



2011 ARRL TAPR Digital Comm Conference

DATVexpress - a Lower Cost Approach to DATV

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Status of Digital-ATV Today

- Video Quality of DATV far exceeds analog-ATV
- Very few hams transmitting DATV in USA today
- European DATV is very active and growing
- Australia/New Zealand has more DATV activity than USA
- Digital-ATV transmitters are currently expensive
- US\$1,000-to-US\$10K range for MPEG/DVB-S XMTR set
- Cost of DATV Transmitter is barrier to more ham use

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Goals of Project?

- Digital-ATV transmitters are currently too expensive
- Minimum US\$1,000 for German MPEG/DVB-S board set
- Cutting that price by 2/3 will encourage more DATV use
- The software and hardware should be open-source
- Design source freely available without restrictions encourages others to contribute new functions and performance

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The DATVexpress Team

- Charles Brain - G4GUO Ferring, England
- Ken Konechy - W6HHC Orange, CA, USA
- Art Towslee - WA8RMC Columbus, OH, USA
- Tom Gould - WB6P Portland, OR, USA
- Charles Beener - WB8LGA Columbus, OH, USA

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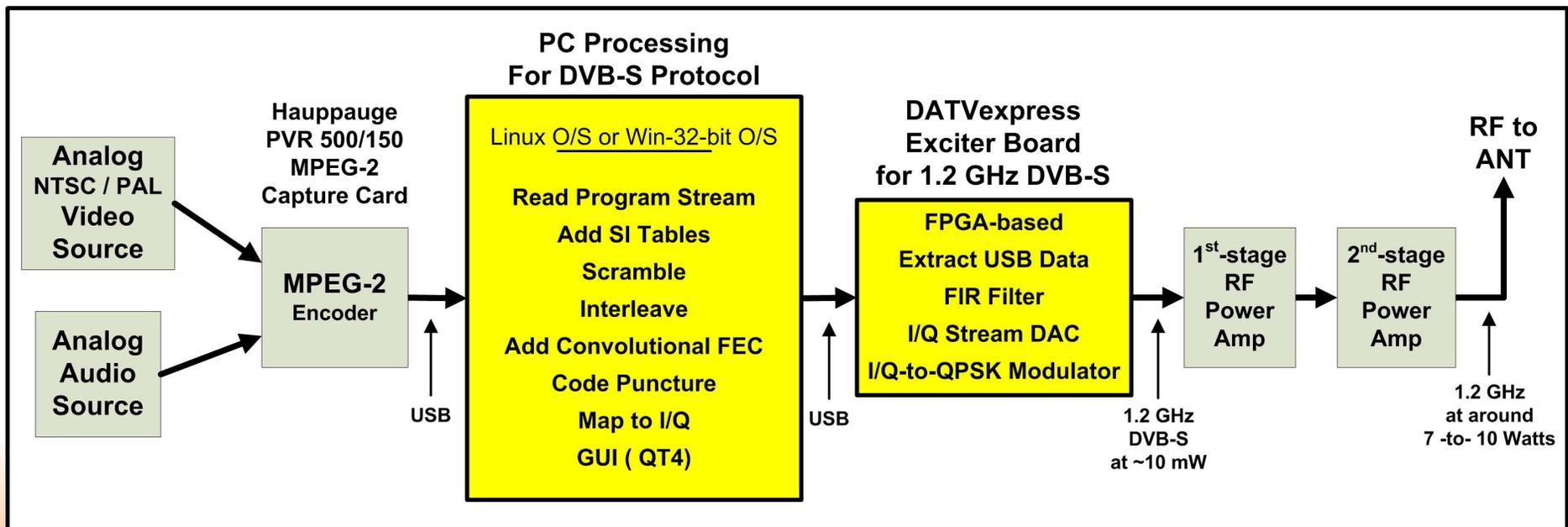
Overview of DATVexpress System

- Video Capture card for MPEG-2 encoding
- PC (Linux or Win) performs DVB-S processing and outputs I/Q stream
- Simple Hardware board exciter preps I/Q stream and does QPSK modulation on 1.2 GHz
- Just add RF Power Amps and Antenna

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Overview of DATVexpress System – cont'd



System Block Diagram for DATVexpress DATV Transmitter

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Overview of PC Software

- Operating System - Linux 32/64-bit then Win32
- Load FX2 firmware
- Load FPGA firmware
- Control 1.3 GHz PLL
- Control symbol rate generator
- Control human peripheral device

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Overview of PC Software – cont'd

- Take program/transport stream from capture card
- Convert to transport stream with correct PIDS
- Add SI Table information

- Add FEC
- Do interleaving
- Keep symbol rate constant, no overruns or underruns
- Generate IQ symbols
- Talk to exciter board via Hi speed USB interface

