

ATCO

Amateur Television in Central Ohio



Digital Television
The New Ham Frontier

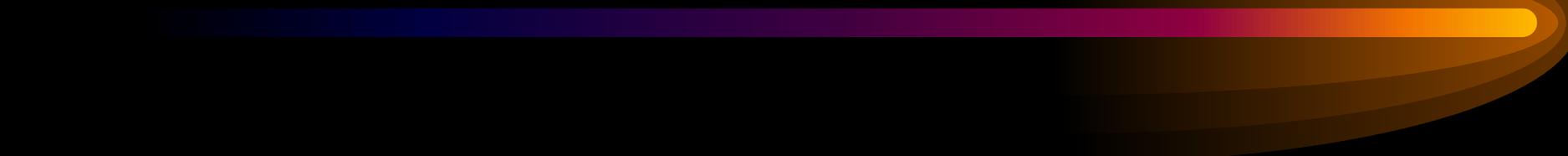
Art Towslee WA8RMC

09/26/09

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 its
really you!

P3

Good Picture

P4

Strong,
a little snow

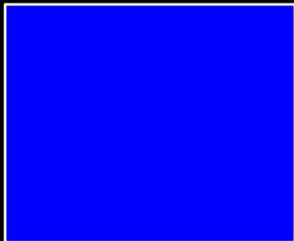
P5

Broadcast Like!



DATV Signal Reporting

P0



P1



P2



P3



P4



P5



Broadcast Standards Overview



Major Standards

- ATSC (8VSB) North America.
- DVB-T (COFDM) 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!!!

DVB-S – Why is it best for DATV?

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.

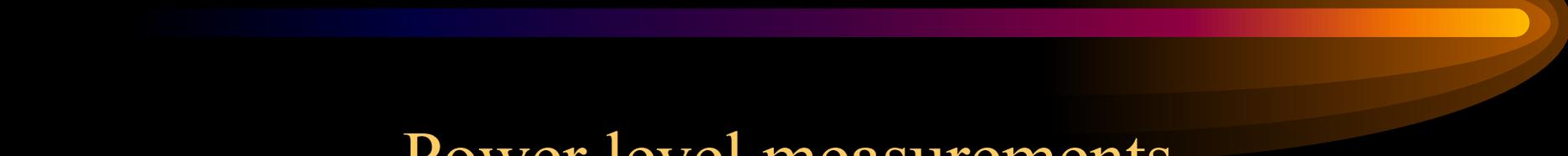
DVB-S Details



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.

ATCO System Identification Slides

WR8ATV



ATCO

REPEATER



ATCO



WR8ATV

Columbus, Ohio

www.atco.tv

WR8ATV

ATV REPEATER

Columbus, Ohio

WR8ATV

Columbus

WR8ATV

COLUMBUS

ATCO

WR8ATV

© 2003 COLUMBIAN BROADCASTING SYSTEM, INC.

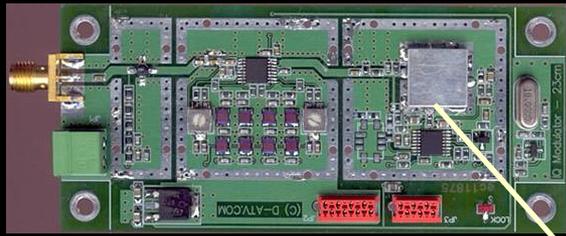
ATCO DVB-S Operation Details

- Operational 24-7 since January 7, 2004.
- 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 13dBd 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!!!!!!!!!!!!**

