CSO – FFTS IF Processor Design Description

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1 Purpose

The purpose of this document is to provide the design description of the IF processor servicing the new FFTSpectrometer made available to the CSO by MPIfR.

2 Applicable documents

AD-01	CSO-MPI-MAN-01	CSO-IF processor User Manual
AD-02	CSO-MPI-ICD-01	CSO-IF processor SCPI commands
AD-03	CSO-MPI-MAN-02	CSO-FFTS User Manual
AD-04	CSO-MPI-DSD-02	CSO-FFTS Design Description
AD-05	CSO-MPI-TRE-01	Commissioning Report
AD-06	folder with: electrical diagrams & data sheets	

3 Introduction

The CSO-FFTS IF-processor is the link between the nominal 4-8 GHz IF output of the CSO heterodyne receivers and the CSO-FFT spectrometer.

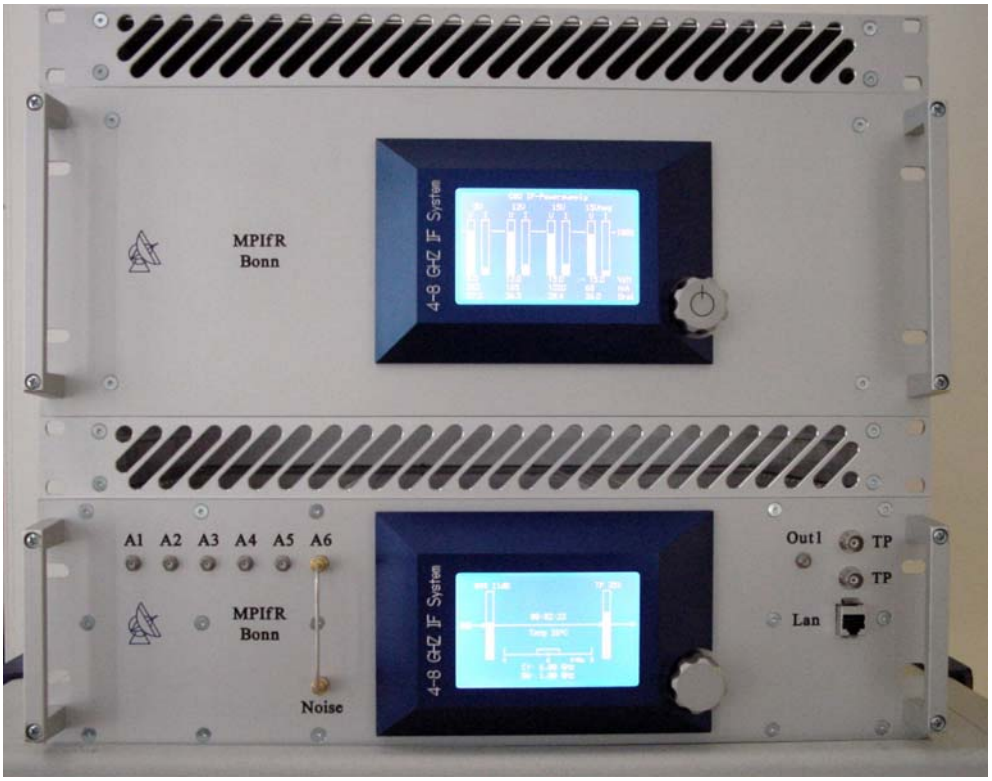

Fig. 1: shows the CSO-FFTS IF processor (bottom) and power supply units (top).

The IF-unit has 6 selectable inputs (A1-A6), with one outgoing “video” IF channel to the FFTS and 2 DC total power outputs. The unit can handle input frequencies between 4 and 8 GHz with a nominal input power level of -40 dBm ±10 dB. The output frequency is always between 0 and 1 GHz with a power level of 0 to +3 dBm.

The conversion between (part of the) input to the output band is done by a double heterodyne mixing process. The mixers are intrinsically double side-band mixers, but band pass and low pass filters ensure that they in fact operate in a single side-band mixing process. We always use the lower side-band (LSB). With the first conversion a (selectable) part of the 4-8 GHz wide input band will be converted to a 2-4 GHz (intermediate) band. This 2-4 GHz band is limited by sharp-edge band pass filters (14 order). In a second conversion the signal is processed (again in LSB mode) to the nominal 0-1 GHz input band of the FFT spectrometers. Once more, the frequency band is limited by sharp-edge low pass filters. The upper edge of the 2-4 GHz filter defines the steepness of the slope of the lower edge of the output band and the upper edge of the 1 GHz low

pass filter provides the slope of the upper edge of the output band. Right after the input select switch an isolator ensures good input match.

