Multipurpose Baseband Instrument

using AsAP Digital Signal Processing

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Outline

Multipurpose Baseband Instrument

Instrument Modes

The multipurpose baseband instrument supports several different operation modes:

1. Spectrum Analyzer
2. Oscilloscope
3. Arbitrary Waveform Generator
4. Signal Source

The operation mode can be changed on-the-fly.

Instrument Specifications

Specification	RF Input	RF Output
Frequency Range	DC to 120 MHz	DC to 120 MHz
BW	120 MHz	120 MHz
Sample Rate	500 MS/s	500 MS/s
Waveform Memory	2 GB	2 GB
Impedance	50 Ω	50 Ω

Measurement Board Assembly

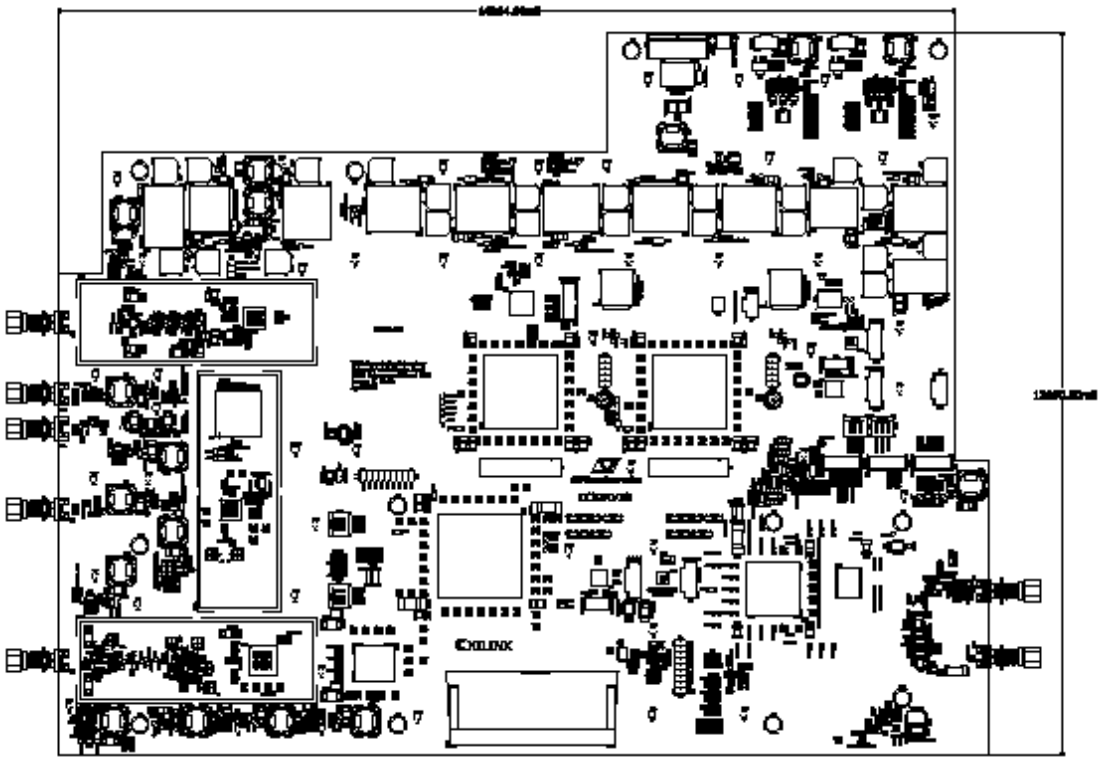

Figure: Measurement Board Assembly Top.

