

# WAVECOM<sup>®</sup> 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.



Complete Automatic Spectrum Monitoring System



### 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

Complete Automatic Spectrum Monitoring System



### 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

pera	ation Direct mode Memory scan Frequence	y search						
	Rx Frequency Mode	Offset	Shift	Remarks	Date & Time	Bauchate	Modulation	Operator Callsign Location Fram
161	16.120000 MHz hf-analysis-classifier-code-chec	sk 0 Hz	849 Hz	Modulation#18, Center:2998.33 Hz, Signal #1 predicted mode(s)	10 Nov 2014 13:11:52	50 Bd	F1B	
62	16.204000 MHz hf-analysis-classifier-code-cher	dk 0 Hz	201 Hz	Modulation #18, Center 2999.83 Hz, Signal #1 predicted mode(s) Signal #1 detected mode(s): CIS-50-50	10 Nov 2014 13:15:45	50 Bd	F18	
63	16.236000 MHz hf-analysis-classifier-code-chec	ck 0 Hz	196 Hz	Modulation#18, Center:2000.69 Hz Signal #1 predicted mode(s)	10 Nov 2014 13:17:07	50 Bd	F1B	
64	16.328000 MHz hf-analysis-classifier-code-chec	ck 0 Hz		Modulation/CW, auto., Center:3998.82 Hz, Signal #1 predicted mode(s): CW-MORSE	10 Nov 2014 13:21:18	7 8d	CW, auto.	
65	16.332000 MHz hf-analysis-classifier-code-chec	ck 0 Hz		Modulation/CW, man, Center/4001.56 Hz, Signal #1 predicted mode(s): CW-MORSE	10 Nov 2014 13:21:28	6 8d	CW, man.	
66	16.804000 MHz hf-analysis-classifier-code-chec	sk 0 Hz	199 Hz	Modulation F1B, Center 3999.42 Hz, Signal #1 predicted mode(s):	10 Nov 2014 13:41:10	75 Bd	F18	
57	12.564029 MHz hf-analysis-classifier-code-chec	ck 3863 Hz		Rx freep 12.564029 MHz Modulation/PSK-8A, Table check predicted modes for signal no Code check detected modes for signal no. 1	11 Nov 2014 14:48:03	2400 Bd	PSK-8A, STANAG-4285 NOR	
58	12.039082 MHz vhf-analysis-dir-classifier	-4116 Hz		Rx free; 12.039082 MHz Modulation:AM, Modulations/M, Center-30.44 Hz, Modulations/M, Center-80.013.84 Hz, Modulation/VOICE AM (AM Subcarrier : 0.00 Modulation/VOICE USB (USB),	11 Nov 2014 14:49:50	2400 8d	AM	
59	10.501113 MHz hf-analysis-classifier	-209 Hz	103 Hz	Rx freq: 10.501113 MHz Modulation/PSK-2A,	11 Nov 2014 14:53:03	120 Bd	P5K-2A, CIS-12 NOR (U58)	
10	10.501113 MHz hf-analysis-classifier	788 Hz	103 Hz	Rx freq: 10.501113 MHz Modulation/PSK-2A,	11 Nov 2014 14:53:47	120 Bd	P5K-2A, CIS-12 NOR (U58)	
1	10.501113 MHz hf-analysis-classifier	788 Hz	103 Hz	Rx freq: 10.501113 MHz Modulation/PSK-8A,	11 Nov 2014 14:54:17	2400 8d	PSK-8A, STANAG-4285 NOR (USB)	
72 :	10.099000 MHz hf-analysis-classifier	289 Hz	448 Hz	Rx freq: 10.099000 MHz Modulation/F18,	06 Oct 2014 11:09:28	50 8d	F18	
	8453000 MHz ht-analysis-classifier	289 Hz	450 Hz	Rx freq: 8.453000 MHz Modulation PSK-8A	06 Oct 2014 11:10:42	2400 8d	PSK-8A, STANAG-4285 NOR (USB)	
73	- Remarks Ro tree: 8453000 MHz Modulation:PSC-84, STANAG-4	ass NOR (USS	Center151	52 Hz, Baudrater,2400.00 Bd, Bandwiddh;2400.01 Hz, Corr	fdence:93%, Level-34 cB			
14 1	8.600000 MHz hf-analysis-classifier-code-ches	ck 0 Hz		Modulation: PSK-88. Center:2953.3 Hz	11 Nov 2014 15:07:28	2400 8d	P5K-88	
75 1	8.616000 MHz hf-analysis-classifier-code-chec	ck 0 Hz		Modulation/PSK-8A, STANAG-4285 NOR	11 Nov 2014 15:08:28	2400 8d	PSK-8A, STANAG-4285 NOR	
16	8.632000 MHz hf-analysis-classifier-code-chec	ok 0 Hz		Modulation/PSK-8A, STANAG-4285 NOR	11 Nov 2014 15:09:28	2400 8d	PSK-8A, STANAG-4285 NOR	
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	rch parameters							
Front	m 6.000000		dHz to	20.000100	MHz 📝	000	Use squeich	Automatic insert
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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

