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# Amateur Television Quarterly


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*DX is over 100 miles snow free line of sight between 14 dBd beams and using 100 ft. of Belden 9913 low loss coax simplex. Check the ARRL Repeater Directory for ATV repeaters near you or call us for info on other ATVers in your area to find out frequencies, antenna polarization and activities.

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## COMPLETE 420-450 MHz 70cm BAND ATV STATION

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**Your video camera or camcorder**

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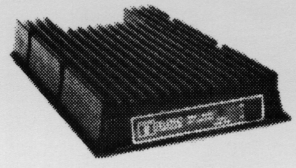
**TC70-20....$529**
**ATV Transceiver**
**20 Watts p.e.p. min.**
**Downconverter tunes 420-450 MHz**
**Req. 12-14 Vdc @ 3A power supply**
**Comes with one crystal, 2ndadd $20**
**Specify transmit frequency(s):**
**439.25, 434.0, 427.25 or 426.25 MHz**

+



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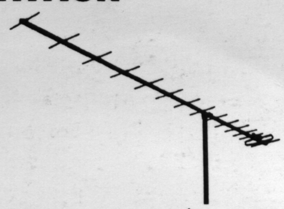

Antennas - see catalogue page 5

| | | |
|---|---|---|
| Dir. Sys. DSFO ATV-25 | 16 dBd | $149 |
| KLM440-6X Yagi end mtg | 8.9 dBd | $65 |
| Diamond X501XA 70cm/2MVert omni | | $199 |
| Diamond F718L Vert omni | 9 dBd | $238 |
| Diamond NR-770H mob/port | 5.5dBd | $59 |

Remember when comparing prices, ours include UPS surface shipping in contiguous USA. **1/2000**

**Hams: Call or email for your full 10 page ATV Catalogue or see our web site http://www.hamtv.com**

# AMATEUR TELEVISION QUARTERLY

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# Amateur Television Quarterly

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# I Hear Packet on 144.34 MHz?

**by Gene Harlan - WB9MMM - email: ATVQ@hampubs.com**
**5931 Alma Dr.**
**Rockford, IL 61108**

Just planning a quiet weekend working on this issue of ATVQ when all of a sudden I hear packet radio. It startled me as I did not have packet hooked up, but, there it was again. It was coming from 144.34 MHz where I listen to a mostly quiet channel. Then I remembered an email I saw earlier that morning. Surely this is not the balloon that was launched in Kansas. I quickly hooked up my TNC, reloaded software in the computer (I just went through a reformat, and not much loaded). There is some data - with a callsign of WB0DRL. Holy Cow! It is that balloon. With a little pointing of the beam, I was getting a signal of S4. But I did not know how to read the data. After looking at it a while, I saw where the Latitude and Longitude was in the reading. I grabbed a world atlas and found that it was just coming into Illinois, heading towards Springfield. I re-read the email and found that they were having a tracking net on 7.170 MHz, so I tuned in and there they were as loud as can be. I stayed with the group, and made a few reports, but mostly listened to the interesting reports.

All of a sudden the packet stopped. I thought it had just gotten out of my range, but pretty soon I heard other stations mention the same thing. At this time it was getting close to Ft. Wayne, IN. Now I was told that the only signal that they could hear was a weak transmitter on, I believe, 141.61 MHz (a fifth harmonic of a 28 MHz signal). Those that could tried to triangulate on that signal as long as they could.

The signal disappeared at 2022z. I guess I did not get much done on ATVQ that day! I wish that they would have had ATV on that flight. Maybe next time.

Seems the balloon, instead of bursting when expected, went up to about 116,000 feet and basically stayed there, floating over Kansas, Missouri, Illinois, and Indiana. The estimated area of landing is 41d03.7mN, 84d25.3mW, which is near the junction of Ohio-613 and Ohio-637 or about 10 miles east of Payne, OH. Email that I got today still indicates that it has not been found.

I had lots of fun that day. Can't wait for the next one!

Sorry about the GPS article. Seems by the time ATVQ hit the stands, the vendor sold all he had left in one lot - to a taxicab company in Australia. I was (and a few readers) not a happy camper. I'll try to be more careful in the future.

Also, I need to mention that the camera article was with permission of ECSC/eio - 1490 W. Artesia Blvd., Gardena, CA 90248.

See ya next issue. - Gene Harlan - WB9MMM

ATVQ

## ATV WITH A CALLSIGN OF K6SEE WE HAD TO PUT UP AN ATV REPEATER!

Our machine is currently transmitting in beacon mode on 2.442 GHz fm ATV. When inputs are active, they will include 2.412 GHz ( if the actual placement allows this!) Desense in lab test at current power levels is acceptable.A 33 cm am input (freq to be determined) and a 70 cm am output (tbd) are currently in the works. Consideration of the existing Bay Area ATV system , W6CX Mt. Diablo, will determine our 70 cm input/ output.

Current power level is just over 1 watt to the antenna ( our lack of test equipment precludes us from accuracy on this point) but ultimate ERP will be increased significantly by the antenna. The 2.442 GHz exciter is by FM Technologies with ERA-5 MMIC amps to boost the output to 1 watt.

The 70cm exciter is a PC electronics TXA5-70c with a Toshiba S-AU4 brick for 10 watts pep output. Currently, a 2.412 GHz input through a P.C. Electronics Video Operated Relay board, VOR-2a, keys the 2.442 GHz exciter.

The lack of easily, and cheaply, obtainable 2.4 gig nondirectional antennas has lead to another project, the 13 cm antenna project. Tests are underway for arrays of folded dipole yagis and other configurations with hopefully minimal phasing loss and significant gain. Any suggestions and help on antennas for 13 cm would be appreciated!

DeWayne, KQ6DY

See cover for this and another ATV shot in COLOR!

ATVQ

# ATVQ TO PAY FOR ARTICLES!

## Payment for Technical Articles

ATVQ will pay for certain articles that it publishes. I will outline the policy here, but it will be subject to change as needed to make sure that ATVQ continues to be an ongoing publication. ATVQ will pay $25.00 for technical articles that are published and are a minimum of 2 pages. While this is not a great amount, it is a starting point and I hope it will encourage more technical type articles to be written. Exceptions will be articles that are written by a manufacturer/seller of equipment that is being written about. While 1 do not want to discourage this type of article, the article itself is an advertise ment of the product. Articles from clubs will be encouraged, and I would expect they would like to share their information with the ATVQ readership. Information gathered from the Internet will not be paid for and is mostly small filler items.

## Ideas

Do you have an idea for an article that you've said to yourself that you wanted to write, but never did. Feel free to check with us to see if it is of interest, or write and send it in. No guarantees that it will get published, but if you don't try, you will never know. I'll be looking to see what you can do! ATVQ

# AUTHORS GUIDE

Preferred method of receiving articles is from **Microsoft Word,** however **Wordperfect** is OK too. Next preference would be **ASKII text,** followed by **typewritten** or **hand written** (clearly). Diagrams or pictures (B&W or Color) can be sent in hard copy, or if you scan them in, save to PCX or **JPG** formats (actually I can read about anything). If you send a computer disk, make sure it is PC (not MAC) format.

When sending in articles in Microsoft Word, please SAVE with FASTSAVEOFF and save in Word 6 format. Also, articles written in any word processor, consider what will happen when it is re-formatted to fit the style that I might put it in. An example would be setting up tables or adding figures into the article. They can be very hard to strip out. If possible, put the tables, figures, each in a file by itself. This will help me to be able to import into the magazine format.

Articles can be sent to: **ATVQ, 5931 Alma Dr., Rockford, IL 61108**
or to our NEW email address: **atvq@hampubs.com**
Also note our new web page address: **http://www.hampubs.com** ATVQ

## Repeater Magazine

Repeater is the leading quarterly European ATV/mmwave magazine. We started about 3 years ago as an independent Dutch magazine. Because of the many (international) questions about translations of the published articles, we decided to transform Repeater into an international magazine starting issue 1/2000. It will be bilingual: Dutch (our roots) and English.
Till this far we published e.g.:
- Nicam encoder
- High Q basebandmodulator (with PLL-synthesized audio carriers)
- 2 Watt FM ATV transmitter with video-text and tuneable audio carriers
- 13 cm converter (the redesigned Chapparal S-band converter)
- 23 cm low noise pre amp (nf 0,6 dB, G 43 dB)
- several PA's for 23 and 13 cm
- 200 mW 10 GHz DRO-transmitter
- pattern generators
- frequency listings, reception reports, etc.

Our website:
http:Nwww.euronet.nVusers/rulrich

Our website will also be bilingual, at the end of January.

Best regards,
Rob Ulrich, Editor

# Eight 10 Ghz Frequency Measuring Methods

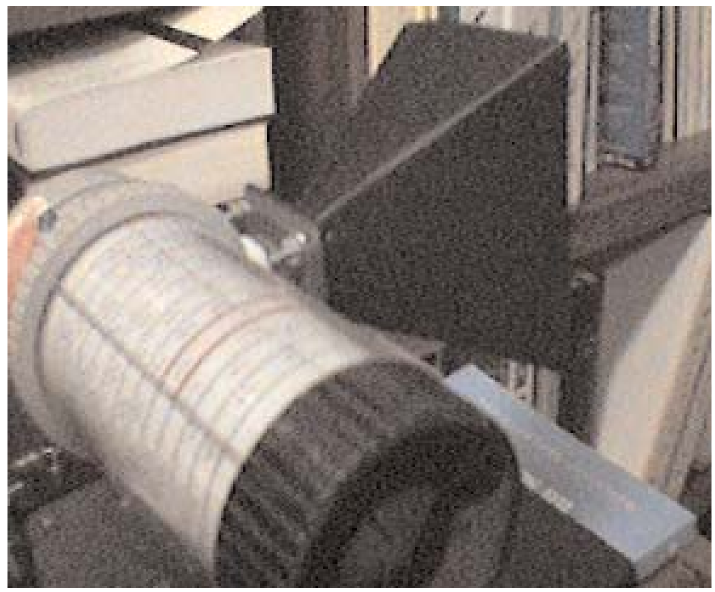
by John A. Jaminet, W3HMS, EMAIL: W3HMS@aol.com
912 Robert St.
Mechanicsburg, PA
17055 USA

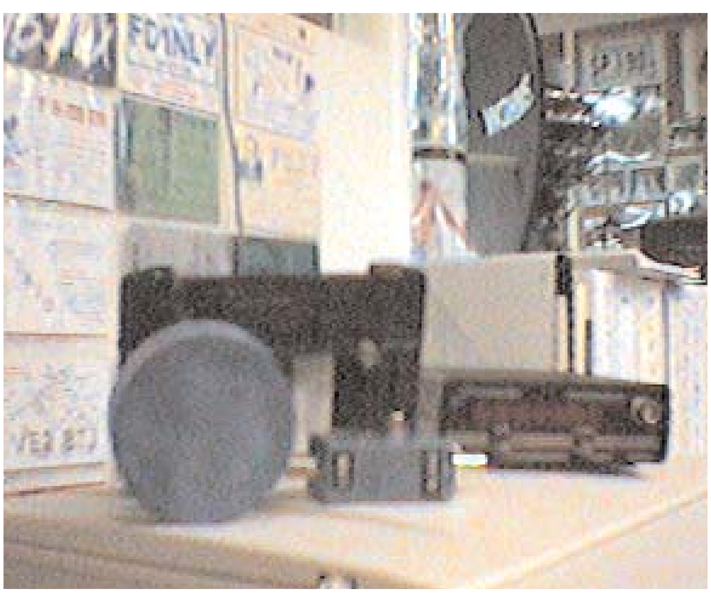
When I started in 10 Ghz work using Gunnplexors, I was unsure if I was transmitting in the band, so precision measurement was just an unfulfilled dream. I looked for but did not find a comprehensive summary of available methods affordable for hams. Of course, if you have a new, modern frequency counter, you can stop reading here since it is academic. But if you are a rather normal ham, continue reading...perhaps we will unearth some new ideas.

Here are 8 methods which I have unearthed:

**1. Ku Band LNB and Counter**. This method uses a Ku band LNB on 9.700 Ghz or 10 Ghz and a counter capable of counting to about 600 MHZ or more with the classic bypass capacitor and choke decoupling the RF from the 18 VDC going to the LNB. I use an old Amstrad European Ku band LNB with LO on 9.750 Ghz and my old 600 Mhz counter. I can't cover the full 500 hz band, but enough of it. This method was described by Michel, HB9AFO in the USKAs "Old Man" for September 1992. The same topic was addressed by Denys Roussel in "VHF Communication" of the UK for January 1995. I saw the same point made by G3RFL from the US ATVQ in a German language version in TV Amateur 28-92/94 in a copy sent to me by Michel Bernard, HB9VAZ. With a LO frequency not easy for calculations, I made a spreadsheet to show counter indicated frequency and actual frequency.

**2. Predivider by 8 with a counter**. This method was described by Serge Riviere, F1JSR, in the Swiss ATV News for August 1995 then in the B5+ of ANTA of France in October 1995. It is a simple circuit using the Fujitsu IC FMM11OHG, but I was afraid to check the price in a US catalog since Serge said it was about 1800 FF and that was close enough to give me fear of causing a heart attack! It would not work with my old 600 MHZ only counter...poverty is a real handicap!





**3. Wave Meter with Field Strength Meter and Amplifier.** I happened to obtain, gratis, a nice Hewlett-Packard absorption frequency meter and I coupled to it a 1N23 crystal detector and a CA3130 meter amplifier as described in the US "73 Magazine" for August 1996, page 54 and in the book "Microwave Building Blocks". I was able to use a friends counter to determine the error at about 10.275 GHZ, a common frequency for us here in PA. In my case, it is the indicated frequency minus 14 MHZ.

**4. Two-meter HT with diode multiplier**. I have not been able to find the full specifications on this but I see references to it here and there. It uses a 1N23 diode mount and a 2 meter HT. Thus 146.42 Mhz times 70 =10.249 Ghz...but I have no more!

**5. C band LNB of the USA oscillator times 2**. I think this is a NEW method. While doing some research on these LNBs and satellite receiver tuning, I discovered that the oscillator is a stable DRO fixed on 5.150 ghz so the 2nd harmonic is most conveniently on 10.300 Ghz. I had an old LNB from prior satellite service with a 100 degree LNB. I just removed the metal cover and checked it! Voila, there it was as predicted and weak enough to avoid overloading a receiver yet strong enough to find it even

3 meters or so from the receiver. It is quite light so can I use mine in the field with two 9 volt batteries in series and a non-metallic cover over the oscillator compartment. An audio tone for modulation would make it even more usable. Idea: Take one of the Christmas jingle devices from a Christmas card!

**6. LNB and Alinco receiver**. For information, I have used the modified European 11 Ghz LNB as described and modified by Denys, F6IWF, in his article in "VHF Communications" for January 1995 on pages 2-17 and US ATVQ for Fall 1997 page 14-18 to feed my satellite receiver on US Transponder 12-14 on about 1250 Mhz.

Then, the 70 Mhz output is sent to my ICOM 706 receiver in WFM audio mode. When I recently purchased my Alinco X-10 receiver with multi mode reception, I realized I had a new method for reception and also for measurement as I could feed it directly from the LNB on about 1250 Ghz in Wide Band FM using the blocking capacitor and series choke method as used with the counter/LNB method as described above. This not only provides a direct frequency readout on the Alinco receiver for reception of the other station your are working, but it does so with reduced weight and reduced error thanks to the DRO which, per Denys, is accurate to +- 1 Mhz. I made a simple spreadsheet chart to relate received frequency to receiver digital readout frequency. I have also used a UK LNB from Bob Platts, G8OZP, in England with great results.

**7. European Satellite Receiver.** I have one purchased new in Prague in November 1997 which works nicely on US Ku band TV. Unfortunately, I can't get it to read the input frequency directly on 10 Ghz even though I can use a LNB purchased from England with the LO on 9 GHZ. If you know how to do this.....great...and please share it with us all!



**8. A friends frequency counter**. My friend Joe, WA3PTV, has a frequency counter effective to 18 Ghz but he lives about 60 miles from me!!! This is not too handy for my measurements BUT...I have used it to establish the margin of error on my wave meter and LNB/counter.

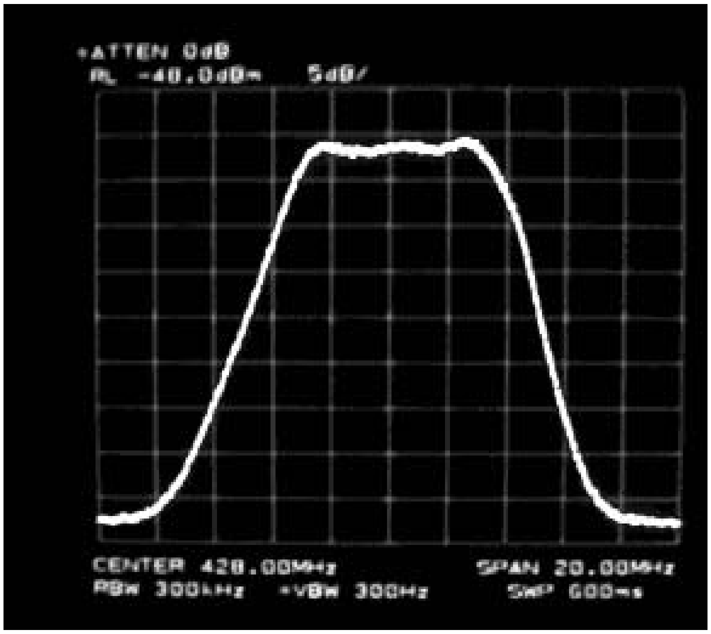
I would be delighted to learn of other methods and I hope you will share them with me by EMAIL or regular mail.

73 de John, W3HMS; EMAIL W3HMS@aol.com ATVQ

# Putting Together an Interdigital Filter

**by Clint Turner - KA7OEI - Email: turner@vsat.ussc.com**
**2898 W. 7525 S**
**West Jordan, UT 84084**

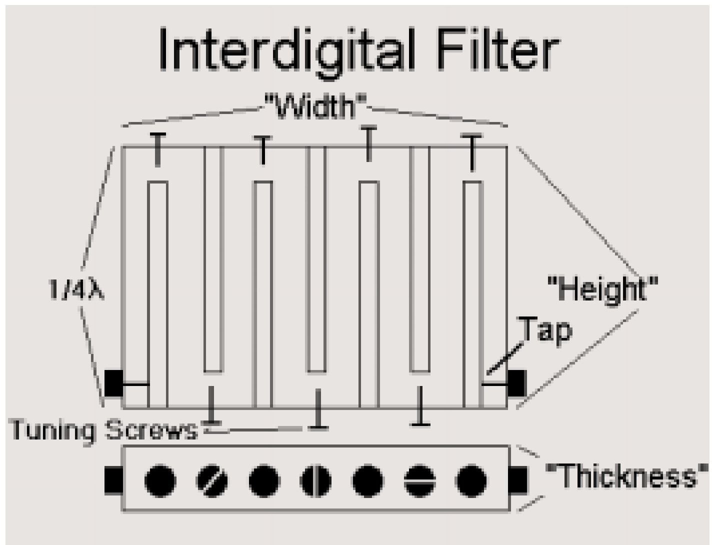
### What is a bandpass filter?




Passband of the described interdigital filter, tuned for 426.25 MHz video. (Vert: 5 db/div, Horiz: 2 Mhz/div)A Bandpass filter, as the name implies, is a filter that only passes a certain range of frequencies (a spectrum analyzer plot of the interdigital bandpass filter described below is shown to the left.) Bandpass filters are the elements that allow any receiver to have selectivity, eliminate image responses, and prevent overloads from off-frequency signals, to name a few examples. Bandpass filters take many physical forms from capacitors and coils, pieces of feedline, cavities, and waveguides. The interdigital filter is but one implementation of a bandpass filter. It is so-called because of the physical construction of filter itself. Referring to the image below, you can see that the elements are interleaved, and hence the name.

The Interdigital Filter consists of these interleaved rods sandwiched between two parallel conducting plates (ground planes), usually with conductive plates along the sides. The "height" of the filter (the vertical dimension on the image) is typically one-quarter wavelength while the elements themselves are physically shorter (or else both ends of the rods would touch the walls!) Because the dimensions of these filters are one quarter of the physical wavelength at the frequency at which they were designed, building such a filter (using air as the dielectric) for frequencies much below the 70cm amateur band would involve a physically large filter. It is not uncommon to find an interdigital filter for frequencies as high as 8-10 GHz.

Pictorial diagram of the described interdigital filter. (Drawing is not to scale)




Why go through the trouble of building such a filter? Why can't one simply use a pile of coils and capacitors? At the frequencies involved, the losses and small physical sizes of such components make them difficult to work with and can severely limit their power-handling capabilities. Why can't one simply use a cavity or two? Well, you can, but the precise application may dictate something other than a cavity filter.

