ICE

Innovative Computer Engineering

2009 FPGA Developer Conference

ICE Corporate Overview

- Innovative Computer Engineering
  - Founded in 1994 by Jeff Schoen (Arizona Corp.)
  - Purpose: To create high performance frameworks for Digital Signal Processing (both HW & SW)
  - Developed NextMidas DSP software suite and the ICEPIC data acquisition card series
  - June 2008: ICE Inc. of AZ, Rumel Inc. , and LowNoiseFloor LLC merge to become the new ***Innovative Computer Engineering Inc.*** (a Virginia Corporation)

ICE Corporate Overview

- Innovative Computer Engineering
  - New company has over 150 supported products with customers located around the world
  - Merger allows us to create a more coherent, tightly integrated, customer-responsive product line
  - Focus is on high performance, cost effective hardware, and software for signal processing systems
  - OEM supplier to Tier-1 system builders, engineers, and integrators

ICE Product Categories

- DSP Interface Cards and Software

- I/O Modules

- Processing Modules

- Integrated Subsystems

DSP Interface Cards

- ICEPIC Series (**ICE P**eripheral **I**nterconnect **C**omponent)

  - Series 4 provide PCI interface

  - Series 5 provide PCI-X interface

  - Series 6 provide PCI-Express interface

- All ICEPIC series cards provide: I/O module sites, processing module sites, host bus interface site

- Data flow between sites provided by our high performance crossbar architecture

- All ICEPIC interface cards suitable for wideband data acquisition, playback, spectral analysis, digital tuning

- Advanced DSP functions supported by processing modules

DSP Interface Cards

- Software
  - Drivers
    - Linux fully supported (RedHat, SuSE, 32 & 64 bit)
    - Windows XP drivers also available
  - Application Programming Interface libraries written in "C"
  - Realtime control and monitor from NextMidas
    - JAVA-based DSP package
    - Source code freely available and distributable