Complete Automatic Spectrum Monitoring System



### **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



### **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.

SDR Sett	tings					
Rx Freq	8.453000 MHz	Demod DSB 🔻	Demodulator BW 60.000	kHz	AGC Slow S-level (-90 dB)	
Mode [	hf-analysis-classifier-code-check 🔹	Freq Offset 5276	Hz NB FFT Gain 20	dB Shift 200	Hz Date: 20 February 2015 Time: 08:55:19	Status: auto
Display [	FFT   Color scheme Grey	Remarks Frequency: 8.4	458276 MHz Modulation: PSK-8A, S	TANAG-4285 NOR, Center:	1728.34 Hz, Baudrate: 2400.05 Bd, Bandwidth: 240	0.05 I Insert Overwrite Edit

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)

	1
Connect Discor	nnect
Receiver startup set	tings
8.453000	MH
60.001	kHa
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	Connect Discor Receiver startup set 8.453000 60.001 DSB Slow

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 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.



# 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 (C\Users\Public\Documents\WAVECOM\WSpectra\Data-Output\Hf_20141107.xml)	
File Run Configuration Tools Help	
Operation Direct mode Memory scan Frequency search	
SDR Settings	
Rx Freq 8.453000 MHz Demod DS8   Demodulator BW 60.000 kHz AGC Slow   S-level (-90 d8)	
Mode hf-analysis-classifier-code-check C Freq Offset 0 Hz NB FFT Gain 20 dB Shift 200 Hz Date: 20 February 2015 Time: 10:14:20	0 Status: auto
Display FFT Color scheme Grey Remarks Frequency: 8,453000 MHz Modulation: PSK-8A, STANAG-4285 NOR, Center: 1801.36 Hz, Baudrate: 2399.92 Bd, Bandwidth: 2:	399.921 Insert Overwrite Edit
(48)	database operations
USU Wideband spectrum display	
-sol and media player/recorder	
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1500	how how have have have have have have have have
7.453 7.653 7.853 8.053 8.253 8.453 8.653 8.853 9.053	9.253 9.453 [MHz]
File El.work/W-SPECTRAI:Recordings/Recording_20150216_g33ddc_NB_mixSR_moving_5min.pxgf	PXGF 🔻
[dB] 8.453 MHz [BW 18.37 kHz]	
Narrowhand spectrum display	
And media player/recorder Move the md-cursor to place a signal	
-000 and media prayer recorder	
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8405 8.415 8.424 8.434 8.443 8.453 8.463 8.472 8.482	8.491 8.501 [MHz]
File Elwork/W-SPECTRA/Recording_20150218_g33ddc_mixSR_9min.pxgf	PXGF 🔻
Shift: 357 Hz 20124104 bautrate: 239392 b0 10:14:04 Bandwidth: 2399392 Hz Classification or decoding result	Clear Timestamps
use the two curspire's to: 04 Confidence 8% Chastine attent of a Coording result. Mode part	ameters
measure the signal by y our polarity polarity	normal •
M M 10:14:05 Code check started, checking signal no. 1	4800 -
10:14:18 Mode detected for signal no. 1 10:14:18 Code Check foriest	n iq 🔻
10.13/10 Code Creation Institution Control Con	1000
10:14:18 Code check detected modes for signal no. 1: STANAG-4285	Continuous 🔹
Start Stop Previous Next	Fvit
	LAIL

