VHF/UHF/SHF Receiving and Decoding

Application Note

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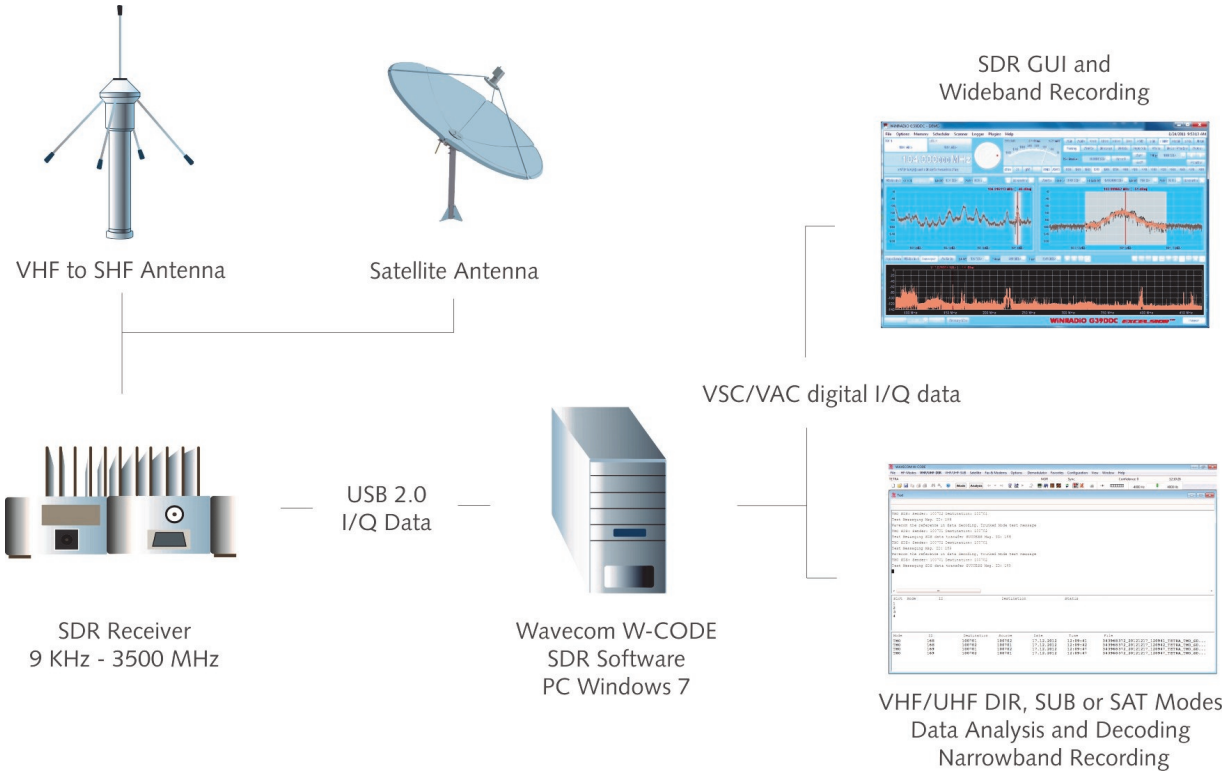
Introduction

This document is intended to provide a step by step guide on how to decode directly modulated modes in the VHF, UHF and SHF bands (VHF/UHF -DIR modes) using W-CODE, WiNRADiO G39DDC SDR and W-PCIe or W-PCI. It describes various hardware and software setups and the corresponding settings. This guide is not exhaustive and other configurations may also lead to successful decoding, but the same concepts apply.