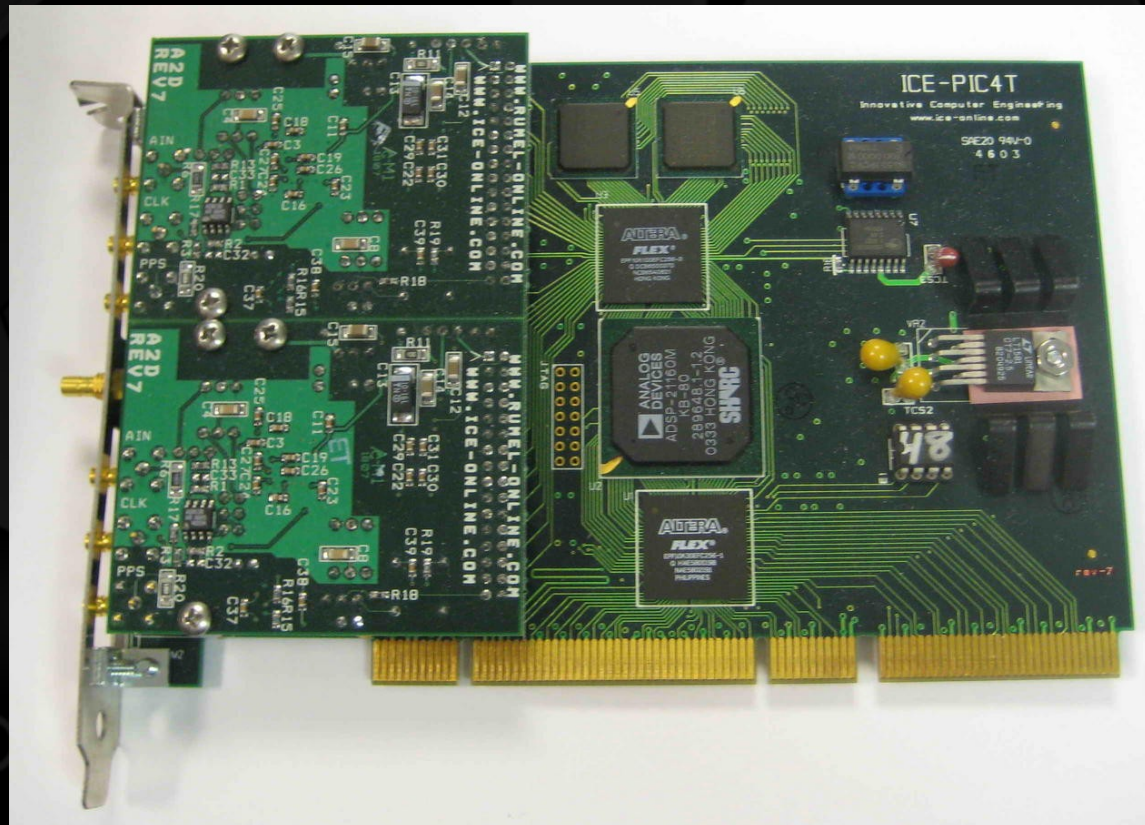# *DSP Interface Cards*

- Crossbar Architecture and API
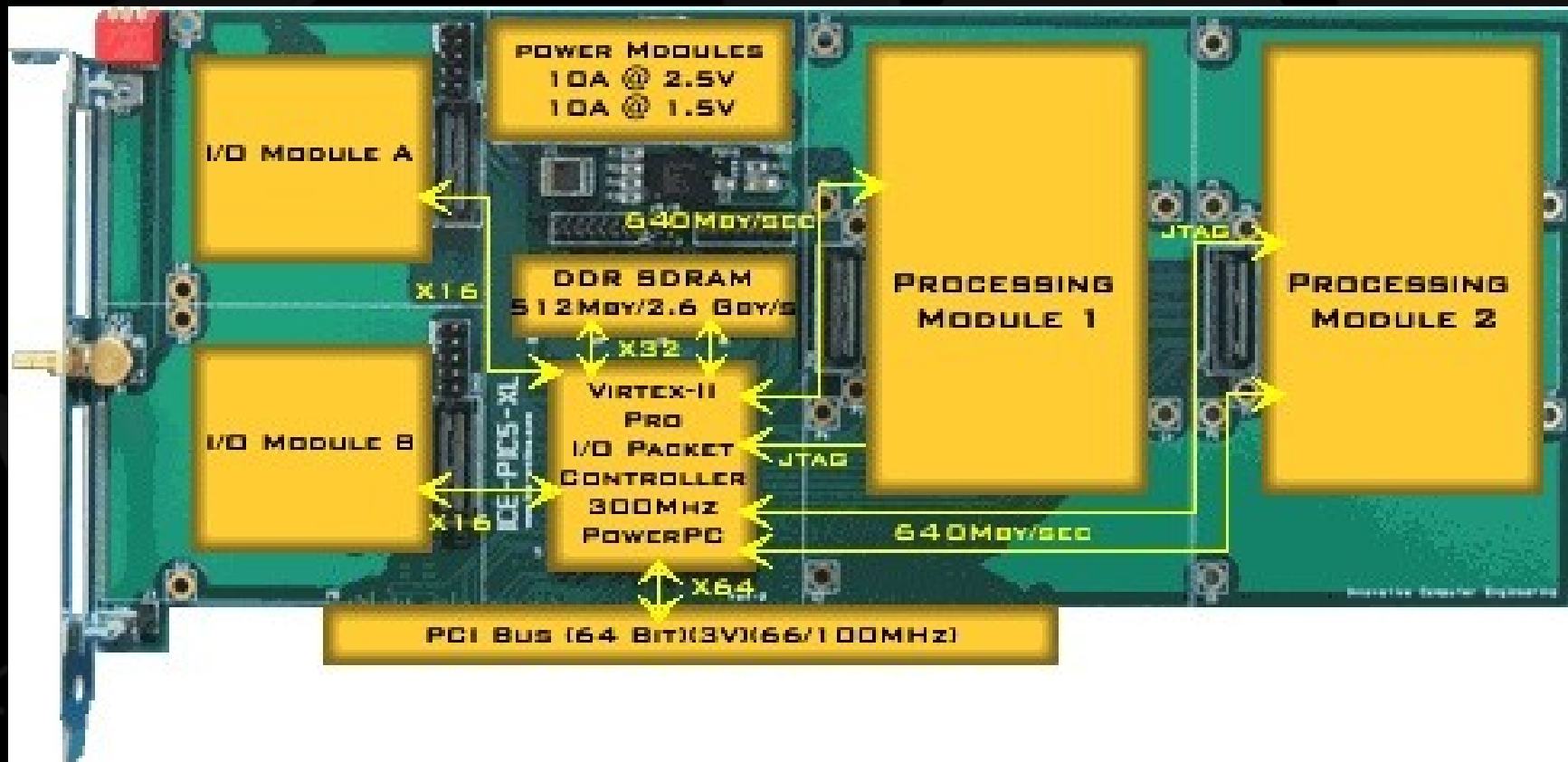
DSP Interface Cards

- ICE-PIC4T / ICE-PIC4X / ICE-MBT4

  - Legacy PCI bus interface card

  - 32/64-bit 33/66MHz 5/3V Universal PCI

  - SHARC-21160 & Alterra Flex10K100 crossbar

  - 2 I/O module sites, and 2 GC4016 Tuners

  - 1 processing module site (ICE-PIC4X / ICE-MBT4)