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.

pera	ation Direct mode Memory scan Frequency search						
1	Rx Frequency Mode Offset 8.408000 MHz hf-analysis-classifier-code-check 0 Hz	Shift Remarks Modulation:PSK-8A, STANAG-4285 NOR, Signal #1 predicted mode(s) Signal #1 detected mode(s): STANAG-4285	Date & Time Baudrate 07 Nov 2014 16:16:59 2400 Bd	Modulation PSK-8A, STANAG-4285 NOR	Operator Callsign L	Location	Frame Format
	8.436000 MHz hf-analysis-classifier-code-check 0 Hz	852 Hz Modulation:CW, man., Centen955.6 Hz, Modulation:CW, man., Centen955.97 Hz, Signal #1 predicted mode(s): CW-MORSE Signal 2 - Predicted Mode(s): CW-MORSE	07 Nov 2014 16:19:24 47 Bd	F18			
	8.444000 MHz hf-analysis-classifier-code-check 0 Hz	206 Hz Modulation: 10, Center:Solaw.23 Hz, Signal #1 predicted mode(s): CW-MORSE Modulation:F18, Center:2551.24 Hz, Signal #1 predicted mode(s): ARQ	07 Nov 2014 16:20:04 100 Bd	F18			
	8.452000 MHz hf-analysis-classifier-code-check 0 Hz	Modulation:PSK-8A, STANAG-4285 NOR, Signal #1 predicted mode(s) Signal #1 detected mode(s): STANAG-4285	07 Nov 2014 16:21:29 2400 Bd	PSK-8A, STANAG-4285 NOR			
	8.468000 MHz hf-analysis-classifier-code-check 0 Hz	Modulation:PSK-8A, STANAG-4285 NOR, Signal #1, predicted mode(s) Signal #1 detected mode(s): STANAG-4285	07 Nov 2014 16:22:53 2400 Bd	PSK-8A, STANAG-4285 NOR			
	8.476000 MHz hf-analysis-classifier-code-check 0 Hz	Modulation:PSK-8A, STANAG-4285 NOR, Signal #1 predicted mode(s) Signal #1 detected mode(s): STANAG-4285	07 Nov 2014 16:23:38 2400 Bd	PSK-8A, STANAG-4285 NOR			
	8.480000 MHz hf-analysis-classifier-code-check 0 Hz	Modulation:CW, Center:4051.61 Hz, Signal #1 predicted mode(s): CW-MORSE	07 Nov 2014 16:24:01 15 Bd	CW			
	8.484000 MHz hf-analysis-classifier-code-check 0 Hz	Modulation:CW, Center:4052.22 Hz, Signal #1 predicted mode(s): CW-MORSE	07 Nov 2014 16:24:22 16 Bd	CW			
	8.492000 MHz hf-analysis-classifier-code-check 0 Hz	Modulation: PSK-8B, Center:2197.8 Hz, Signal #1, predicted mode(s): Signal #1 detected mode(s): STANAG-4285	07 Nov 2014 16:25:01 2400 Bd	PSK-8B			
.0	8.500000 MHz hf-analysis-classifier-code-check 0 Hz	Modulation:PSK-2A, CIS-12 NOR,	07 Nov 2014 16:26:16 120 Bd	PSK-2A, CIS-12 NOR			
1	8.504000 MHz hf-analysis-classifier-code-check 0 Hz	Modulation:PSK-2A, CIS-12 NOR,	07 Nov 2014 16:26:36 120 Bd	PSK-2A, CIS-12 NOR		-	
2	8.512000 MHz hf-analysis-classifier-code-check 0 Hz	Modulation:PSK-8A, STANAG-4285 NOR Signal #1 predicted mode(s): Signal #1 detected mode(s): STANAG-4285	07 Nov 2014 16:27:16 2400 Bd	PSK-8A, STANAG-4285 NOR			
3	8.524000 MHz hf-analysis-classifier-code-check -14921 H:	z Modulation: PSK-88, Center:2622.5 Hz, Signal #1 predicted mode(s):	07 Nov 2014 16:28:20 2400 Bd	PSK-8B			
.4	8.564000 MHz hf-analysis-classifier-code-check -2537 Hz	851 Hz Modulation:F1B, Center:3641.21 Hz, Signal #1 predicted mode(s)	07 Nov 2014 16:31:52 50 Bd	F18			
Swee	ep parameters		m				,
Ran	ge 30000 Hz Step 1	100 Hz Dwel	15	sec			Save