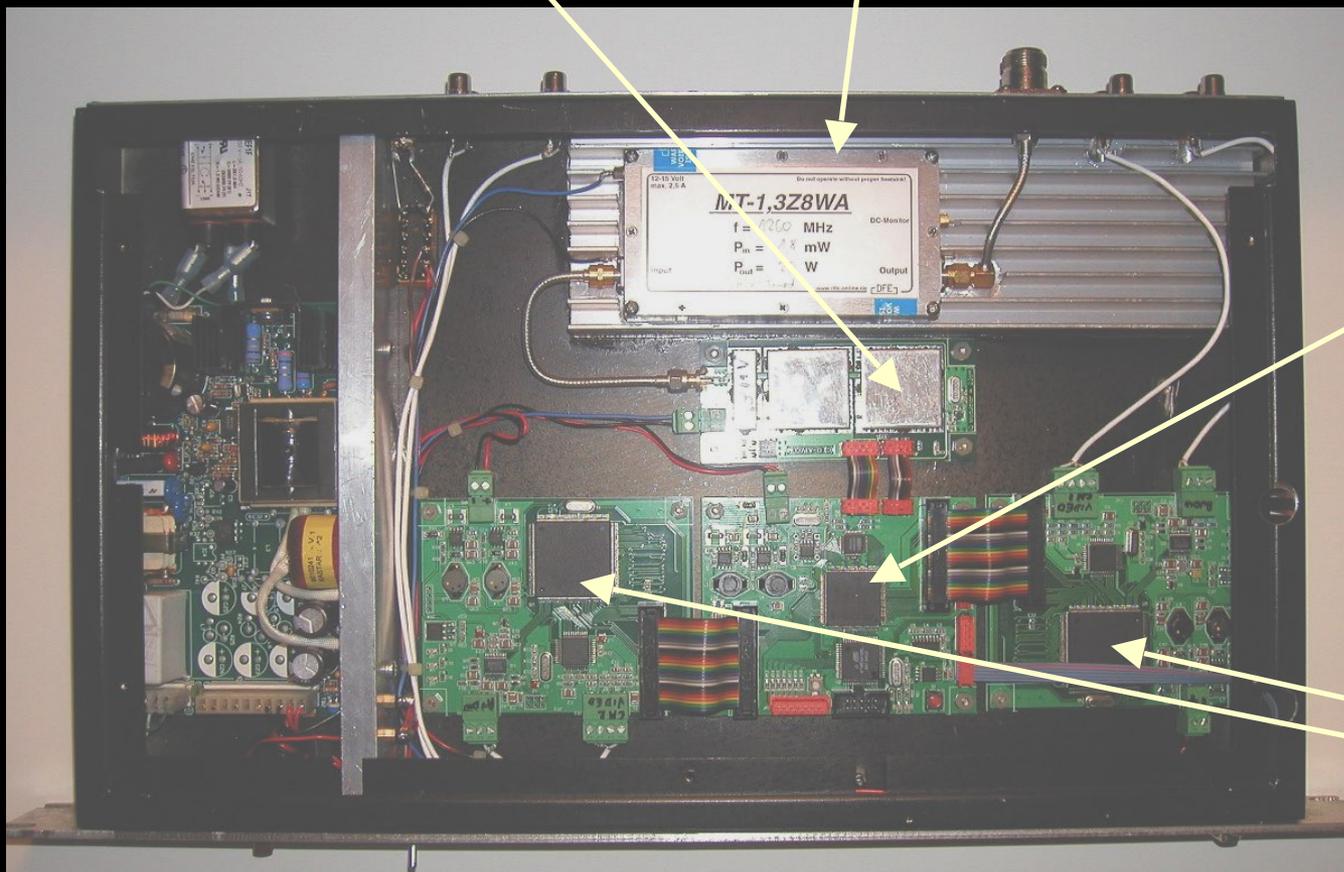
ATCO Repeater DATV Transmitter

Netherlands 3 Board Set

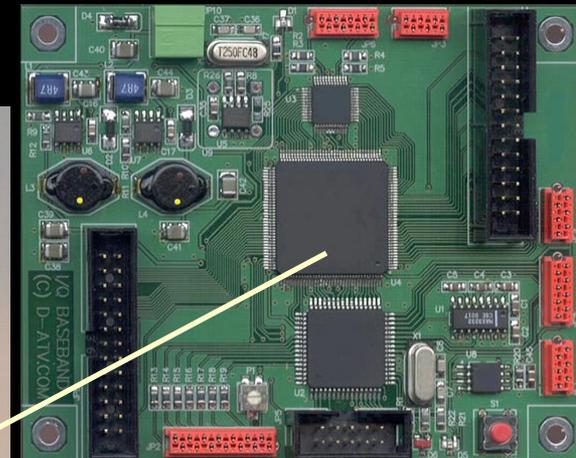
23 cm 1.8 mw Exciter



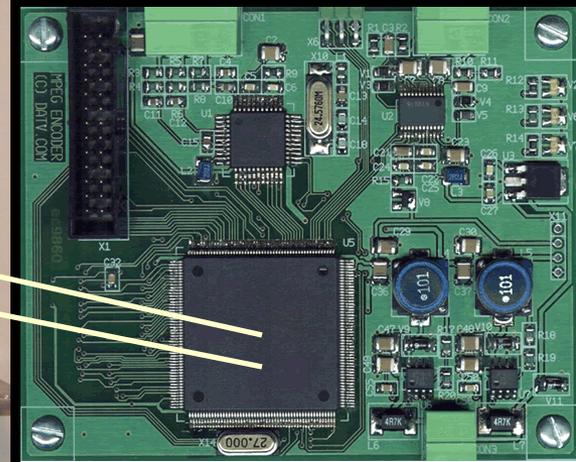
2.5 WATT Power Amp



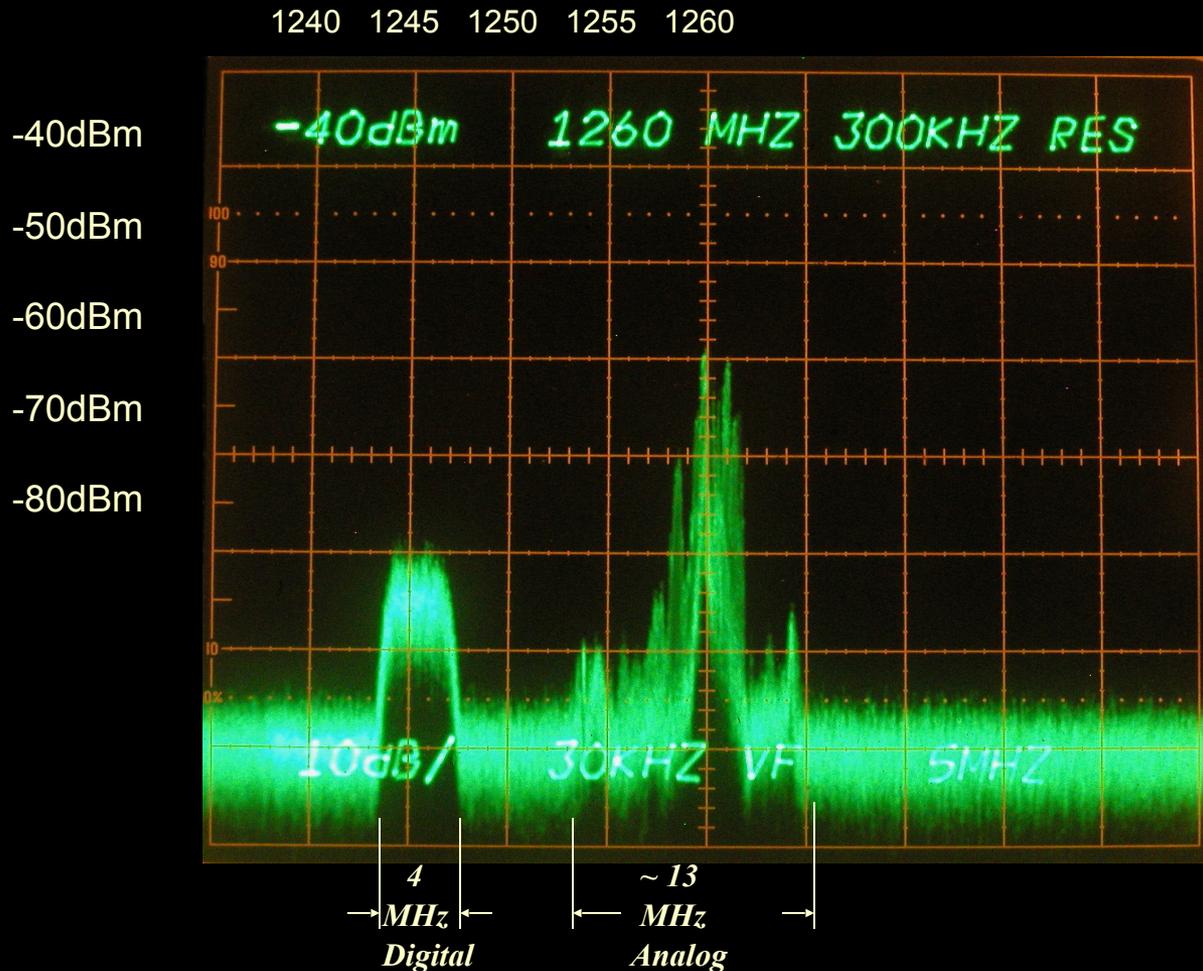
I/Q Base Band Board



MPEG 2 PCBs



ATCO Repeater DATV Transmitter (comparison to analog transmitter)



ATCO Repeater DATV Transmitter

Computer setup screens

DVB Config 2005 - settings henk.dvb

File Setup Transfer Firmware Help

[DVB SI] Event Information | Teletext Settings | Modulator Settings | MPG Enc1 Settings | MPG Enc2 Settings

Network Info

Network Name: Dutch Digital ATV Team Network

Network ID: 53 TS ID: 1109

Service Info

Service Provider Name: Dutch D-ATV team Imperium

Program Info 1

Program Name: PE1JOK TV1 Enable Teletext

PMT PID: 32 Video PID: 163 Teletext PID: 304

PCR PID: 133 Audio PID: 88 Service ID: 5004

Program Info 2

Program Name: PE1OBW TV Enable Teletext

PMT PID: 33 Video PID: 257 Teletext PID: 304

PCR PID: 256 Audio PID: 258 Service ID: 5005

COM1 RT Off PLL Locked Encoder 1 Ok No video Receiving

DVB Config 2005 - settings henk.dvb*

File Setup Transfer Firmware Help

[DVB SI] Event Information | Teletext Settings | Modulator Settings | MPG Enc1 Settings | MPG Enc2 Settings

Program 1

Short Event Name: Digital Amateur Television

Short Event Text: Welcome in our Shack!

Extended Event Text: Enjoy the live transmissions of the Dutch D-ATV team members during this technical session.