  - 200Mby/sec data capture/playback

  - 400MFLOP sustained processing power

  - 8 Channel Digital Tuning up to 100MHz

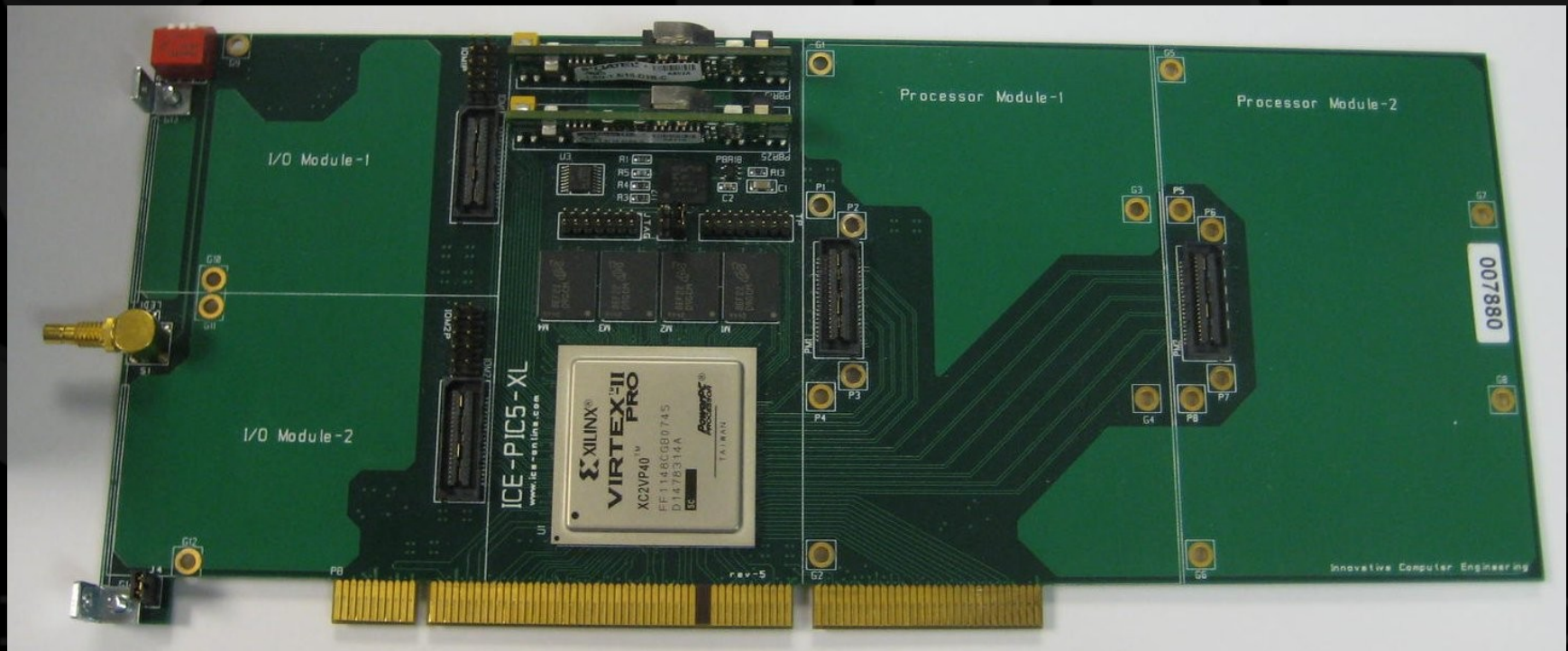# *DSP Interface Cards*

- ICE-PIC4T / ICE-PIC4X / ICE-MBT4

DSP Interface Cards

- ICE-PIC5XL / ICE-MBT5
  - PCI-X (64-bit 66/100/133MHz) bus interface
  - Virtex-II Pro at crossbar interface
  - 2 I/O module sites
  - 2 processing module sites
  - 500 Mby/sec data capture/playback to PCI-X bus
  - 256 MByte on board DDR SDRAM
  - 2-channel digital tuner implemented in fixed point processor