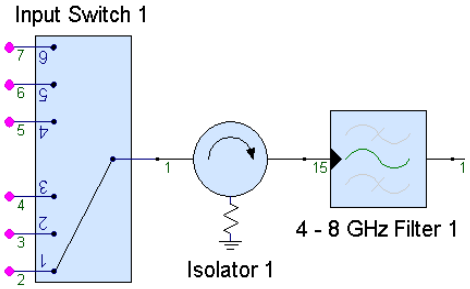

Fig. 2: Input selection switch with the isolator and band definition filter.

At the 2-4 GHz level a step attenuator with a nominal attenuation of 10 dB (attenuation range ±10 dB, in steps of 1 dB) is used to provide the nominal output level of 0 to 3 dBm to the FFTS.

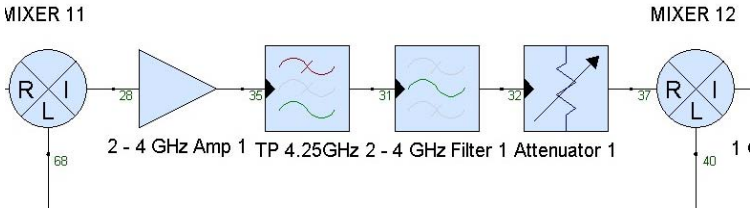

Fig. 3: The block diagram shows the processing at the 2-4 GHz intermediate frequency stage. The first part is a 2 – 4 GHz high gain amplifier, followed by a low pass filter, a bandpass filter and the step attenuator. The low pass filter is used as a band stop filter for the LO (8–11 GHz) The upper edge of the 2–4 GHz filter defines the lower band edge of the output band. The step attenuator is set nominally to 10 dB, with an attenuation range of ± 10 dB.

The total power detector is limited to the same 1 GHz wide band, selected for the spectrometer, so to provide the total power with the same atmospheric transmission.

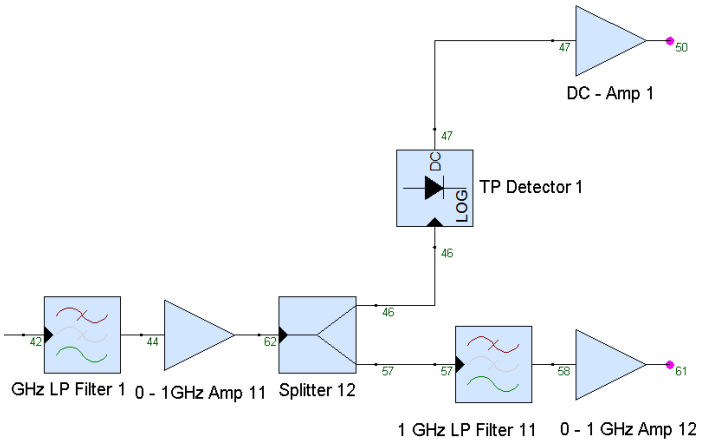

Fig. 4: shows the 0-1 GHz part of the IF processor: two 1 GHz low pass filters define the upper edge of the output band. The total power detector is located close to the output of the processor chain and detects the power level of the signal in the same frequency band that is delivered to the FFTS. The total power signal is available on the front panel (BNC connector, Fig.1).

We integrated a 4 - 8 GHz noise source for general test purposes. The output of the source is available at the front panel of the IF- processor and is normally connected to the input port number 6.

