIF#2	IF70#1a, IF70#1b and IF70#2
Connector	SMA female	SMA female
Frequency range	50 Hz to 25 MHz	52.5 MHz to 87.5 MHz (SAW filter)
Bandwidth	5 kHz to 500 kHz	5 kHz to 500 kHz
Frequency raster DDC	1.0 Hz	1.0 Hz
Signal level	2 mVrms to 0.5 Vrms 20 mVrms to 2.5 Vrms with 20 dB attenuator (jumpered)	20 mVrms to 2.5 Vrms
Input impedance	> 1 kOhm	50 Ohm
Input max sampling rate	92.16 MHz	92.16 MHz
Input sampling rate jitter	1 ps (RMS 12 kHz to 20 MHz)	1 ps (RMS 12 kHz to 20 MHz)

Card type	Half-size PCIe card (PCI Express)
Number of concurrent, independent inputs	2 AFIF#1 or IF70#1a or IF70#1b -with- AFIF#2 or IF70#2
Dimensions (L x W x H)	168 x 106 x 22 mm
Weight	0.15 kg
Power requirement (typical values)	+3.3V max. 1.0 A +12V max. 0.5 A
Bus interface	PCIe x1 Link 2 Gbit/s
Operating temperature range	0 °C to 50 °C
Case temperature range	0 °C to 55 °C
Storage temperature range	0 °C to 70 °C
Relative humidity	10 to 90 % (non-condensing)
A/D converter	AD9268 dual 16 bit ADC
Dynamic range	> 60 dB
Digital down converter DDC	FPGA Cyclone IV 55K
DSP	TI DSP320C6454
Watchdog for on-board generated voltages	Yes
Conformity	CE ISO 9001 ISO 14001 RoHS

W-SPECTRA

Complete Automatic Spectrum Monitoring System

WAVECOM NACHRICHTENTECHNIK

Since more than 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/MonitoringSystemOnlineHelp/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 and Ordering Information

	Minimum	*Recommended*
CPU	Core i7 2.8 GHz	Core i7 3.2 GHz
Memory	8 GB RAM	12 GB RAM
OS	Windows 7 32-bit or Windows 7 64-bit	Windows 7 32-bit or Windows 7 64-bit

Product Code	Description
WSPECSYS	Complete automatic spectrum monitoring system, including a native Wavecom W-PCIe receiver.
WSPECTRA	Complete automatic spectrum monitoring system. Wavecom receiving device (W-PCIe) not included.
WSA	Spectrum analysis tool (96 kHz bandwidth). Option to W-SPECTRA.
WCLWB	Wideband signal classifier (96 kHz bandwidth). Option to W-SPECTRA.

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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