The response of a single cavity is limited to that of just a single peak (in the area of the fundamental design frequency, that is.) Its shape can be stretched to a broad peak with gently sloping sides, a narrow spike with fairly steep sides, or anything in between by adjusting coupling and/or Q but you cannot get a broad, flat response with steep sides.

Why would you want a filter that was both wide and sharp? This sort of filter is invaluable for video, data, and other applications where this is precisely the sort of response that is desired. To get this type of response, one requires several filter sections.

This could be done with several cavities, but it takes very careful attention to details like coupling and tuning in order to provide a desired response and the resulting filter network will likely be quite large, fragile, and very expensive.

One (of the several) way(s) to get a multi-pole filter that can do what we want is with a properly designed interdigital filter. We needed such a filter for the transmitter of the WB7FID ATV repeater (a 70cm inband repeater) to attenuate the lower sideband (which was regenerated somewhat by nonlinearities in the amplifier chain) and to keep low-level intermod products from the transmitter out of the receiver. The picture below shows an example of a filter that we (Clint, KA7OEI, Dale, WB7FID, and Marv, KA7TPH, and Dave, N7UWQ) built several years ago. It is constructed of 1/8” thick aluminum plate and it is partly TIG welded and partly screwed together. (The “top” cover and coaxial connectors are really the only components that are held on by screws.)

**Exterior view of the 7 pole interdigital filter**

Assembling a filter with the desired characteristics isn’t trivial, though. The internal dimensions play a large part in determining the bandwidth, the steepness, the center frequency, and properties of the bandpass (i.e. ripple.) For design guidance, we have used a program that first appeared starting on page 12 in the January 1985 issue of Ham Radio magazine. This program was written in BASIC and it can downloaded from here. (Dale Heatherington, WA4DSY, has an online version of this same program). In this form, it has been written to run under the old GWBASIC but it should run with minimal modification on more current BASIC implementations. (Note: To download this program, you might want to click on the link with the right mouse button and choose the “save link as” option. Note that although the listing of the program appears in the January 1985 issue of Ham Radio magazine, there is an errata that appears a few months later. The correction (which has been made to the listing provided) fixes a problem with the plots that the program generates and not with the datum that is produced.

## How to run the program

Without having access to the article, the program may be somewhat cryptic, so I’ll step through a sample design. Assuming that you’ve gotten the program to execute in your BASIC implementation, you might want to follow along. If you do use GWBASIC, I’d recommend starting it with the following command-line:

**gwbasic intdig.bas > outfile.txt**

This will not only run the program, but it will cause the output of the screen to also be “piped” (output) to a text file (called “outfile.txt” in the example) so that you can review (and/or print) its output later using a text editor.

Let’s design a filter for 426.25 MHz ATV.

Since the video goes from 425.0 to 431.0 MHz, our center frequency will be 428 MHz (0.428 GHz.) We want to pass 6 MHz of video with minimal distortion, so we should really design the filter to be 7 MHz wide (to allow for some fudge factor, as the overlap between theory and practice is sometimes smaller than we’d like...).

Another consideration has to do with how much ripple we wish to allow in our passband. If we specify 0db ripple, we have also specified a Butterworth filter response. If we do specify a certain amount of ripple, then the program will design a filter with a Chebychev response. Which type of response do we want? A Butterworth response has a nice, smooth passband (ideally) but the passband edges typically aren’t as sharp as those of a Chebychev filter design with the same number of elements. A Chebychev has ripple, but it has the advantage of being sharper than a Butterworth filter of similar complexity.

We’ll do a compromise: We’ll specify 0.1db of ripple. This minor amount of ripple will have a negligible affect the video but, for the same number of filter elements, it results in much sharper skirts than you’d get if you’d specified no ripple at all.

We’ll design for 7 elements. Why 7? I’ve run the program, and 7 is a nice number: It produces a fairly low-loss filter with excellent filter bandpass/bandstop properties, suitable for most transmit applications. For a receive filter, 5 elements would likely be adequate.

Of course, this filter will be designed to operate in a 50 ohm system.

**Note that all dimension are in inches.**

First, run the program. You'll be asked:
# OF ELEMENTS, P-P RIPPLE IN PASSBAND (DB)?

At this point, we'll enter:

7, 0.1

for 7 poles and 0.1 db of ripple.

INPUT FILTER CENTER FREQ. (GHz), BW(MHZ)& LOAD IMPEDANCE ZO?

We enter:

0.428, 7, 50

for 0.428 GHz (428 MHz), 7 MHz wide, and 50 ohms.

The next information it wants is:

INPUT GROUND PLANE SPACING, ROD DIAMETER
& DISTANCE TO CENTER OF FIRST AND LAST ROD?

If you look at the picture of the filter, you'll see the long, narrow dimension of the filter (with the tuning screws.) The "Ground Plane Spacing" is the inside dimension of the "thickness" of the filter. Again, from experience, a 2.5 inch space makes for comfortable filter dimensions. The filter elements are assumed to be round, and we'll use 1/2 inch diameter rods. The "distance to center of first and last rod" cryptically refers the spacing between the center of each end rod (the ones with the taps on them) and the adjacent inside end wall. 1.5 inches is a good distance for this. (Remember that that makes the rod 1.25 inches from the wall - we are measuring from the center of the rods).

So, we enter:

2.5, 0.5, 1.5

for the "thickness," rod diameter, and rod-to-endwall spacing.

The next parameter we are asked for is:

NO. OF FREQU. REJECTION PTS AND STEP SIZE (mhz)?

This has to do with the ASCII plot that the program produces. You can ask for up to 40 points of data and specify the resolution of those steps. We'll specify 25 steps at 0.5 MHz spacing, so we'll enter:

25, 0.5

At this point, the program will start spitting out data:

CENTER FREQ. .428 GHZ
CUTOFF FREQ. 0.4245 (ghz) AND 0.4315 GHZ
RIPPLE BW. 7.000029E-03 GHZ
3 DB BW. 7.476034-03 ghz
FRACTIONAL BW. 1.635521E-02
FILTER Q 57.24961
EST QU 3598.194
LOSS BASED ON THIS QU .809367 DB
DELAY AT BAND CENTER 249.5265 NANOSECONDS
press any key

At this point, you might want to write this information down (or at least start printing the screen if you didn't start GWBASIC with the output piped to a file.) Here is an explanation of the data:

☛Center Freq.: Well, that's obvious...
☛Cutoff Freq.: This shows the frequencies at which the filter's attenuation hits 3db (for the Butterworth filter) or the amount of specified ripple (in the case of the Chebychev filter.) In our case, that's where the attenuation hits 0.1db for the last time.
☛Ripple BW: The ripple bandwidth is related to the the distance between the upper and lower cutoff frequencies (above.)
☛Fractional BW: The 1.635521E-02 really means 0.01635521, or 1.635521% bandwidth. (The percentage that 7 MHz is of 428 MHz)
☛Filter Q: The equivalent "Q" (Quality Factor) of the filter. Look this up if you don't already know what it means:-)
☛EST QU: The estimated unloaded Q of the elements.
☛Loss based on this QU: Because the Q relates to filter losses, this is a prediction of the insertion loss of the filter.
☛Delay at band center: How much delay this filter introduces at it's design frequency.

My experience with the filter shown is that if it is tuned for maximum flatness, the group delay is pretty consistent throughout the passband.

Pressing a key will cause the program to generate an ASCII graph of the predicted filter response, the frequency of the data point, and the calculated insertion loss (rounded off to within 1db) of the filter.

Pressing a key again will give some more data:

QUARTER WAVELENGTH = 6.894159 INCHES
THE LENGTH OF THE INTERIOR ELEMENTS = 6.38665 INCHES
LENGTH OF END ELEMENTS = 6.407211 INCHES
GROUND-PLANE SPACE = 2.5 INCHES
END PLATES 1.5 INCHES FROM C/L OF END ROD
TAP EXTERNAL LINES UP .3113659 INCHES FROM SHORTED END
LINE IMPEDANCES: END ROD 108.2183, OTHER 110.9835, EXT. LINES 50 OHM

☛The Quarter Wavelength is the internal size of the filter (the vertical dimension of the drawing.)
☛The "Interior Elements" are those elements that are not on the ends (the 5 in the middle) while
☛The "End Elements" are, well, those on each end.
☛The "Ground Plane Space" is that 2.5 inch spacing between the two ground-plane sheets (the covers.)
☛The "End Plates 1.5 inches from C/L of end rod" is that 1.5 inch spacing of the C/L (CenterLine) of the end elements to the end plates.
☛The next line says that the 50 ohm point is 0.311 inches from the ground end and that they should be tapped there.
☛The final line just gives some internal impedances that you may or may or may not be interested in as well as the input/output impedance that you specified.

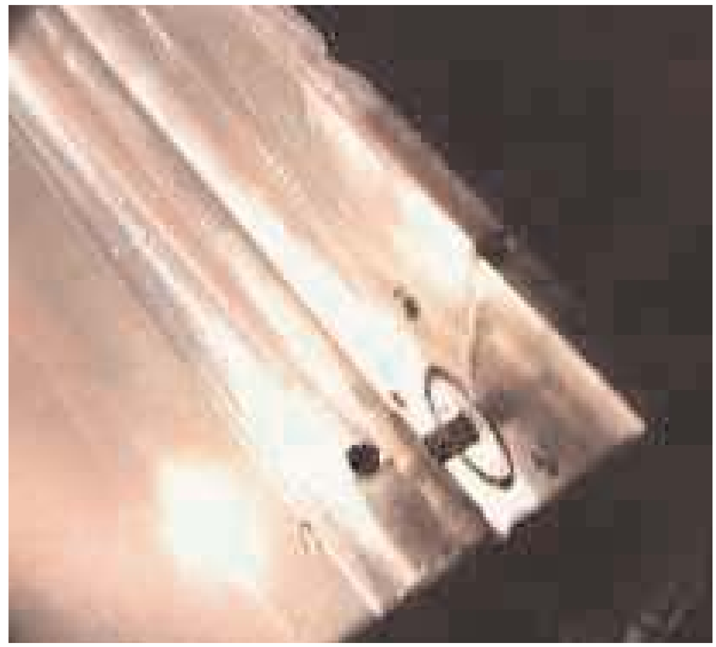
Pressing a key again (for the final time) will display the internal element spacings. The "END TO C" refers to the distance (in inches) of center of that particular element to the end wall, and the "C TO C" spacing just refers to the spacing between adjacent elements. The G(K) and Q/COUP are coupling coefficients for the given elements. Note that "Element 8" isn't an element at all, but is just the distance from one wall to another (the "width" or the horizontal dimension on the image above.)

**A word of warning:** The above lengths are those predicted for exact tuning assuming that the predictions were perfect. The reality is that you'll want to be able to tune the elements slightly to allow for the (inevitable) departures from the predicted parameters. So, you'll actually want to make the elements a few percent shorter than the predicted lengths and **you should be prepared to shorten them even more!**

## Building a filter

**Another exterior view of the 7 pole interdigital filter**

Before you start building, design the filter that you believe you want. This may sound silly, but I strongly recommend that you try several variations of the filter (number of poles, ripple, ground-plane spacing, etc.) and carefully weigh the resulting properties for each predicted filter (i.e. insertion loss, physical size, etc.) One thing that you'll immediately notice is that the length of the filter increases dramatically with the increasing ground-plane spacing, but the insertion loss goes down. What material to use? Silver-plated brass or copper would provide some of the best performance (i.e. lowest loss) but polished copper (without the silver) will work nearly as well (provided that it is protected from moisture...) Aluminum would be the second best choice, and brass would be the third. How does one hold the filter together? Perhaps one of the most practical ways (although laborious and time-consuming) to assemble such a filter is with screws, with threads drilled and tapped. For this case, you will need at least one screw per element along the length of the filter (that's 4 screws per element if you count the top and bottom screws and the ones on the back. Along the sides, you'll need to put screws at intervals no larger than the spacing of the elements - and probably more than that, with at least two screws on the "thickness" part of the side walls.



**Closeup of the tapped end-element. The back of the "N" connector and the setscrew connecting to the element may be seen.**

In the case of copper, brass, (or other silver-plated metals) the filter can be (at least partially) soldered together. Of course, you would never want to solder the filter completely together as you would find it extremely difficult to disassemble should repairs (or modification) be necessary. For aluminum, you would probably use screws to assemble the filter and using appropriate amounts of anti-oxidant on mating surfaces to assure continuity. Of course, it is possible to TIG weld the filter (as we did in the filter shown above) or even use aluminum-capable solder (which is expensive and usually contains cadmium - a toxic heavy metal.)

One of the somewhat unusual aspects of this particular filter is that it uses tapped end-elements (tapped at the point at which they exhibit the designed impedance) rather than the end-fed resonators that are shown in the oft-quoted March, 1968 QST article by Fisher. This makes for simpler construction. The picture to the right shows the tap-point for our aluminum filter. You can see the rear of the chassis-mounted N connector and the conductor that goes through the element at the tap point. In this case, it is a short piece of #12 copper wire, held in place with a hex-head (allen-type) setscrew. The connection is coated with anti-oxidant to reduce the effects of electrical connections of dissimilar metals. In the 5 (or so) years that this filter has been used, we have never had any problems with these connections.

**Interior of the interdigital filter, showing one of the elements TIG welded to the sidewall**

The elements themselves are also aluminum, but they could have been brass or copper. Since we had access to a TIG welder, the elements themselves were first mounted with screws and then tack-welded to the sidewall to assure mechanical strength and a consistent electrical connection. If we had used copper or brass, we would have just used a stainless-steel screw, the connection would be coated with anti-oxidant, and the wall-end of the element would have been counterbored in concave so that the outside "rim" of the element would be making solid contact and not the center of the element, which could "wobble" about.

**Closeup showing the tuning screws (with capacitive disk) for one of the elements.**

How does one tune the elements? Firstly, remember that these elements are electrically shorter than 1/4 wavelength. Secondly, **remember that the length of the elements as predicted by the program are the idealized lengths for the desired response**. In other words, if everything were perfect these would be the lengths of the elements for the exact response desired. Since everything is not perfect, **you will have to make the elements slightly shorter than the predicted lengths so that they can be tuned for the desired response.** The amount of this shortening is on the order of a few percent and is rather difficult to predict. **Be prepared to trim the elements slightly after the filter is assembled!** In the case of the filter shown, the elements had to be shortened by over 1/8 of an inch. A rotary tool (such as a Dremel) and a file was used for this task, as the element could not be removed (remember: it was welded into place!) Normally, only tuning screws are used and the proximity of the screw to the end of the element adds just enough capacitance to tune the element down into proper resonance. In the case of our filter, it was originally designed to operate on the 439.25 MHz ATV frequency but we needed to retune it to 426.25 MHz. While the screws could tune the filter to frequency, the spacing between the screw and the end of the element was very small. This could reduce the mechanical stability of the filter's tuning and the small spacing could permit arcing at higher power levels. Small disks were soldered to the end of the screws in order to increase their surface area and thus the capacitance. On the outside of the filter, there are jam nuts on the screws (both of which are brass, by the way) to allow the filter tuning to be locked once the desired response is achieved.

**Full interior view of the interdigital filter.**

The interior of the complete filter is shown above. Although they are difficult to see in the picture, you can just make out the tapped holes at each element and at several points along the sides. There are 20 screws (14 for the 7 elements, 3 along each side) that hold the top on the filter. It should be noted that during the initial tune-up of the filter, it was **not** possible to get any sort of representative filter response without putting the cover plate(s) on and the screws in. In other words: If you need to trim the elements to allow them to be tuned, you will have to put the cover(s) back on and the screws in **every** time you want to see if you have shortened the elements enough.

## Tuning the filter

A bit of advice: **Do not even waste your time trying to tune the filter unless you have some test equipment to tune the filter!** Let me say that again. Unless you have some test equipment, you are going to pull your hair out trying to tune the filter! Even if you do have the equipment, it is likely that you will still lose some hair!

**There are several equipment lineups that will allow tune-up:**

☛A sweep generator on the input and a diode detector on the output that goes to an oscilloscope, the X-axis of which is driven from the sweep voltage output of the generator. This is what was used for the original tune-up of the filter and, assuming that the filter isn't so badly detuned that you can't get enough signal to bias the detector, it works well. If it is badly detuned, one can take the brute-force approach and transmit into the filter with a handie-talkie and twiddle the tuning screws until you get some output and finally have a starting point. If you don't have a calibrated sweep generator, then do this trick:

☛Couple a bit of energy from the sweep generator into an FM receiver.

☛Feed the unsquelched audio output into the Z axis (brightness) input of the oscilloscope that you are using on the diode detector.

☛If you are careful, you should be able to see the change in brightness on the trace where the generator sweeps through the frequency to which the radio is tuned.

☛Doing this, you can figure out where the start and stop points are on the sweep by tuning the receiver.

☛If you have a fast squelch and/or if you use a very slow sweep, you could also squelch the radio and observe the brightness change on the sweep as generator sweeps across the receive frequency and causes an audio "pop" as it breaks the squelch.

☛Do this for the "start" and "stop" frequency, noting where they are on the oscillicope.

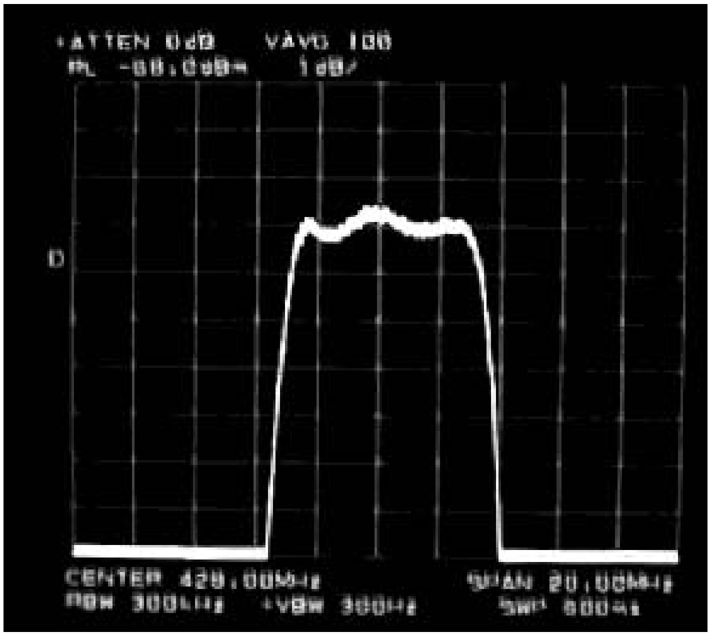
☛What about if you don't have a sweep generator at all? I suppose you could (carefully!) disconnect the PLL of a synthesized radio and connect the VCO tuning line (with proper voltage scaling and offset) to a sawtooth wave generator (like a 555...) Assuming you can get the radio to produce output with an unlocked PLL, this makes a dandy, high-powered sweep generator.

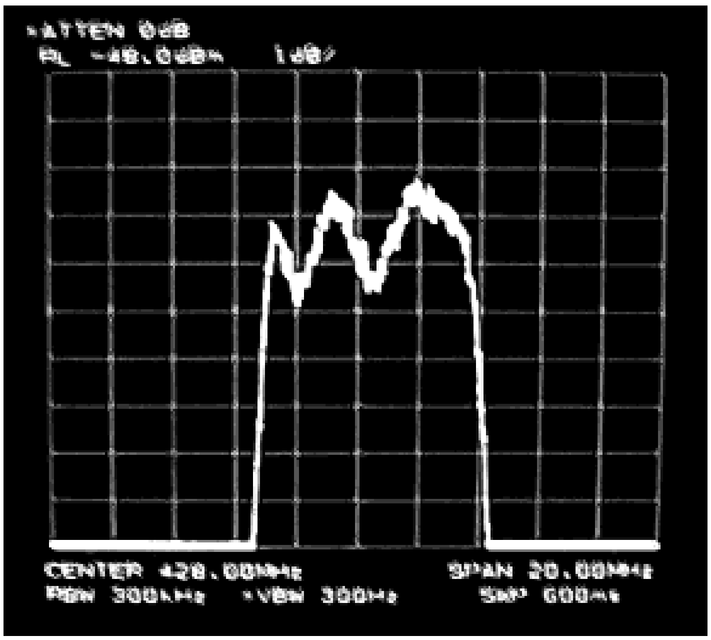
☛A spectrum analyzer and a tracking generator. This is handy, if you have it. It has the advantage that there is a logarithmic display and you therefore have a lot more dynamic range and can see "deeper" into the sides of the response than you can with the diode detector. If you have access to a spectrum analyzer but not a tracking generator, you can use a broadband noise generator. (That is how the trace at the beginning of this article was generated, by the way...)

☛You could use a network analyzer. This is the very best tool for the job, but you may have to ask someone in the RF design industry (or a related field) if they have one and if you can use it...