Direct Mode tab with database and sweep parameters setting

Complete Automatic Spectrum Monitoring System



### **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.

<mark>%</mark> W- File	SPECTRA (C:\Us Run Configura	ers\Public\Documents ation Tools Help	s\WAVECOM\WSpectra	\Data-Output\Hf_20141107	.xml)						
	) 👛 🕻	<b>)   )</b>	<b>Q</b>								
)pera	ation   Direct mo	ode Memory scan	Frequency search								
1	Rx Frequency 8.408000 MHz	Mode hf-analysis-classifier-	Offset -code-check 0 Hz	Shift Modulation:PSK- Signal #1 predict Signal #1 detecte	Remarks 3A, STANAG-4285 NOR, ed mode(s): ed mode(s): STANAG-4285	Date & Time 07 Nov 2014 16:16:59	Baudrate 2400 Bd	Modulation PSK-8A, STANAG-4285 NOR	Operator Callsign	Location	Frame Format
2	8.436000 MHz	hf-analysis-classifier-	-code-check 0 Hz	852 Hz Modulation:CW, Modulation:CW, Signal #1 predict Signal 2 - Predict	nan., Center:955.6 Hz, nan., Center:1955.97 Hz, ed mode(s): CW-MORSE ted Mode(s): CW-MORSE Center:3044.25 Hz	07 Nov 2014 16:19:24	47 Bd	F1B			
3	8.444000 MHz	hf-analysis-classifier-	-code-check 0 Hz	206 Hz Modulation:CW, Signal #1 predict Modulation:F1B, Signal #1 predict	nan., Center:2650.55 Hz, ed mode(s): CW-MORSE Center:2551.24 Hz, ed mode(s): ARQ	07 Nov 2014 16:20:04	100 Bd	F1B			
4	8.452000 MHz	hf-analysis-classifier-	-code-check 0 Hz	Modulation:PSK- Signal #1 predict Signal #1 detecte	3A, STANAG-4285 NOR, ed mode(s): ed mode(s): STANAG-4285	07 Nov 2014 16:21:29	2400 Bd	PSK-8A, STANAG-4285 NOR	2		
5	8.468000 MHz	hf-analysis-classifier-	-code-check 0 Hz	Modulation:PSK- Signal #1 predict Signal #1 detecte	3A, STANAG-4285 NOR, ed mode(s): ed mode(s): STANAG-4285	07 Nov 2014 16:22:53	2400 Bd	PSK-8A, STANAG-4285 NOR	0		
6 •	8.476000 MHz	hf-analysis-classifier-	-code-check 0 Hz	Modulation:PSK- Signal #1 predict Signal #1 detecte	3A, STANAG-4285 NOR, ed mode(s): ed mode(s): STANAG-4285	07 Nov 2014 16:23:38	2400 Bd	PSK-8A, STANAG-4285 NOR			
7	8.480000 MHz	hf-analysis-classifier-	-code-check 0 Hz	Modulation:CW, Signal #1 predict	Center:4051.61 Hz, ed mode(s): CW-MORSE	07 Nov 2014 16:24:01	15 Bd	CW			
3	8.484000 MHz	hf-analysis-classifier-	-code-check 0 Hz	Modulation:CW, Signal #1 predict	Center:4052.22 Hz, ed mode(s): CW-MORSE	07 Nov 2014 16:24:22	16 Bd	CW			
9	8.492000 MHz	hf-analysis-classifier-	-code-check 0 Hz	Modulation: PSK- Signal #1 predict Signal #1 detecte	8B, Center:2197.8 Hz, ed mode(s): ed mode(s): STANAG-4285	07 Nov 2014 16:25:01	2400 Bd	PSK-8B			
.0	8.500000 MHz	hf-analysis-classifier-	-code-check 0 Hz	Modulation:PSK-	2A, CIS-12 NOR,	07 Nov 2014 16:26:16	120 Bd	PSK-2A, CIS-12 NOR			
1	8.504000 MHz	hf-analysis-classifier-	-code-check 0 Hz	Modulation:PSK-	2A, CIS-12 NOR,	07 Nov 2014 16:26:36	120 Bd	PSK-2A, CIS-12 NOR	0		
2	8.512000 MHz	hf-analysis-classifier-	-code-check 0 Hz	Modulation:PSK- Signal #1 predict Signal #1 detecte	3A, STANAG-4285 NOR, ed mode(s): ed mode(s): STANAG-4285	07 Nov 2014 16:27:16	2400 Bd	PSK-8A, STANAG-4285 NOR			
3	8.524000 MHz	hf-analysis-classifier-	-code-check -14921 Hz	Modulation: PSK- Signal #1 predict	8B, Center:2622.5 Hz, ad mode(s):	07 Nov 2014 16:28:20	2400 Bd	PSK-8B			
14	8.564000 MHz	hf-analysis-classifier-	-code-check -2537 Hz	851 Hz Modulation:F1B, Signal #1 predict	Center:3641.21 Hz, ed mode(s):	07 Nov 2014 16:31:52	50 Bd	F1B		5	•
Scar	n parameters										
Fro	m row 2			To row 452		Inte	erval 15		s	ec 🔽 Loc	p Save
lx Fre	8.476000		MHz Demod DSB	Demodulate	or BW 60.000	kHz	AGC Slow	S-level (-90 dB)			
St	art Sto	Previous	Next								Exit