Enable Parental Rating Minimum Age: 15 Event ID: 293

Program 2

Short Event Name: High Res Channel

Short Event Text: MPEG Performance Testing

Extended Event Text: PE1JOK and PE1OBW will guide you through the wonderful world of MPEG2 encoding and transmission.

Enable Parental Rating Minimum Age: 4 Event ID: 292

COM1 RT Off PLL Locked Encoder 1 Ok No video Receiving

DVB Config 2005 - settings henk.dvb*

File Setup Transfer Firmware Help

[DVB SI] Event Information | Teletext Settings | Modulator Settings | MPG Enc1 Settings | MPG Enc2 Settings

General

TT Time zone: GMT+1 Subpage header cycle time: 20

Page Header: {GID:ATV.COM Text (PPP) (Y)00:00:00

Header Preview: 0-ATV.COM Text 100 00:00:00

Red (R) Blue (B) Cyan (C) White (W) New backgr. (N)
Green (G) Yellow (Y) Mag. (M) Pagernr. (PPP) Black backgr. (Z)

Teletext Pages

page 100 - C:\Program Files\datv\DotCom\DVB Config 2005\TT Pages\100DVB.TT
page 101 - C:\Program Files\datv\DotCom\DVB Config 2005\TT Pages\DATV101.TT
page 109 - C:\Program Files\datv\DotCom\DVB Config 2005\TT Pages\PAG109.TT
page 110 - C:\Program Files\datv\DotCom\DVB Config 2005\TT Pages\FDEMO110.TT
page 120 - C:\Program Files\datv\DotCom\DVB Config 2005\TT Pages\FDEMO120.TT
page 130 - C:\Program Files\datv\DotCom\DVB Config 2005\TT Pages\FDEMO130.TT
page 140 - C:\Program Files\datv\DotCom\DVB Config 2005\TT Pages\FDEMO140.TT
page 200 - C:\Program Files\datv\DotCom\DVB Config 2005\TT Pages\OBW200.TT
page 201 - C:\Program Files\datv\DotCom\DVB Config 2005\TT Pages\GUUST.TT
page 280 - C:\Program Files\datv\DotCom\DVB Config 2005\TT Pages\PAG280.TT
page 281 - C:\Program Files\datv\DotCom\DVB Config 2005\TT Pages\PAG281.TT
page 300 - C:\Program Files\datv\DotCom\DVB Config 2005\TT Pages\PAG300.TT
page 400 - C:\Program Files\datv\DotCom\DVB Config 2005\TT Pages\FTXT400.TT

Add. Remove Select all Unselect all Edit page Upload Teletext

COM1 RT Off PLL Locked Encoder 1 Ok No video Receiving

DVB Config 2005 - settings henk.dvb*

File Setup Transfer Firmware Help

[DVB SI] Event Information | Teletext Settings | Modulator Settings | MPG Enc1 Settings | MPG Enc2 Settings

Modulator Control

Center Frequency: 1270 MHz

Real Time Update Disable Modulation Enable Spectral Inversion

Datarate Control

SymbolRate: 6.250 MSym

FEC Ratio: 3/4

Netto Available Datarate: 8639 kbit

MPEG Bitrates

Transport Stream 1: 4155 kbit Auto

Transport Stream 2: 4155 kbit EnableTS2

Enable Real Time Audio

Used Modulator bitrate: 99%

COM1 RT Off PLL Locked Encoder 1 Ok No video Receiving

DVB Config 2005 - settings henk.dvb*

File Setup Transfer Firmware Help

[DVB SI] Event Information | Teletext Settings | Modulator Settings | MPG Enc1 Settings | MPG Enc2 Settings