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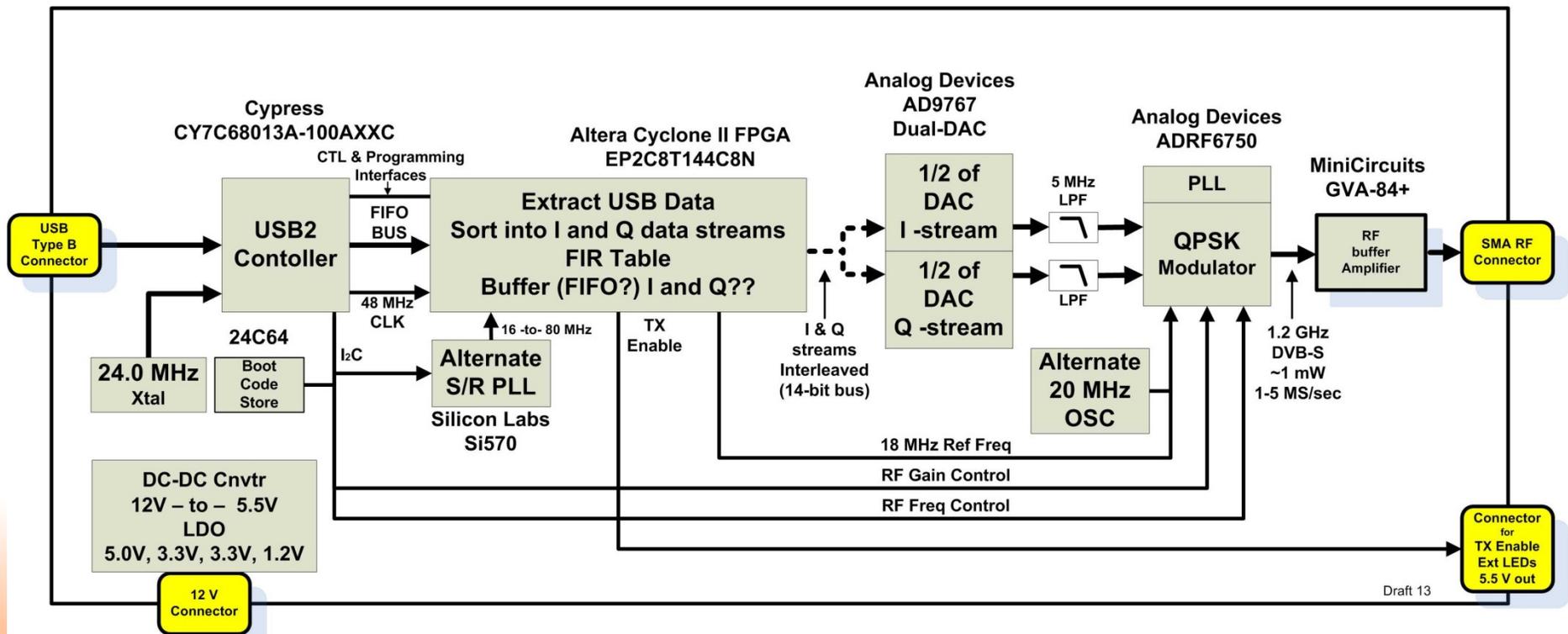
Overview of Hardware Board

- Single custom designed board preps IQ stream and provides QPSK modulation at 1.2 GHz
- Interfaces to PC processing by USB2
- Contains PLL for the 1.2 GHz frequency control
- Controls Symbol-Rate
- Provides small buffer-RF amplifier to ~10 mW
- DC-DC power supplies allows single 12V input
- Connect to RF Power Amp stages and antenna

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Overview of Hardware Board – cont'd



Block Diagram for DATVexpress Hardware Board

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Overview of Hardware Board Coding

FX2 code (USB chip has 8051)

- Program FPGA
- Manage USB FIFO interface with FPGA
- I2C interface with 1.3 GHz PLL
- I2C interface with symbol rate generator
- General Housekeeping

FPGA code

- Interpolate symbols to final sample rate
- Channel filter
- Write to DAC

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DATVexpress System Specs

- DVB-S protocol
- QPSK modulation
- Frequency Range:
 - 1240–1300 MHz (allowed in USA)
 - 1240–1325 MHz (allowed in Europe)
- Symbol-Rate:
 - Adjustable: 1 MSymb/sec -to- 5 MSymb/sec
- Forward Error Correction is selectable
- RF output ~ 10 mW buffered (SMA connector)
- Video Capture card allows for NTSC or PAL
- Initially designed for one video stream
- Operating system – first Linux-32/64 then Win32

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Current Project Status

- Architecture – completed
- Schematic Capture – completed in DXdesigner tool
- PCB Layout - nearing completion in PADS tool
- Next Step – design review of PCB layout, Gerbers, etc
- Then Fabricate first-article PCB blanks and stuff
- Then check-out and software integration begins

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What about DVB-T or DVB-S2?