**WARNING, ATTENTION, ACHTUNG, AVIS, ALERT, NOTICE:**

If you are using the sweep generator/detector or tracking/noise generator/spectrum analyzer method (or some combination) you **must** put resistive pads on the **input** and **output** of the filter, **at** the filter! Even though it may say 50 ohms on the test equipment, **do not believe it**! At the very least, the cables will transform the impedance to something other than 50 ohms resistive during the tuning process. Use at least 6 db pads (and preferably, 10 db pads.) If you don't do this, you'll be chasing your tail.




**Plots of the same filter with (top) and without resistive source and termination. Note that while the filter with the resistive attenuators on the input and output shows about 0.5db of ripple, the one without the pads has almost 2 db of ripple!**

The two pictures above demonstrate this very clearly. The picture on the left is shown using 10 db pads on both the input and the output while the picture on the right demonstrates the ripple that can result if you rely on the test equipment to source and terminate at 50 ohms (notice the almost 2db ripple on the one on the right!.) Unfortunately, it can be difficult to maintain a 50 ohm system (using ferrite isolators and watching VSWR helps) but it is important that you have a known starting point. **YOU HAVE BEEN WARNED!**

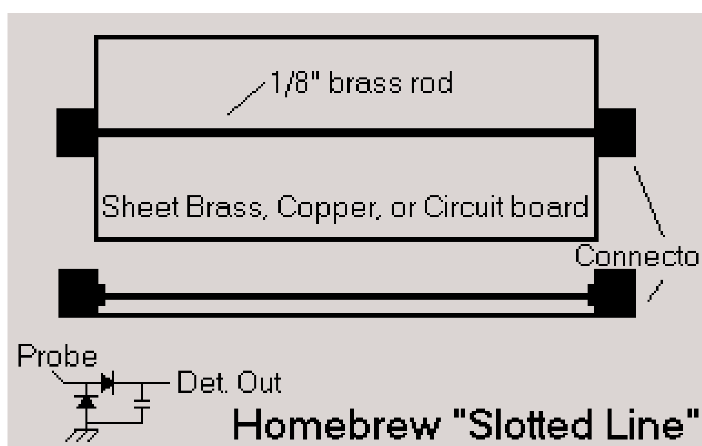
Assuming you have the equipment, you are now faced with trying to tune the filter. It may **not** be easy to try to tune a filter with numerous highly-interactive adjustments. If you have a "knack" for such a thing, sometimes you can get the "feel" of the filter by tuning each screw, observing it's effect, and then tuning it by the seat of your pants. Be forewarned. **Not everyone can do this, so don't kill yourself trying!**

Firstly, you have to determine if the elements are short enough so that there is adequate tuning range. Having a network analyzer available greatly simplifies this. If you don't have one, you can use a slotted line. Anyway, the procedure (sometimes called "The Dishal Method") is approximately thus:

1. Turn all tuning screws in such that all elements are shorted out on the ends.
2. Terminate the filter with the proper impedance.
3. Using a fairly high-output signal generator, put a signal into the slotted line on the center design frequency. Connect the other end of the slotted line to the input of the filter (i.e. the end that is not terminated.)
4. Slide the slotted line to find either a peak or a null standing wave. Do not touch the slotted line again during the procedure.
5. Tune the element closest to the slotted line so that the peak becomes a null, or vice versa (depending on what you started with...)
6. Tune the next element for a null or a peak (opposite what the previous element produced...)
7. Repeat the previous step for each of the remaining elements, alternating between the peak and null.

By the way, since you are looking for standing waves, etc. you do not use attenuators for this procedure.

If you have a network analyzer, you can infer from the above procedure what it is that you should be doing. If the elements are of the proper length, you should be able to easily tune through the null or peak (whatever it was that you tuned for) without the screw being too close to element rod end or being almost completely removed. In the case of the latter, the element needs to be shortened. In the case of the former, you cut the element too short and you either need to lengthen it (preferred) or put a disk on the screw.




**Pictorial of a quick and dirty "slotted line" that may be used to aid in tuning an interdigital filter.**

If you don't have access to a slotted line, you might want to ask around to find one. Alternatively, you can construct a "reasonable facsimile" (see the picture on last page.) This is essentially an open-air transmission line that is suspended above a ground plane. Ideally, it should be about 1/2 wavelength long at the test frequency but you can make it shorter if you have an assortment of short pieces of coax that you can insert/delete. The idea is to place the peak (or null) somewhere along the slotted line. Strictly speaking, this is not really a slotted line, but but the whole point of this exercise is to get access to the center conductor so that you may sample some if its energy.

Place the line (consisting of some brass rod, stiff copper wire, etc.) about 1/8 inch above the ground plane (if you are a purist, you can go ahead and calculate the proper height for 50 ohms... Since we are utilizing the standing waves anyway, it isn't all that critical.) With the procedure above (with all elements shorted) you would place the probe very close (but not touching!) to the line and slide the probe (the diodes, etc.) along the ground plane until you find the peak/null. You may need some reasonable amount of power for this in order to get enough energy to get a good detector reading: I used a handie-talkie on low power (1/2 watt) for this. Once you have found the peak/null, you can then tack-solder the ground of the probe to the plane. Once the ground is soldered down, you can usually move the probe back and forth slightly to fine-tune the peak/null. Using some circuit board material makes soldering much easier. For the diodes, use 2835-type shottky mixer diodes, 1N34 types, or 1N914/1N4148 types (in order of most to least sensitive) and all but the 2835 types are available at Radio Shack. For the capacitor, a small 0.01 uf disk ceramic is adequate. Keep all leads (except for the probe lead - which could be the lead of one of the diodes) as short as practical.

Alternatively, you could etch (or cut) a 0.110 inch wide line into a length of G10 or FR4 0.062 inch thick double-sided **glass epoxy** (don't use any other kind!) circuit board. Leave about 0.1 inch gaps between the line and the surrounding ground plane. Wrap the edges of the board with copper foil and drill small holes in the ground planes alongside the strip and put small wires (soldered on both sides) to make sure the ground integrity is maintained. Like the suspended line, you would place the probe very close to (but not touching) the line.

## The results:

This procedure also reveals something about what the "natural" response of the filter is supposed to be. If you built it exactly right, it will produce a response that somewhat resembles the original design parameters (you hope...) At this point the tuning should need to be only slightly changed to attain the desired response or, at the very least, you should have a good starting point for tuning. If you can't get the response that you desire, then there are at least four possibilities:

1. You should try harder, or maybe you should let someone else try. Maybe they'll have better luck.

2. One (or more) of the elements are too long. Try tuning it up 5 to 10 MHz lower in frequency. If it tunes up you need to shorten the elements slightly. Knowing the frequency at which it does tune up might clue you in as to how much you need to shorten the elements.

3. One (or more) of the elements are too short. Try tuning it up 5 to 10 MHz higher in frequency. If it tunes up you need to lengthen the elements (perhaps blobs of solder, in the case of copper or brass elements) or increase tuning screw capacitance (by putting disks on the tuning screws.) The preferred method is to lengthen the elements.

4. You built the filter wrong! Hopefully you can figure out what went wrong.

## Additional Comments:

There are a few things we learned when building our filter (some of which fall under the heading "If we do this again, we'll do this differently!")

☛We placed the end elements too close the the end walls. We believe that this has some effect on the ability to tune the end elements since we had to make them quite a bit shorter than the program suggested. We also believe that this contributed to insertion loss that was somewhat higher than we predicted.

☛Avoid leaving sharp edges on the edges of the elements and tuning screws (or disks.) The ends should be slightly rounded (we beveled our elements and then sanded the sharpness off.) If there are sharp points or spikes at the ends of the elements this can lead to flashover if you attempt to run very much transmit power. Remember that there is high RF voltage at the ends of these elements!

☛We used 1/8 inch aluminum plate for the entire filter. This is plenty thick enough for adequate mechanical stability: It takes a lot of pressure on the top/bottom to (temporarily) detune the filter and once pressure is released, the original tuning is restored. The biggest problem is that 1/8 inch thick plate is just not thick enough to comfortably accept drilled and tapped 4-40 screws. If you look carefully at the picture above that shows the element tack-welded to the sidewall, you'll notice a "bulge" in the sidewall where the threads were drilled and cut. None of the screws have actually stripped out, fortunately. To prevent this from happening, there are several possible solutions that occur to me:

☛Use thicker metal.

☛Use smaller screws. (This isn't a very good solution in my book...)

☛Run a weld bead on the outside and/or inside of the wall to increase the effective thickness where the screw will be. This would be true for TIG-welded aluminum filters. For copper/brass, I suppose you could braze more material there...

☛Weld/Braze/Solder a piece of metal on the outside of the filter and drill/tap into that, instead. You could even attach an already-threaded standoff.

☛Run very long screws (or use some "allthread") between the top and bottom covers and don't even tap into the filter. The compression between the two covers should keep the covers in place.

Remember, you still need to figure out how to hold the sides of the filter together (i.e. solder, welding, brazing, or with screws.)

☛We would connect the tap-points of the end elements differently so that we could adjust the tap points slightly. I'm not sure exactly how we would do that with aluminum rods, but we really haven't thought about it much. With brass/copper rods, the tap-points could be soldered into place.
☛A **word of warning**: This filter is based on 1/4 wavelength elements. Like **any** filter with elements that are based on odd 1/4 wavelength elements (this includes cavity filters!) it **will have a bandpass response at odd multiples of the 1/4 wavelength frequency!** In other words, almost any 70cm interdigital, combline, or cavity-based filter will pass some 23cm signal through it. The response and insertion loss may be poor, but signals will get through! If you are running a crossband repeater with a 70cm transmit at a 23cm receive, your 3rd harmonic may cause you some grief. You will want to place a lowpass filter somewhere in the line (after the isolator/circulator, if you have one, as it can generate harmonics and intermod of its own, plus it doesn't work well too far from it's design frequency!) to prevent this energy from getting through. We will be using a disk-and-rod filter that was extricated from a commercial 450 Mhz transmitter, but you could use practically anything.
☛I should mention that the design parameters given above reflect more along the lines of what we should have done, and not what we did do. For example, the end elements are too close to the side wall.

Did you wonder what the specifications of the filter were when we finished it?
Here they are as I recall them:

- ☛Insertion loss at 439.25 Mhz: 1.3db
- ☛Insertion loss at 442.83 (Chroma subcarrier): 2.1 db
- ☛Measured 3db bandwidth: about 7.5 MHz

You'll no doubt notice that there is almost 1db more insertion loss at the chroma frequency than at the video carrier frequency. Again, I should mention that this is a filter that we would have built differently if we knew then what we know now!

When we did the final tuneup we were fortunate enough to have access to an HP Network Analyzer. After "diddling" the tuning for a while, we noticed that we could get the tuning absolutely flat if we wanted an insertion loss of about 1.8 db or so, or we could tune it to favor the video carrier frequency and cut our losses by about 0.5 db. We chose the latter since that is where most of the power is. We could always crank up the chroma a bit on the video processor (and we did) to make up the difference. I don't remember what the group delay parameters were precisely on the final tuneup, but they were more than acceptable for amateur use (the effects weren't visible in the video, anyway.)

When we recently retuned the filter for the 426.25 MHz video frequency (remember that this filter was designed for 439.25 MHz!) we got approximately the following results:

- ☛Insertion loss across the passband: 2.3 db
- ☛Ripple: <0.5 db
- ☛3 db bandwidth: 6.8 MHz
- ☛10db bandwidth: 8 MHz
- ☛20 db bandwidth: 10 MHz
- ☛30 db bandwidth: 12 MHz
- ☛60 db bandwidth: 19 MHz
- ☛80 db bandwidth: 32 MHz
- ☛110 db bandwidth: 43 MHz

The range of the test equipment used prevented measurement of the filter's attenuation below 110 db.

The spectrum analyzer plots above (the one at the top of the article, plus the two showing the effects of not providing proper resistive termination of the filter) are of this filter, as tuned for the 426.25 MHz frequency (the filter center frequency is 428 MHz, 5 db/vert. div., 2 MHz/horiz. div.)

You'll have noticed two things here. The insertion loss was higher, and the filter was tuned for flatness and not for "minimum attenuation where it matters most." The increased insertion loss is likely the result of the taps being in the wrong positions for the frequency, and for the internal dimensions of the filter being a bit too small. Additionally, we had to put the disks on the tuning screws in order to load the resonators down to the proper frequency and that probably increases the losses slightly.

**Update:**

Dale, WB7FID, did some experimentation to reduce the insertion loss of the filter at the 426.25 Mhz frequency and was successful in reducing the insertion loss from 2.3db to about 1.8 db at the video carrier frequency. More details will follow.

**Looking forward:**

Actually, we are building a new filter. This one will also be made out of aluminum, but it will have silver-plated copper rods. It will be much larger (physically) and we are trying to get the insertion losses well under 1db. It will not be TIG welded together (as the heavier stock makes that more difficult) but rather it will be put together with lots of stainless-steel screws and anti-oxidant to maintain good connections and to prevent the screws from seizing in their threads. We have just acquired most of the material but, since we already have a useable filter (the old one) we'll go forward with the repeater project and get it on the air with the old filter first. We'll worry about replacing the filter once we're on the air.

**Other References:**

From the WA4DSY site, there is an online calculator on the Design a custom Interdigital Bandpass Filter page.
**http://www.wa4dsy.radio.org/cgi-bin/idbpf**

ATVQ

# Photographing the TV Screen

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**Reprinted from CQ-TV #183 - August 1998**

## Camera type

The best for this job must be a 35mm Manual (or semi manual), Through The Lens metering, Single Lens Reflex with a lens or vertical focal plane shutter action. With the SLR you can get in close to check the actual focus and avoid missing the shot due to parallax from a separate viewfinder. Autofocus cameras can get it wrong if they accidentally focus on the TV tube's glass surface and not the phosphor.

Don't use flash mode - although obvious, many small modern cameras insist on a flash rather than give a long exposure time.

## Lining up the shot

Try to get close to the tube and aim to nearly fill the viewfinder, a wide angle or zoom lens can help with this, but do not get close enough to cause optical pin-cushion distortion from the bulbous tube. Keep the camera axis in line with the centre of the TV for best geometry and even focus.

If possible take the picture in a shady room so that black is black and watch out for reflections (e.g. yourself) etc. that never seem to be there when you take the picture! Set-up the TV to give a good sharp well colour balanced picture with the brilliance set so that the blacks are just visible.

If the shot is off a video recording then with a few practice plays you can select the best action, subject, steady shots, to snap. A VCR freeze frame will never look as good as a longer exposure snap with no motion!

## The shutter

For shots of moving video, a 1/25 sec may be the best option if your camera can do this speed but there is a problem. With a lens or vertical focal plane shutter, horizontal brilliance bars may be visible as the shutter snaps approximately 2 TV fields, if the shutter timing happens to open and shut during TV flyback a perfect picture will be the result. So take several snaps of moving action and some will be OK. With a sideways focal plane shutter there will always be diagonal brilliance bars, so don't use fast shutter speeds or use the camera in portrait mode. If you need a fast action without bars try a VCR still frame with a long camera exposure time.

When there is no video motion, then slower shutter speeds give much better results - not only does the depth of focus greatly improve, but there are so many frames averaged that any shutter timing brilliance bars are too faint to notice.

With noisy but well locked pictures there is a distinct advantage in using long exposure times, as much of the noise will be removed. Shutter speeds of 1/12, 1/8, 1/4 of a second or longer work well, but may require a tripod.

## Gadgets

Using a tripod can help as you have more to view and set up the shot, you can use a very slow shutter speed without problems. Cable release can reduce the chance of disturbing the camera's aim even when on a tripod, this is especially true if using a telephoto lens or slow shutter speeds.

## Exposure & Film

Use a normal daylight film, as TV sets are set up to give of lots of blue light that is seen by film as a daylight balance, even though your eyes do not. I recommend 200 ASA as being the most versatile.

If the exposure meter is not TTL or you cannot easily fill the viewfinder with the whole picture then take the meter/camera to the screen to take the light reading.

With low light subjects watch out for viewfinder backlight error readings that are possible with some TTL systems! Also with slow exposures the metering may give out or give silly readings. So take a reading at a more normal shutter speed then do a time/iris stop f calculation, e.g. Double the exposure time means reduce the aperture by 1,f stop position. All these are approximately the same exposure:-

| Stop | | Speed |
|---|---|---|
| f1.4 | @ | 1/100 |
| f2 | @ | 1/50 (l/60) |
| f2.8 | @ | 1/25 (1/30) |
| f4 | @ | 1/12 (1/15) |
| f5.6 | @ | l/8 (l/10) |
| f8 | @ | 1/4 |
| f11 | @ | 1/2 |
| f16 | @ | 1 sec |
| f22 | @ | 2 sec |

## Prints

If the pictures are taken in total darkness, the developer may not align the TV image in tine centre of the print. If this often happens use some lighting behind the TV so that the camera frame stands out, or give printing instructions when you take the film in to be developed.

For use in front of a TV camera prints should be gloss finish, as positioning the lighting etc can eliminate any surface glare. Prints with a matt finish give less highlight glare but always give a speckle grey instead of blacks when seen by a camera. (Daylight reflections can be reduced/virtually eliminated by the appropriate use of a Polaroid filter in front of the lens. - ATVQ ED)

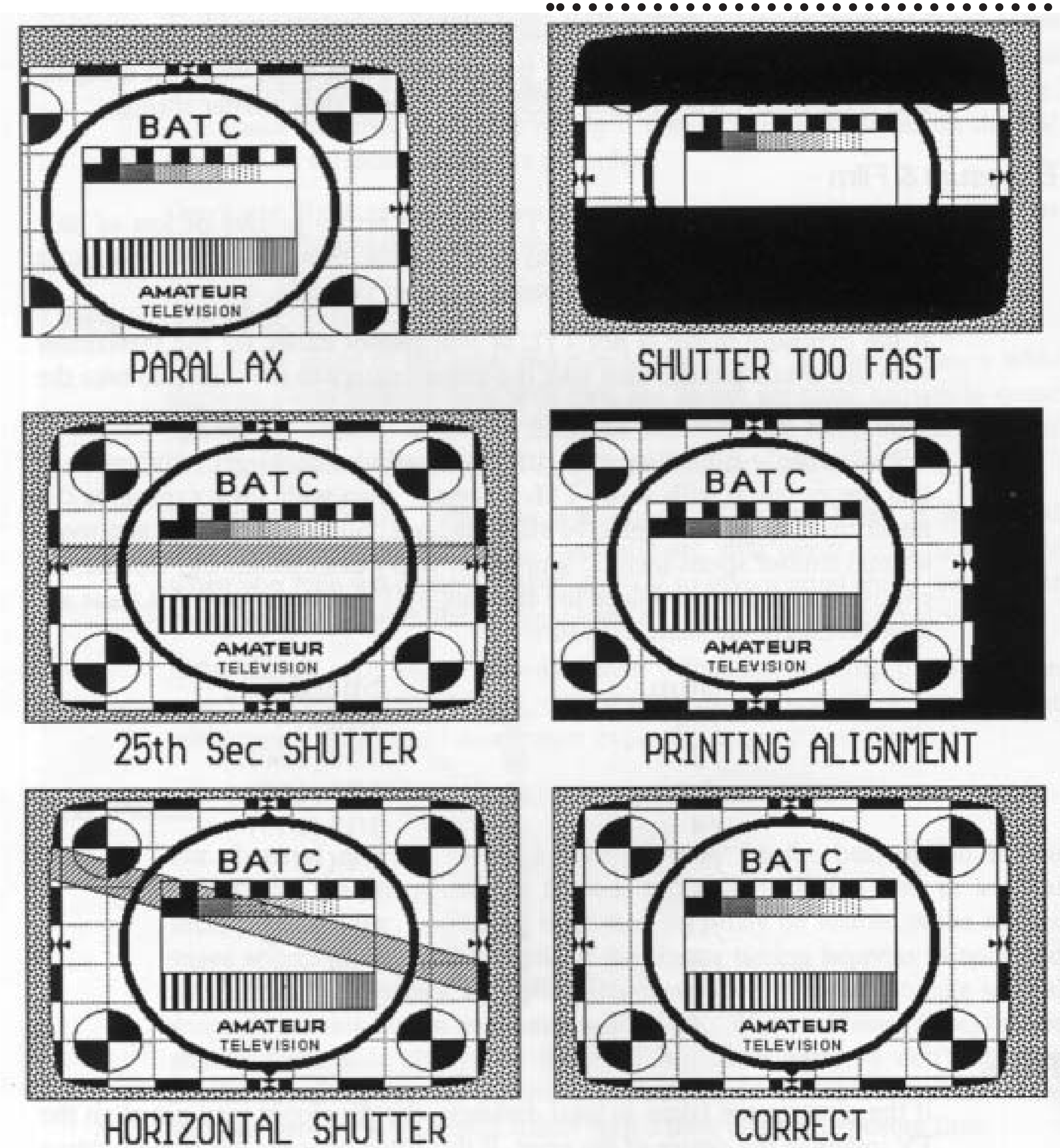
**NOTE: NEW EMAIL ADDRESS FOR ATVQ**

**ATVQ@hampubs.com**

**NEW WEB PAGE IS:**

**http://www.hampubs.com**

**(the old accounts are closed)**




**Various problems with off the screen photographs.**

# Picture DX Bulletin #44 January 2000

**by Danny Van Tricht - ON4VT - email: ON4VT@ping.be**
**Hulshoutveld 2**
**B-2235 Hulshout**
**Belgium**
**SSTV Website http://www.ping.be/on4vt/**
**http://www.qsl.net/on4vt**

May I wish you and your family a prosperous 2000 with a lot of SSTV fun !

