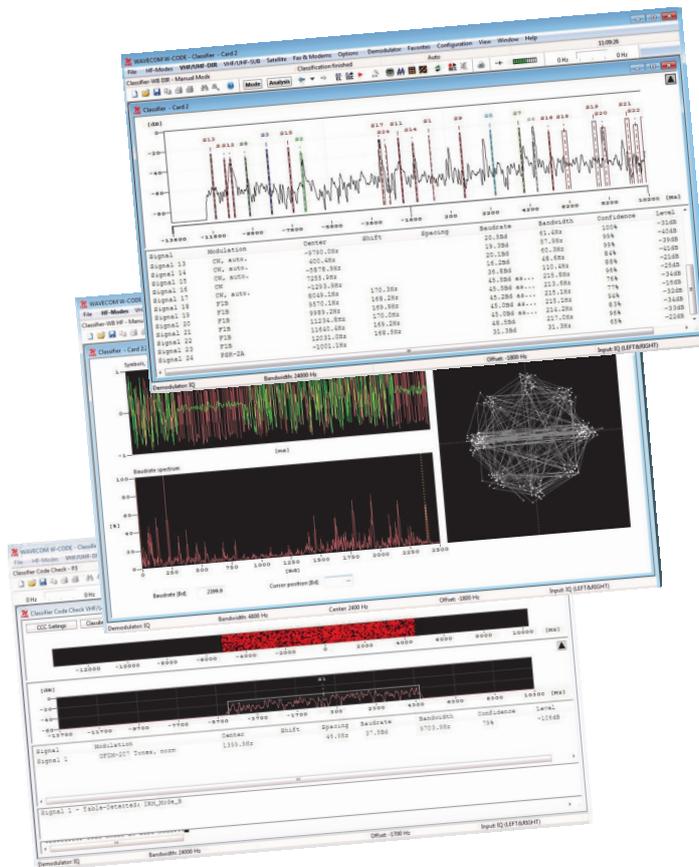


WAVECOM® W-Spectrum Analysis W-Classifier



The ability to rapidly identify unknown signals has become an essential requirement in signal analysis. W-Spectrum Analysis and W-Classifier provide all functions required to automatically detect, analyse and classify multiple signals throughout the full radio spectrum from HF to SHF.





W-Spectrum Analysis Overview

The automation of spectrum analysis and signal classification relieves the operator from manual evaluation, which in most cases requires considerable skill and experience.

W-Spectrum Analysis (W-SA) is a licensed tool and can be activated in all spectrum display functions (FFT and Sonagram). It detects all signals in the display bandwidth (selectable from 4 kHz to 96 kHz) with their most essential parameters:

- ◆ Signal center (Hz)
- ◆ Signal width (Hz)
- ◆ Signal strength (dB)
- ◆ Detection confidence (in percent)

Further, each detected signal can contain multiple sub-signals, they can be sub-carriers or multiple tones of one signal. This feature is very helpful in analyzing wideband signals.

W-Spectrum Analysis can also save the analysis result (detected signals with all details) into an XML file. The file can be exported conveniently to a third-party application for further processing.

W-Classifier Overview

W-Classifier supports these functions

- ◆ Modulation type
- ◆ Baud rate or symbol rate
- ◆ Signal center frequency
- ◆ Number of carriers
- ◆ Frequency shift
- ◆ Carrier spacing or distance
- ◆ CW-Morse detection
- ◆ 8 kHz bandwidth for the Narrowband Classifier (W-Classifier-NB, WCL61PC) and 96 kHz bandwidth for the Wideband Classifier (W-Classifier-WB)
- ◆ All signals within the classifier bandwidth are processed

Additional functions for Wideband (W-Classifier-WB)

- ◆ 96 kHz bandwidth for the Wideband Classifier
- ◆ Voice detection AM, FM, USB and LSB. Demodulated voice output to the speaker for live monitoring
- ◆ Baud rate up to 60 kBd

Wideband Classifier covers all functionalities of the Narrowband Classifier.