- “Yes, it is possible....”
- “But, the team has only committed to DVB-S”

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Conclusion and Plans

- Code written for the USRP2 needs porting
- Write FX2 loader code
- Write FPGA code
- Source files will be freely available with no restrictions
(Software, FPGA, Schematic, PADS-files, etc)
- DATVexpress team on target for low-cost DVB-S board

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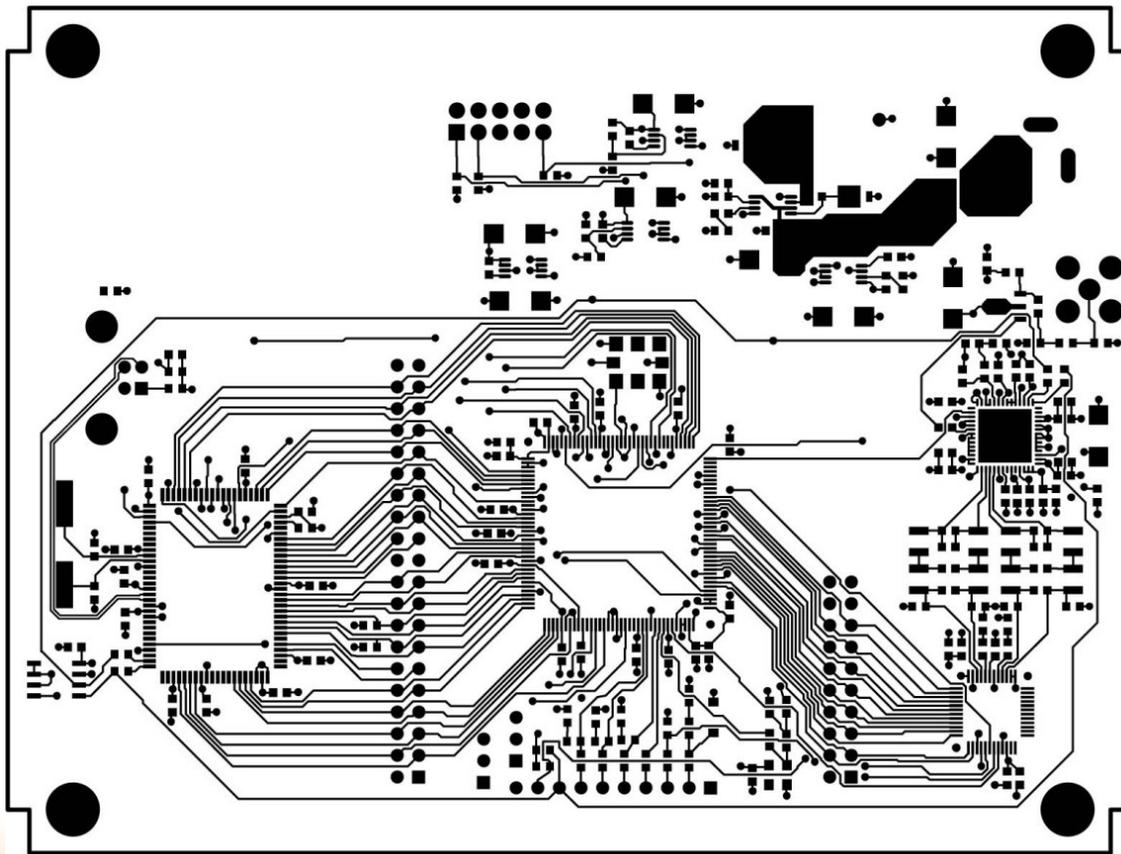
Useful Links:

- Digital Video Broadcasting organization (DVB commercial standards)
www.DVB.org
- Amateur Television of Central Ohio
www.ATCO.TV
- British ATV Club - Digital Forum
www.BATC.org.UK/forum/
- OCARC library of newsletter DATV articles
www.W6ZE.org/DATV/
- Rob-MØDTS D-ATV site including details of F4DAY-design
www.M0DTS.co.uk/datv.htm
- DigiLite Project for DATV (derivative of the “Poor Man's DATV”)
www.G8AJN.tv/dlindex.html
- AGAF D-ATV components (Boards)
www.datv-agaf.de and www.AGAF.de
- SR-Systems D-ATV components (Boards)
www.SR-systems.de and www.D-ATV.org
- Yahoo Group for Digital ATV
<http://groups.yahoo.com/group/DigitalATV/>

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Proof-of-Progress – Top Etch Layer



LAYER 1 TOP