Measurememt Board Information

The Measurement board contains:

- 2 AsAP ICs providing up to 500 GigaOps/sec of signal processing capability.
- 16-bit, 1GS/s Digital-to-Analog Converter.
- 12-bit, 500MS/s Analog-to-Digital Converter.
- Xilinx Virtex-5 SX50T
- QDR-II SRAM, 36Mbit, Burst of 4, 250MHz
- DDR2 SDRAM, 2GB, 250MHz

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AsAP DSP Tasks

- 4096-point Fast Fourier Transforms.
- Window Filters: Hanning, Flattop, and Gaussian
- Signal Statistics: Minimum, Maximum, Average, Frequency.
- Magnitude, Phase, Magnitude Squared.

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Baseband IF Block Diagram

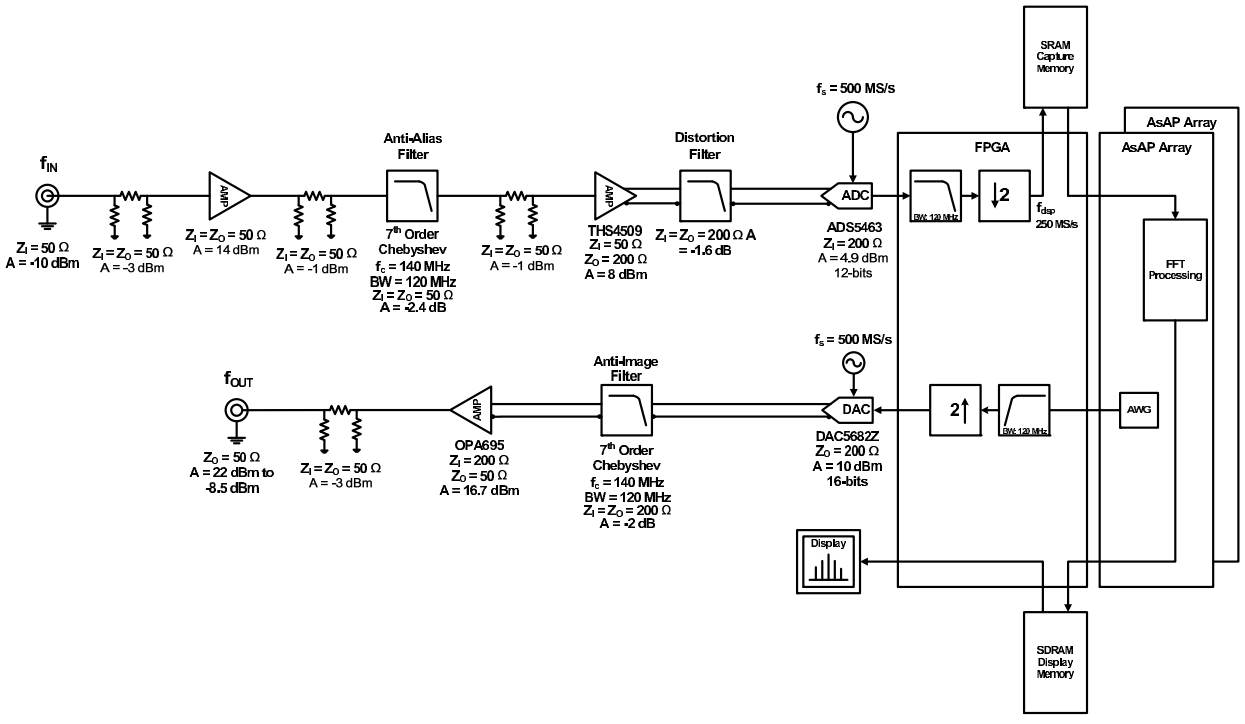

Figure: Instrument IF Block Diagram.

- f_s = 500 MS/s, BW = 120 MHz, and f_{dsp} = 250 MS/s.