W-Spectrum Analysis and W-Classifier

Automatic Signal Analysis and Classification

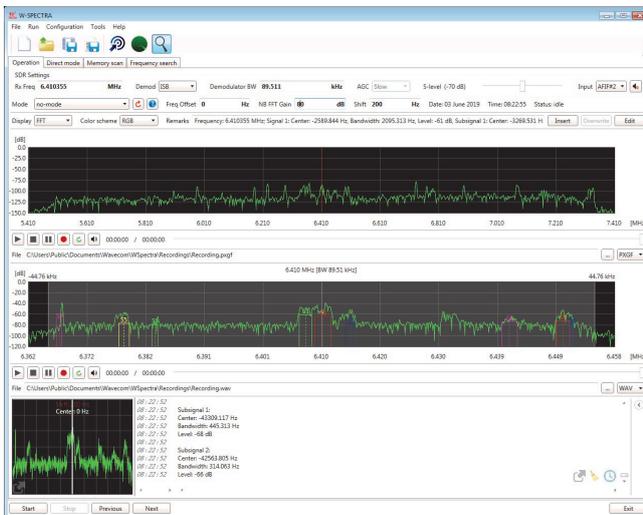
Application

The spectrum analysis and classifier are options to various Wavecom signal detection and decoding applications. They can be used in a number of configurations.

- ◆ Local use as a PC application
- ◆ Remote control via W-CLOUD client-server mode

- ◆ Remote use via LAN with standard W-CODE application instances in client-server mode
- ◆ Remote control from other applications using third party software (using TCP/IP and XML)
- ◆ Remote control via Microsoft Remote Desktop Protocol

Spectrum Display

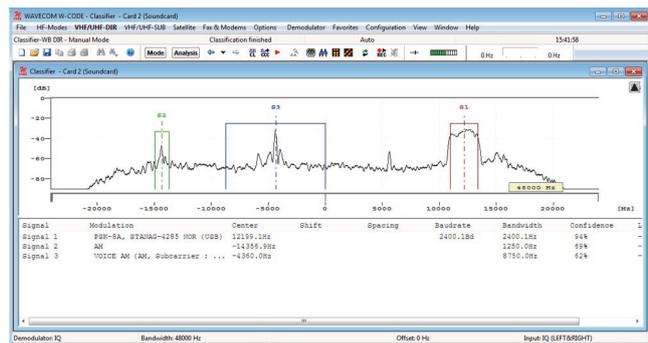


Spectrum Analysis function detects all signals with their parameters and displays them with signal marks in the monitoring frequency band.

All signals are listed in the text output pane. This information can be saved in an XML file.

The classifier marks all signals in a monitoring frequency band in a spectrum pane. At the same time all classified signals with much more details are listed below the spectrum display.

W-Classifier can deliver more signal parameters than W-Spectrum Analysis tool.