A W-CODE and SDR Configuration



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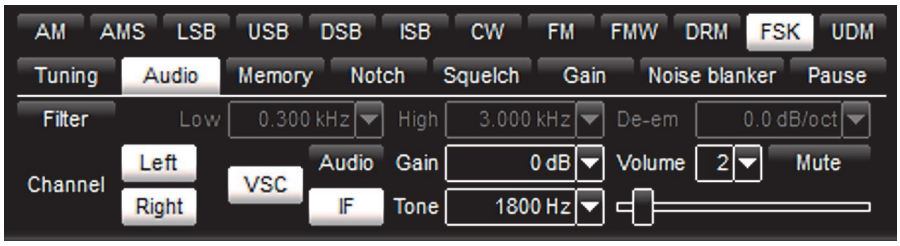
The combined features of the latest SDR from WiNRADiO, the G39DDC, and W-CODE constitute an optimum receiving and decoding environment for VHF/UHF-DIR and satellite transmissions. The most important advantage is the transfer of G39DDC I/Q data directly to W-CODE regardless of whether this is an instance of W-CODE hosted on a PC or a W-PCIe-LAN or W-PCI-LAN. In all cases the USB output of a G39DDC is connected to a USB port of the decoder.

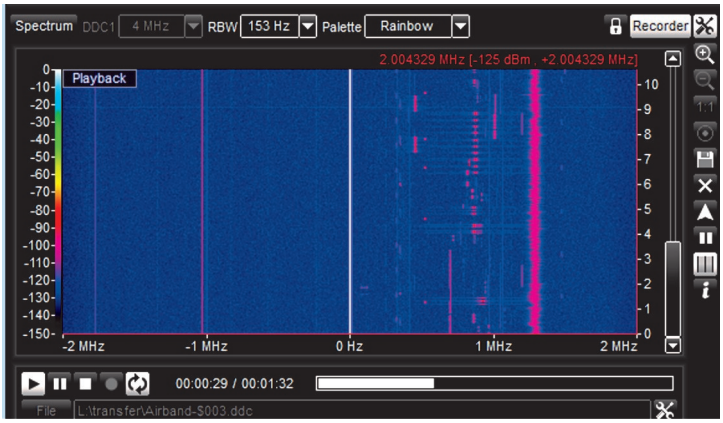
To configure G39DDC for I/Q data transfer, a number of steps are required. In the “Audio” menu “VSC” and “IF” is selected. This combination is only valid if “WiNRADiO Virtual Sound Card” is selected as the “Default” device or as “Enabled" in Windows "Control Panel->Sound->Playback(->Properties)". You may also select the PC built-in speaker as “Default”.

Remember that the Virtual Sound Card (VSC) is a separate WiNRADiO application and that it is only available in the menu if it is installed. Also VSC is only connected to DDC1 of G39DDC.

For VHF/UHF-DIR the G39DDC “Options” and “VSC set-up” menu items can be preset to 48 kHz sampling rate. The sampling rate may be increased to exploit the full bandwidth of W-CODE.



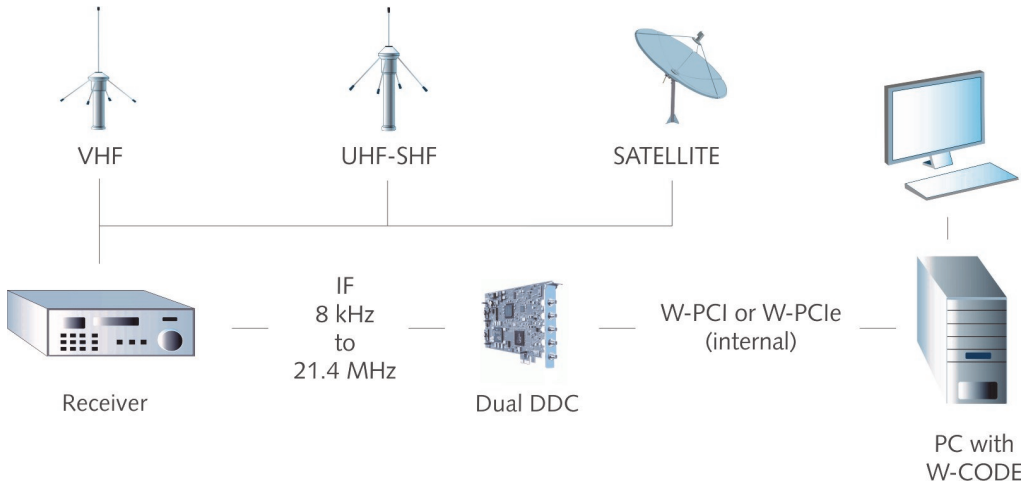
Select in W-CODE “Configuration -> W-CODE Device...”, and “Input: IQ (Left & Right)” for decoding and analytic functions. Once these steps have been completed, the high-quality IF I/Q output of G39DDC is available for W-CODE.