DSP Interface Cards

- ICE-PIC5XL / ICE-MBT5

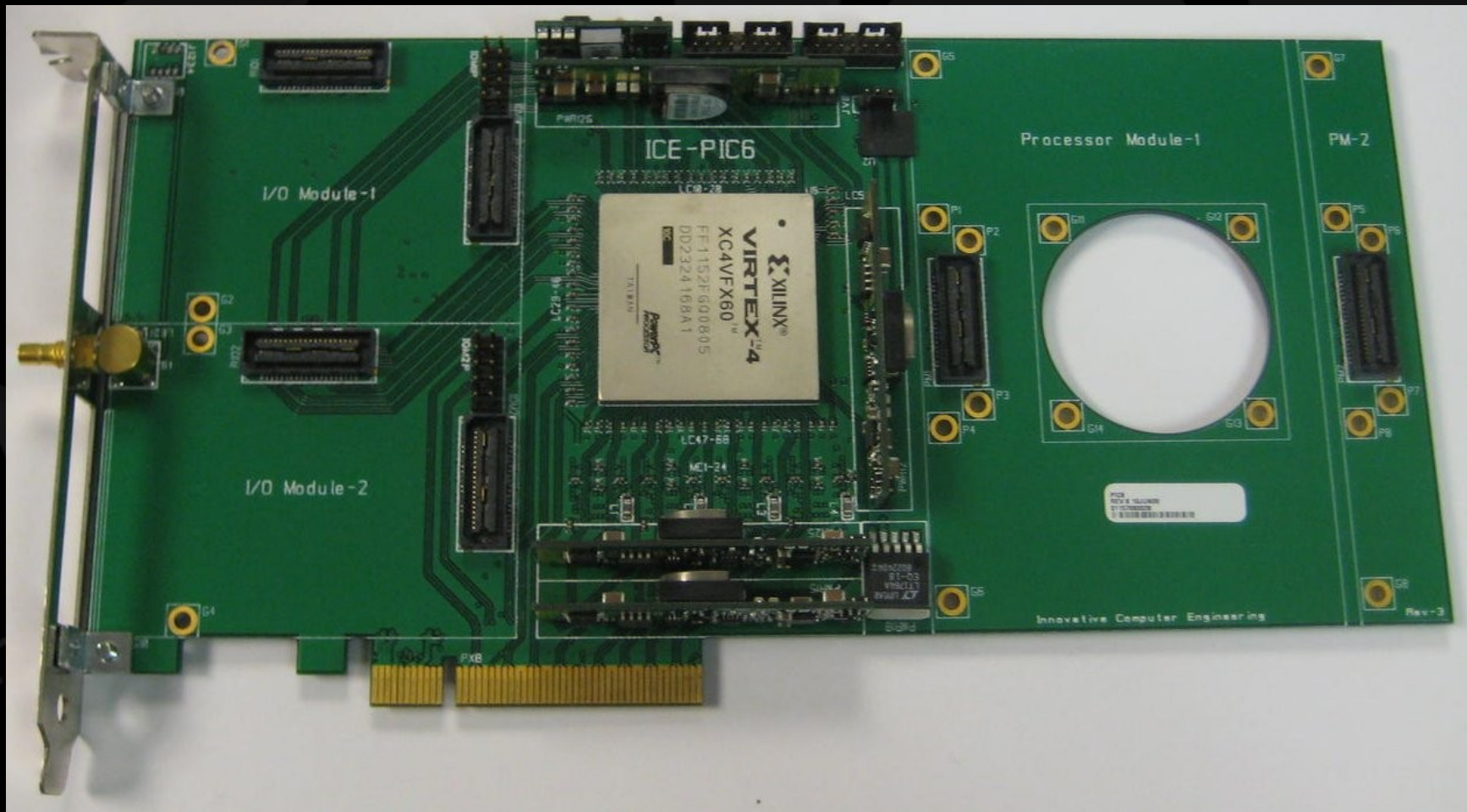# DSP Interface Cards

- ICE-PIC6
  - PCI-Express (8-lane native) bus interface
  - Xilinx Virtex-4 FX60 at crossbar interface
  - 2 I/O module sites
  - 2 Rocket I/O sites
  - 2 processing module sites
  - 1500 MByte/sec data capture/playback to PCI-e
  - 256 MByte on board DDR SDRAM
  - 2-channel digital tuner (22GTap/s FIR, 6us 2K RFFT)

DSP Interface Cards

- ICE-PIC6

I/O Modules

- Standard interfaces supported
  - Digital interface modules
    - ECL, LVDS, TTL, etc.
  - Analog interface modules
    - A/D, D/A, Tuner
  - Network / Optical interface modules
    - SONET (OC-192) / SDDS / GBE / 10Gigabit
- Over 30 I/O modules available