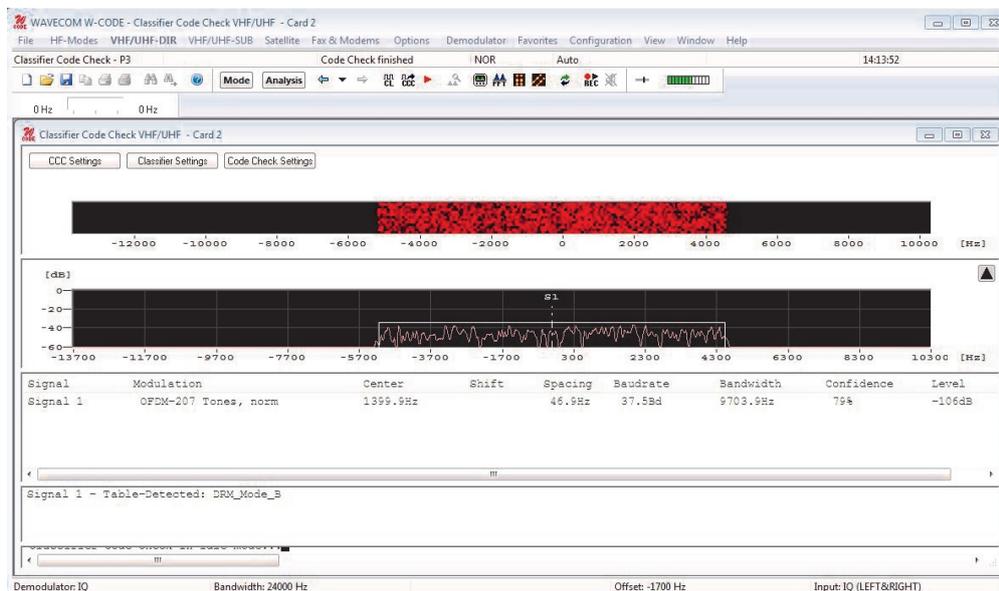
W-Spectrum Analysis and W-Classifier

Automatic Signal Analysis and Classification

CLASSIFIER-CODE-CHECK (CCC)

The Classifier-Code-Check is a versatile analysis tool for the classification of known and unknown signals and the determination of the mode (protocol) in use. The CCC will attempt to process all signals within the bandwidth of the narrowband or wideband 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 an XML-formatted mode list. The code check will attempt to synchronise against classified modes. Finally the signal can be forwarded to a decoder for output.



Classifier-Code-Check (CCC) with table detected DRM Mode B (OFDM)

Classifier-Code Check process levels

Process Level	P1	P2	P3	P4	P5
	Classification is performed, but no decoding	Classification and table check are performed, but no decoding	Classification, table check and code check are performed, but no decoding	Classification and table check are performed and finally the signal is decoded if a mode with an associated, valid detector was found	Classification, table check and code check are performed and finally the signal is decoded if a mode with an associated, valid detector was found

