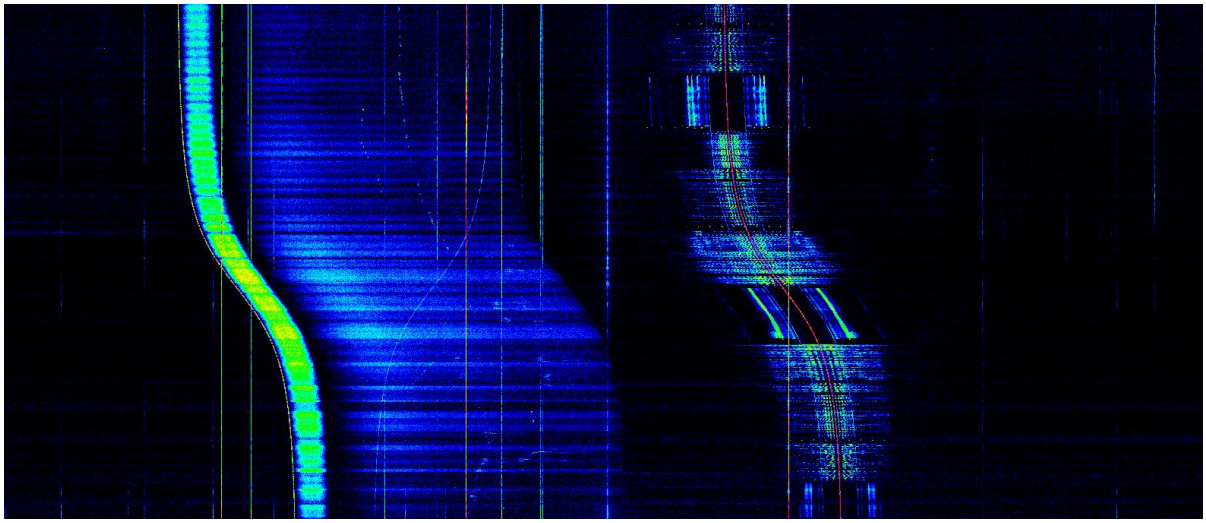

IQ Data Files

Recording, Playback, Analysis

SDR-RADIO.com

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1 Introduction

The SDR-RADIO.com can record the raw IQ (in-phase and quadrature modulator) data returned from the SDR radio or soundcard in a sequence of WAV files http://en.wikipedia.org/wiki/WAV .

WAV files are used as they have become a de-facto standard supported by the most common SDR software. The maximum size of a single file is 2GB.

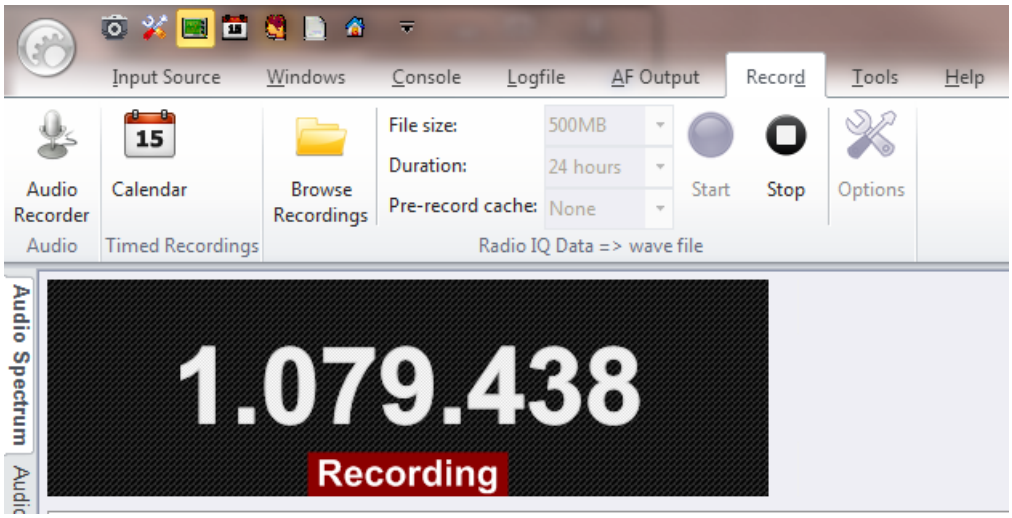
The console also supports playback and analysis of WAV files created by:

- SpectraVue http://www.moetronix.com/ ,
- WINRadio http://www.winradio.co.uk/index.htm ,
- WINRad (and derivatives) http://www.winrad.org/ ,
- Linrad http://www.sm5bsz.com/linuxdsp/linrad.htm ,
- Perseus http://microtelecom.it/index.html .