I/O Modules

- ICE-A2DR13
  - 12 Bit 250MHz A/D Converter
  - Near theoretical performance (>72dB SFDR)
  - AC Coupled, Analog input range up to 750 mVp-p
  - Variable gain input: -4dB to +20dB (1dB step size)
  - Multiple clock source
    - direct external clock drive using 1Vp-p input signal
    - clock synthesized from external 10MHz reference
    - clock synthesized from on-board 10MHz reference
  - For use with ICE-PIC5XL or ICE-PIC6
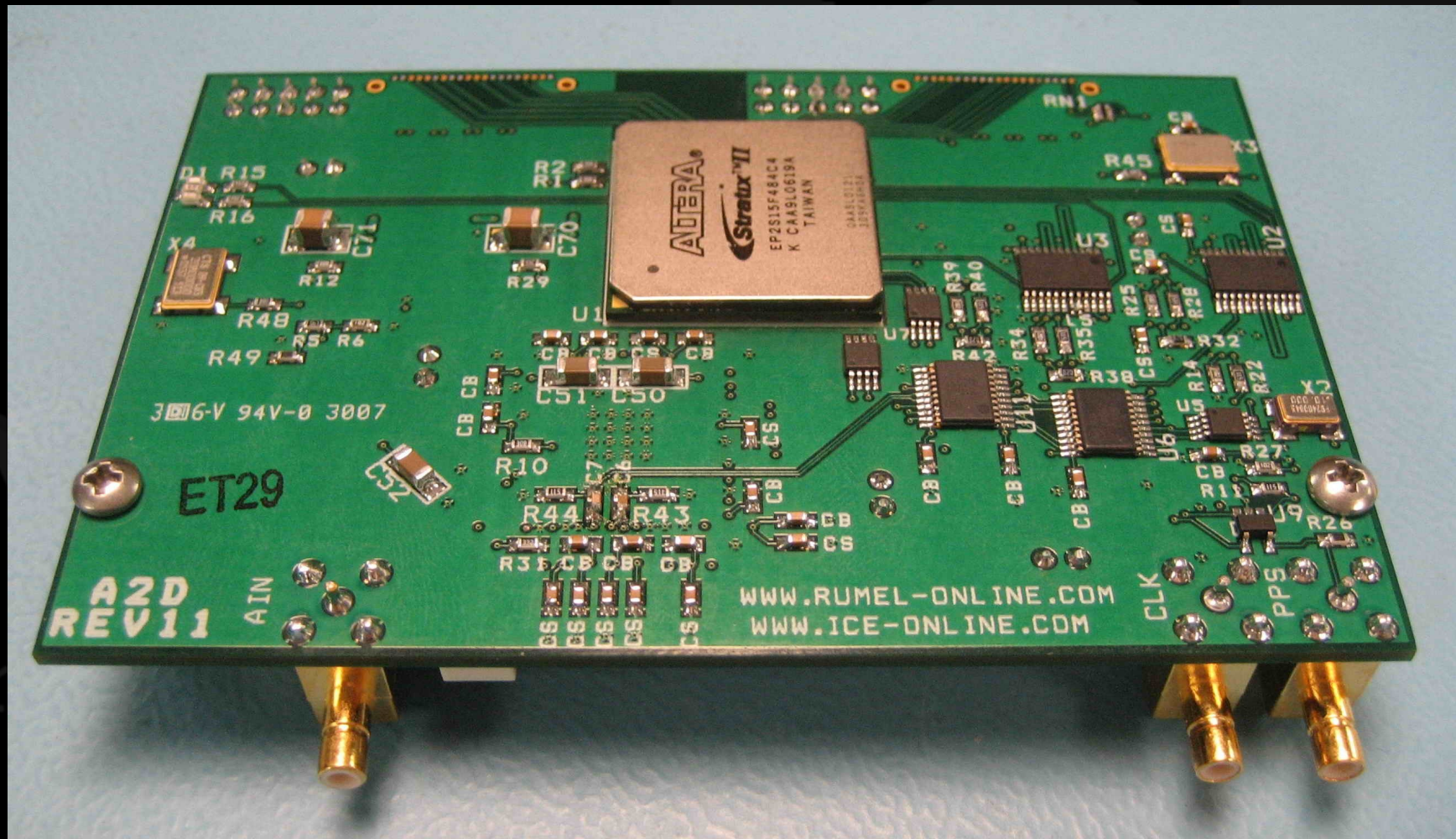
I/O Modules
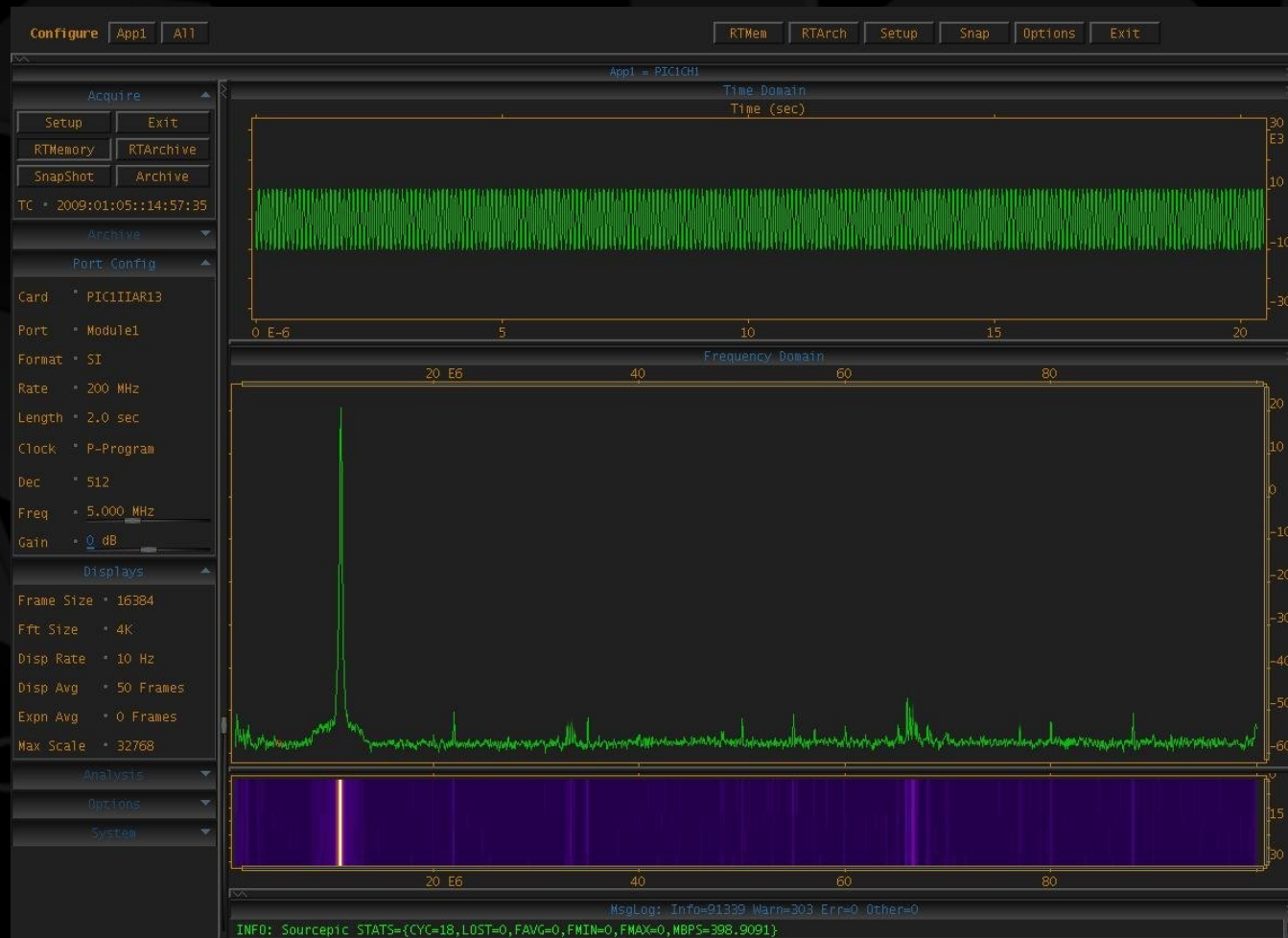
- ICE-A2DR13

