Polarimetric Spectrometer ASIC

Keywords: Polarimetric spectrometer ASIC, Earth observation, polyphase filter, FFT, ADC

Technical Summary

The P23801A polarimetric spectrometer ASIC processes two 10GHz bandwidth (H/V) input signals from RF front ends. Signal spectrum is channelized into 4,096 frequency bins, the frequency-domain results of each channel as well as the cross-products (4 stokes parameters) are calculated, and then accumulated. The analog front ends include VGAs and 6-bit ADCs. The digital back ends include PFB based FFT cores, accumulators and cross-channel analysis functions. The chip also includes an output data interface, a PLL based clock synthesizer and an SPI interface for the ASIC's programming and data interchange at low speed (Fig.1). The chip is offered in a BGA package (Fig.2). The ASIC (P23801A) is offered as a component and as a bord level solution (Fig.3). Fig. 4 shows measured ASIC performance results.

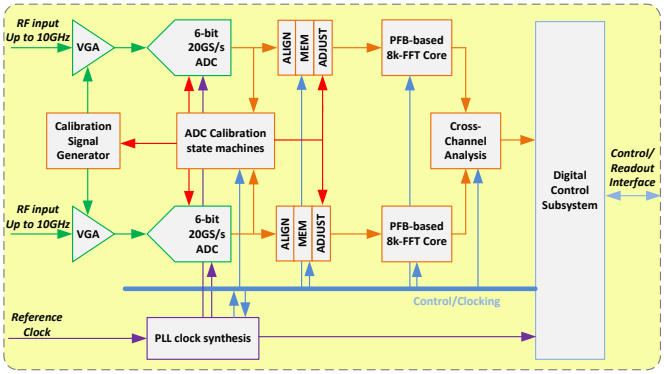

Figure 1. A block diagram of the ASIC.

Figure 2. The chip photo and expected view of the BGA packaged ASIC part.

Figure 3. An evaluation PCB.

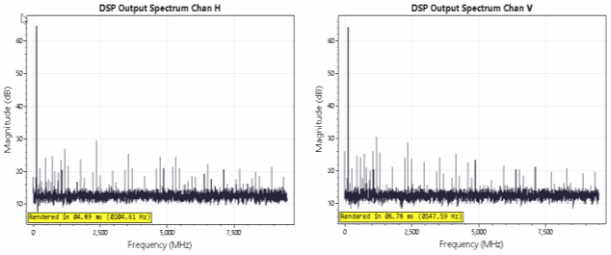

Figure 4. Demonstration of ASIC functionality.

Operational Capabilities

The ASIC includes 2 channels that digitize the RF signal and split spectrum into 4,096 frequency bins, thus, achieving 2.44MHz spectral resolution. Specific capabilities/features:

- Input signal -3dB bandwidth up to 14GHz
- Sampling rate up to 20GS/s
- Input signal FSR programmable from 100mV to 400mV pp differential and 4dB gain adjustability
- Digitizer ENOB > 4-bits up to 10GHz
- Power consumption < 4.5W (full functionality)
- Selectable number of frequency bins within 0 to 10GHz, maximum of 4096.
- User-defined window function can be applied
- Output data is 4 stokes parameters
- Less than ±0.5% (0.02dB) non-linearity over 10dB input power range
- Accumulation time programmable from 1us to 0.4s
- An integrated 20GHz PLL, selectable Fref
- An SPI interface for control, diagnostics and readout
- A high-speed 1.25Gbps LVDS readout interface
- Temperature range -40°C to 125°C
- 15 x 15 BGA package (12.8mm x 12.8 mm)
- Fabrication technology 28nm CMOS

Applications

- Remote sensing instruments
- Radio astronomy
- Planetary exploration missions
- Synthetic aperture radiometers
- Spectrum analyzers

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