Amateur Television in Central Ohio
Digital Television
The New Ham Frontier

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DATV Advantages over Analog

- Picture quality near perfect.
- Noise and Multipath cancellation possible.
- Noise reduction.
- Can occupy less bandwidth.
- Less transmit power for same range.
- It’s neat to be on the cutting edge (Bragging rights).
DATV Disadvantages

- Most DATV is in Europe.
- Transmit boards are expensive.
- Transmit boards are difficult to build.
- Modulators require interlaced video.
- Transmit/receive latency delay of 1 to 2 seconds.
- Ungraceful fade margins. (signal chart follows)
**Analog vs Digital ATV**

### Analog ATV Signal Reporting

- **P0**: I think I see you!
- **P1**: I see you!
- **P2**: I can tell it's really you!
- **P3**: Good Picture
- **P4**: Strong, a little snow
- **P5**: Broadcast Like!

### DATV Signal Reporting

- **P0**: Blue
- **P1**: WA8RMC
- **P2**: WA8RMC
- **P3**: WA8RMC
- **P4**: WA8RMC
- **P5**: WA8RMC
Major Standards

- ATSC (8VSB) North America.
- DVB-T (CODFM) Europe terrestrial.
- DVB-C (QAM) Eu. / USA cable (many variations).
- DVB-H (QAM) Europe handheld.
- DVB-S (QPSK) Europe and USA satellite.
8VSB Disadvantages

- Complex modulation scheme.
- Fixed data rate of 19.4 MegSymbols.
- AM modulation (VSB) needs hi linearity amps!!!
- Audio channel not receivable on some sets.
- Ham band not available on broadcast TV’s.
- Special receive converter needed for std. TV’s.
- Cannot use for mobile DATV with receiver in motion.
DVB-T Disadvantages

- Receivers not in use in USA.
- Need high signal to noise ratio receivers.
- DVB-T set top boxes not available in USA.
DVB-C Disadvantages

- No common standard.
- Variations by cable company.
- Common receiver not available.
DVB-H disadvantages

- No well defined standard.
- No receivers available.
DVB-S disadvantages

• No one using it in the USA (except ATCO).
• WE NEED DESIGNERS!!!
• I can’t think of any others!!!
Advantage Summary

- Used Free-to-Air receivers available.
- Receivers are “cheap” - $10-$50 on Ebay, $125 new at Sat. stores.
- High linearity amps NOT required for error free signal.
- Inexpensive LDMOS “brick” amps can be used & are easy to build.
- Multipath cancellation adequate for Ham use.
- Modulation not subject to motion limits – OK for mobile DATV.
- Less bandwidth than others needed for acceptable picture.
- Bandwidth is modifiable for motion/resolution tradeoffs.
- Easy to achieve multiple channels within single carrier.
- Seems best for Space Shuttle DATV communication.
DVB-S Details

Modulation Methods

- QPSK (4) quadrant FM modulation.
- Low signal to noise ratio requirements.

Encoding

- MPEG2 used.
- Reed-Solomon /Viterbi forward error correction.
- Error correction selectable with FEC setting.
Linearity Requirements

- Hi linearity amps are very expensive.
- DVB-S very tolerant of system non-linearities.
- FM modulation tolerates non-linearities.
- Amp can be close to 1dB compression point before errors are noticeable.
- AM modulation NOT tolerant of linearity errors.
- Excessive errors from non-linearities cause signal spectral regrowth.
DVB-S Details

Power level measurements

- “Bird” type averaging wattmeters read too high.
- “Bird” reading / 3-5 will approximate peak value.
- Bolometer meters (HP #432) will read too high.
- Spectrum analyzer best for peak readings.
ATCO Club and Repeater Details