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.

w	-SPECTRA (C:\U	sers\Public\Document	ts\WAVECOM\WSpect	a\Data-Ou	tput\Hf_20141107.xml)							
ile	Run Confiau	ration Tools Help										
	) 🎥 🛙	🔒 🔛 🔊										
per	ration Direct m	node Memory scan	Frequency search									
	Rx Frequency	Mode	Offset	Shift	Remarks	Date & Time B	audrate		Modulation	Operator	Callsign	Location Fran
61	16.120000 MHz	hf-analysis-classifier-	-code-check 0 Hz	849 Hz	Modulation:F1B, Center:2998.33 Hz, Signal #1 predicted mode(s):	10 Nov 2014 13:11:52 50	0 Bd	F1B				
52	16.204000 MHz	: hf-analysis-classifier-	-code-check 0 Hz	201 Hz	Modulation:F1B, Center:2999.83 Hz, Signal #1 predicted mode(s): Signal #1 detected mode(s): CIS-50-50	10 Nov 2014 13:15:45 5	0 Bd	F1B				
53	16.236000 MHz	hf-analysis-classifier-	-code-check 0 Hz	196 Hz	Modulation:F1B, Center:2000.69 Hz, Signal #1 predicted mode(s):	10 Nov 2014 13:17:07 5	0 Bd	F1B				
64	16.328000 MHz	hf-analysis-classifier-	-code-check 0 Hz		Modulation:CW, auto., Center:3998.82 Hz, Signal #1 predicted mode(s): CW-MORSE	10 Nov 2014 13:21:18 7	Bd	CW, auto.				
65	16.332000 MHz	hf-analysis-classifier-	-code-check 0 Hz		Modulation:CW, man., Center:4001.56 Hz, Signal #1 predicted mode(s): CW-MORSE	10 Nov 2014 13:21:28 6	Bd	CW, man.				
66	16.804000 MHz	hf-analysis-classifier-	-code-check 0 Hz	199 Hz	Modulation:F1B, Center:3999.42 Hz, Signal #1 predicted mode(s):	10 Nov 2014 13:41:10 7	5 Bd	F1B				
67	12.564029 MHz	hf-analysis-classifier-	-code-check 3863 Hz		Rx freq: 12.564029 MHz Modulation:PSK-8A, Table check predicted modes for signal no Code check detected modes for signal no. 1:	11 Nov 2014 14:48:03 24	400 Bd	PSK-8A, STA	ANAG-4285 NOR			
68	12.039082 MHz	: vhf-analysis-dir-class	sifier -4116 Hz		Rx freq: 12.039082 MHz Modulation:AM, Modulation:AM, Center:31.44 Hz, Modulation:AM, Center:43031.38 Hz, Modulation:VOICE AM (AM, Subcarrier : 0.00 Modulation:VOICE USB (USB), Modulation:VOICE USB (USB),	11 Nov 2014 14:49:50 24	400 Bd	AM				