The IQ WAV files can be played back to analyse received signals, for example after an extended period of recording.

2 Recording

To record the IQ data you first start a radio and select *Record* from the ribbon bar.

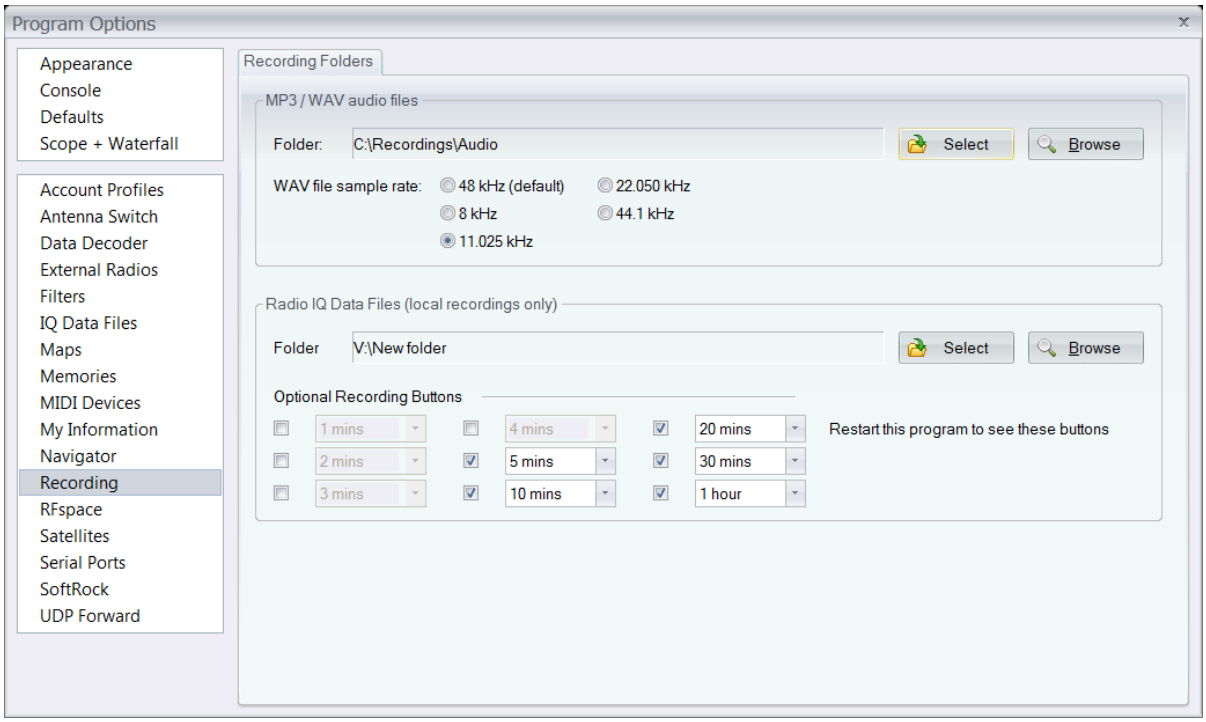


You select:

- The size of each file in the sequence,
- The duration of the recording,
- The size of the pre-record cache. This cache contains up to 30 seconds of data prior to the start of the recording.

To select the location where the files are saved select *Options*, then in the Recording Options window select a folder on your computer.

Press *Start* to start the recording.