Video Settings

Brightness: 100

Contrast: 100

Saturation: 100

Sharpness: 2

Real Time Update

Input Selection: CVBS Y/C Standard PAL NTSC Defaults

Encoder Settings

Auto settings Audiorate: 384 kbit

Resolution: D1 Noise Prefilter Mode: Off

ScanType: Alternate Noise Filter Gain: 0

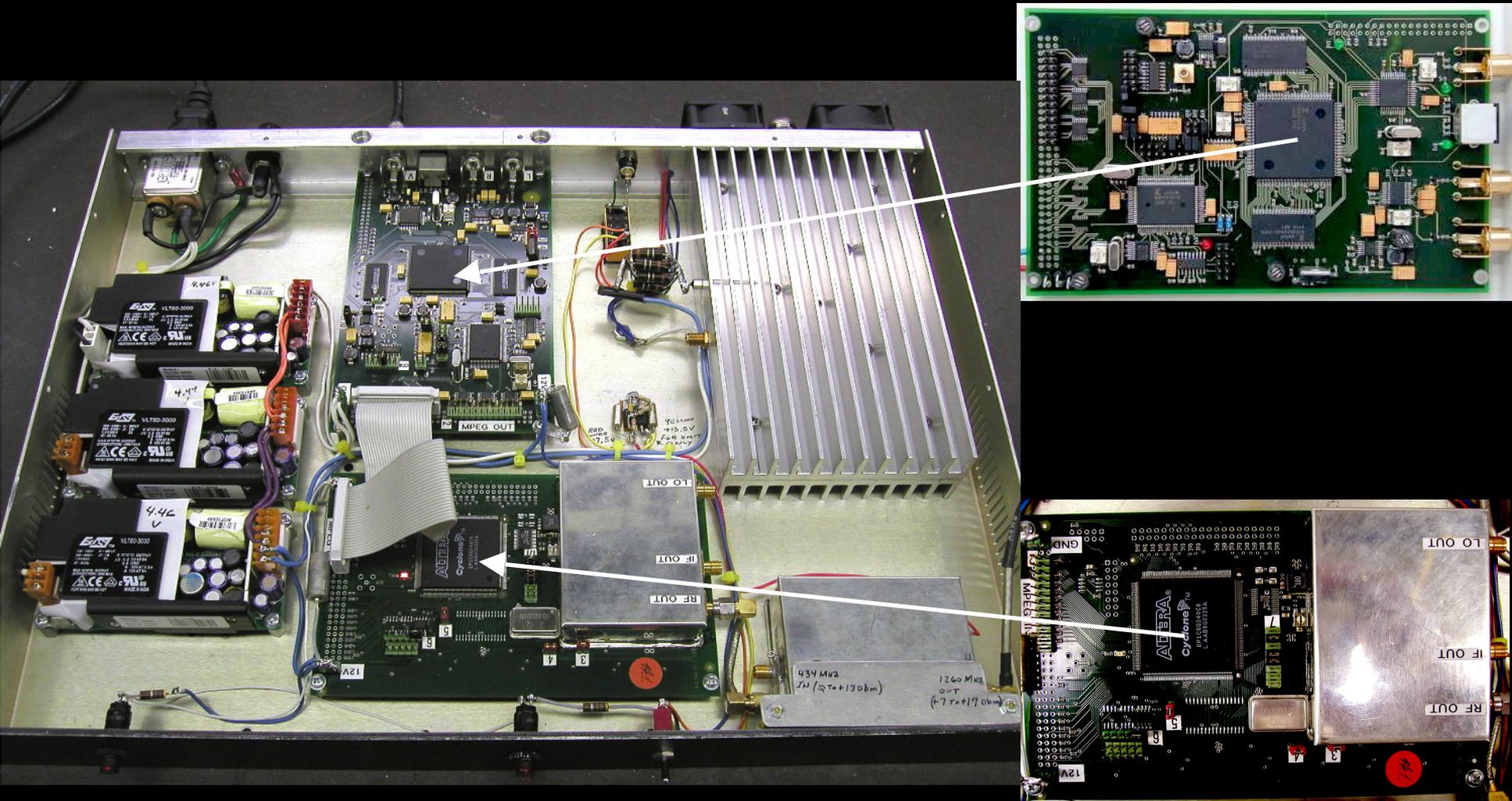
GDP Structure: JPPPPPPPPPPP

GOP Length: 12 Reference Frame Distance: 1

COM1 RT Off PLL Locked Encoder 1 Ok No video Receiving

ATCO spare DATV Transmitter

German 2 board set + Upconverter



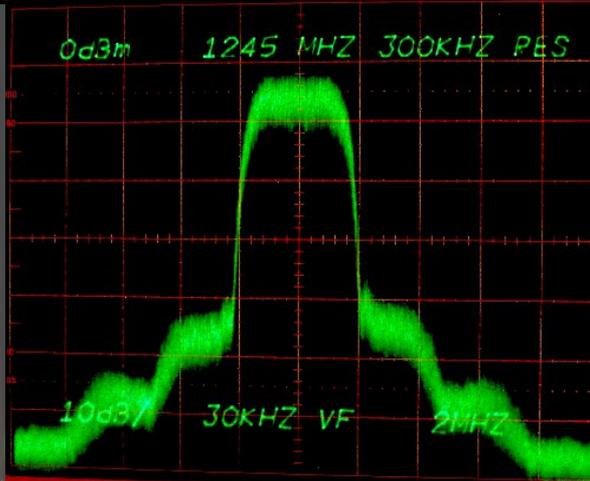
DVB-S Spectral Regrowth Through Amplifiers

Square sides with
very little sideband
energy.



