

# WAVECOM<sup>®</sup> 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.



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Automatic Signal Analysis and Classification

## **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.



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### **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**

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Display FFT	Color scheme	RGB • R	marks Frequency: 6.41035	55 MHz; Signal 1: C	enter: -2589.844 Hz,	Bandwidth: 2095.313	Hz, Level: -61 dB, Subs	ignal 1: Center: -3269.	531 H Insert	Dverwrite Edit
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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. These 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.





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.

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

Classifier-Cod	Classifier-Code Check process levels				
Process Level	P1	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			
	Ρ4	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			



Automatic Signal Analysis and Classification

## **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.

File Edit Vie	w Help										
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Name	Decoder	Modulation	Subcarrier	Baud / Symbol	Shift	Bandwidth	No. of Tones	No. of Carriers	Spacing	Pilot Frequency	Coder
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	q-tor	FSK		200	200		2				2
G-TOR	q-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
				100.05			-				

User defined list of modes for automatic recognition

Edit Signal:	○ FSK ○ MFSK	PSK OFDM	© cw	
Name:	GW-OFDM	Subcarrier:	PSK-4	•
Decoder:	gw-ofdm 🔻	] Symbol Rate:	62.5	Bd
Modulation:	OFDM -	No. of Carriers:	16	
Codecheck Count:	5	Minimum No. of Carriers:	15	
	Recognition disabled	Bandwidth:	937	Hz
ITU Designator:		Spacing:	62.5	Hz
Comments:	Guard 2 ms	Pilot Frequency:		Hz

Classifier-Code-Check Editor input template

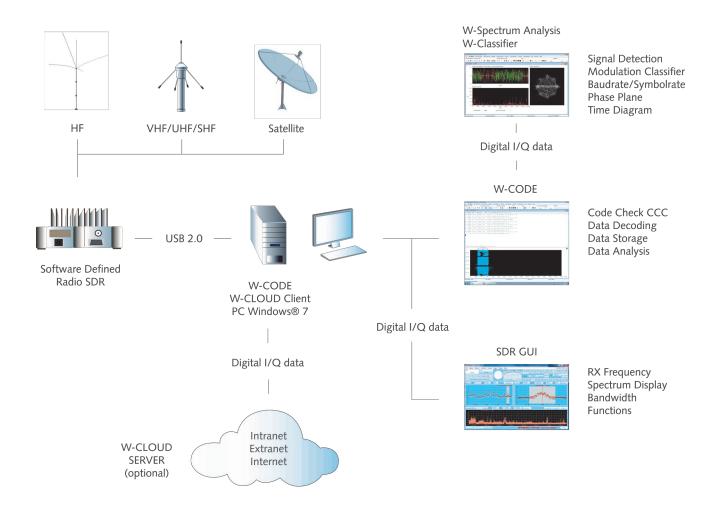
An unlimited number of XML tables may be set up. Any table may be loaded from the "Code-Check-Settings" menu.

🕋 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

## W-Spectrum Analysis and W-Classifier Automatic Signal Analysis and Classification



### W-Spectrum Analysis and W-Classifier in Application with a **Modern SDR**



W-CODE with W-Spectrum Analysis and W-Classifier 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-Classifier 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.



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 ≤ 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 %



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 ≤ 30 kHz 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 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 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 ≥ 2: 100-2400 Bd m ≥ 2: 50 Bd	12 dB (Eb/N0) 15 dB (Eb/N0) 14 dB (Eb/N0) 16 dB (Eb/N0)
PSK 2/4 Variant A/B	100-2400 Bd	14 dB (Eb/N0)
PSK 8/16 Variant A/B	100-2400 Bd	16 dB (Eb/N0)
CW-Morse	8-50 Bd	18 dB (Eb/N0)

#### W-Classifier-WB Accuracy of Measured Parameters

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

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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**

	Minimum	Recommended
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



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