59	10.501113 MHz	hf-analysis-classifier	-209 Hz	103 Hz	Rx freq: 10.501113 MHz Modulation:PSK-2A,	11 Nov 2014 14:53:03 1	20 Bd	PSK-2A, CIS	-12 NOR (USB)			
0	10.501113 MHz	hf-analysis-classifier	788 Hz	103 Hz	Rx freq: 10.501113 MHz Modulation:PSK-2A,	11 Nov 2014 14:53:47 1	20 Bd	PSK-2A, CIS	-12 NOR (USB)			
1	10.501113 MHz	hf-analysis-classifier	788 Hz	103 Hz	Rx freq: 10.501113 MHz Modulation:PSK-8A,	11 Nov 2014 14:54:17 24	400 Bd	PSK-8A, STA	ANAG-4285 NOR (U	ISB)		
72	10.099000 MHz	hf-analysis-classifier	289 Hz	448 Hz	Rx freq: 10.099000 MHz Modulation:F1B,	06 Oct 2014 11:09:28 5	0 Bd	F1B				
	8.453000 MHz	hf-analysis-classifier	289 Hz	450 Hz	Rx freq: 8.453000 MHz Modulation:PSK-8A,	06 Oct 2014 11:10:42 24	400 Bd	PSK-8A, STA	ANAG-4285 NOR (U	ISB)		
73	Remarks Rx freq: 8.45300	0 MHz Modulation:PSK-8A	A, STANAG-4285 NOR (USB)	Center:151	52 Hz, Baudrate:2400.01 Bd, Bandwidth:2400.01 Hz, Con	fidence:93%, Level:-34 dB						
74	8.600000 MHz	hf-analysis-classifier-	-code-check 0 Hz		Modulation: PSK-88, Center:2953.3 Hz,	11 Nov 2014 15:07:28 24	400 Bd	PSK-8B				
75	8.616000 MHz	hf-analysis-classifier-	-code-check 0 Hz		Modulation:PSK-8A, STANAG-4285 NOR,	11 Nov 2014 15:08:28 24	400 Bd	PSK-8A, STA	ANAG-4285 NOR			
76	8.632000 MHz	hf-analysis-classifier-	-code-check 0 Hz		Modulation:PSK-8A, STANAG-4285 NOR,	11 Nov 2014 15:09:28 24	400 Bd	PSK-8A, STA	ANAG-4285 NOR			
		1. A . A	17 N 18 1935			ш						
Sea	rch parameters											
Fro	6.000000		N	Hz to	20.000000	MHz 🔽 Loc	op		Use squelch	Automa	atic insert	
Ste	ep 1000.000			Hz Inter	val 15	sec Search	strategy	hf-analysis	s-classifier-code-che	eck [Classify]		• Si
x Fr	eq 8.453000		MHz Demod D	se 🔹	Demodulator BW 60.000	kHz AG	SC Slow	•	S-level (-90 dB)		0	
				_								_
S	tart Si	Previous	Next									E

Frequency Search mode with a database and search parameters setting

Recommended configuration and typical search results on page 21.

