



RFsRio1

Wideband Spectriometer

Cross Spectriometer FPGA Firmware Specification

The RFsRio1 Wideband Spectriometer is part of the RF-shamaanit Oy Scientific Radio generic platform family. The instrument is a self contained standalone system that is designed for superb RF performance, providing first class scientific data. By carefully adhering to the manufacturers instructions, the RFsRio1 will provide the user with many years of reliable service.

FFT Riometry Calculation

Two crossed polarized linear polarization components are digitized at a sample rate of 125 MS/s each.

The sample streams are decimated by three into two complex sample streams of 41.6666... samples per second. Antialiasing filters for the frequency range of 20 – 60 MHz are realized in the FPGA.

Both sample streams are sliced into $2^{15} = 32768$ long strings that are Fourier transformed in the FGPA. The power spectra of these Fourier transforms are obtained by calculating the summed squares of the transform absolute values over time period durations of approximately 10 ms. Also the cross spectrum is calculated by multiplying the first sample stream Fourier transform with the second sample stream conjugate. Similarly the cross spectrum is accumulated over a period of approximately 10 ms.

This results in two power spectra and one cross spectrum of 32768 point lengths each. Being complex, the cross spectrum results in the generation of $4 * 32768 = 131072$ points over a time period of approximately 10 ms. These valuse are transferred to the Zync chip CPU for further processing where the customer may use their own software to further compress the data by integrating over time and frequency dimensions.

With 16 bit resolution, the transfer rate is $2 * 131072 * 100 = 26$ MB/s and double this with 32 bit resolution.

Improvements

The manufacturer retains the right to improve the product without prior notice.