The wideband recordings may be searched for signals of interest using a scroll function. This functionality allows the recordings to be directly decoded by W-CODE.

The WiNRADiO application enables wideband recording with a bandwidth up to 4 MHz.

W-PCIe or W-PCI and analog VHF/UHF Receiver



This setup includes an analog VHF/UHF receiver and the W-PCIe or W-PCI. We use receiving and decoding TETRA as an example. Allocated frequencies for TETRA systems are in the VHF band, therefore a VHF analog receiver is needed to downshift the actual transmission frequency to a fixed output IF frequency which is supported by the W-PCIe (12 kHz-25 MHz). Commonly available VHF receivers have an IF output frequency of 10.7 MHz (wideband) or 455 kHz (narrowband).

1. Prepare the receiver

- Connect the antenna to the antenna input of the receiver
- Connect the IF output of the receiver to the AFIF#1 or AFIF#2 input of the W-PCIe or W-PCI Cards
- Turn on the receiver. Set the frequency to the main frequency of the TETRA downlink channel
- Adjust the output bandwidth to a value larger than 25 kHz

◊ For AOR AR5000A: Press the FUNC button and then IF BW and set the bandwidth with the knob
◊ For AOR AR8600: Press FUNC button and then MODE and select WFM with the knob
◊ For other receivers make sure that the output bandwidth is larger than 25 kHz
◊ Note that if the receiver does not have an output larger than 25 kHz you cannot decode TETRA

2. Open the W-PCIe or W-PCI

- Go to Configuration->W-PCIe Card. Make sure the W-PCIe card is selected

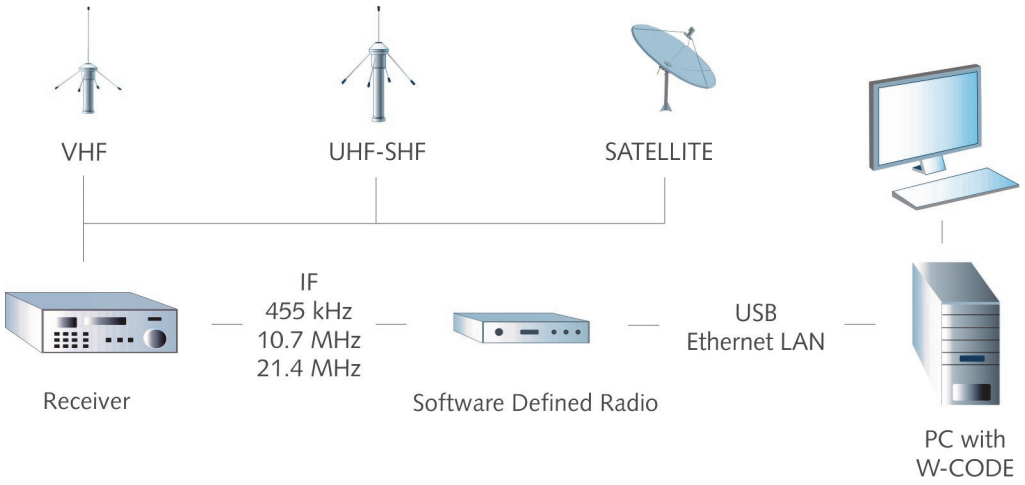
3. Select VHF/UHF-DIR ->Analysis->FFT

- Input: AFIF#1
- Bandwidth: 96000 Hz
- Offset: Set the offset equal to the output IF
- frequency of the receiver. The common values are 10700000 Hz or 455000 Hz
- Adjust the Gain to see a signal spectrum
- Optionally, you can change your receiver settings (bandwidth, squelch) to observe the effect on the output signal

4. Open VHF/UHF-DIR ->TETRA

- Adjust the offset according to the bar graph to correct the center frequency
- Press F1 for HELP

W-CODE and SDR Receiver



This setting uses an SDR (Software Defined Radio) receiver and W-CODE. In this example we are using the RF Space SDR-IQ receiver. The SDR-IQ has an input frequency coverage of 10 kHz to 30 MHz. Since the VHF/UHF-DIR transmissions are taking place above 30 MHz, an analog receiver must be used to downshift the signal into the range below 30 MHz. The receivers described in Setting 1 with an IF output frequency of 10.7 MHz are therefore suitable.