I/O Modules

- ICE-A2DR11
  - 8 Bit 1.5GHz A/D Converter (National ADC08D1500)
  - AC coupled 1Vp-p max input
  - Multiple clock source
    - direct external clock drive using 1Vp-p input signal
    - user supplied on-board 14 pin package oscillator
    - clock synthesized from external 10MHz reference
    - Clock synthesized from on-board 10MHz reference
  - Requires no extra heat sinking or fans
  - Dual site module (uses both I/O ports of ICE-PIC)
  - For use with ICE-PIC5XL or ICE-PIC6
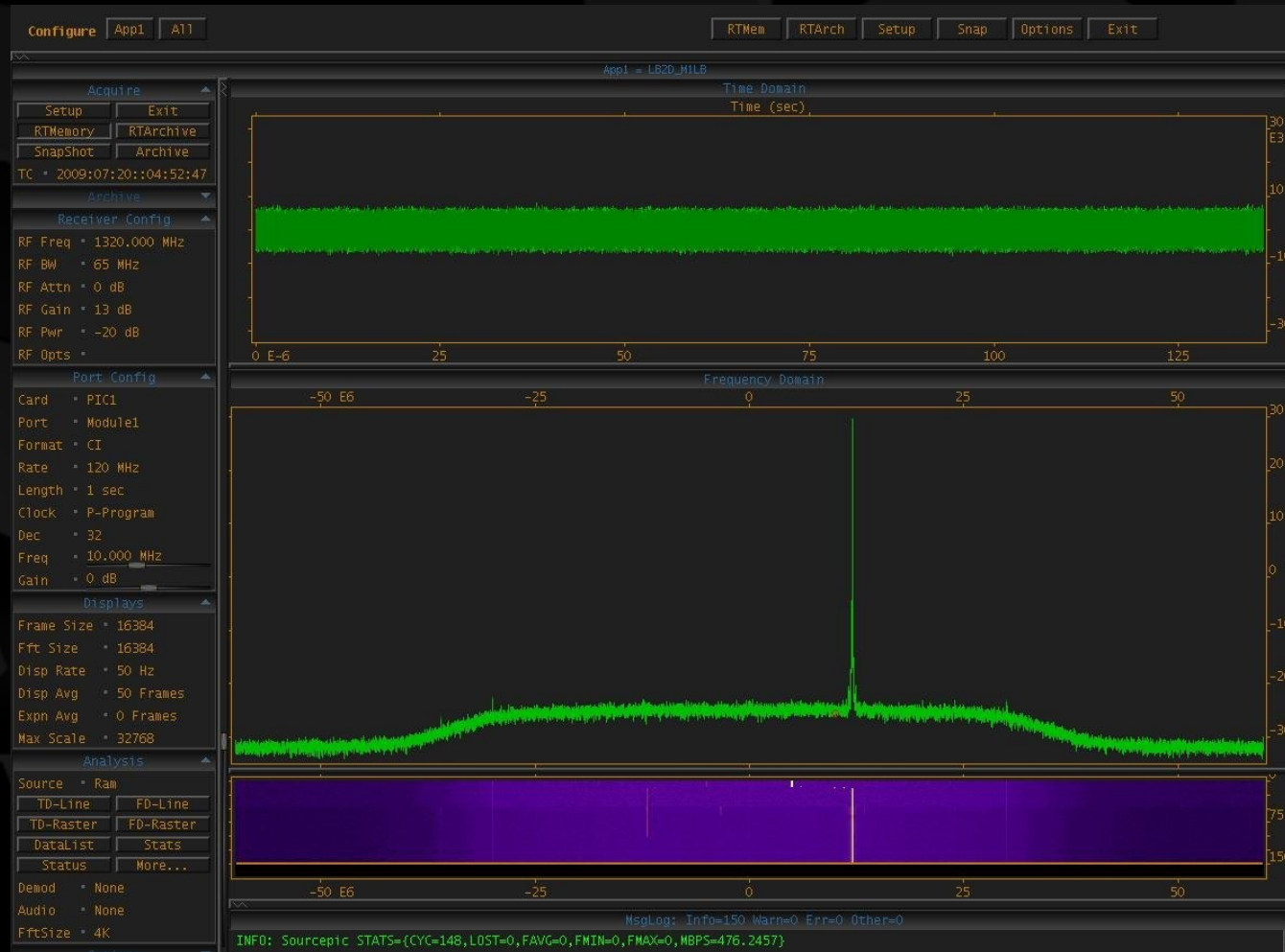
I/O Modules

- ICE-A2DR11

I/O Modules

- ICE-LB2DR1
    - L-Band direct downconversion receiver module
    - Covers entire 800-2250MHz range
    - 100kHz analog tuning resolution
    - Wide input level range (-70dBm to +10dBm)
    - Selectable bandwidth (1MHz to 70MHz)
    - Dual channel 14-bit A/D for I/Q output
    - Adaptive digital compensation for I/Q DC offset
    - Adaptive image suppression (AIS) for >50dB image suppression across output bandwidth

I/O Modules

- ## ICE-LB2DR1

I/O Modules

- ICE-10GSDDS
  - 10Gbit/sec SDDS module
  - Operates at full line rate
  - Supports minimum inter-packet gap
  - SDDS compliant packet acquisition and playback

Processing Modules

- Several processing modules available
  - ICE-DTDM, ICE-DTDMX, ICE-ZPPM, ICE-V5M,
  - ICE-V6M (Available October 2009)
- Provide both generic (tune, resample) and application-specific (decode, demux) functionality
- User configurable and programmable
- High performance API for data I/O to/from module site

Processing Modules

- ICE-DTDM / ICE-DTDMX

  - Virtex-II Pro Digital Tuner / Demultiplexer Module

    - software programmable I/O routing, filtering, demodulator LUTs, and bit processing (~22GOPS)