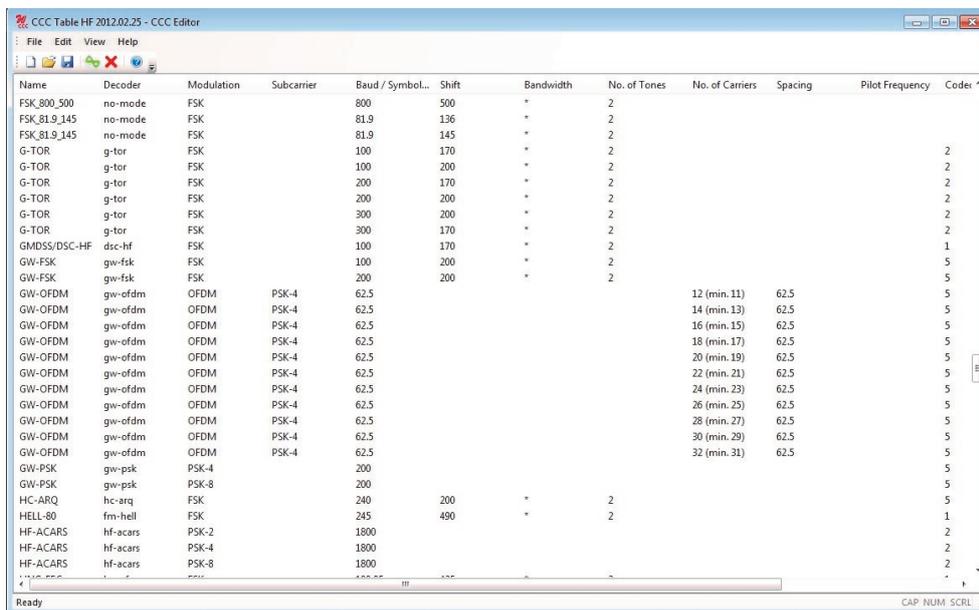
W-Spectrum Analysis and W-Classifier

Automatic Signal Analysis and Classification

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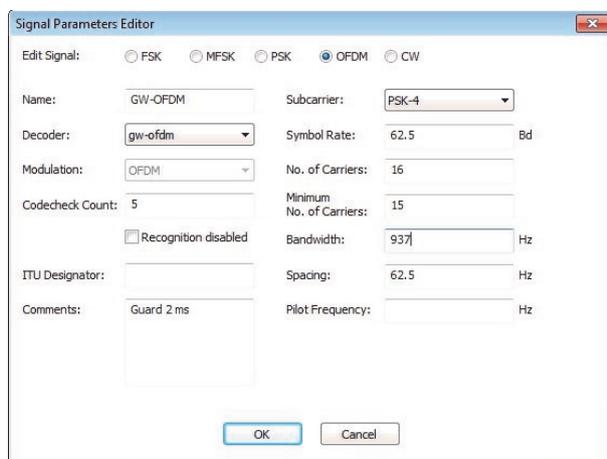
CLASSIFIER-CODE-CHECK (CCC) EDITOR

An XML table editor allows extending, modifying or deleting records in the XML table used for mode look up. An input template containing all important parameters is available for each modulation type. All parameters, record name and file name is 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_819_145	no-mode	FSK		81.9	136	*	2				
FSK_819_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
HIC-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

User defined list of modes for automatic recognition



Signal Parameters Editor

Edit Signal: FSK MFSK PSK OFDM CW

Name: Subcarrier:

Decoder: Symbol Rate: Bd

Modulation: No. of Carriers:

Codecheck Count: Minimum No. of Carriers:

Recognition disabled Bandwidth: Hz

ITU Designator: Spacing: Hz

Comments: Pilot Frequency: Hz

OK Cancel

An unlimited number of XML tables may be set up. Any table may be loaded from the "Code-Check-Settings" menu.

-  CCC Table HF 2012.04.29 XML-Dokument
-  CCC Table VHFUHF 2012.02.25 XML-Dokument
-  CCC Table VHFUHF-DIR 2012.02.25 XML-Dokument
-  CCC Table VHFUHF-SUB 2012.02.25 XML-Dokument

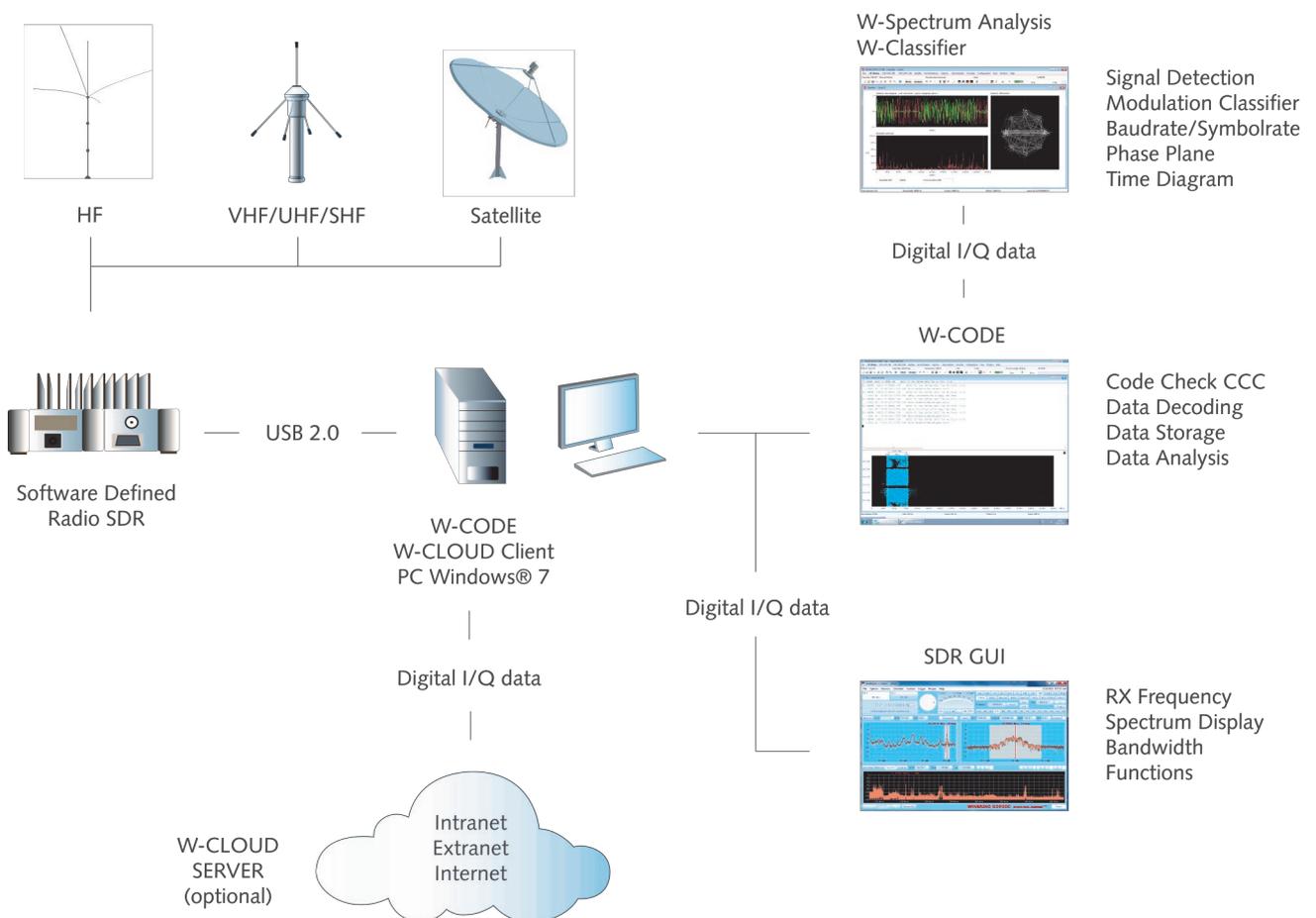
Classifier-Code-Check Editor input template