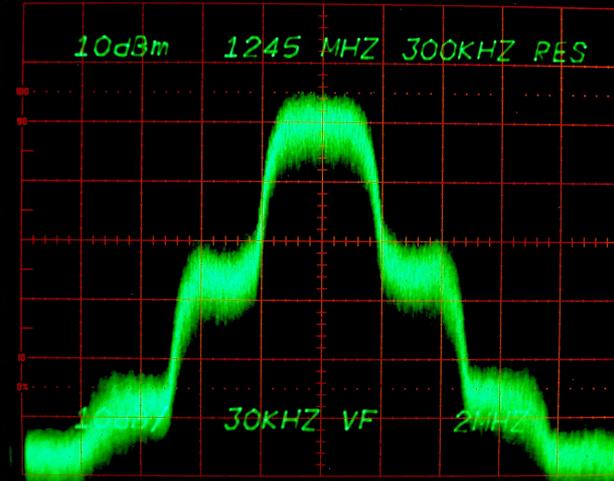
Output from modulator
Level ~ 2 milliwatts

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



Output from Kuhne
2.5 watt "hi linearity"
amp

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



Output from 18 watt
LDMOS brick amp
before output filter

ATCO Bulletin Board



ATV Bulletin Board

ATCO
 Amateur Television in Central Ohio

Bulletin Board Tone "BUL" (TT 285+9)
 WA8RUT/Repeater

Second Annual ANTENNA MEASUREMENT PARTY
 AUG. 29 - noon
 AT TED'S PLACE (N8KQN)
 1267 Richter Road
 .439, 1.280, 2.4GHz measurements

Photo 2

ATCO Repeater

427.25 MHz/ 1250 Mhz/ 2433.75 Mhz FMATV

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

Site	URL
ATCO	psyche.psy.ohio-state.edu/atco
F.C. Electronics	www.hamtv.com
Houston ATV	www.atvms.com/HATS/home.html
Atlanta ATV	www.mindspring.com/~rof/atal.htm
Utah ATV	ugate.aim.utah.edu/
Baltimore ATV	www.smart.net/~brat/
Hamfest list	www.arrl.org/hamfests.html
ARRL	www.arrl.org
AMSAT	www.amsat.org

ATCO ATV Repeater

Transmitters (Output):	427.25 Mhz A5	1250 FMATV
	440.350 FM (Voice)	2433 FMATV
Receivers (Input):	427.25 Mhz A5	1250 FMATV
	915 Mhz FMATV	2430 FMATV
	147.45 (Voice)	
Beacon	915 Mhz FMATV	
Features:	Wx RADAR	Wide Area
	NASA Select	Open to All
	Bull Board	Beacon Mode
	Remote Pt. Sites	Current Temp/Wind
	Roof Camera	Rain Fall

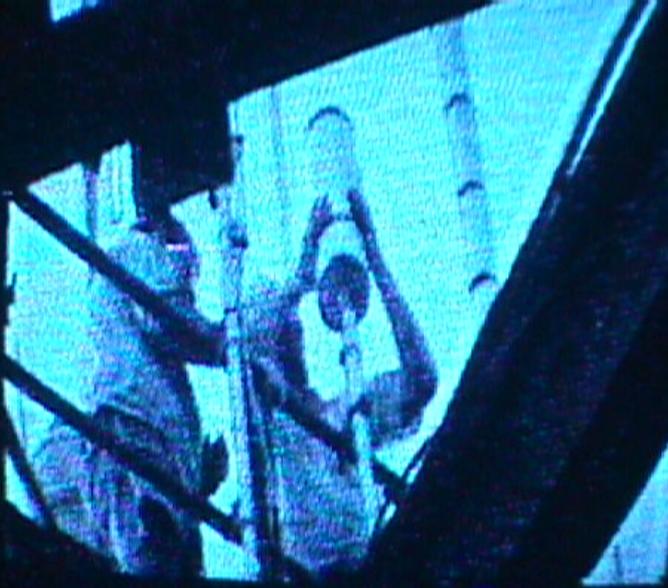
WA8RUT/Repeater

ATCO Events

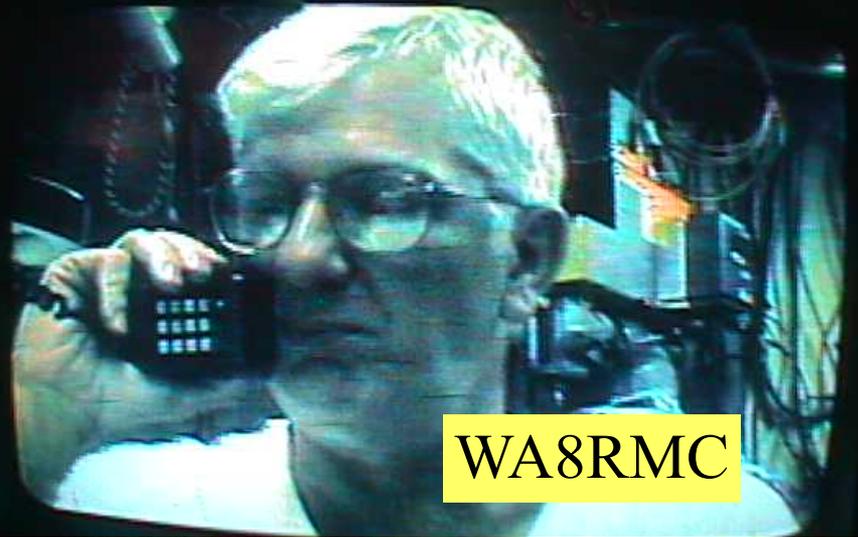
- Tuesday Night Net, 147.48 @ 9pm
- Spring and Fall Meetings & Events
- Antenna measuring events
- Tour TV Stations
- Columbus Hamfest/meetings/presentations
- Red, White & Boom (July 4th fireworks)
- Quarterly newsletter (see www.atco.tv)
- Model Airplane CAM
- Pizza Parties

*What would I see if I “tuned in”
to the ATCO repeater?*

Lots of Stuff!