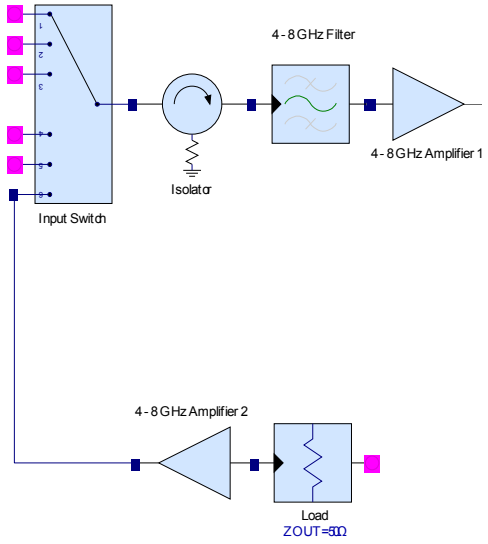

Fig. 5: shows the layout of the 4-8 GHz noise source. The noise source consists of a 50 Ohm load as the generator and a 4 – 8 GHz microwave amplifier.

4 System layout

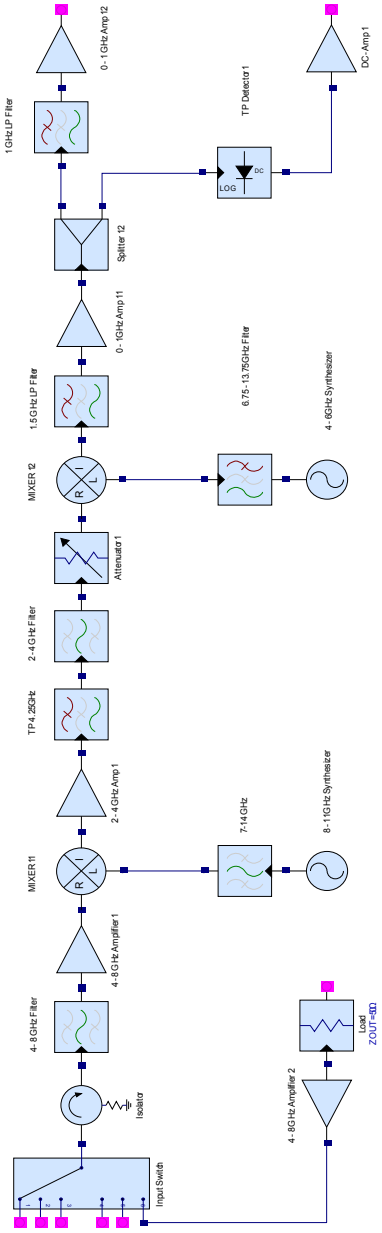

Fig. 6: Complete block diagram of the CSO-FFTS IF processor.

5 Technical Data

We summarize the technical data of the CSO-FFTS IF-processor:

Number of processor channels	1
Number of inputs per processor channel	6
Input frequency	4 – 8 GHz
Input power	-40 dBm ±10dB
Output frequency	0 – 1 GHz
Output power level	0 – 3 dBm
Nominal total power level (output)	2 – 3 Volt (max 5 Volt)
Noise source output	~ -40 dbm
Interfaces	Input : SMA female Output : SMA female Total Power : BNC female LAN: RJ45, 100MBit Ethernet
Total weight	Approx. 17 kg
Volume of the unit	5 height units 19 inch for the power supply 3 height units for the IF-system
Power consumption of the drive system	<30W, 230V/50Hz

6 Components list

Data sheets for all components can be found in the documentation package delivered to the project. Ich will hier nicht von spare parts reden, das formal die einheit nur geliehen ist. Ob sie oder wir reparaturen ausführen, müssen wir diskutieren und dann irgendwo festhalten.

Part	Frequency	Type	Company
Relay	0 -18 GHz	TS 610 – 10	Tesoel
Amplifier	4 – 8 GHz	JS3-04000800-15-10A	Miteq
Amplifier	2 – 4 GHz	JCA24-300	JCA
Amplifier	0.02 – 2.5 GHz	AML0022L3401	AML
Amplifier	0.02 – 2.5 GHz	AML0022L2401	AML
Attenuator	0 – 6 GHz	3406-55 / 12V	Aeroflex / Weinschel
Mixer	4 – 12 GHz	DM0412LW2	Miteq
Mixer	2 – 8 GHz	DM0208LW2	Miteq
Synthesizer	8 – 11 GHz	MLSL-0811IC	Micro Lambda
Synthesizer	4 – 6 GHz	MLSL-0406IC	Micro Lambda
Increment decoder	DC	STEC11B01	
Display	DC	EA eDIP240-7	Electronic Assembly