    - Xilinx XC2VP7 on DTDM / Xilinx XCVP40 on DTDMX

  - Eight 100 MHz GrayChip GC4016 Digital Tuners

  - 64MBytes of DDR400×32b NDRAM

    - shared by PLD and Tuners with 1.6Gby/s ram access

  - Tuners treated as software accelerators to allow flexible access to tuner resource
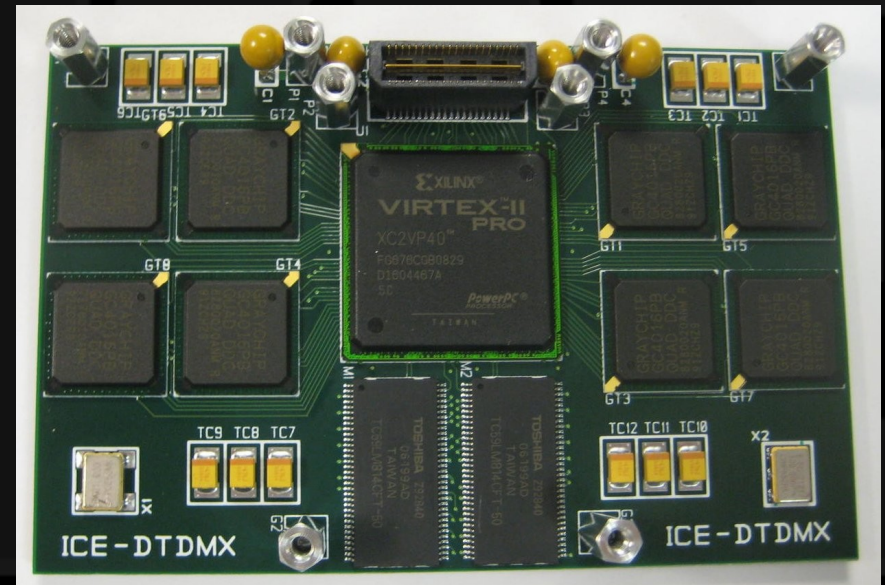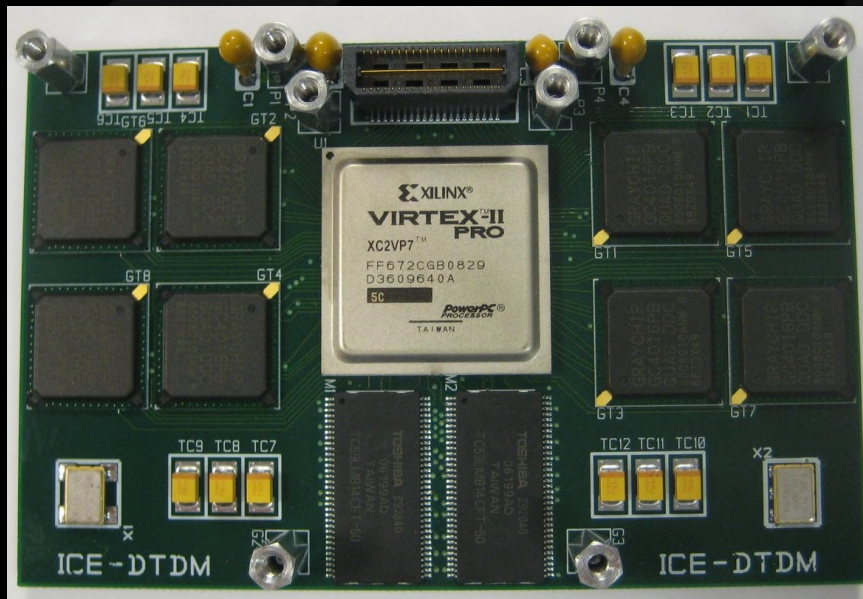
Processing Modules

- ICE-DTDM / ICE-DTDMX (cont.)

  - Digital resampling

    - preTuner at 200MSPS/28taps

    - post tuner on each channel

  - FPGA based AM/FM/PM/QAM demodulators for all tuner outputs

  - Apps: 32 channel tuning at 100MHz input, 64 channels at 50MHz, 128 at 25MHz, 8 at 400MHz, etc.

Processing Modules

- ICE-DTDM / ICE-DTDMX (cont.)
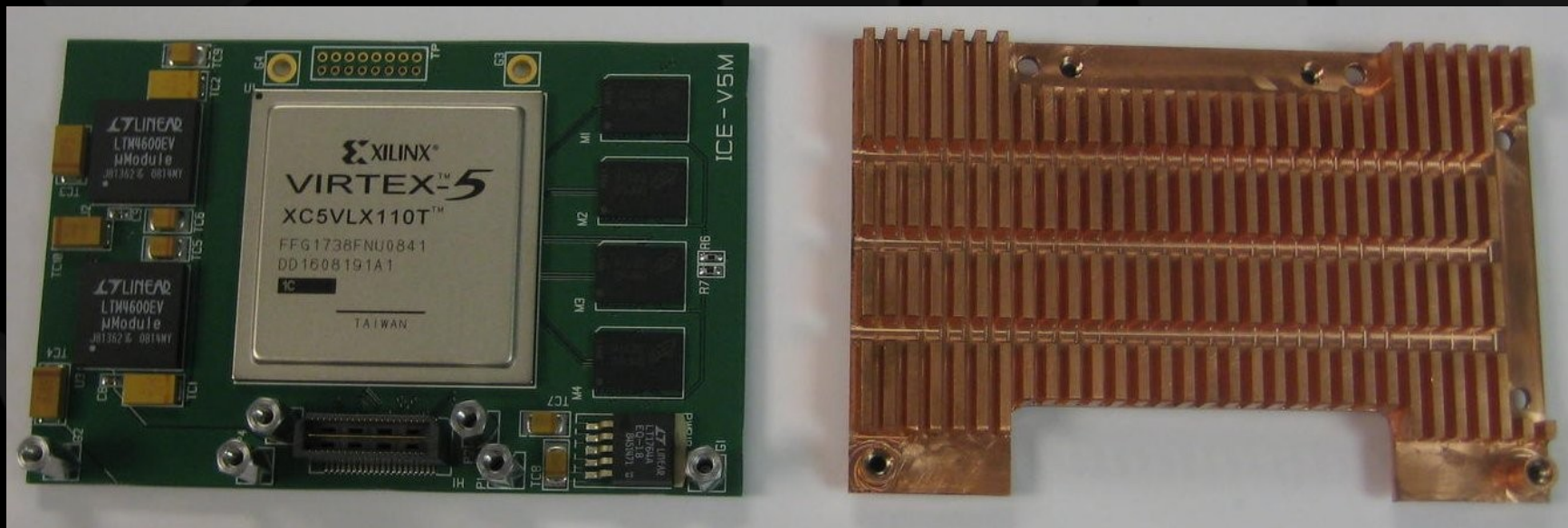
Processing Modules