Complete Automatic Spectrum Monitoring System



### **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

1/2 W-SPECTRA (C:\Users\Public\Documents\WAVECOM\WSpectra\Data-Output\Hf_20141107.xml)	
File Run Configuration Tools Help	
🗋 🖕 🕼 🔛 🔊 💽 🤇	
Operation Direct mode Memory scan Frequency search	
SDR Settings	
Rx Freq         14.072000         MHz         Demod         DSB         T         Demodulator BW         60.000         kHz         AGC         Slow         S-	level (-111 dB)
Mode hf-analysis-classifier-code-check 🔻 🛃 Freq Offset -1373 Hz NB FFT Gain 20 dB Shift 200 Hz Date: 20 February 20	15 Time: 10:28:38 Status: auto
Display FFT Color scheme Grey Remarks Frequency: 14.070627 MHz Modulation: PSK-28, Center: 786.4 Hz, Baudrate: 31.22 Bd, Bandwidth: 31.22 H	Hz, Confidence: 67%, Level Insert Overwrite Edit
[dB]	
0.0 -250	
-50.0	
-75.0	
-100.0	1
	www.wernet. And have wind wind how how
13.072 13.272 13.472 13.672 13.872 14.072 14.272 14.472	14.672 14.872 15.072 [MHz]
File E:\work\W-SPECTRA\Recordings\Recording_20150216_g33ddc_NB_mixSR_moving_5min.pxgf	PXGF 🔻
[dB] 14.071 MHz [BW 18.37 kHz]	
0.0	
-20.0	
-80.0	
-100.0	
-120.0 IA //	
14.024 14.034 14.043 14.053 14.052 14.072 14.082 14.091	14.101 14.110 14.120 [MHz]
Image:	
File E\work\W-SPECTRA\Recordings\Recording_20150218_g33ddc_mixSR_9min.pxgf	PXGF
Shift: 3.57 kHz 10: 28: 37 Center: 2003H hz 10: 28: 37 Baudrate: 62:52 Bd	Clear     Timestamps
10:28:37 Bandwidth: 62.52 Hz	Mada assessmentar
10:28:37 Contidence: 95% 10:28:37 Level-44 dB	polarity normal •
10:28:37	bandwidth
10:28:37 Table check predicted modes for signal no. 1: PSK-31, PSK-31-FEC, PSK-AM Signal 2- Predicted Models/ PSK-31, PSK-31-FEC, PSK-AM	madulation in v
10:28:37 Signal 3 - Predicted Mode(s): PSK-31, PSK-31, FEC, PSK-AM	induction ind
1 10:28:37 Signal 4 - Predicted Mode(s): PSK-63, PSK-63F, PSK2_62.5 10:28:37 Code check started checking signal no. 1	center 1000
4 > 4	, mode Continuous • *
Start Stop Previous Next	Exit

Multiple signal classification and code check

Complete Automatic Spectrum Monitoring System



### **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

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

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.

available for each modulation type. All parameters, the record name and the file name are user selectable.

File Edit Vie	w Help										
	X 🛛 👳										
Name	Decoder	Modulation	Subcarrier	Baud / Symbol	Shift	Bandwidth	No. of Tones	No. of Carriers	Spacing	Pilot Frequency	Codec
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
J-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
SW-FSK	gw-fsk	FSK		200	200	*	2				5
W-OFDM	gw-ofdm	OFDM	PSK-4	62.5				12 (min. 11)	62.5		5
SW-OFDM	gw-ofdm	OFDM	PSK-4	62.5				14 (min. 13)	62.5		5
SW-OFDM	gw-ofdm	OFDM	PSK-4	62.5				16 (min. 15)	62.5		5
SW-OFDM	gw-ofdm	OFDM	PSK-4	62.5				18 (min. 17)	62.5		5
W-OFDM	gw-ofdm	OFDM	PSK-4	62.5				20 (min. 19)	62.5		5
W-OFDM	gw-ofdm	OFDM	PSK-4	62.5				22 (min. 21)	62.5		5
W-OFDM	gw-ofdm	OFDM	PSK-4	62.5				24 (min. 23)	62.5		5
W-OFDM	gw-ofdm	OFDM	PSK-4	62.5				26 (min. 25)	62.5		5
SW-OFDM	gw-ofdm	OFDM	PSK-4	62.5				28 (min. 27)	62.5		5
W-OFDM	gw-ofdm	OFDM	PSK-4	62.5				30 (min, 29)	62.5		5
SW-OFDM	aw-ofdm	OFDM	PSK-4	62.5				32 (min, 31)	62.5		5
W-PSK	gw-psk	PSK-4		200							5
GW-PSK	gw-psk	PSK-8		200							5
HC-ARO	hc-arg	FSK		240	200	*	2				5
HELL-80	fm-hell	FSK		245	490	*	2				1
HE-ACARS	hf-acars	PSK-2		1800	241725-0		000.0				2
HE-ACARS	hf-acars	PSK-4		1800							2
F-ACARS	hf-acars	PSK-8		1800							2
				400.05	105	~	-				