Anti-Alias Lowpass Filter

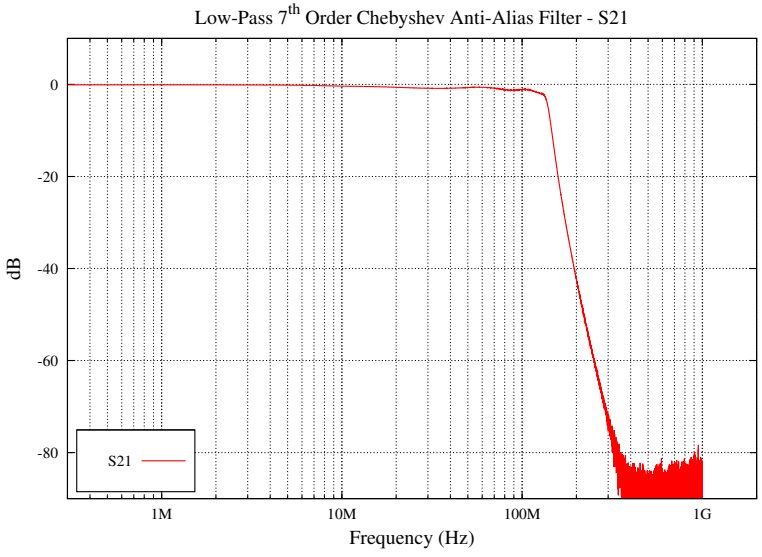

Figure: Frequency Response

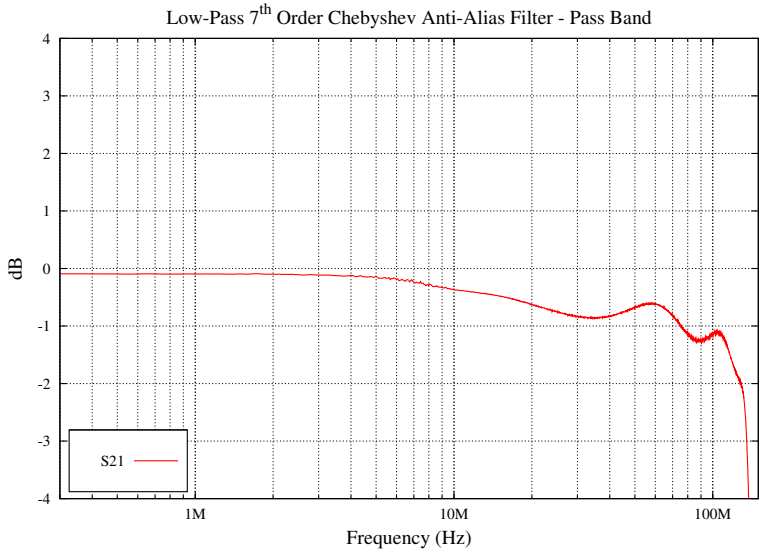

Figure: Pass-band Response