- ICE-V5M-LX110

  - Virtex-5 based processing module

  - 512MB on-board memory

  - Standard module uses Virtex-5 LX110

  - Custom builds available for pin-compatible parts

    - V5M-LX220, V5M-LX330

    - V5M-FX200

    - V5M-SX240

    - Minimum quantities apply

  - Good fit for bit manipulation and logic

Processing Modules

- ICE-V5M-LX110

Processing Modules

- ICE-V6M-LX240 (available October 2009)
  - Virtex-6 based processing module
  - 512MB on-board memory
  - Standard module uses Virtex-6 LX240
  - Custom builds available for pin-compatible parts
    - V6M-LX130, V6M-LX195, V6M-LX365
    - V6M-SX315, V6M-SX475
    - Minimum quantities apply
  - Good fit for many DSP problems
    - From 480 to 2016 DSP multipliers, 768 in the 240T.

Integrated Subsystems

- ICE provides integrated subsystems in addition to DSP components

  - Over 200 subsystems currently deployed to customers worldwide

  - Most can be rapidly reconfigured to address a wide range of data acquisition, playback, and processing needs

  - Allows customers to focus resources on their real problem instead of developing missing infrastructure components
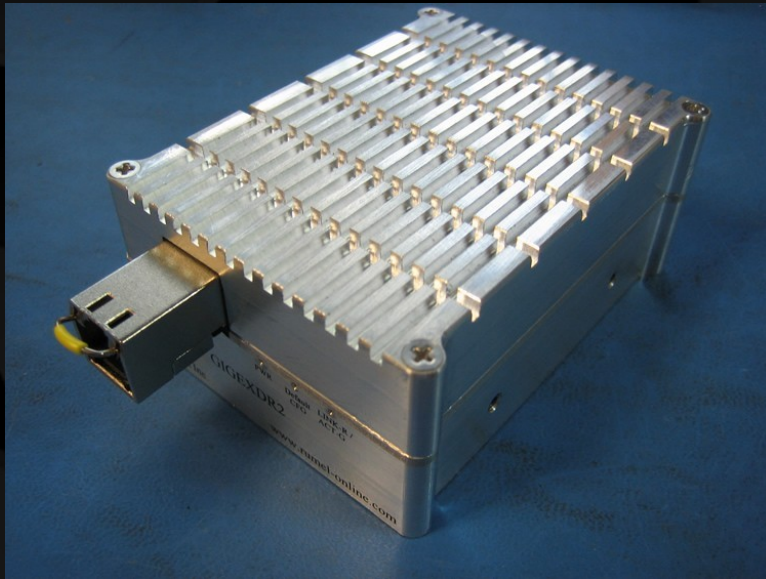
Integrated Subsystems

- ICE-GIGEXDR2

  - Converts analog IF input to UDP gigabit ethernet stream of packets (SDDS format)

  - Uses ICE-A2DR13 for data conversion

  - SFP for copper/fiber gigabit ethernet output

  - Unit has been independently qualified for precision timing applications

  - Sub-nanosecond data timestamps are supported

  - Available as single units (2.7in x 1.5in x 3.5in)

  - Also available in a 4-channel 1U configuration

Integrated Subsystems

- ## ICE-GIGEXDR2

Integrated Subsystems

- ICE-QT464-10G
  - Fully portable data recording / playback
  - 1400MB/second sustained to disk
  - 4 Terabyte disk capacity / 16 Gbytes RAM
  - Total power consumption less than 300W
  - Total weight less than 30lbs
  - Configurable I/O modules
    - A2DR11 for 1.5GSample/sec recording
    - Dual A2DR13 for dual 250MSample/sec
    - SONETR4/R5 for optical recording

Integrated Subsystems

- ICE-QT464-10G

Integrated Subsystems

- ICE-POD-G1

  - Fully functional ICEPIC-6 with COM-Express motherboard in rugged, portable housing

  - 2.5GHz Intel Core 2 Duo CPU with up to 8GB RAM

  - USB and Gigabit Ethernet standard

  - 8GB internal solid state system drive

  - Up to 1Terabyte internal solid state data storage

    - High speed at RAID-0 (>320MB/sec)

  - Less than 85 Watts total power dissipation

  - Small size (5.7in x 1.7in x 11.2in)

Integrated Subsystems

- ## ICE-POD-G1

  - All ICE-PIC6 I/O Module and Processing Module options available (*iPhone not included*)

Questions / Comments

- ## Follow-up after this presentation

  - ### Offline discussions on specific requirements

  - ### Detailed descriptions of capabilities

- ## For pricing and additional info check out:

  ### www.ice-online.com