W-Spectrum Analysis and W-Classifer

Automatic Signal Analysis and Classification

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W-Spectrum Analysis and W-Classifer in Application with a Modern SDR



W-CODE with W-Spectrum Analysis and W-Classifer options provides all functions required to detect, analyze, decode and process radio data communications throughout the radio spectrum from HF, VHF, UHF to SHF. W-Spectrum Analysis and W-Classifer accept input from the host built-in sound card, a number of SDRs, analog or digital audio outputs, WAV files, I/Q data or TCP/IP streams.

W-Spectrum Analysis and W-Classifier

Automatic Signal Analysis and Classification

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 \leq 3500 Hz Modulation index: 0.5-20 Signal must be continuously present during sampling interval
FSK-4 (F7B)	30 to 300 Bd, Shift \leq 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 $T_g/T_u = 1/1$ 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 \geq 2: 100-2400 Bd m \geq 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-Spectrum Analysis and W-Classifier

Automatic Signal Analysis and Classification

W-Classifier-WB Technical Data (covers All Functionalities of W-Classifier-NB)

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: 0.5-20 Signal must be continuously present during sampling interval
FSK-4 (F7B)	30 to 300 Bd, Shift \leq 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 \geq 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 and LSB. Demodulated voice output to the speaker for live monitoring
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 \geq 2: 100-2400 Bd m \geq 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 %





W-Spectrum Analysis and W-Classifier

Automatic Signal Analysis and Classification

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/DecoderOnlineHelp/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

	<i>Minimum</i>	<i>Recommended</i>
CPU	Core i5 or Core i7 2.8 GHz	Core i7-6700 3.4 GHz
Memory	4 - 8 GB RAM	16 - 32 GB RAM
OS	Windows 7	Windows 10 32-bit or 64-bit

Product Code	Description
WSA	Spectrum analysis tool (96 kHz bandwidth)
WCLWB	Wideband signal classifier (96 kHz bandwidth). Covers all functionalities of the narrowband classifier
WCLNB	Narrowband signal classifier (8 kHz bandwidth)
WLV	Live voice option to output demodulated voice signal to the speaker

Distributors and Regional Contacts

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