Information this month came from: *FRA1AG, HA9RG, ON1DNH, SWL Pierre,JA2BWH/1, HB9AXG, SM5EEP, ON4PL, PT2BW, VK6ET, JR0CGJ*

**AFRICA**
5H - TANZANIA 5H3MG, John showed up in SSTV mode. He's on holiday in 5H until middle January 2000. QSL via IN3YYQ.

**ASIA**
EK - ARMENIA EK6RMM, Arman, was seen and worked on 10m SSTV.
JY - JORDAN I convinced JY9NX to try SSTV and he he did ! Look for Koji on the usual SSTV frequencies. He works on the Japanese Embassy in Amman. QSL via JH7FQJ or to Mr. Koji Tahara, Embassy of Japan, BOX 2835, Amman 11181, Jordan.
UN - KAZAKSTAN UN7GDL, Yuri, is active on all bands SSTV. QSL via W8JY.
VR2 - HONG KONG VR2K is a special Y2K event station operating also in SSTV. QSL via VR2XRW.
XZ - MYANMAR The XZ0A DX-pedition planned for January 2000 will has received also permission to do the very first SSTV ever from Myanmar !
JR0CGJ will be the SSTV responsible and he arrives in XZ around 26 of January !

**EUROPE**
EA6 - BALEARIC Look for EA6MQ, José, active all band SSTV.
HA - HUNGARY HA5DW made more than 1500 SSTV QSO's as HG5P with more than 100 DXCC's ! From the 1st of January on he will be active as HG5PAX .
IS0 - SARDINIA IS0FMI is seen and worked very often on several bands !
ON - BELGIUM Very unexpected I operated as OT4VT to celebrate the wedding of Prince Filip and Princess Mathilde. I made about 100 SSTV QSO's.
Also OT7NW was on the air in SSTV !

**NORTH AMERICA + CARIBEAN**
CO - CUBA CO7GG, Gerondo, still remaining QRV in SSTV
KP4 - PUERTO RICO KP4EMP is very active in SSTV all band.
XE - MEXICO XE1FAA is almost daily seen on 10m SSTV.

**OCEANIA**
3D2 - FIJI JA0SC, Hiro, did a great job by bringing 3D2HY on the air in SSTV. Hiro made 113 QSO's. QSL via homecall. Thanks for the new one !
FK - NEW CALEDONIA FK8HC, Franck, has a booming signal on 10m SSTV.
V7 - MARSHALL ISLANDS V73JK is set up for SSTV. No pictures seen so far!
VK - AUSTRALIA The VK6ET SSTV repeater is still running on 21.349 USB!
YB - INDONESIA YB1AQU worked on 15m SSTV

**SOUTH AMERICA**
PY - BRAZIL PT2BW will operate the Special Y2K Event station ZW2OOO in SSTV mode. QSL via PT2BW !
PYOF - FERNANDO DA MORONHA PY8IT (JA1FQI) was active in SSTV as PY0FT. QSL via JA1ELY
VP8A - ANTARCTICA From time to time 8J1RL shows up in SSTV. QSL via JA9BOH !

**SHORT NEWS**
*Please put your callsign on the botton of your picture. Very often you tune in on a picture, missing the start.
*I guess still a lot of people don't know that there is a SSTV reflector on the internet. To subscribe go to **http://www.qth.net**, choose "SSTV-ATV" and fill in the online form !

* What's new on my SSTV website ?
  -PDXB # 44 with pictures of the month
  -Rules for the MOBILE SSTV contest
  -Direct Callsign look up via QRZ

**SSTV QSLs RECEIVED**
Direct : KG7BC, TO0DX, K3NEF, W9HWQ, ZM75AA, KA9BCF, W0TUP, KE1AC, 3D2HY, EZ8BM, RV3TH

ATVQ

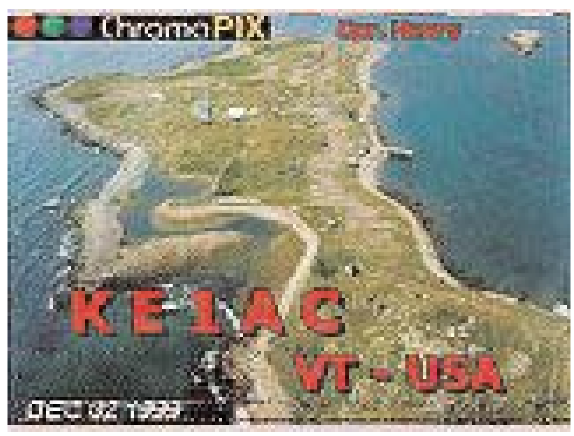

PY0FT


JY9NX


3D2HY


FK8HC


5H3MG




KE1AC


UN7GDL


EA6MQ

# REMOTE POSITION CONTROL OF THE xl0VIDEO SENDER

**by Louis Hutton K7YZZ - K7YZZ@AOL.COM**
**12235 SE 62nd St.**
**Bellevue, WA 98006-4401**

Until recently my ATV camera positioning was limited to the length of the cable supplying power to the camera and sending audio and video data from the camera to the ATV transmitter. Then I learned about a small color camera that was part of a 2.5 Ghz remote video transmitter/receiver system. I went on the internet (www. xl0.com) and took a look at the product. I ordered one and after it arrived, I hooked it up and found that I was now able to position that camera/transmitter unit anywhere upstairs around the house and receive and re-transmit, in my basement ham shack, the pictures over my 434 Mhz ATV transmitter. It worked so well I figured there should be a way to remotely control the position of that camera from my ham shack. This remote position control unit is the result of my approach to this problem. The system shown in photo #1 consists of the xl0 video sender components, a Futaba Attack 2DR model car radio control transmitter and a scratch built remote controlled camera positioning unit.

**Photo 1**

The positioning unit shown in photo #2 is 6 inches wide by 6 1/2 inches deep by 5 1/2 inches high. The servo driven camera table can be tilted up or down and swiveled left or right. Three assemblies made of wood make up the unit as seen in photo #3.




**Photo 2**

The little table that holds the camera is 4 1/4 inches wide by 6 1/2 deep. A 3/16 by 3/16 wood rail is glued around the edge of the table to help hold the camera/transmitter in place when the table is tilted. A 3/4 inch diameter wood dowel pivot rod 4 3/4 inches long is glued underneath the table 3 1/4 inches from the front edge of the table. The base unit is 6 inches wide by 6 1/2 inches deep by 2 inches high. The center of the base is located and drilled to support a 6/32 blind nut. The rotating platform is 6 inches in diameter by 1/16 inch thick. A 1/4 pie section is

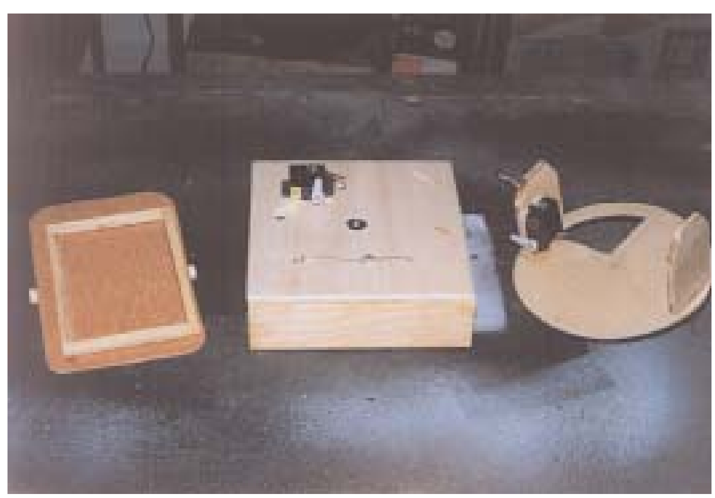
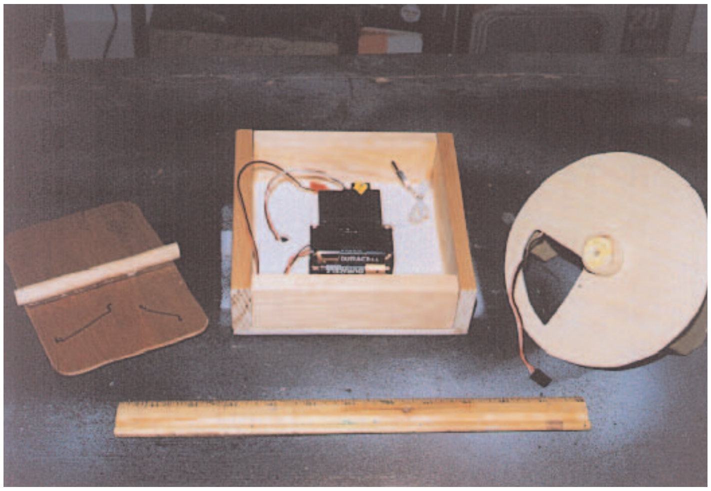


**Photo 3**



removed from this platform to make clearance for the azimuth drive servo. The supports for the tilt table are 2 inches wide and 2 1/2 inches high and 1/4 inch thick. The supports are glued to the rotating table with model airplane CA type glue. The servos are attached to the unit by double sided sticky foam tape of the type used in model airplane projects. A 1 inch diameter by 1 inch long piece of wood dowel is centered and CA glued to the underside of the rotating table. A 6/32 hole is drilled vertically down through that dowel using the previously located center hole as a guide.

From the bottom view of the base unit ( photo # 4) the location of the radio control receiver and the 4 cell battery pack are shown. They are also attached to the underside of the base using double sided foam sticky tape. The receiver's antenna is unfurled and routed around the inside of the base sides. It is held in place with strips of masking tape. The radio receiver's battery switch is mounted in the rear right hand corner of the base. Two servo push rods are fabricated from small diameter piano wire. The longer one shown in photo ›3 is formed to drive the camera platform. The shorter one is formed to drive the rotating circular platform. On the camera platform the push rod mounting hole is located 2 inches back from the front of the platform's left hand side. The rotating table push rod mounting hole is located about 1 1/2 inches from the center hole on the edge of the pie shaped hole. Shows up in photo ›4 as a black dot on the edge of the pie shaped hole near the center dowel rod.

The Futaba Attack 2DR radio's control sticks are of the self centering position type. The instruction manual on page 14, "Changing The Neutral Position," describes just what to do to free up those control sticks. If it is desired to make the modified sticks to be of the ratchet type, instructions are also included on the same page for that modification. The ratchet plate spring is Futaba part number FUT01677 ( two required) and the screw to hold the spring in place is Futaba part number FUTJ55043 (two required). I modified my control sticks per their manual instructions with no problems.

The finished unit was given a coat of grey paint to jazz it up a bit. Also, a piece of that I inch diameter dowel rod was hollowed out, with a Dremel tool, to the shape of a small cup to hold the xl0 camera lens cover. It had a habit of disappearing every so often. The cup is glued to the front top right hand corner of the base.

How long did it take me to build this stand, well I figure it took about 7 hours from start to finish. The thin plywood, radio control transmitter, blind nut, bolts and screws, piano push rod wire, and CA glue for the project came from a model airplane store.

If the reader has any questions, I can be reached via e-mail at K7YZZ@AOL.COM.

ATVQ



## Michael Stone WB0QCD - SK

TIPTON, Iowa — Services for Michael W. Stone, of 300 W. 4th St., will be 10:30 a.m. Saturday at Fry Funeral Home, Tipton. Burial will be in Glendale Cemetery, LeClaire. Visitation is 4-7 p.m. Friday at the funeral home. Mr. Stone died Tuesday, Dec. 7, 1999, at his home. He owned and operated Cedar County Computers. He was born Jan. 17, 1948, in Moline. He married Rosemarie Frutos in 1970 in Vinadelmar, Chile. During the Vietnam War, he served in the Navy. A memorial fund has been established. Survivors include a daughter, Wendy Stone, Davenport; a son, Jeff, Wilton; a grandson; a sister, Joyce Macias, Rock Island; and a brother, Terry, Davenport. He was preceded in death by his father, Paul Stone, in 1999.

ATVQ

# Report on the ARCC/CAATN Band Plan Meeting held January 8, 2000 at York, Pa.

**John Shaffer W3SST - Email: w3sst@juno.com**

Representatives of the Central Atlantic Amateur Television Network (CAATN) met in Executive Session at 10 AM prior to the band plan meeting to affirm the CAATN position regarding Amateur Television Band plan that was generated several years ago. In Attendance were Ron Cohen, K3ZKO; Harry DeVerter,N3KYR; Robert Bennett, W3WCQ; John Shaffer, W3SST; Dave Stephenoski, KC3AM And James Bear, WB3FQY. In a round table discussion they reaffirmed their previous support of the present band plan as recommended in the ARRL Repeater handbook with very minor modifications for The 70-cm band and the 900 MHz bands. The reasoning for the recommendations are too numerous to cover in one document. If enough interest is forthcoming a more complete discussion can be covered at a later date. Basically the present band plan is working in a large part of the U. S. and until FM Voice repeaters migrated into the upper vestigial sideband of the 439.25 ATV channel it worked very well.

*The recommended plan is as follows:*

**420 to 426 MHz**

ATV  Repeater outputs only.

(Some limited use of point to point packet or fm links could be inserted between 423 and 424 MHz either users).

**425 to 431 MHz**

ATV Repeater inputs only Completely protected.

**438 to 444 MHz**

ATV Repeater outputs and simplex.

(Some limited use of FM, packet, and linking point to point could be accomplished with little or no interference to users in the 441.25 to442.25 MHz portion)

*In the 900 band the following was recommended:*

**909 MHz to 915 MHz**

Local option repeater in or out. (again some limited use could be made of low energy portions if the channel were used as a repeater output)

**921 MHz 927 MHz**

As local option repeater in or out  (With the same stipulations as above)

*The plan  for 1200 band is :*

**1240 to 1255**

Protected ATV in or out was also approved

and

**1276 to 1291**

For the second ATV in or out also approved.

This would allow 2 ea AM stations in each or one FM channel per section. More thought is required to refine this plan for 1240 - 1300 MHz band, and the 2300 MHz area.

John Shaffer W3SST CAATN/ATNA

The ARCC meeting opened with remarks and a meeting agenda plan with Dave Laustsen, W3LAW, President of the Area Repeater Coordination Council of Eastern Pennsylvania and Southern New Jersey. (ARCC).  Over 20 repeater owners both ATV and FM voice were represented. The first item on the agenda was a presentation by John Shaffer, W3SST, of CAATN and ATNA on the status of linking the Baltimore, Md. (BRATS) ATV repeater with York, Pa. (Keystone Club) system. This presentation just naturally moved into the related problems of Amateur Television and FM voice repeaters as well as packet digipeter co-existence. Discussion evolved into the composite signal required for ATV repeater user's and compatibility with other modes. The CAATN Band plan was presented and discussed. Many alternate suggestions were discussed but no additional Band Plans were forthcoming. In addition to the ATV representatives already listed Joe Lockbaum, WA3PTV and Tim Keener, N3VGS of the Greencastle, PA and Hagerstown, MD area were in attendance. In addition Harry DeVerter, N3KYR of Lancaster, PA;  Ron Cohen, K3ZKO of Philadelphia; Dave Stephnowski, KC3AM of Wilmington, DE represented their repeater systems. Four FM voice repeater owners were represented and discussed problems in their respective areas generally unrelated to the ATV activities. No complaints were voiced concerning Coordinated ATV repeaters interfering with FM voice repeaters. However several FM voice repeaters were pinpointed as causing interference with ATV operation. Some very severe. Amateur Television of North America (ATNA), was represented but has not established an official position on the ATV Band Plans At this time.

John Shaffer W3SST w3sst@juno.com
Senior V. P. ATNA

ATVQ



## KB9FO Will Blow Your Socks Off!

(Left) Full legal power output all solid state no tuning 420-450 Mhz class A amplifier for all mode operation capable of 100% duty cycle forever. Replaces a Henry 3004 tube amp, although a bit bigger at two racks vs one half rack. Consists of 16 amplifiers, 28 cooling fans and 8 switching power supplies for the 26 volt devices. Each amp puts out up to 150 watts, four amps drive the other 12 amps using coax hybrid splitters and combiners. Each amp has 4 PTV7025 transistors in parallel push pull operation. Requires only 10 watts drive, any mode.

(Below) The Henry amp may see Rover duty in Henry's converted ENG news van for FLP ATV/SSB/FM on 70 cm mobile operations. The solid state amp feeds 7/8" heliax to an array of 8 long boom M2 antennas at 80 feet. The rover van has a KLM switchable polarity yagis for V/H and CP operation on 2 meters and 70 cm.

Henry Ruh - KB9FOHAM@aol.com

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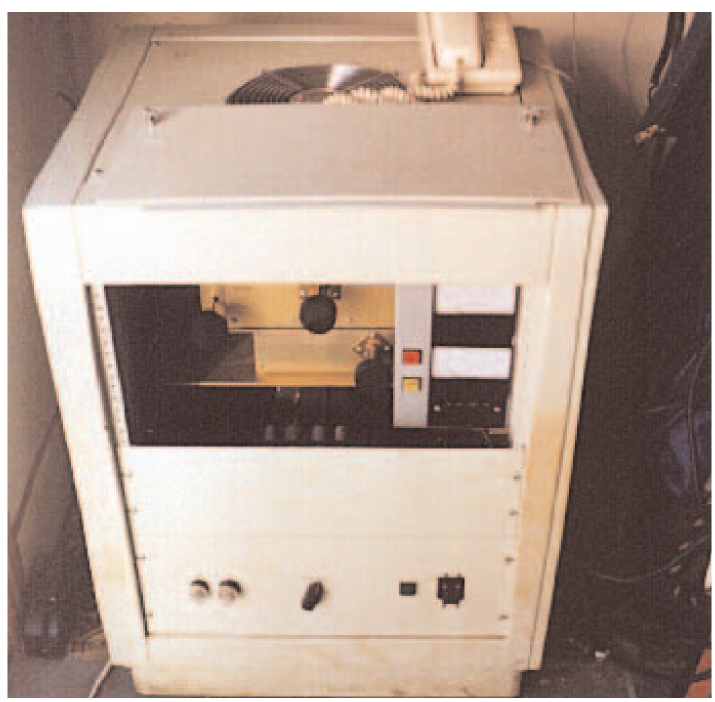

# Change of address?? Please notify us before the postoffice does!

# Becoming Active on 10 Ghz FM ATV

**by John A. Jaminet, W3HMS - EMAIL: W3HMS@aol.com**
**912 Robert St.**
**Mechanicsburg, Pa. 17055**


**W3HMS 10 Ghz Gunnplexor with 24 inch round dish for audio/ATV**

Some times a great question causes major action. In September 1999, I worked Bernie, W4SW, and associates on 10 ghz WFM as was reported in ATVQ for Fall 1999, page 36. Such was the case when Bernie asked me: "What references can you cite for getting on 10 Ghz ATV? "

**General.** As I commenced to find some references among my several notebooks of microwave information for him, I discovered that most recent technical information was in overseas publications from England, France, and Switzerland and much was not in English. The available information in US magazines was often old and cited methods which are now obsolete, as I see it. The only way to remedy this situation, then, was for me to write this article.

The European community has made great strides in covering long distances on 10 Ghz ATV using Ku band satellite LNBs for reception into European satellite receivers. The record setting activities have been described in ATVQ for Summer 1999 on page 35 and in prior editions for prior year records. The current record by I/HB9AFO/P and F1AAM/EA/P is 610 miles from Italy to Spain on 17 June 1999.

**Operational.** Before plunging into the LNB method of video reception, it is worthwhile to start at the most basic method of Wide Band FM (WFM) audio reception at 100-200 khz band width and work progressively to more complex audio methods and then go to TV reception methods.

One of the reasons for doing this is operational: we have found it most desirable to establish the audio contact then switch to video. We also use 2 meter HTs in simplex for the liaison channel and these are usable to about 60 miles dependent on the Line of Sight path. The audio QSO will ensure antennas are pointed correctly and that there is in fact a path. You don't have to do this and it might simplify the circuitry if you worked ATV only...but we like it!


**W3HMS 24 Ghz MACOM Gunnplexor with 18 inch offset dish**

**Sun shield**. Another consideration for ATV is the need for a VERY GOOD sunscreen. Murphy and associates will be on the job and insure that it is a bright sunlight day and that all the best positions for your gear are in direct sunlight. When I first visited the station of Michel, HB9AFO near Lausanne, Switzerland, I wondered why he had a sun-shield like the old fashioned radar scope shield with cut-outs for eyes and nose? On the first day of outside TV tests...I knew! Then I built a most usable model with two dark green plastic trash cans nested together usable vertically or horizontally. This seems basic...but if you can't see him then you can't work him!

