

Spectrometers for THz radiometers

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Abstract—To meet the wide spectrum of requirements in THz radiometers, Omnisys has developed state of the art back-end spectrometers based on Filterbank, Autocorrelation and FFT techniques.

The FilterBank (FB) solution may be optimum for wideband spectrometer requirements with few channels and was selected for the ALMA WVR instrument, covering 0.5-8 GHz divided on four detection channels. Meeting stability requirements, both absolute and relative between channels, is the major challenge for implementing a FB spectrometer. For the ALMA WVR, Omnisys deployed several techniques to meet the very stringent specification and these will be presented.

For high resolution spectroscopy, the FFT based technology is a natural selection. Omnisys is today developing a FFT module capable of processing 5 GHz continuous bandwidth with more than 16 k channels. The module will be 200x120x20 mm and consume 15-25 W depending on configuration (preliminary). This design will be presented.

For wide bandwidth / medium resolution requirements with limited resources, the autocorrelation spectrometer has few competitors. The HIFAS ASIC developed by Omnisys now enable spectrometer designs with up to 6 GHz bandwidth and 1024 channel resolution with only a few watts of power consumption in a very compact package. The ASIC itself is 5x6 mm in size. Examples of complete spectrometer and spectrometer systems will be presented, including the STEAMR 12 GHz wide system, a METOP back-end for 56 GHz line observation and the GUSSTO system with 3x16 spectrometers for balloon based THz observation, each of the 48 pixels being processed with more than 2 GHz bandwidth.