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.

lle			
Default fields		Field layout	_
Default fields  Rx Frequency  Mode  Offset  Shift  Frequency2  Date & Time 2  Callsign  Location  Custom fields  Frame Format  Burst Specs  Operator  Direction  Longitude  Custom fields  Custom field  Custom field  Custom field  Custom field	(Double) (Text) (Double) (Double) (Text) (Double) (Text) (Text) (Double) (Text)	Field layout Rx Frequency Mode Offset Shift Remarks Date & Time Baudrate Modulation Operator Callsign Location Frame Format SNR Antenna ITU Designator	•

Customize a database template

Complete Automatic Spectrum Monitoring System



### 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

Complete Automatic Spectrum Monitoring System



### **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.

🌇 Split a record	ling									
Input file	E:\work\W-SPECTRA\Recordings\Recording_20150123_g39ddc_mixSR_moving_8min.pxgf									
Output folder	E:\work\W-SPECTRA\Recordings\SmallRecordings									
Split into	3 + parts of 1029 MB	Start Stop								
Part progress	15	.0%								
Total progress	2/3	38.0%								

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.

W. Convert a wav re	cording into a pxgf recording
Input file	E:\work\W-SPECTRA\Recordings\Aufnahmen 2MHz\HDSDR_20150303_094833Z_8500kHz_RF_TEST_1024k.wav
Output file	E:\work\W-SPECTRA\Recordings\Aufnahmen 2MHz\HDSDR_20150303_094833Z_8500kHz_RF_TEST_1024k_2.pxc
Receiver frequency	8.5 MHz
Timestamp	13 Mar 2014 11:41:58
	Start Stop
Progress	

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



### **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 fre- quency manually. Use "Sweep" mode to catch a signal in a small range	Rescan and verify signals according to database ent- ries. New result can be inser- ted into the database	Automatic search signals (classify and code check) over a predefined frequency band according to a search strategy. Results automati- cally 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 fre- quency according to the step size	Jump to the previous data- base entry	Jump to the previous fre- quency 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)



### **Signal Recording and Playback**

Wideband	Narrowband
IQ PXGF	IQ PXGF and WAV
Up to 2 MHz	96 kHz
16 bits each I and Q	32 bits each I and Q
Receiver frequency (Rx Freq), recording bandwidth and timestamp	Receiver frequency (Rx Freq), recording bandwidth and timestamp in PXGF format
<ul> <li>WB spectrum display with side information</li> <li>A selected 96 kHz band displayed in NB spectrum and processed by the classifier or decoder</li> <li>Signal output to speaker for acoustic monitoring</li> </ul>	<ul> <li>Signal displayed in NB spectrum with side information</li> <li>Selected signal processed by the classifier or decoder</li> <li>Signal output to speaker for acoustic monitoring</li> </ul>
<ul> <li>0.5 Gigabytes for 1 minute</li> <li>30 Gigabytes for 1 hour</li> <li>720 Gigabytes for 1 day (24 hours)</li> </ul>	<ul> <li>46 MB for 1 minute</li> <li>2.7 Gigabytes for 1 hour</li> <li>64 Gigabytes for 1 day (24 hours)</li> </ul>
	WidebandIQ PXGFUp to 2 MHz16 bits each I and QReceiver frequency (Rx Freq), recording bandwidth and timestamp• 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• 0.5 Gigabytes for 1 minute• 30 Gigabytes for 1 hour• 720 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



#### 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 %



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 $\leq$ 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	P1	Only classification is performed, but no decoding
	P2	Classification and table check are performed, but no decoding
	Р3	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 spect- rum 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)	

Complete Automatic Spectrum Monitoring System



DCV 10

#### **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-SELCAL
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 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-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

P3K-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

Complete Automatic Spectrum Monitoring System



### **VHF/UHF** - Protocols

ACARS	
AIS	
APCO-25 (P25)	
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) 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-TEL FX-MM

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



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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