**Antennas.** There are two basic types: horns and parabolic antennas and of the latter, the circular and the oval. These are also called offset from DSS/Dishnet fame. I like parabolas of about 2 ft diameter circular or offset as they offer gain of about 30 dbi or more and will fit in the back seat of a sedan for us non-truck types. There is an excellent book on the subject by Paul Wade, W1GHZ, available for the downloading from his home page at http://www.tiac.net/users/wade/. The ARRL UHF/Microwave Project Manuals Volumes 1 and II also cover antennas for 10

**W3HMS 10 Ghz Gunnplexor with 24 inch round dish for audio/ATV**

Ghz. Antennas are a subject in themselves, so we will say no more here except that Paul Wade's book and prior articles are truly superb and worthy of the Nobel Prize for Microwaves......when they get around to it, HI!

**Power levels**. In general, microwave operation is very QRP. The usual Gunnplexors run 5-10 milliwatts though some operate at 100 mw. Even the QRO is only 1/10 of a watt! In spite of this, some very nice ATV and audio QSOs ensue. High power is expensive....my 200 mw linear cost $219 from DB6NT, but it is the best. I am just now in process of putting in use a 2.75 watt output 10 GHZ amplifier which I obtained used from Woody, KJ4SO. It will draw about 60 watts in 12 volts DC and it uses a huge heat sink...calculate that efficiency, or rather inefficiency! If you can get a used TWT, great.... as power levels from 10-100 watts plus are available. HB9AFO made one of his ATV distance records at about 360 miles using just 1 watt output. Thus, TWTs' are not necessary to enjoy the hobby. If however, you are really rich, buy a new solid state amplifier or TWT...you will feel the pain and your accountant the grimaces, HI!

**Line of Sight versus Home Operation**. Virtually all of my points assume Line Of Sight (LOS) operation. I have read of some folks working from home but mostly with SSB and power. For low power ATV work, get a LOS path......otherwise you will have only a path of frustration. Summer days in the hills and mountains are fun...even if you have no QSOs, HI!

**Progressive Stages for Audio Reception then Video Reception**.
In each case we show the advantages...as we see it... after Pro and the downside after Con. One point I like about the Gunnplexor audio transmission method is the duplex high fidelity audio where both stations can talk and listen at the same time.

**NOTE: NEW EMAIL ADDRESS FOR ATVQ**
**ATVQ@hampubs.com**
**NEW WEB PAGE IS:**
**http://www.hampubs.com**
**(the old accounts are closed)**

The two stations are offset in frequency by the IF difference, normally 30 Mhz. On many QSOs that we have had out to 28 miles with only 10 milliwatts, the signals were full quieting and the other chap sounded as if he was sitting in the studio of the local 100 kw FM broadcast station. This is a real "eye-opener" for those who, like me as well, work HF SSB...no Donald Duck here!

1. Audio: Gunnplexor with 30 Mhz IF receiver (ham standard) with WFM audio. Pro: Simple, cheap, and it gets you on the air. Con: No gain before mixer.

2. Audio: Gunnplexor with 30 Mhz receiver (ham standard) with WFM audio with 30 Mhz IF preamplifier. Pro: Simple and cheap and more gain than #1. Con: Still no gain before mixer.

3. TV: Gunnplexor with 70 Mhz LNA type satellite receiver (ham standard) to standard TV set. Pro: Simple and cheap as LNA receivers are low priced at hamfests. Con: No gain before mixer.
4. TV: Gunnplexor with 70 Mhz LNA type satellite receiver (ham standard) to standard TV set but with 70 Mhz pream-

plifier. Pro: Simple and cheap and more gain than #3. Con: Still no gain before mixer.

5. Audio: LNB to USA type satellite receiver on about 1250 Mhz IF. Output from satellite TV set on about 70 Mhz goes to receiver capable of tuning WFM at about 70 Mhz. I have used Alinco X-10 and IC-706. Pro: 55-65 db gain in front of mixer, very sensitive and low noise front end of less than 1 db in the LNB. Con: Satellite receiver may require 117 VAC power hence inverter and about 15-20 amp hour Gelcell with attendant size, cost and weight. Satellite receivers use voltage levels of about 5 VDC, 12 VDC, 18 VDC, and 24 VDC so conversion to 12 VDC and battery operation is often not feasible.

**Modified satellite LNB by Denys, F6IWF with feed horn under construction by W3HMS**

6. Audio: LNB to small DC operated satellite receiver on about 1250 Mhz IF with output to WFM receiver. Pro: 55-65 db gain in front of mixer, very sensitive and low noise front end of less than 1 db in the LNB, light weight, small size. Con: May be costly.

7. Audio: LNB to wide band receiver with WFM mode. When I purchased my Alinco X-10 receiver with multi mode reception, I realized I had a new method for reception and also for measurement as I could feed it directly from the LNB on about 1250 Ghz in Wide Band FM using the blocking capacitor and series choke method. This not only provides direct frequency readout on the Alinco receiver for reception of the other station you are working, but it does so with reduced weight and reduced error thanks to the DRO in the LNB which can be accurate to +- 1 Mhz. I made a simple spreadsheet chart to relate received frequency to receiver digital readout frequency. I have used both Denys, F6IWF and Bob Platts, G8OZP LNBs with great results on both 10 Ghz. On 24 Ghz I use a superb LNC by Michael, DB6NT. He calls it a LNC even though it functions as what is normally called a LNB. Pro: 55-65 db gain in front of mixer, very sensitive with low noise front end of less than 1 db in the LNB, accurate frequency readout, light weight, small size. Con: Cost more than you might like, especially the LNC for 24 Ghz!

8. TV: LNB to small DC operated satellite receiver on about 1250 Mhz IF with a line amplifier on 1250 Mhz with output as direct video or RAF Channel 3/4 to small color TV set. Pro: 55-65 db gain in front of mixer, very sensitive and low noise front end of less than 1 db in the LNB, light weight, small size, truly the best to my knowledge. Con: Can be costly.

**SHF Microwave PS/MOD kit for Gunnplexors under construction by W3HMS. Pliers and Swiss Army Knife are for size comparison**

**Discussion of Using Modern Ku Band Satellite LNBs.**

Amateurs operating 10 Ghz have benefited from the technology developed for the Ku satellite band service between about 10.7 Ghz and 12.7 Ghz. There are two sources that I am aware of for very sensitive LNBs offering 55-65 db gain before the mixer. Contrast that with the old technique, # 3 above, of using 70 Mhz LNA receivers following Gunnplexors where the gain before the Gunnplexor mixer was 0 db. ATVQ has covered some of this in the article "Reception of FM TV" on 10 Ghz by Denys Reseal, F6IWF, in the Fall 1997 edition of ATVQ on pages 14-18.

These LNBs, as modified by Denys, are sold for about $125.00. The local reseal is on 11.475 Ghz and they can operate with C band satellite receivers using local oscillators on 5.150 Ghz. This means that video inversion is not required as the LNB local oscillator is above the reception frequency. Please see Note #1.

Another source for British LNBs with a 9 Ghz local oscillator and less than 1 db RESEAL is Bob Platts, G8OZP in England at about $60.00-100 dependent on the model delivered to the USA and the Sterling/dollar exchange rate. With a European satellite receiver in the C band position, video inversion is not required. With a standard USA C band only receiver, inversion is required as the LNB 9 Ghz local oscillator is below the reception frequency.
See Note 2.

**Dual band 10 and 24 Ghz LNBs for use with Alinco receiver for audio reception**

**Dual band 10 and 24 Ghz LNBs for use with Alinco receiver for audio reception**

The inexpensive DSS single LNBs often found at about $40 are tempting. I have calculated the probable IF for 10 Ghz ham work and found it outside of the range of European and US satellite receivers. I also bought one and ran the tests and did not find my signal. Yes, Virginia, education is costly! The formula is:

10 Ghz frequency used.

minus sat receiver at LO frequency.

---

IF

Example:

10.300 Ghz operating frequency
-9.000 Ghz LO.....ex. is Bob Platts LNBs.

---

1300 Mhz IF

To see how it all fits together, at least in my case, you might want to review the equipment configuration which we cited in my article on Skyline Drive operations in ATVQ for Fall 1999 on page 36.

**Satellite Receivers**. USA standard receivers cover 950 -1450 Mhz and may or may not have independent tuning of about +- 50 Mhz. It may be necessary to invert the video signal in older receivers not designed for Ku band reception. European satellite receivers even new are most reasonably priced. I bought a Mascom receiver in Prague, Czech Republic, for about $117 and each channel is tunable about +- 50 Mhz. It covers 900-2150 Mhz and it also offers a choice of local oscillator high or low which avoids having to invert the video signal. It is made in Germany and no TM is available; the company did not answer my emails. Other satellite receivers known to me are the Simex and Bensat sold by PC Electronics for about $130 and advertised in ATVQ.

**Test Signal**. While doing some research on C band LNBs and satellite receiver tuning, I discovered that the oscillator is a stable DRO fixed on 5.150 Ghz, so the 2nd harmonic is most conveniently located at 10.300 Ghz. I had an old LNB from prior satellite service with a 100 degree LNB; these are available at a very low price at hamfests and the 100 degree amp has no adverse impact on the oscillator. I just removed the metal cover and checked it! Voila, there it was as predicted and weak enough to avoid overloading a receiver yet strong enough to find it even 10 feet or so from the receiver. It is quite light and I can use it in the field with two 9 volt batteries in series and a non-metallic cover...plastic wrapping tape.... over the oscillator compartment. An audio tone for modulation would make it even more usable. Idea: take one of the Jingle Bells oscillators from a Christmas card...it is hardly music, HI!...or scratch build an audio oscillator.

**Progressive Stages for Audio then Video Transmission.**

In each case we show the advantages after Pro and the downside after Con:

1. Audio: Gunnplexor Oscillator modulated by a simple audio modulator. I like the MACOM Gunn oscillators and use two on 10 Ghz and two on 24 Ghz. The 10 Ghz version is available for about $90.00 from SHF Microwave in La Porte, Indiana. It uses a varactor so electronic tuning with 0-20 VDC can cover about 80 Mhz. I would not use a Gunnplexor without varactor tuning because the flexibility of tuning is just so important. I have had very satisfactory business transactions with Alan who also stocks a simple Power Supply/Modulator board in the $20 price class. I have built and put four in use. Pro: Easy and simple to put in use and is fun to use in duplex audio. Con: It is WFM and it is low power, DX is rare. Gunnplexors all drift several megahertz and do not have the stability of even DROs and much,

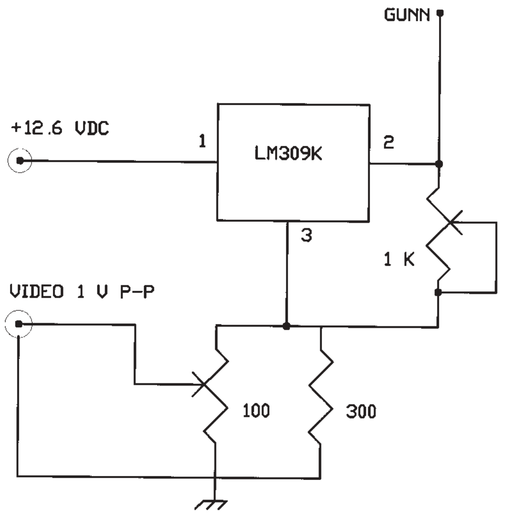


**Figure 1. A Super Simple ATV Modulator.**

much less stability that SSB/CW methods used on 10 Ghz. In establishing a QSO, you have the double task of finding the other station in frequency, with drift at each end due Gunnplexors, and pointing accurately as parabolic antennas are sharp to within a few degrees, even on a 2 ft dish. But..it is still fun!

2. TV: Gunn oscillator modulated by the HB9AFO "World's Simplest ATV 10 Ghz Transmitter". The circuit of Figure 1. is essentially the "World's Simplest ATV Transmitter" by Michel Vonlanthen, HB9AFO, from the "Old Man" magazine of the USKA in Switzerland for Sept 1992. I added a video gain control. In use, the output marked to "Gunn" goes to the Gunn diode in a Solfan type unit. I have had good results with it by adjusting both the 1 k pot and the 100 ohm video gain for best pix and ensuring the Gunn does not exceed about 8.5 VDC. I believe it could also go to a varactor in a MACOM type Gunnplexor and go up to 20 VDC though of course a higher input voltage would be required. I have not tried modulating the varactor with this circuit. For the voltage regulator, I have tried other than the LM309K with NO good results.

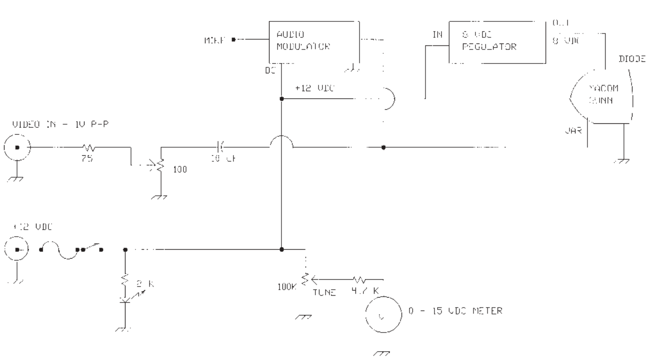

**Figure 2. Modulating the MACOM Gunnplexor with your color or B and W camera or camcorder.**

Pro: Easy and simple to put in use and pictures are good. Stability on TV is acceptable after a few moments of running. Con: It is low power, DX is rare, some drift will occur. With only pointing accuracy to deal with and a visual display constantly on, pointing is much easier than with audio.

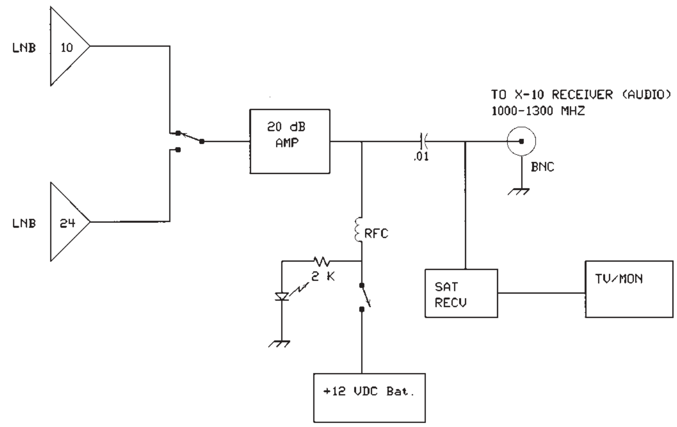


**Figure 3. The dual band 10 and 24 Ghz LNB receiver.**

3. TV: This is a variation of #2 as depicted in Figure 2. The circuit is not totally complete in that the optional audio modulator and the 8 VDC regulator are shown in block form only. In my case, I used a SHF Micro PS/MOD board for both functions. Very little audio is needed to swing the varactor so I have used a simple 2N2222A audio amplifier as a modulator connected via a capacitor directly to the varactor diode of the MACOM Gunnplexor. Equally simple is the voltage regulator which needs only to provide about 8 VDC to the Gunn diode. The modulator is quite simple as this circuit provides the tuning of the varactor from 0-20 VDC or 0-12.6 VDC as you choose. It gives a frequency swing of about 40 Mhz + or - dependent on carrier frequency within the 500 Mhz allocation at 10 Ghz. The Pros and the Cons are the same as for #2.

4. Audio/TV. Dielectric Resonance Oscillator (DRO). DROs offer higher output than Gunnplexors, e.g. 40 mw instead of 10 mw and much greater stability. They are, however, difficult to tune electrically over a wide range so most ATVers in Europe set them on 10.450 GHZ. They are the favorite ATV transmitter in Europe and the circuit by Denys Reseal, F6IWF, in ATVQ for Summer 1999 on page 6 is the standard. They can be modulated by the same methods as a Gunnplexor. Denys sells a kit which I have had on the shelf waiting for the right moment to start.....but we all know how that goes?

Pro: More power than with a Gunnplexor, simple to put in use and pictures are good. Stability is better than with a Gunnplexor. Con: It is still low power, some drift will occur, sources are rare, some DROs are failure prone, and electronic tuning is very difficult to achieve.

5. TV. Gunnplexor, DRO, or home brew oscillator modulated by special purpose ATV modulator. I believe that the

# ATVQ ON THE WEB

Don't forget that due to the courtesy of Dave Stevens and Fred Juch of HATS, we have a web site with much information about ATVQ. You will find:

1. List of ATV'ers (5500) (updated April 99)
2. ATV Repeater Listings (updated April 99)
3. Index of ATVQ articles (updated January 99)
   and MORE!

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ATVQ

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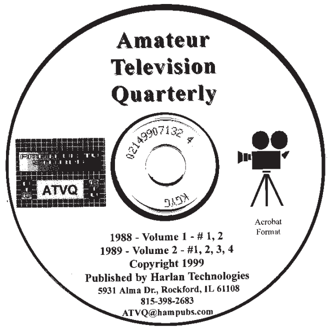




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**Previous issues still available. The following list shows the issues that are still available at $4.95 each (postage included for USA). I have acquired all the remaining copies from Henry Ruh and Ralph Wilson. If you are interested in just the reprint of an article, please consider purchasing the complete issue. Since I do not have a copy machine in house, going out to make copies will only raise the price higher than the magazine itself. Missing issues are available as photocopies only. Quantities are limited. Some real good articles exist in these issues!**

V6 #2 - Spring 1993
V6 #4 - Fall 1993

V7 #1 - Winter 1994
V7 #2 - Spring 1994
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V7 #4 - Fall 1994

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modulator/power supply unit sold by PC Electronics under model number GVM-1 for about $30.00 is excellent for ATV use. It does not provide for audio-then-ATV transmission as detailed above. It does provide two independent audio sub-carrier channels and for transmission on the best frequency in lieu of QSYing with the electronic tuning pot as we do in audio operations. Thus a tuning potentiometer is provided but it is not a front panel control, although it could be per Tom. I purchased this unit but have not installed it preferring instead the "audio-then-video" method of operations. I stress that this is a personal choice! PC Electronics also has a Gunnplexor Control Box which simplifies getting the parts together and getting on the air.

Pro: Power and stability are a function of the oscillator type, pictures in B/W and color are good and can be adjusted to be the best. Con: No "audio then ATV" transmission and QSYing with the electronic tuning potentiometer is not recommended.

**Amplifiers**. Any of the above transmission methods can employ an amplifier to increase the signal from a normal 10-40 milliwatt range to 250 mw or more. Some solid state amps operate in the 1-5 watt range using reasonably small solid state devices. Some home brew circuits are available in the technical literature but it is rather rare. Please see my comments above about power near the start. The relays for switching are special microwave units and I have purchased one from Downeast Microwave at a reasonable price....for a microwave relay.

**References**: Here are some books, magazines, and newsletters of value to microwavers though in my view not all are equal.

Books:

1. Paul Wade, W1GHZ, Antenna Manual on-line for microwave...great!!!

2. ARRL UHF/Microwave Project Manuals Volumes 1 and II...very good.

3. ARRL Handbooks, Microwave sections...last 30 yrs or so.

4. RSGB Microwave Manuals Volumes 1,2, 3....costly but good.

5. ARRL "Proceedings of Microwave Update for 199__"....good info, sometimes a bit too complex.

Magazines:

1. VHF Communications of UK.... the translation of a German magazine.

2. DUBUS.....from Germany...UHF through 47 Ghz.... in German and English.

3. QEX by ARRL...some editions have FB articles.

4. QST...articles on microwave from time to time.

5. CQ-TV...the BATC ATV publication from the UK.

Newsletters:

1. AMRAD... not all editions cover microwaves.

2. North Texas Microwave Newsletter....some good microwave material from time to time.

3. Packratts Cheezebits....some editions have articles.

4. RSGB Microwave Newsletter.....good info on operating in the UK.

NOTES:

Note 1. F6IWF LNBs are available from Denys Reseal whose EMAIL address is 0256.145@compuserve.com.

Note 2. British LNBs with a 9 Ghz local oscillator are available from Mr. Bob Platts, G8OZP, 220 Rolleston Road, Burton upon Trent, DE13 0AY, England at about $60.00-100 dependent on model and exchange rate. His EMAIL is: **Bplatts@compuserve.com**. ATVQ

## NASA Y2K STATUS FOR 3 a.m. EST (0800 UTC) Jan. 1, 2000

Following the transition to the Year 2000 in the Pacific Time Zone, NASA continues to be "green", meaning Agency systems have not been substantively affected by any problems during the year-end transition. During the primary monitoring period (8 a.m. EST Dec. 31 through 3 a.m. EST Jan. 1) the agency suffered a few minor anomalies that were easily fixed. Only one, involving a piece of planning software, appeared to be Y2K related, and it did not affect any mission-critical systems.