1. Set up the receiver as in Setting 1

- Connect the IF output of the receiver to the input of the SDR
- Plug SDR into the USB slot
- Use the Spectravue application — a spectral analysis tool which automatically supports the SDR-IQ receiver

2. Open Spectravue

- Select “Input Device->SDR-IQ”
- Select “SDR-IQ Setup”
- Adjust the “Center Frequency” to be equal to your receiver’s IF output frequency (typ. 10.7 MHz or 455 kHz)
- Press “Start–F12”
- Choose “W-CODE demodulator” from the lower right and press “Setup”. Adjust “Low Cutoff Frequency” to 0 Hz and “High Cutoff Frequency” to 24000 Hz. This is the widest filter possible
- Adjust the filter center so that it overlaps the signal. This sets the output signal center to +12000 Hz
- Go to “OutputSetup”. Make sure that “Output to Sound Card” is selected. Spectravue receives the SDR output signal, filters it and sends it to the sound card. This stream should be forwarded to the sound card input so that W-CODE can process the signal

3. Forward the sound card output signal to the sound card input

- by using a physical cable and connect the sound card output to the sound card input

or

- by using the VAC (Virtual Audio Cable) software

4. If you are using VAC

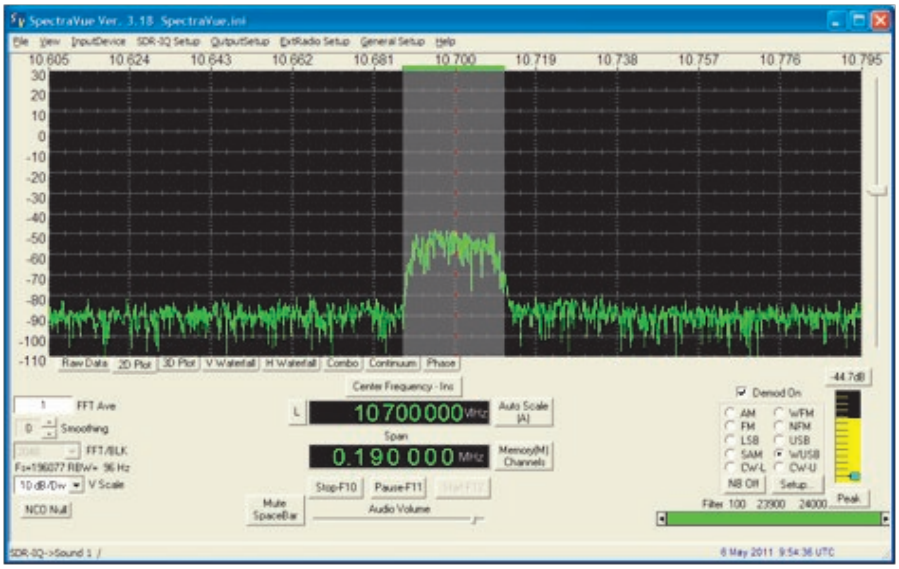
- Use Wavecom Virtual Audio Cable (W-VAC)
- Restart Spectravue
- In Spectravue, open the “OutputSetup” and choose “Virtual Cable 1” as the output sound card
- Open W-CODE. Open “Configuration->W-CODE Device...” and select “Virtual Cable 1” as the input device

5. Go to “VHF/UHF-DIR ->Analysis->FFT”

- Select Bandwidth: 96000 Hz
- Input: AF LEFT, AF RIGHT, AF (LEFT & RIGHT) or IQ (LEFT & RIGHT)
- Offset: 12000 Hz (see 5.e)
- Adjust the gain
- You should see a 25000 Hz signal centered on 12000 Hz

6. Open “VHF/UHF-DIR ->TETRA”

- Adjust the frequency offset according to the bar graph to correct the center frequency
- Press F1 for HELP



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

	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

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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