Installing Roof Camera



WA8RMC



KB8ZLB
Greenfield, Oh



Pete

W8RUT

Columbus, Ohio

WB8CJW

COLUMBUS



W8RUT

Columbus, Ohio





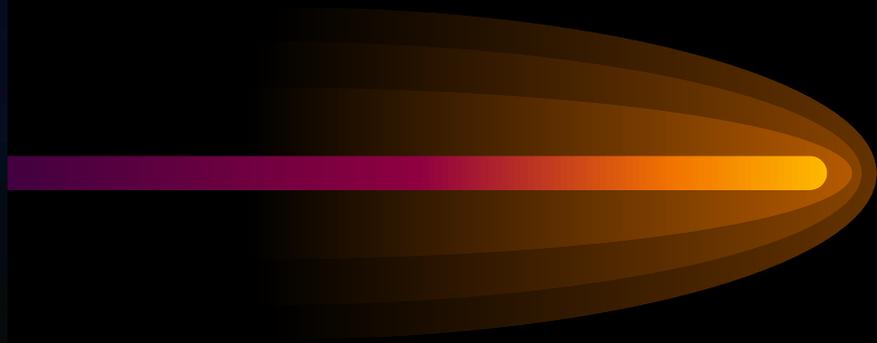
W8DMR, Bill
Columbus, Oh

KB8YMQ, Jay
Columbus, Oh

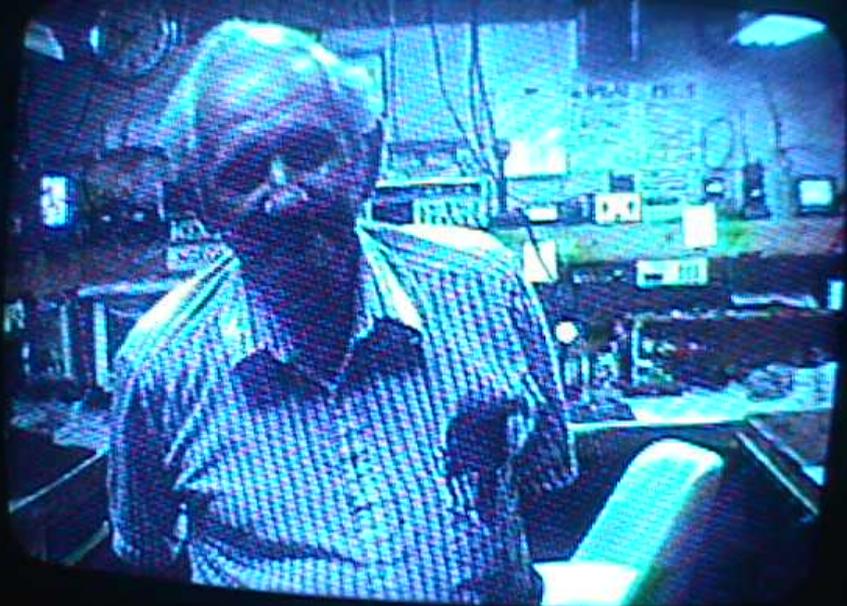




WB8CJW, Dale
Powell, Oh



KB8WBK, Dave
Jersey, Oh



N8KQN, Ted (SK)
Franklinton, Oh



K8AEH, Wilbur (SK)
Reynoldsburg, Oh

KB8ZLB