Flight controllers continue to make contact with NASA spacecraft according to previously planned schedules. The spacecraft and related communications systems are functioning without incident. Remaining NASA spacecraft, which have been configured so as not to require commanding over the Y2K transition, will be contacted by controllers over the next several days.

The Johnson Space Center reports that the Mission Control Center for the International Space Station, which was taken offline before the Y2K transition in Moscow (4 p.m. EST Dec. 31), was successfully brought back online.

Also over the next few days, NASA will continue to monitor its infrastructure and business systems. The agency expects to resume business as usual on Monday, Jan. 3.

Unless events warrant otherwise, the next NASA Y2K status report will be issued the afternoon of Jan. 3

ATVQ

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The CD's are organized with two years on each. All except for the first CD have 8 issues on each. The first has two issues from 1988 when it was first published. So many of the articles are still valid. I know I still dig out the antenna articles and many others.

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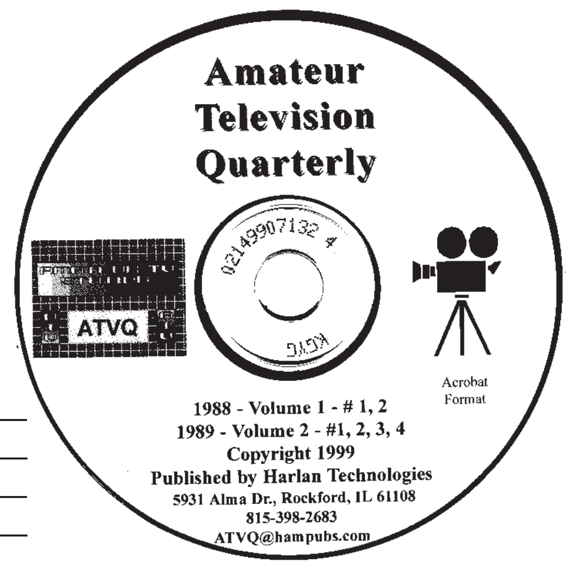


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Email messages about ATNA operations will be distributed on the following Internet list server atv@atv.tallahassee.net

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# Followup From Fall 1999 - Another Slot Antenna Design For ATVQ

**by Henry Ruh - KB9FO - email: KB9FOHAM@aol.com**
**5317 W. 133rd Street**
**Crown Point, IN 46307**

Slot antennas are of two basic varieties, traveling wave and standing wave. The design in the last issue is a standing wave type. Normally the entire center conductor length is a multiple of full wavelengths and is shorted at the end. Thus the signal waves are standing in place, and change polarity and amplitude over the period of the wave. The end short is 1/2 wave (velocity) after the last slot.

To tune the antenna, each slot is brought to resonance by adjusting the length of the slot. The slot is cut slightly short, then the adjustable tab adds length to the slot by increasing the path length across the part of the slot the tab covers.

Using an RF probe, the signal level is equalized in each slot by bending the tab closer or farther from the center conductor, thus increasing or decreasing the coupling to the slot. Each slot is a folded dipole.

As we should all know, the transmitted field is constantly exchanging energy between the electric (E) and magnetic (H) fields. The E and H fields are at right angles to each other. The slots are conductive, so an E field in generated in the vertical slot. This translates to a horizontal H field so the antenna is horizontally polarized. The H field is in proximity to a ground plane, the outer skin of the antenna. Thus it has a tendency to bend around the pole. Since the outside is ground, there is not a significant dimension to the outside diameter of the antenna, although smaller is usually better.

The antenna can be directionalized easily with the addition of flaps or wings. The flaps are simply flat sheets of conducting material, typically copper or brass, although steel will work. The flap extends from the surface of the antenna at right angles to the point of attachment. The flap is 1/4 wavelength long (outside edge to soldered edge) and runs the entire length of the antenna. The flaps decouple the remainder of the ground plane that is behind and between the flaps, only the space over the slots and in between the flaps is seen by the signal. A second 1/4 wave length folded back at 90 degrees to the outside ends of the first flap ... imagine a letter L and letter J looking on end ... adds further decoupling and beam forming. The placement of the flaps determines the width of the pattern, from very narrow (high directional gain) to very broad (low directional gain). The flaps are equal distant from the edges of the slots. You can make non symmetrical patterns by using non symmetrical dimensions from slot to flap.

A good use of the flaps is to reduce signals in areas you do not want to cover, and increase signal in the area you do. It also reduces reflections from mountings. If faced with a problem in side mounting, the reduced back signal level helps reduce reflections and pattern distortions.

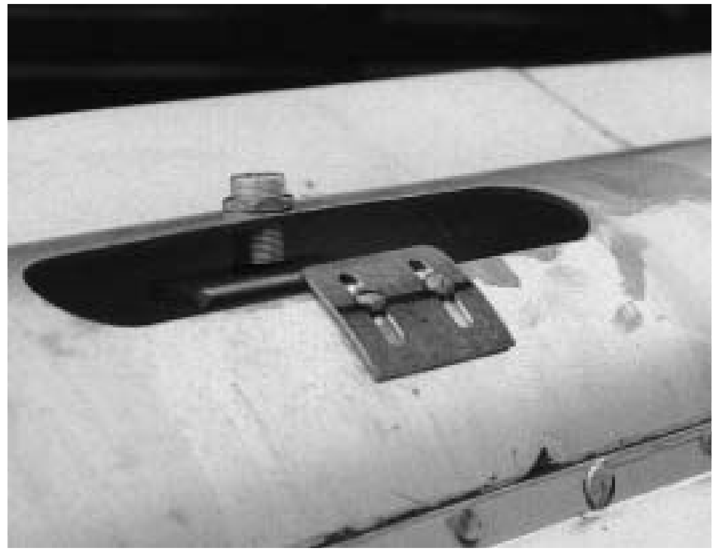
A “fish spine” reflector can be added to the back side for additional F/B ratio. It is a single pole, with dipole like arms. The arms (ribs) should be .55 to .65 wavelength long and spaced not more than .1 wavelength apart. (1/10y). The reflector is typically the same distance as a Yagi reflector element for the frequency of choice, adjusted to get the desired F/B ratio.

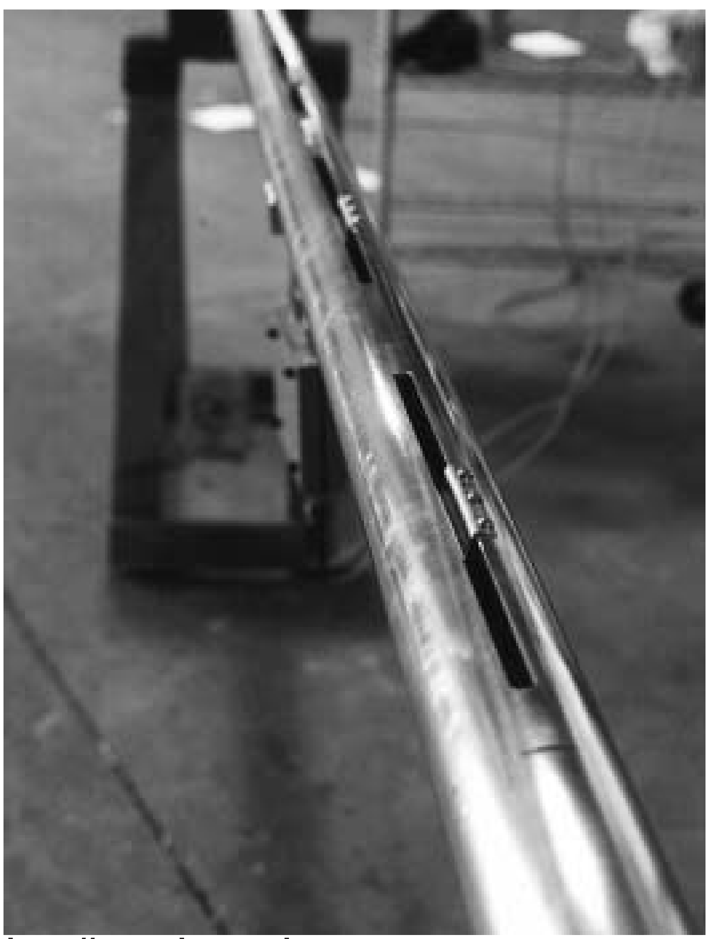
The antenna can be made in any convenient length by just replicating the slots and overall wavelength multiples. You can also center feed using a coax connector between the center most slots to connect to the inner conductor, and you can stack them up vertically to get more gain. The phase to each antenna should be the same, so use equal length coax cable to each section from the power divider.

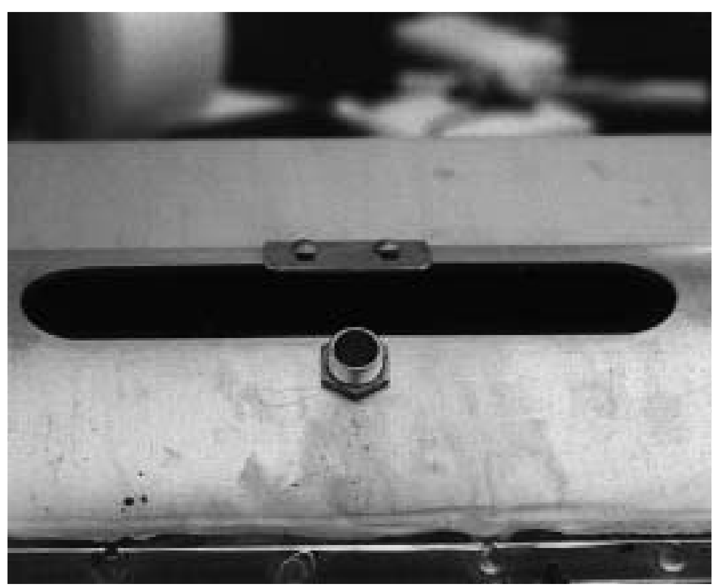
Fine matching is done by using a “slug.” A slug is nothing more than a threaded bolt, and by increasing or decreasing the penetration so it probes deeper or less deep. The location of where to insert the tuning slug is determined using a slotted line and RF probe. Typically between 1/8y and 1/4y above the feed point, in a short additional section (1/2y) added to the bottom of the antenna. the RF probe is used to find the point of maximum VSWR, and then the probe is turned to minimize the mismatch. A good antenna should not need more than one slug unless you are trying to match over 10 Mhz bandwidth, and then one slug per 10 Mhz is typical. Commercial versions easily achieve 1.02 maximum VSWR across 12 Mhz. and are at 1:1 at the frequency of choice. For return loss folks, that is 30-40 db or better return loss.

My particular antenna measured 31.887 db worst case, and 34.836 db best case from 420-445 Mhz.

The diameter has nearly no effect. The antenna is a resonant cavity of N half wavelengths long. The E field is aligned with the inner conductor. The slots are also aligned with the E field, so there is no radiation out to speak of until you induce some. The metal Z bracket coupled RF into the resonant slot. The slot space now is active in the e field and the H field is radiated from the slot. The width of the slot is not particularly critical either. The width is typically chosen to determine power handling capa-







bility based on voltage breakdown. a 3/8” wide slot is good for 7 KV before corona discharge, a 1/2” slot is 19 kv. The only critical dimension of the slot is the center of each slot must be 1 wavelength from the center of the next slot. As the frequency goes lower, the slot actually gets longer than expected for the frequency. This is adjusted by making the tab (z bracket) longer or making the slot slightly longer.

The amount of RF coupled to the slots should be equal. The line length being resonant, the rf goes past the probe and a portion is induced into the slot. The reflected wave from the far end, then contributes etc, until all the rf is coupled out.

It is not like the skeletal slot since the slots are not fed directly from the input coax and are not actual “dipole” elements of N wavelength. Thus the element diameter is not important. (outer conductor). The outer conductor is just the physical support for the holes. (resonant spaces)

The antenna is normally shorted at one end, regardless of the number of slots. That is what makes it a resonant cavity. However, it is sometimes necessary to place a short at the bottom, 1/4 y from the input. This is determined when resonating the slots. Placing an internal short also increases the Q of the antenna and narrows the bandwidth by typically a factor of 4. The 1.1:1 bandwidth is typically 40 Mhz, and l.04:1 broadcast spec is usually 12 Mhz. If you center feed the antenna, both ends are shorted.

I only show spaces in one place for clarity. Spacers are usually staggered at 90 degrees for all direction stability.

The bandwidth is more than enough to cover 420-450 at less than 1.1:l when tuned.

By the time Dayton arrives it will likely be on the top of a very tall building, and not easily removed for show and tell. it has already been range tested at 7.9 dBd. when the directional flaps were added to reduce a little off Lake Michigan it became 9.5

dbd over 270 degrees and 3.3 db on the back side “null” the flaps added to make it directional are spaced at half wave length centers, attached to the outer at 90 degrees from the slots (physical) and each “tab” is about 7 inches long (pipe to edge) and then folded back at 135 degrees (like a folding door) with an equal size rear flap. (fold a piece of paper in half to visualize this). ATVQ

## SLOT EMAIL - Q&A

From: <TOMSMB@aol.com>

I have been trying to understand your slot antenna on page 40 of the latest Q (Fall 99) and have some questions:

1.If the Z strip is what makes the coupling from the center conductor, it is capacitive and therefore, the distance and the area at the end of the Z would be significant. This will vary with the diameter of the tubing used and you don’t call that out. You just have “depth” for only one dimension of the Z strip, but I don’t see any widths.

2. If this is anything like the skeleton slot, the diameter vs frequency is critical as to the omni pattern dB variation. Is this one?

3. You say the end of the antenna is open or shorted depending on the number of slots but you don’t say how many for open or short.

4. You show what appears to be the teflon spacers on the end view, but with only spacers 180 degrees apart in the same plane down the length, it could move at a right angle to the spacers unless shorted on the end. For the open end version, I would think there should be staggered spacers at 90 degrees rotated from the previous.

5. What is the band width? Wide enough for 420-440 for a single antenna for an inband repeater?

From: <KB9FOHAM@aol.com>
To: <TOMSMB@aol.com>

In a message dated 12/9/1999 6:16:52 PM Central Standard Time, TOMSMB writes:

1. If the Z strip is what makes the coupling from the center conductor, it is capacitive and therefore, the distance and area at the end of the Z would be significant. This will vary with the diameter of the tubing used and you don't call that out. You just have "depth" for only one dimension of the Z strip, but I don't see any widths.

*I haven't seen it in print, but the width is typically 2-4 inches. the width is chosen to make the slot resonant. The manufacturing method is to use aluminum foil, and when the slot resonates, then substitute a metal bracket of the correct size.*

From: <TOMSMB@aol.com>

Sounds good. However for the most hams, a dimensioned example for the 70cm band in the Q would make it very useable to a wide range of hams. Especially if you can cite some standard copper pipe sizes.

From what you say, it would seem to me that smaller pipe could be used for ATV repeaters running 200 watts or less (Not every one is power mad like you) with 1" pipe which is available at most hardware and plumbing supplies. Then a type N jack could easily be soldered at one end with least impedance bump.

Maybe a 3rd installment is possible?

From: <KB9FOHAM@aol.com>
To: <TOMSMB@aol.com>

I would not suggest using less than 2" or 1 1/2" OD because the slots are too hard to tune on small diameter stuff like 1" or less. The best bet is scrounge a piece of 1 5/8" or 3 1/8" hardline from a radio or tv station. 10' 3" is just about right. the stuff comes in 19, 19.5 and 20 foot pieces. Old stuff works just fine, or copy the dimensions from a sample. the diameter of the pipe has nothing to do with power, its mechanical stability and ease of tuning. the less surface area, the harder it is to get close with an RF probe to tune the slots.

To RF probe the slots, take a piece of styrofoam and cut it to fit the diameter of the outside pipe. cut it to have about 6 inches of space from the touching surface side to where you can insert an RF probe. The old "sniff it" works great. Or if you have access to a network analyzer, put that probe on the styrofoam. Make the styrofoam wide enough your hand is 1 wavelength away. If you have a brick, one side on the pipe, the opposite side on the rf probe and your hand on one edge away from the other two. You can tape it in place with common electrical tape (not metallic duct tape!) make the Z probe with aluminum foil extensions on each side, and slowly cut them off symmetrically from each end in 1 /8" bites until you get resonance. Then cut and attach a final size Z coupling probe to match the size of the foil. Solder it in place.

To adjust the Z probe for equal RF coupling in each slot, bend it so it moves closer or farther from the center conductor.

You can trim the overall length if you think you goofed by sweeping the input. it should look like a suck out filter, shorted at resonance (lowest vswr). This would be done before any slot tuning.

OD size 1 5/8" for 1288 Mhz
1 inch OD is used for 2400 Mhz and 3/4" OD for 3.3, or waveguide for 3.3 Gig and up.

From: <KB9FOHAM@aol.com>
To: <TOMSMB@aol.com>

Screw probs do not work, But you can induce some vertical pattern by making a hole and inserting a capacitive coupling to an external dipole array. The vertical elements are two folded elements, each looks like a square U the horizontal portion is center fed from the probe, it is 1/4 wave long. The vertical elements have two elements, one passive, one active. The elements then bent 90 degrees and the two "legs" are 1/2 wave long. The active element is similar to a j-pole, with one side of the element 1/4 wave long and one side 5/8 wave long. The vertical elements are fed from an isolated probe with a quarter size plate on the end inside the transmission line. The depth is adjusted to couple the desired amount of RF to the element. They are also equally spaced at 1 wavelength and are centered between the slot elements. This produces a circular radiation polarization. Any axial ratio can be achieved as desired. the spacing between the two halves of the elements is about 3/16" with a teflon insulator in between. Overall it looks like an H shape with one leg long and a slight space between the two pieces. Mechanically the legs are supported on standoff insulators. ATVQ

## VHF COMMUNICATIONS MAGAZINE HAS A NEW OWNER!

We have been informed that VHF Communications Magazine has a NEW OWNER effective 01/01/2000. The company name stays the same, but the address will change. The owner name is Andy Barter and can be reached by email at:

AndyBarter@compuserve.com

The new address is below. Subscriptions will still be taken by ATVQ Magazine. The current rate is $32.00 per calendar year.

KM Publications — tel/fax +44 1582 581051
63 Ringwood Road
Luton
Beds
LU2 7BG - U.K. ATVQ

# SLOW SCAN TV IN WACO

**By John L. Gafford, N5XAK - Emailjlouisgaff@aol.com**
**3237 Brannon Drive**
**Waco, TX 76710-1355**

Slow Scan Television (SSTV) is becoming an interesting new endeavor for several members of The Waco Amateur Television Society (WATS) in Waco, Texas. The system is built around a personal computer with a sound card, an amateur radio transceiver, a suitable source of photographs in a computer format, and an interface between the computer and the radio. A computer software program is also required to handle the transition from a digitized picture to audible sound for use by the transceiver.

Most members of WATS are using a program called JVComm32, which was written by Eberhard Backeshoff, a German amateur radio operator whose call sign is DK8JV. The program may be downloaded from Eberhard's web site, HYPERLINK **http://www.jvcomm.de/english/roote.htm**. The software is shareware, and Eberhard asks for a nominal fee for those who continue to use it after a trial period. The software is well documented with an excellent HELP utility. Another program for SSTV is Silicon PIXELS that may be downloaded from the web site HYPERLINK **http://www.siliconpixels.com**. It is a little more difficult to use as compared to JVComm32.

Picture formats handled by JVComm32 include PNG, BMP, PCX, JPG and TIF. Pictures may be transmitted in several SSTV modes. Included modes are Martin 1, Martin 2, Scottie 1, Scottie 2, Scottie DX and Robot 36.

Larry Bush (W5NCD) started this activity in Waco. He and his son David (KC5UOZ) were the first participants, and have constructed a two-meter SSTV repeater. Larry also has a web page at HYPERLINK **http://www.sstvham.com** where he tells all about it. John Chamberlain (AC5CV), John Gafford (N5XAK), Marshall Mabry (KD5IQ) and Horace Bushnell (W5TAH) have also joined in the activity. By accessing Larry's web page, the last three pictures sent to the repeater may be viewed

Kenwood Corporation produces a device about the size of a HT transceiver, which they call an Interactive Visual Communicator (VC-H1). It is essentially an SSTV camera and computer, which plugs directly into selected Kenwood HTs. With the HT, it is a completely portable SSTV station. Default SSTV mode is Robot 36, but if the VC-H1 receives a picture in another format such as Scottie 1, the VH-H1 transmits in that format until it is turned off or receives another picture in a different format. The camera portion of the VC-H1 can be removed, and an NTSC source connected in its place for extended video capability.

Larry has designed some interface circuits to connect the VC-H1 to a number of mobile transceivers, one of which he shows on his web page.

John Gafford has done it differently. He uses a dual band Kenwood HT with the VC-H1, and a dual band mobile transceiver with cross-band repeater capability in his vehicle. He transmits with his VC-H1 and HT on 70cm to his vehicle which then cross-bands on 2M to Larry's repeater. John also maintains a base station using JVComm32 and a 75MHz Pentium computer.