Digitized 100MHz Sine Wave

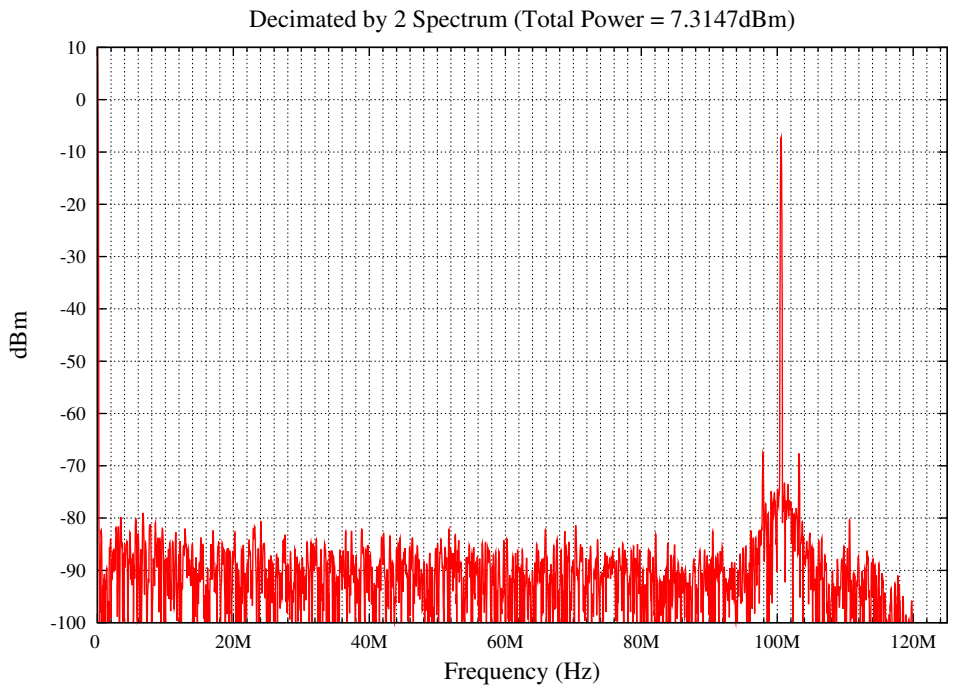

Figure: f_{in}: 100 MHz - Decimated-by-2.

40MHz Sine Wave

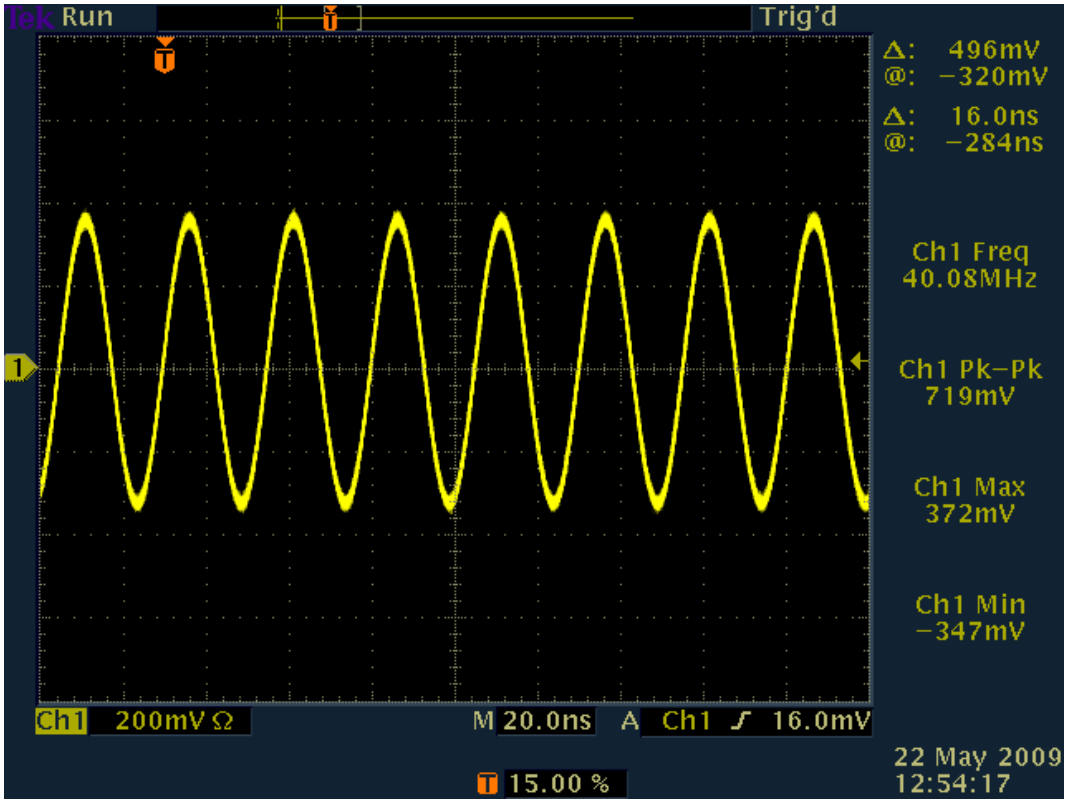

Figure: f_{out}: 40 MHz