To compute the maximum size required for a recording: Sample rate in bytes * No of channels * bytes per sample where:

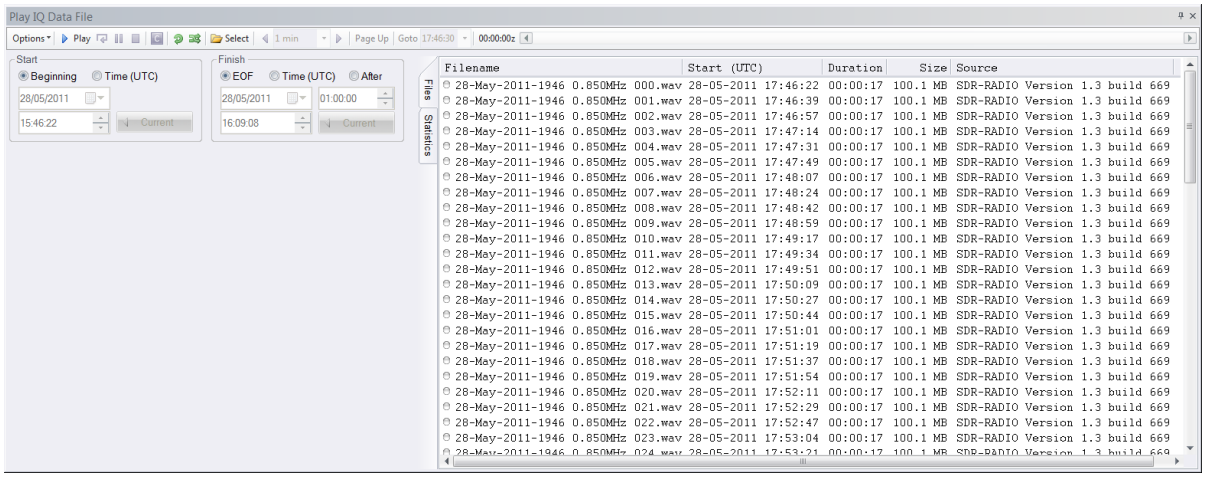
- Sample rate is selected when starting the radio, for example 400kHz is 400,000 bytes,
- Number of channels is 2 (I + q),
- Bytes per sample is 3 (24-bit samples when using the RFspace SDR-IP and NetSDR).

When recording using the NetSDR-X2 (Q4 2011) the size will be doubled again as the X2 contains two identical synchronized receivers.

3 Playback

Playing back IQ files is almost the same as using a SDR radio in that all demodulation options such as mode, noise reduction etc. are available.

From the Input Source pane in the ribbon bar select *Play IQ Data File*, the Play IQ Data File window is displayed.



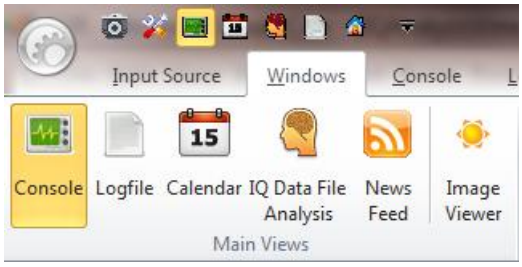
Select any of the files in the recording sequence; all files are displayed. Now just press *Play* to start the playback. To advance or move back through the recording just click in the scroll bar or double-click on any of the files shown in the file list.

Press the pin icon (top right) to auto-hide the window during playback if more screen real estate is desired.