Greenfield
AMATEUR TV

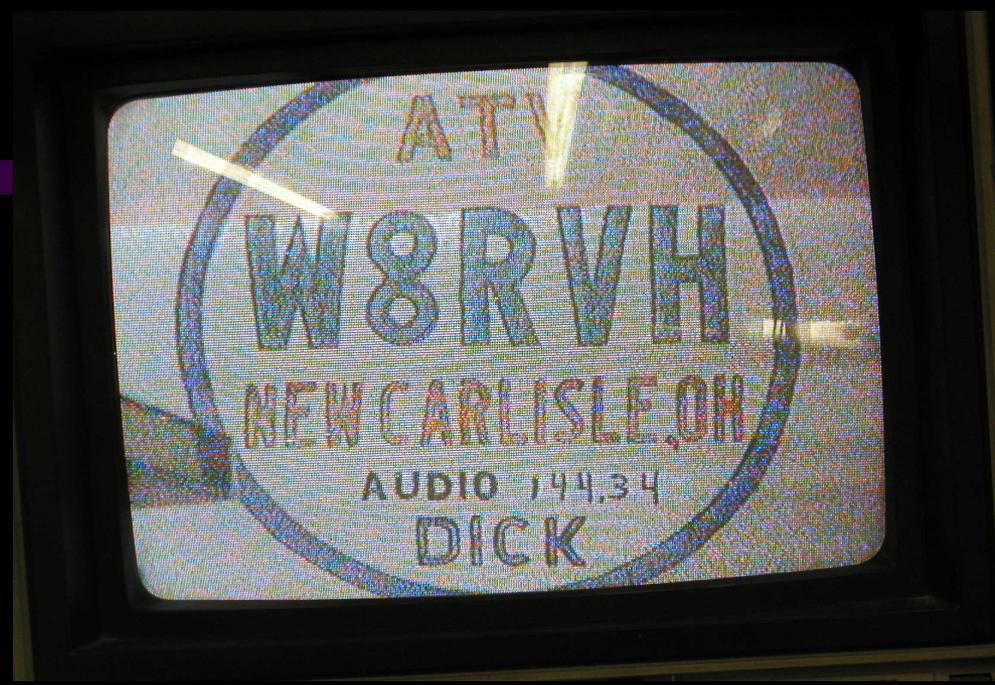
KB8WBI
PATASKALA
OHIO
144.34
ATCO
HIGGINS HAMS

WA8RMC

24GHZ
N8LRG

And even more test patterns!



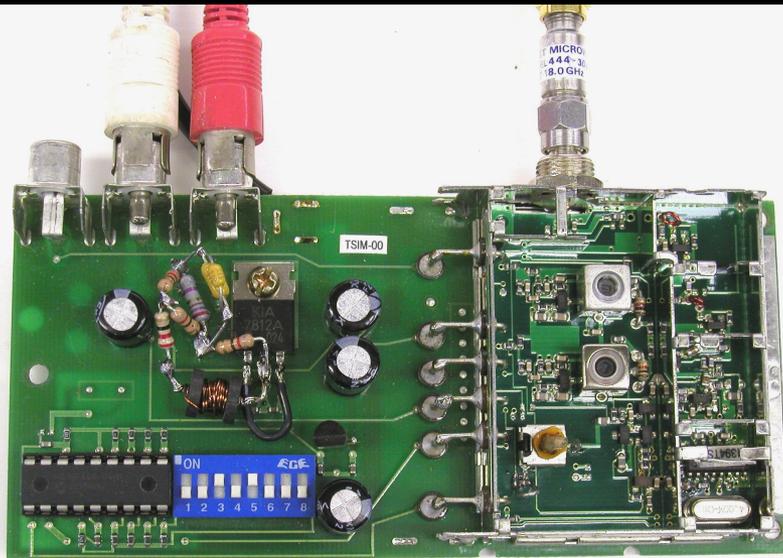


Take ATV on the Road!!

**Mobile ATV!
W8RUT**

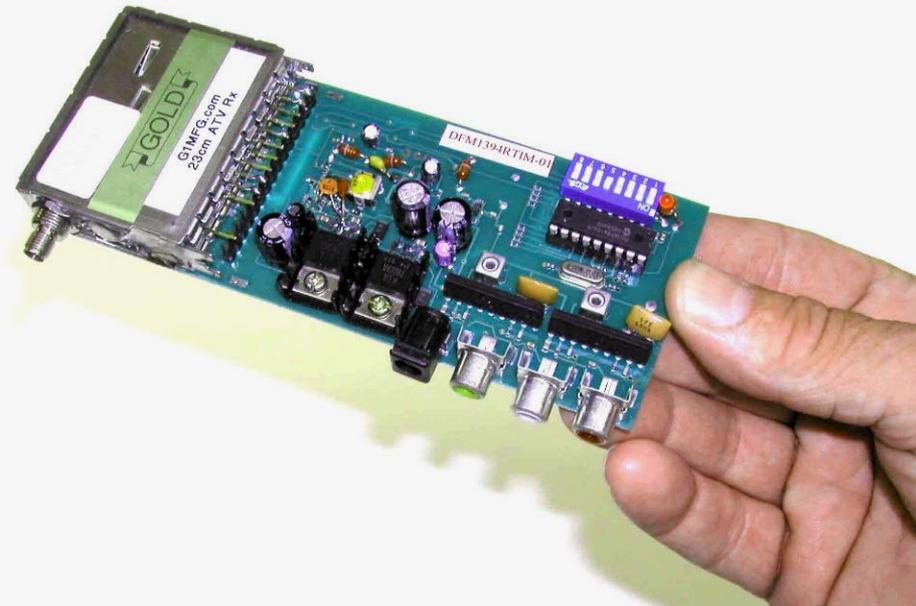


*Comtech boards are also available
for 23 & 13 cm.*



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?