Horace uses a Sony Mavica MFC-FD83 Digital Still Camera to gather images for transmission over SSTV. It records images in JPG format on a standard 3-1/2" floppy. The floppy may then be put in the personal computer and fed straight into the SSTV setup and transmitted.

John Chamberlain and Marshall both have video cameras, which may be used, as a source of SSTV pictures.

Scanning times vary depending on the clock speed of the computers being used, picture format, and the SSTV mode. For example, a picture in JPEG format and 75 MHz Pentium computer will scan a Scottie 1 picture in about two minutes. Scanning the same picture in Scottie DX mode takes twice as long, about four minutes. As one might expect, the longer scan time results in a received picture of higher resolution.

It is possible to operate SSTV with just the software and without an interface connection between the computer and transceiver. By opening a picture on the computer, to transmit the picture one can hold the transceiver microphone next to the computer speaker and pressing the PTT on the radio. To receive a picture, hold the computer microphone next to the radio's speaker. Picture quality using this procedure will result in lower quality than that obtained with an electrical interface.

Besides being a fun activity to swap family photos back and forth, mobile SSTV has a very practical application in field events, and also as a supplemental communications medium during emergencies. It provides one more opportunity for radio amateurs to serve their communities in critical times. Also, club members can use their regular ATV capabilities to assist each other to get set up on SSTV. The member having trouble aims his ATV camera at his/her camera at the computer screen and the other members watch and advise via the club's ATV repeater.

ATVQ

# ATV REPEATER INFO

The following form is for all the repeater owners to fill out so we can keep up to date information available for all ATV'ers. The information is available on the web at the address listed below.

I need someone, preferably the repeater owner, to keep us informed on a regular basis so we can have the ATV information available, especially for the new people that Shari & I get inquiries from saying what is in my area. We really want to help the new ATV'ers as much as we can.

Please advise us of any corrections. I have all of the information in Microsoft Access Database, so it will be easy to keep current. The reason we want the ZIP code of the repeater is so we can plot YOUR repeater on a USA map. I know that some repeaters (on mountains for instance) do not have a zip code, so just give us one as close as you can.

You may download the complete file on the Internet at:

**http://www.stevens.com/atvq**

The following is the complete form with all the information that I would like to have. Any suggestions for additions will be appreciated.

Repeater Callsign __________________ Sponsor Callsign _________________
Sponsor (Club or Individual) __________________________________________________________
Repeater City _________________ State _____ Zip ___________ Country _________ Postal Code _______
Tower/Building Name __________________________ Coordinated? ____________ Linked? ____________
Input 1 Freq _________ AM/FM _____ Upper/Lower VSB ______ Polarity H/V _____ Access _________
Input 2 Freq _________ AM/FM _____ Upper/Lower VSB ______ Polarity H/V _____ Access _________
Input 3 Freq _________ AM/FM _____ Upper/Lower VSB ______ Polarity H/V _____ Access _________
Input 4 Freq _________ AM/FM _____ Upper/Lower VSB ______ Polarity H/V _____ Access _________

Output 1 Freq ________ AM/FM ____ Upper/Lower VSB ____ Polarity H/V ___ ERP_______Omni? _____
Output 2 Freq ________ AM/FM ____ Upper/Lower VSB ____ Polarity H/V ___ ERP_______Omni? _____
Output 3 Freq ________ AM/FM ____ Upper/Lower VSB ____ Polarity H/V ___ ERP_______Omni? _____

WX Radar? _____ Nasa _____ Web site http:// ________________________________________________
Contact person __________________________________ Call ____________
Email ______________________________________________
Address ____________________________________________
City ________________________ State ____ Zip ___________ Country ________ Postal Code _________
Other information _______________________________________________________________________
_______________________________________________________________________________________
_______________________________________________________________________________________

# 12GHz Prescaler


**By David Wrigley, G6GXK**
**45 Norford Way**
**Rochdale, OL115QS, England**


**Reprinted from CQ-TV #183 - August 1998**

**Background and design aspects**

This unit is a practical way of extending the range of a 1.5GHz frequency counter It uses the Fujitsu FMM110VJ chip to divide the input frequency down by a factor of eight. Working over the frequency range of approximately 1 to 12 GHz, it was built to fit directly onto the input socket of an inexpensive frequency counter, successfully extending its range up to 12GHz.

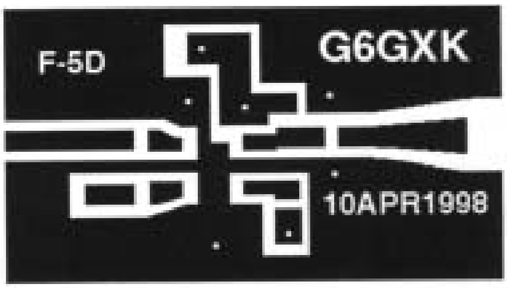



**Figure 2 - PCB Artwork**

The circuit (fig. l) follows that shown in the Fujitsu data sheet for test purposes and a decision made at the outset was that no exotic components would be used if they could be avoided. All the other components were in fact SMD's salvaged from old LNB's or other microwave boards. They were all examined for good solder connections and checked for value prior to fitting. New SMD's can be obtained from Maplin in 25-off minimum quantities. The circuit is laid out on a tiny PCB using ordinary glass fibre insulated double sided copper clad board about 1.5 mm thick. The PCB layout is shown in figure 2 at four times full size (actual length 30mm). The back plane is almost all copper with only clearances being required for the 5volt link and connection - these can be cleared with a drill - the backplane doesn't need to be etched. It was decided to put in four link pins using short lengths of wire to bond the earthy parts of the component side to the backplane as in good microwave practice.

The overall assembly can be seen in figure 3 and is governed mainly by the size of the BNC connector to the frequency counter. The box was formed from 0.5mm tinplate.

The LM78M05CV regulator had to be used because the high current taken by the prescaler chip couldn't be supplied from the frequency counter's internal regulator. It should be noted that the Fujitsu chip gets fairly hot when in use - it is dissipating around 0.65 Watts in that tiny case. For this reason and in order to obtain good grounding it is wise to ensure that it is soldered down to the PCB and that both sides of the PCB are soldered to the tinplate box. The regulator chip will also get hot, especially if it is fed from 10 volts or more, so it is best to mount it on the tinplate box. The prototype had its regulator bolted to a piece of tinplate soldered across the back of the box.

**Construction**

The PCB is small and simple enough to be cut with a modellers knife if an etching facility is not to hand. There should be nothing very critical about the tracks provided the basic layout is followed. Drilling the PCB was accomplished by hand using a 0.8mm PCB drill (ex-radio rally) mounted in the chuck of a pin vice. With a sharp drill this is a speedy process.

The author's eyesight is not as good as it used to be and he has found it necessary to use a headband mounted binocular magnifier to carry out fine work such as this. These are useful devices and are strongly recommended.

Since starting to construct microwave units the author has made himself a low electrostatic field assembly area which consists of a sheet of 0.5mm tinplate over the working surface, with wires soldered to it, to the earthing point of a low voltage temperature controlled soldering iron and to a wrist strap. This was used to assemble the unit and has been used successfully in the past to assemble discrete GaAs FET devices. Of course, modem IC's are tremendously robust but it isn't wise to take unnecessary risks.

**Mounting file Fujitsu Integrated Circuit**

The first component to be mounted onto the PCB was the IC package. It should be noted that the Fujitsu IC package is very small and the connections are very close to adjacent connections and also to the case, which is ground. It is very easy to bridge these connections with solder, or by poor alignment to the wrong part of the PCB, either of which would of course prevent the chip from working. The important points are:-

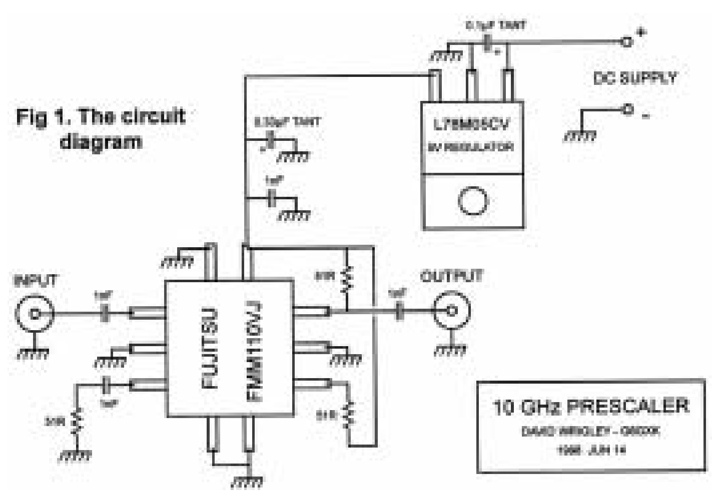



**Fig 1. The circuit diagram**

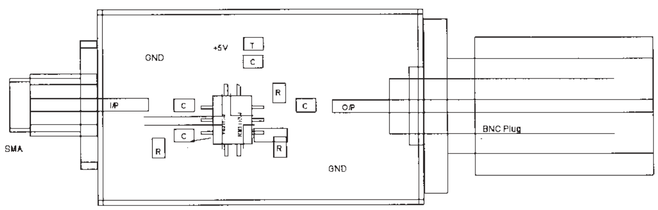



**Figure 3 - Assembly Drawing**

Mount the PCB in a small vice or other holding device to keep it steady.

Try the IC in place and make sure that the IC connections, which go under the IC package, are clear of other tracks.

Tin both the underside of the lC package and the PCB area and connections leaving the minimum of solder on the PCB. Use solder wick to remove any excess.

Use a clean finely pointed temperature controlled soldering iron with the minimum of solder on the tip.

Hold the lC in place with tweezers, carefully aligning all the pins and gently dab one of the ground pins to attach it to the pcb at it's tip, you will find the top left one is the most convenient in the long run. This will locate the lC and minimize misalignment whilst giving sufficient flexibility to enable the underside of its body to be soldered down.

Hold the iron close to the chip touching the PCB and the two ground pins which are together at the bottom of the IC so that the heat will melt the solder under the chip. Press it down with tweezers when the solder is melted and hold for a few seconds until set. It is important

that the IC doesn't move out of alignment during this part.

The pin connections can now be completed using very fine cored solder wire and with the iron away from the lC to avoid bridging. Use solder wick to clear away excess solder if things go wrong.

After successfully mounting the Fujitsu lC, the rest of the components can be mounted, along with the wire links. The PCB is then soldered into the tinplate box, constructed in the same style as TV tuner unit, with lids either side. (For source of tinplate see ref. 3)

**Completing the assembly**

The DC supply is fed through a lnF feed-through capacitor soldered into the tinplate wall alongside this the return lead is soldered to a bent up 6BA solder tag soldered to the tinplate wall. At the back of the PCB the regulator was bolted with cut down leads (4mm) to a piece of tinplate which was soldered across the box so that the leads of the regulator were close to the feedthrough cap. and the 5volt connection to the PCB. It is important to fit the 0.1uF capacitor across the input to the Regulator - otherwise it may oscillate. It was soldered directly across the regulator leads. The output of the regulator goes to the 5volt input and this is then linked across the back of the PCB to the other 5volt point. A view of the completed unit with its lid off is shown in Figure 4.

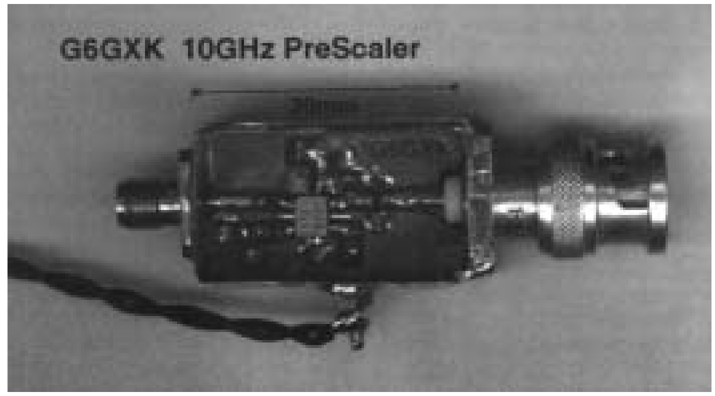



**Figure 4 - A view with the lid off**

**Testing**

The unit is very easy to test. Firstly spend some time checking visually the soldered connections. Apply power and check current consumption (about 130 mA). With no input there will be a high level of output at about 870 MHz. This is because the chip oscillates when not driven and this is normal just remember that if you think that you are seeing 6GHz or so - it may be because the output has fallen to too low a level to trigger the prescaler. Find a source of RF at a level of about lmW and frequency of 800MHz or more. Apply this to the input and check the counter. It should work without any problem, giving a reading of one eighth of the input frequency. It should also be checked using a 10GHz source such as a Gunn diode. For measurements like this, one useful technique is to feed the prescaler from an SMA to waveguide transition and a small diecast horn. This can then be pointed at the end of a waveguide or at a horn feed and adjusted until a good steady reading is obtained.

**Conclusions**

Overall a very satisfying project, which continues to prove its worth on a daily basis.

Two prototypes have been built so far with a third one in process. No problems have been experienced in their construction or operation.

There are some limitations and possible improvements.

1. It needs to remembered that a strong reading of about 870MHz (6900MHz) will most likely be a "no signal" or "low signal" input condition. As the signal falls off the effect is to move fairly quickly to the 870MHz condition but it doesn't jump there and if measuring frequency by tuning a rapid increase in tuning rate can be noticed. Please don't think that you have discovered a new way of generating 6.9GHz.

2, You need a calculator to multiply the result by 8, not quite as

*Continued on page 50*

## 1999 THIRTEENTH ANNUAL ATV BANQUET 11-14-99

## LITCHFIELD, ILLINOIS

With Thanksgiving rapidly approaching and Halloween just celebrated, the Central Illinois/St. Louis Area Amateur Television Club celebrated its thirteenth annual banquet. With 60 degree weather the dedicated group of ATV operators and their wives enjoyed another night of friendship and meeting new members. The banquet was held at the Ariston Restaurant in Litchfield which is the central point for the club with members coming from the Champaign, Bloomington, and St. Louis, Mo. areas. There were 33 members attending.

Activities began at 4:45 PM with Happy Hour and WB9QLY, Kathy Millick, registering the guests. As they arrived from the distant points members made and renewed acquaintances telling stories about their last years activities .

At 5:15 PM Scotty K9SM called the group to order. After that the clatter of dishes glasses, and utensils and chit chat continued during the course of the main meal and dessert.

The ninth annual Central Illinois/St. Louis Area ATV Operator of the Year was presented to Harold Mathis from Troy, Il. Harold has been on ATV for several years is always around to help those who need it. He is active in his local club and is always seen at the local hamfests. He had done a lot of emergency work with the Red Cross and ESDA.

The prize portion was next with the card draw for prizes and the heads and tails game for special restaurant certificates, which provided a lot of fun and laughter.

With all the prizes passed out farewells were said and everyone made their way home with the next banquet scheduled for November 12, 2000.

The above information is dated 11-20-99. Further information or questions should be directed to:

Central Illinois/St. Louis Area ATV Club
Scott Millick K9SM
907 Big Four Ave.
Hillsboro, Illinois 62049

217 532-3837
smillick@cillnet.com

ATVQ

## Digital Amateur TV Tests Started In Germany

On the 16th of December 1999 about 20 hams from 4 DARC districts gathered at the Telecommunications Institut of "Bergische University" in Wuppertal in order to receive a pilot series of Digital ATV equipment. After an introduction by Prof. Uwe Kraus, DJ8DW, his fellow workers DL1EIN and DJ8VR explained details of the TX and RX modules and the PC interface card for software control.

Each of the four districts has got the following tested prototypes in working order: 1) one TX with relay switch, 2) one RX, 3) one PC with monitor, 4) one PC interface card, 5) appropriate software. All devices are in cases without power supply (12 Volt DC). A 10 W PA is built into the TX case, two more RX devices for each district will be constructed in Wuppertal afterwards for field tests. The whole effort is powered by financial support of DARC headquarter, the four districts, AGAF e.V. and by private donations.

The upcoming test transmissions on 434 MHz in GMSK will carry MPEG-1 video from the PC hard disk, but in a lab of the Wuppertal University a little hardware MPEG-2 coder processed live camera pictures - the next generation of DATV (or digital ham TV).

Klaus, DL4KCK (AGAF e.V.)

ATVQ

## Annapolis, MD ATV

For what it is worth, the Annapolis, MD ATV repeater is back on the air at 180' HAAT (been off for about 5 years due to neglect). Output is currently only 1 watt bruning a hole in 421.25 with a commercial VSB filter...

Input will be 439.25 from directed Beams pointed at Baltimore BRATS, and Wash DC Metrovision. Local input will be 1280 MHz and 2.4 GHz...

Range is only about 4 miles until we up the power...

Bob Bruninga - bruninga@nadn.navy.mil

ATVQ

**NOTE: NEW EMAIL ADDRESS FOR ATVQ**

**ATVQ@hampubs.com**

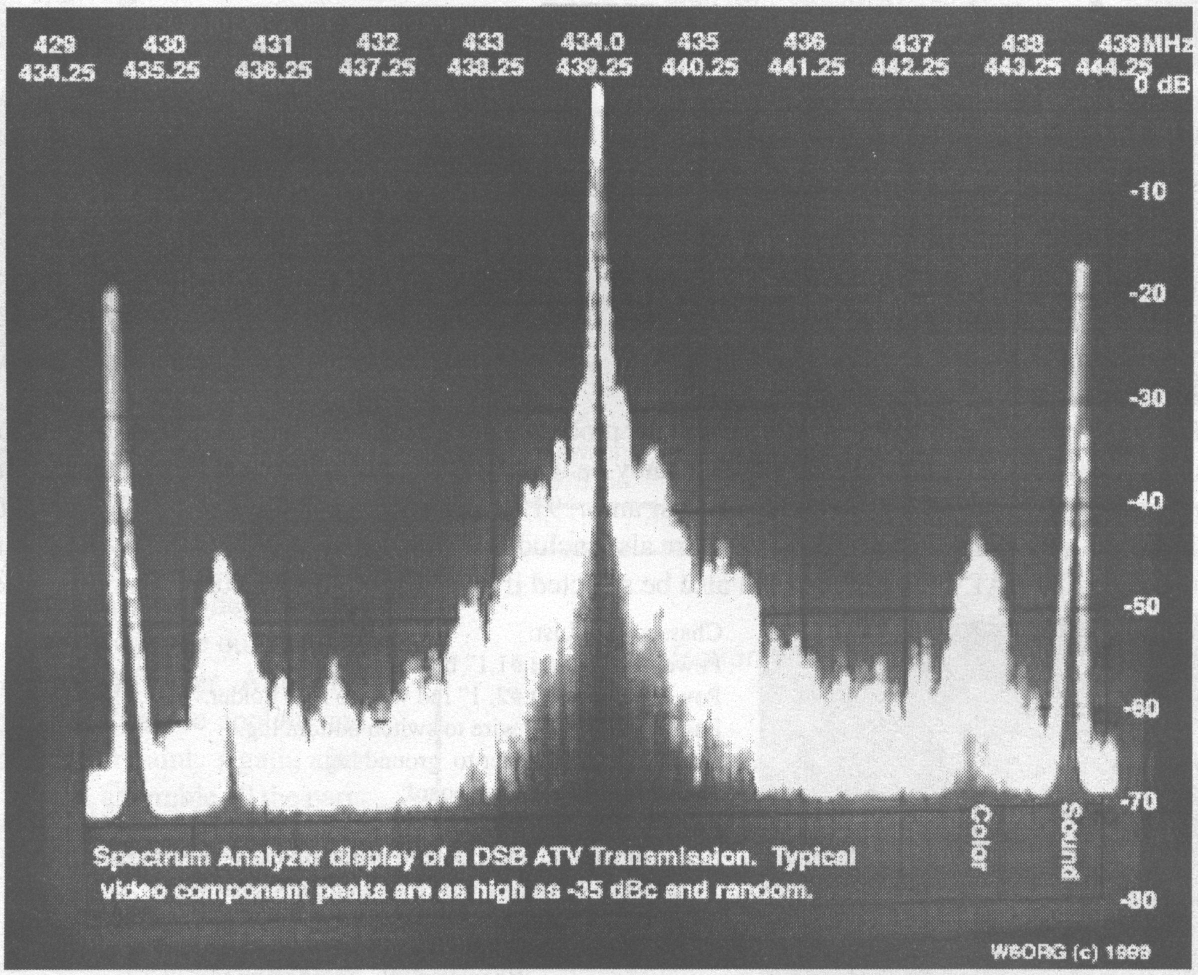
**NEW WEB PAGE IS:**

**http://www.hampubs.com**

**(the old accounts are closed)**

# 70 cm AM DSB Spectrum Power Density

By Tom O'Hara W6ORG




Actual AM sideband levels are misunderstood by most hams when discussing a new local 70cm band plan especially when just the total bandwidth is given. The necessary receive bandwidth is 6 MHz in the TV set but the actual transmitted power is complex and varies with what is in the picture. This is why other narrowband modes within the ATV passband have a higher probability of interfering with ATV but ATV rarely interferes with them. ATV can see interference from other modes down 40 dB in the video and greater than 1 microvolt.