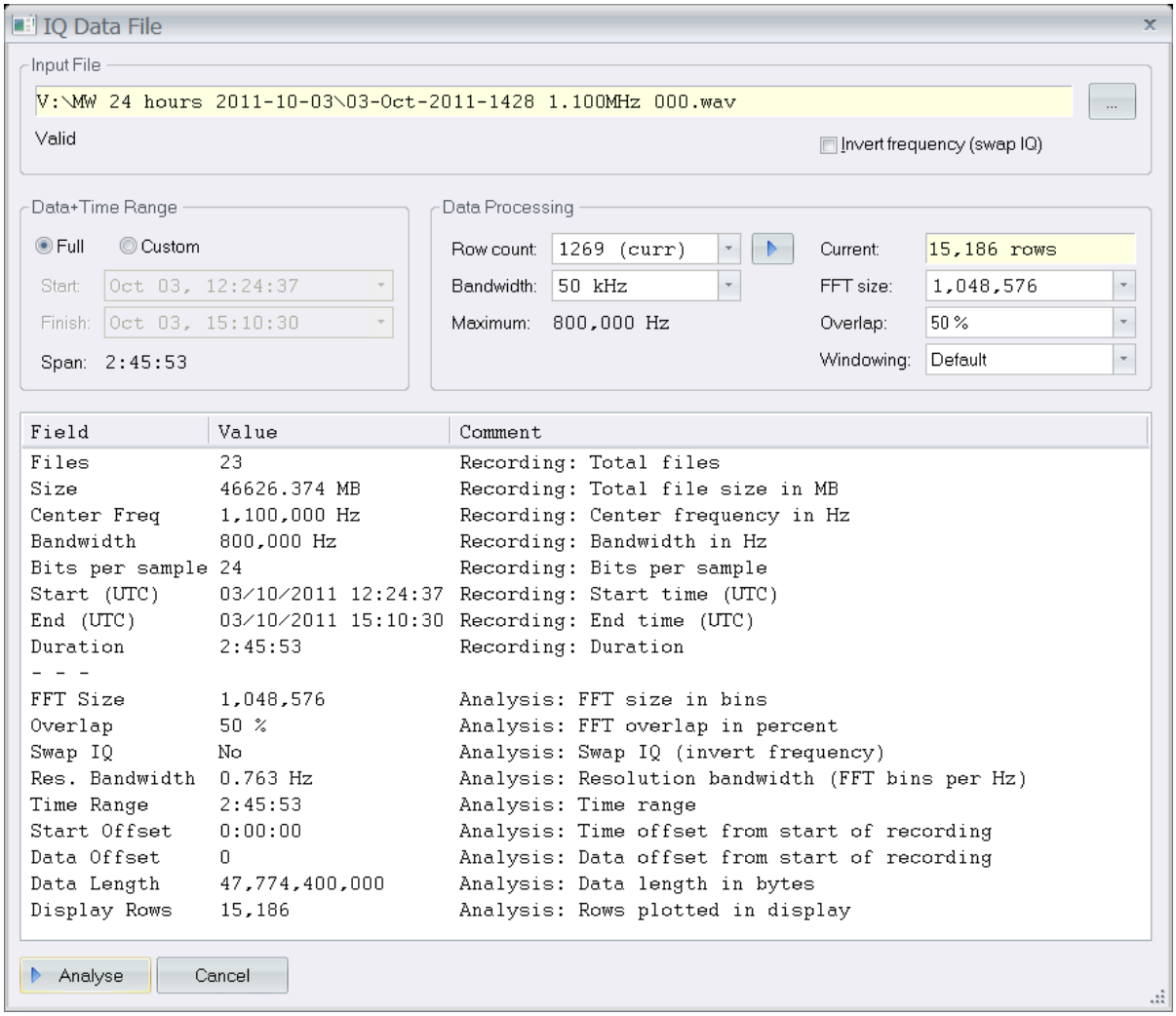
4 Analysis

4.1 Starting

From the Windows pane in the ribbon bar select *IQ Data File Analysis*.



Select Input File from the toolbar, the IQ Data File window is displayed.



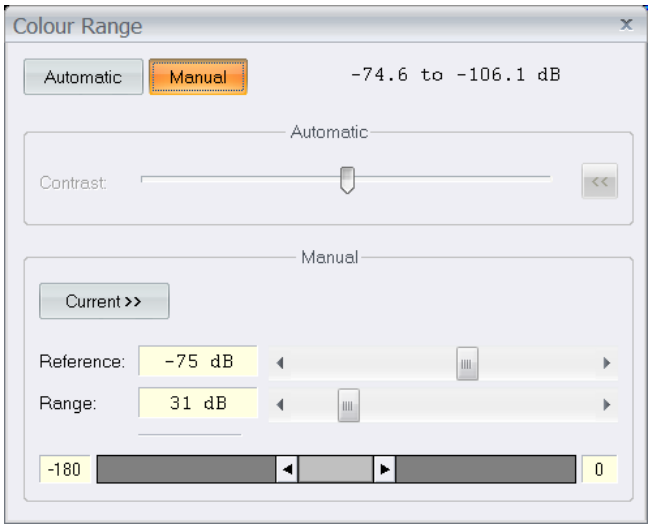
Here you select:

- The input file – just select any of the files in the recording sequence.
- The time range from the recording.
- Either:
    - The number of lines to be displayed, or
    - The DSP processing parameters.
- The display bandwidth.