ATCO Repeater located up here… …with the antennas here.
Use 3.125 Msymbols with 3/4 FEC, 2 channels of video.
Initial output was 2.5 watts (Bird) at antenna.
Added 18 watt LDMOS amplifier June 2009.
Typical range is now about 40 mile radius.
Signal has better range than our 50 watt analog signal.
Xmit Ant. is Diamond 13dBi omni 650 feet above street fed with 30 feet of 7/8” Heliax.
Working on a video link between Columbus and Dayton.
Initial interference with ODOT and Russian GPS satellite!!!!!!!!!!
ATCO Repeater DATV Transmitter
Netherlands 3 Board Set

23 cm 1.8 mw Exciter

2.5 WATT Power Amp

I/Q Base Band Board

MPEG 2 PCBs
ATCO Repeater DATV Transmitter
(comparison to analog transmitter)
ATCO Repeater DATV Transmitter

Computer setup screens
ATCO spare DATV Transmitter
German 2 board set + Upconverter
DVB-S Spectral Regrowth Through Amplifiers

Square sides with very little sideband energy.

Increased spectral regrowth in first amp. Is about 30dB below carrier.

Spectral regrowth amplified in second amp. Is now only 20dB below carrier.

Output from modulator
Level ~ 2 milliwatts

Output from Kuhne 2.5 watt “hi linearity” amp

Output from 18 watt LDMOS brick amp before output filter
ATCO Bulletin Board

ATCO Repeater

ATV Bulletin Board

ATV World Wide Web Sites
Check Them Out! WEB ATV!

Site | URL
--- | ---
ATCO | psyche.psy.ohio-state.edu/ATCO
P.C. Electronics | www.hamtv.com
Houston ATV | www.stevena.com/HAY3/home.html
Atlanta ATV | www.mindspring.com/~rsw/nwats1.htm
Utah ATV | ugate.aum.utah.edu/
Baltimore ATV | www.smart.net/~brats
Hamsfest list | www.arrl.org/hamsfest.html
ARRL | www.arrl.org
AMSAT | www.amsat.org

ATCO ATV Repeater

Transmitters (Output):
- 432.75 MHz AS
- 460.350 MHz (Voice)
- 430 MHz AS
- 1296 MHz (Voice)

Features:
- WA8RUT/Repeater
- Wide Area
- Open to All
- Beacon Mode
- Current Temp/Wind
- Rain Fall

Antenna Measurement Party
Aug. 29 - noon
AT Ted's Place (N8KQN)
1267 Richter Road
.439, 1.280, 2.4GHz Measurements
ATCO Events

- Tuesday Night Net, 147.48 @ 9pm
- Spring and Fall Meetings & Events
- Antenna measuring events
- Tour TV Stations
- Columbus Hamfest/meetings/presentations
- Red, White & Boom (July 4th fireworks)
- Quarterly newsletter (see www.atco.tv)
- Model Airplane CAM
- Pizza Parties
What would I see if I “tuned in” to the ATCO repeater?

Lots of Stuff!
W8RUT
Columbus, Ohio

WB8CJW
Columbus

KBBYMQ

W8RUT
Columbus, Ohio
W8DMR, Bill
Columbus, Oh

KB8YMQ, Jay
Columbus, Oh
WB8CJW, Dale Powell, Oh

KB8WBK, Dave Jersey, Oh
N8KQN, Ted (SK)
Franklinton, Oh

K8AEH, Wilbur (SK)
Reynoldsburg, Oh
And even more test patterns!
Take ATV on the Road!!

Mobile ATV!
W8RUT
Comtech boards are also available for 23 & 13 cm.

1200 MHz Transmit board with module cover removed

1200 MHz receive board
More Info About ATV

- ATCO Internet Home Page: www.atco.tv
- Quarterly ATCO Newsletter: www.atco.tv
- ATVQ Magazine: www.atvquarterly.com
- Net: Tuesday 9pm 147.48
- Streaming video at: www.batc.tv
- PC ELECTRONICS: www.hamtv.com
- DOWN EAST MICROWAVE: www.downeastmicrowave.com
Questions?