Note the spectrum analyzer photo above of a transmitted camera video signal. Most of the power is within the first MHz due to the sync and its rise and fall time harmonics and is greater than -40 dBc above 1 MHz. At any narrow band frequency above +/- 1 MHz from the carrier, the camera video energy rarely gets above -35 dBc. This is because as the camera beam sweeps across it doesn't see a full white to black transition for very long which results in a short pulse rather than a continuous sine wave. A multiburst test generator which puts out full vertical screen sine waves can go all the way to -18 dBc as a worst case, but not a typical camera picture. The color subcarrier at +/- 3.58 MHz is the first significant energy which has a worst case of -22 dBc if a full bright red screen is on camera but typical camera shots are at a much lower level. So the actual side band energy at any given narrow band frequency depends on the white to black or vice versa change (gray scale) amplitude, its rise/fall time, how much of it is vertically in the picture so that it repeats with each horizontal scan, and other variables.

If we use -35 dBc as a reference this means that an ATV camera transmission will have no more than about 30 milliwatt's out of a 100 Watt pep ATV transmitter in any given narrowband segment +/- 1 MHz from the video carrier up to the sound subcarrier set to no more than -15 dBc at 4.5 MHz.

Quite a small pulse signal, which the narrow mode receivers audio and IF filters will roll off even more since at the 15.7 kHz scan rate and random. Add to this being cross polarized to the narrow band mode you can get 20 or more dB putting the video energy well below a milliwatt for a normal camera picture.

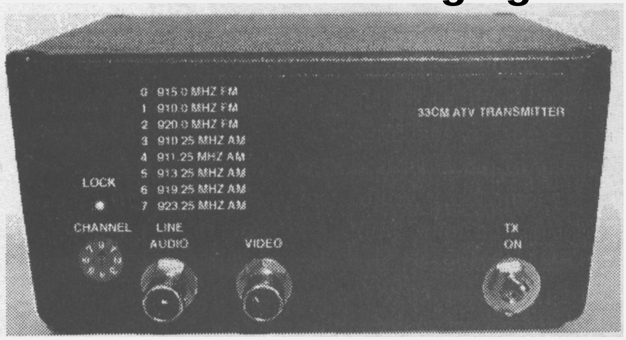
P. C. Electronics 2522 Paxson Lane Arcadia CA 91007-8537 USA

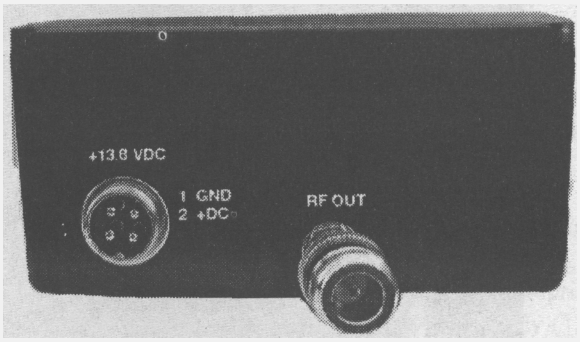
Tel: **1-625-447-4565** m-th 8am-5:30pm pst (UTC - 8) Tom (WGORG) & Mary **Ann** (WB6YSS) O'Hara

24 hr **FAX** order line 1-626-447-0489 Email: tomsmb@aol.com
Web site: http://www.hamtv.com

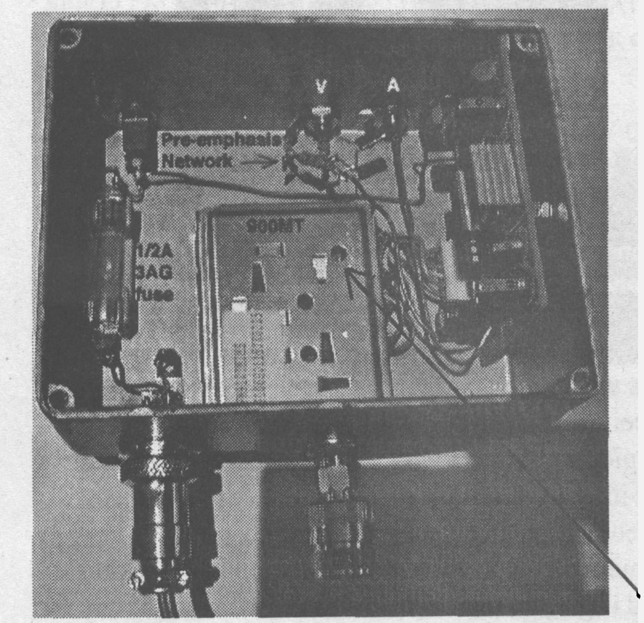
ELECTRONICS

# Packaging The 900MT 33cm FM ATV Transmitter




The 900MT 100mw 8 channel 33cm FM ATV tranmitter module can be packaged in a CAI3234 die cast aluminium box for base or portable use. At the home shack, it may be used as is if the 33cm FM ATV repeater is just a few miles away, or add the 3310PAWP 10 watt Downeast amp. 915 MHz is suggested for FM ATV due to the wide bandwidth required - 16MHz - but 910.0 or 920.0 are also included in case other users must be avoided but still be just inside the band. AM ATV frequencies can also be selected if an external AM modulated amp is added later.

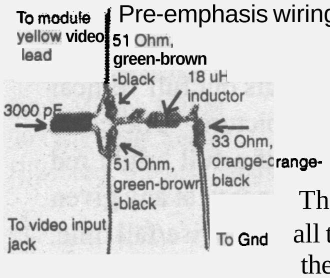



Chassis Wire List:
Power jack socket #1, 1" buss to ground lug
Power jack socket **#2,** 1" red wire to fuse holder.
Fuse holder 1" red wire to switch bottom lug.
Fuse holder 15V zener to ground lug.
From the PIC/regulator board;
Switch center lug ***5.5"*** red wire to removed + power input jack solder hole.
Audio input 3.5" white wire to center of audio in RCA jack.
Video input 3" yellow wire to pre-emphasis network.

Regulator/PIC Board wiring:
Unsolder and remove the **4** wires on the regulator/PIC board. Solder the **3.5"** wire to the Audio solder pad.
Solder the **3"** wire to the Video solder pad.
Unsolder and remove the power in jack and solder the ***5.5"*** wire at the + input solder pad.

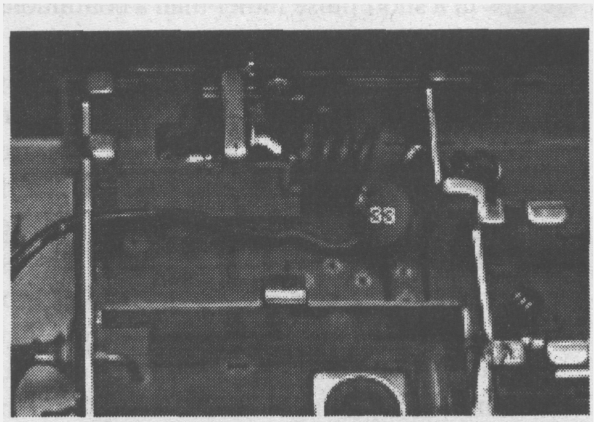
Set deviation pot for 1Vp-p out of a known receiver with a de-emphasis network and output level set for **4** MHz deviation. Or, if you have a spectrum analyzer, plug in a 1 volt peak to peak **2.33** MHz sine wave to the video input and adjust the deviation pot for a carrier null.

Pre-emphasis wiring



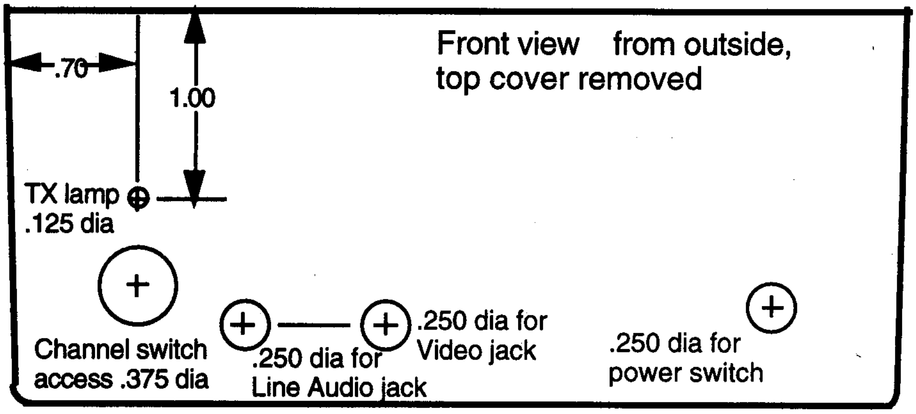

## Coax Power Mod for the Antenna Mounted 331OPAWP amp

The 900MT's RF output is capacitor coupled. So all that is needed is an inductor connected directly to the center solder lug of the ouptut SMA jack. The inductor is made by winding **4** turns at the end of a 7" long **#22** insulated wire using a 1/8" dia drill as a form. Strip one end 1/8" to connect to the jack and strip 1/8" on the other side of the coil to solder a 33 pF disc cap. Solder the ground side of the **33** pF to the shield wall as shown to the right. Run the wire out through a hole in the side of the can to a toggle switch and then to the power on center lug.. Change the fuse to a 3 Amp. The power from the 900MT must be attenuated by 10dB to 10mW so as not to overdrive the amp - 65 ft of RG58U (Belden 9201) or 125 ft of RG8 (Belden 8237).



P. C. Electronics 2522 Paxson Lane Arcadia CA 91007-8537 USA ©2000
Tel: **1-626-447-4565** m-th 8am-5:30pm pst (UTC - 8) Tom (W6ORG) & Mary Ann (WB6YSS) O'Hara
24 hr FAX order line 1-626-447-0489 Email: tomsmb@aol.com
Web site: http://www.hamtv.com

# Packaging The 900MT 33cm FM ATV Transmitter

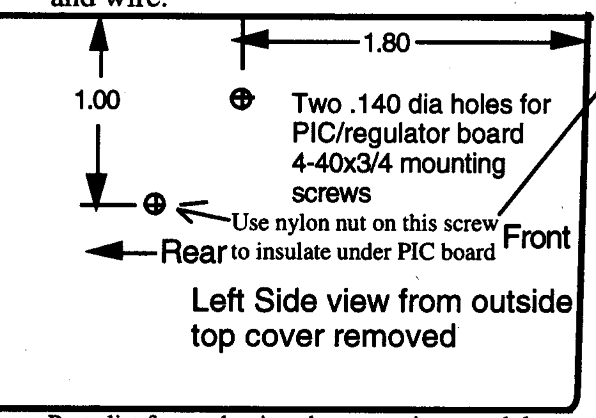


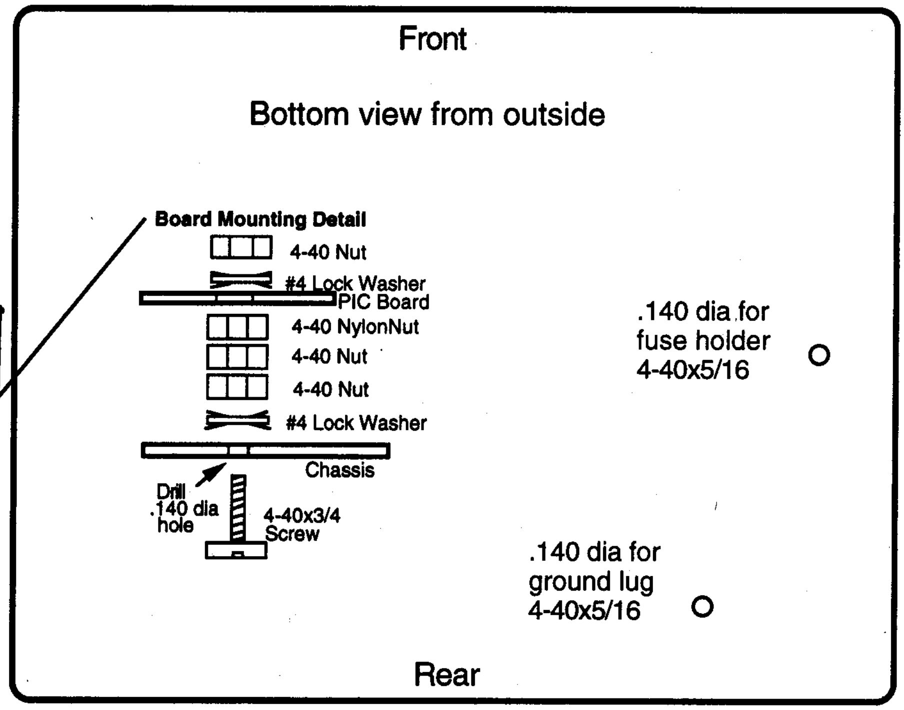

## Chassis Layout

Cut out the drill templates and place over the CAB234 aluminum box. Align with the edges and center punch through the paper, or poke a hole through the paper, then place on the box and mark with a pencil.

Drill all holes with a .140 dia drill first, check alignment, then finish with the larger drill. Debur all holes.

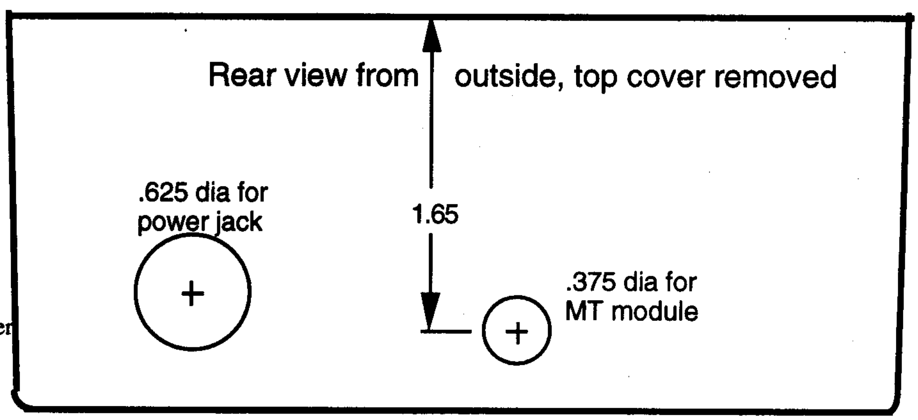
Check all parts for fit, then clean the box with isopropyl alcohol prior to painting. Spray paint the outside surfaces of the box and cover. After drying, rub on letters can be applied and then a coat of clear paint. Again, after complete drying, assemble all the parts and wire.




Parts list for packaging the transmitter module: RS part numbers = Radio Shack, the alternates after are Mouser -800-346-6873

- 1 900MT TX module, P. C. Electronics
- 1 CAB234 Aluminum box, P. C. Electronics
- 1 1N4744 15V Zener, RS 276-564, 583-1N4744A
- 1 Fuse holder, RS 270-739, 504-S-8001-1
- 1 1/2 amp 3AG fuse, RS 270-1003, 504-AGC-1/2 or use 3A if 3310PAWP amp is used.
- 2 4-40x5/16 screw, nut & lock washer
- 2 4-40x3/4 screw, 4 nuts and 2 lock washers ea.
- 1 4-40 nylon nut - 561-G440 - under PIC board. lower screw. Upper screw has all metal nuts.
- 2 RCA Phone jack, 161-1052
- 1 Power jack, RS 274-002
- 1 Power plug, RS 274-001
- 1 Toggle switch, RS 275-612, ME108-MS550K



## ADVERTISERS INDEX



**Please mention that you saw it in**
**Amateur Television Quarterly!**

*12 GHz Prescaler from page 45*

convenient as a direct reading device. There is no easy solution unless the counter you use has provision for prescaler multiples to be input. Any other solution would either require extensive modification to the counter or a worsened resolution.

3. The power-input limitations could be improved by using an input buffer amplifier that could both improve sensitivity and provide some limiting against higher powers. Perhaps two opposing diodes across the input would provide some protection against possible overload as available power levels increase.

Future developments using this prescaler will be a 10GHz PLL using possibly a Gunn or DRO as the 10GHz source that will be locked against a 10MHz or so Xtal oscillator.


Ref .1, A 12GHZ Prescaler l:8.by Angel Vilaseca, HB9SLV and Serge Riviere, F1JSR, DUBUS TECHNIK IV 1995.

Ref. 2, Fujitsu Microelectronics Ltd, Compound Semiconductor Division, Network House, Norreys Drive, Maidenhead, Berkshire, SL6 4FJ. Tel 01628 504800, Fax: 01628 504888.

Ref. 3, Source of 0.5mm tinplate sheets approx. 860mm by 800mm about œ5.00 each (as at June 98): Lancaster & Winter Ltd, Steel Stockholders, Bradford, West Yorkshire, BD8 9AE, Tel: 01274 498454.


ATVQ

# ATV RFI Filters

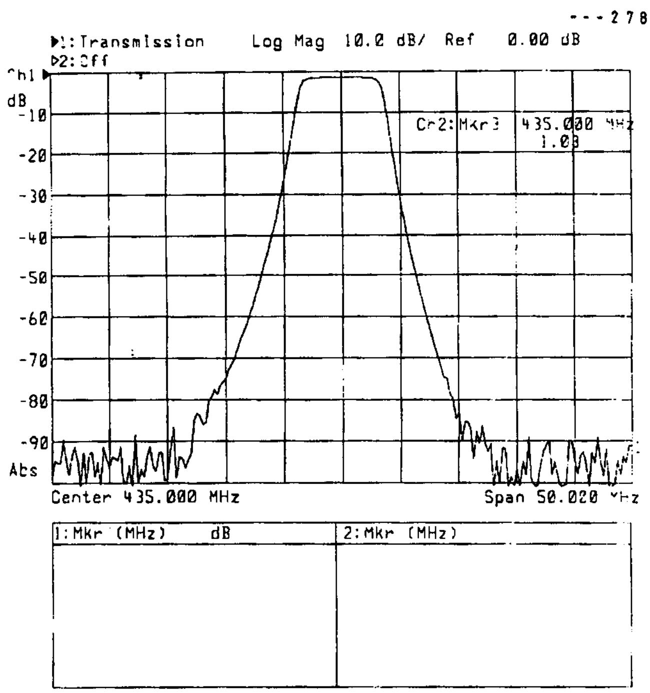
## Custom tuned to your video carrier frequency

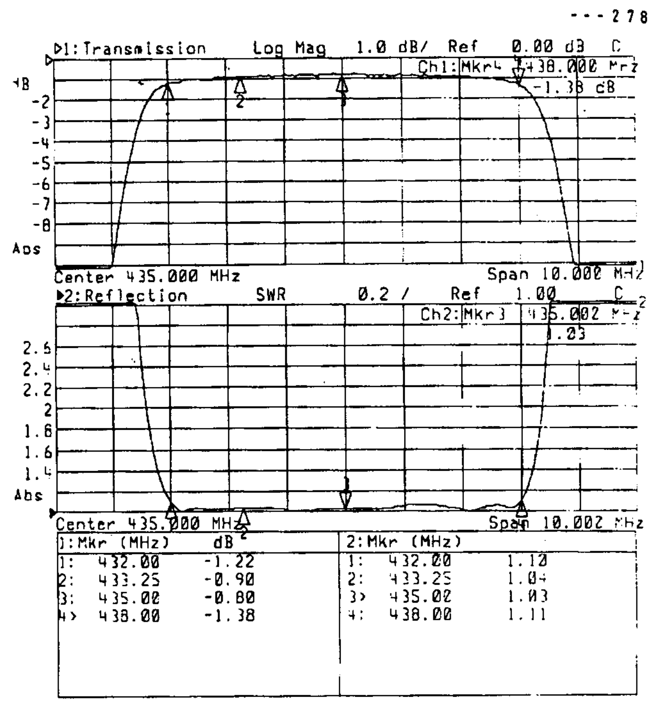
Improve your picture quality by reducing interference from pagers and other sources of RF near your reception frequency. On transmit, your signal bandwidth will be reduced so you don't interfere with other services.

DCI bandpass filters are solidly constructed from extruded aluminum and brass. DCI filters are passive and can be used in both the TX and RX pass. They are DC grounded on both inputs and outputs for additional lightning protection. Power rating is 200 watts for a 6 MHz bandpass.

| Configuration | 8-pole In-line | 8-pole Folded | 8-pole Rack-mount |
|---|---|---|---|
| Weight (approx) | 12 lbs. | 12 lbs. | 14 lbs. |
| Dimensions (inches) | 24 x 3 x 8 | 12 x 6 x 8 | 19 x 6 x 8 |

The graphs below show the characteristics of a typical DCI 8-pole ATV filter with a video carrier frequency at 433.25 MHz. We make similar filters for 900 and 1200 MHz.

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