Press *Analyse* to save the selection and start the analysis. Depending on the size of the files, your CPU speed and the speed of the disk drive where the recording is stored the processing may take between just a few seconds to many minutes or even an hour.

4.2 Colour Range

After you have analysed your data the next step is to adjust the colour range to accentuate the data of interest.



There are two options: Automatic and Manual.

4.2.1 Automatic

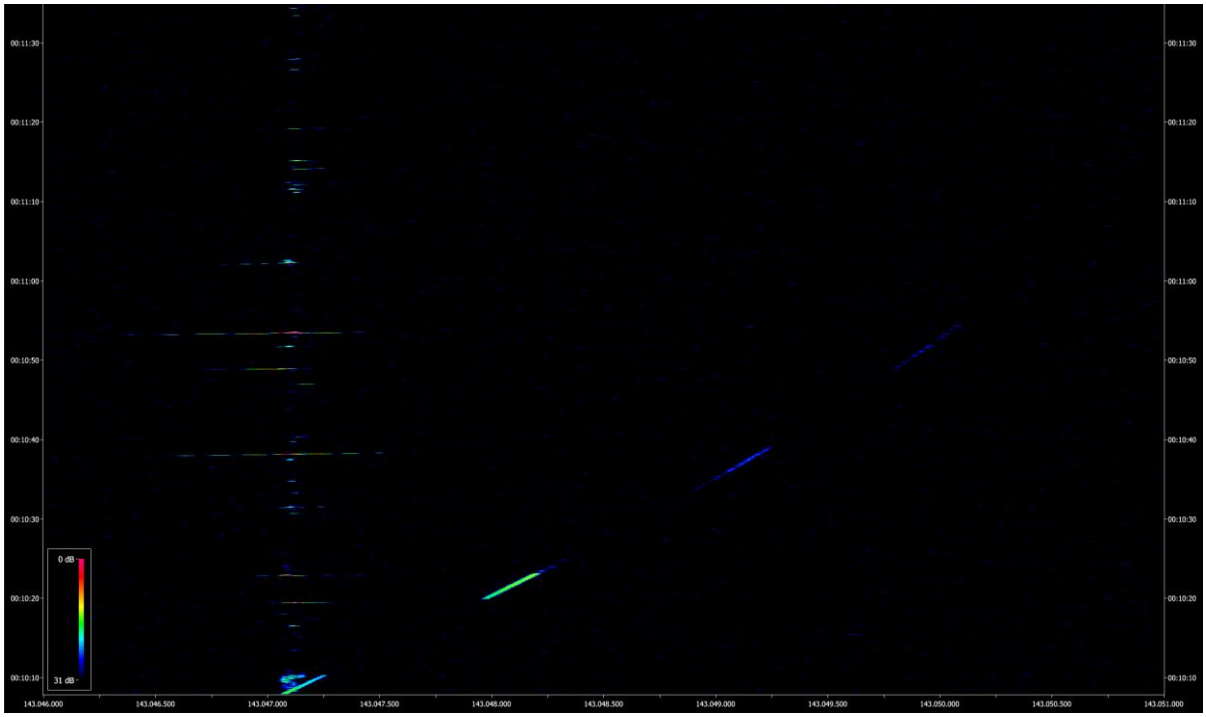
The automatic option uses and advanced proprietary algorithm to display the data with the maximum possible contrast.

4.2.2 Manual

In manual mode the colour mapping is adjusted using reference and range (similar to a laboratory spectrum analyser):

- The reference level is the lowest signal level.
- The range is the signal range of interest.

Judicious usage of this option can greatly enhance the image, here's an example of reflections from the Graves radar during a meteor shower http://en.wikipedia.org/wiki/Graves_(system) .



4.3 Performance Considerations

The speed of image generation depends on the transfer rate from the file storage and the speed of your CPU.

A simple way to improve performance is to use a low bandwidth when making the recording – the bandwidth is selected when you start the SDR radio. A low bandwidth results in a smaller file which can be read and processed faster.

Other solutions include using SATA3 SSD drives in a RAID 0 configuration and the faster i7 / multi-core processor you can afford.