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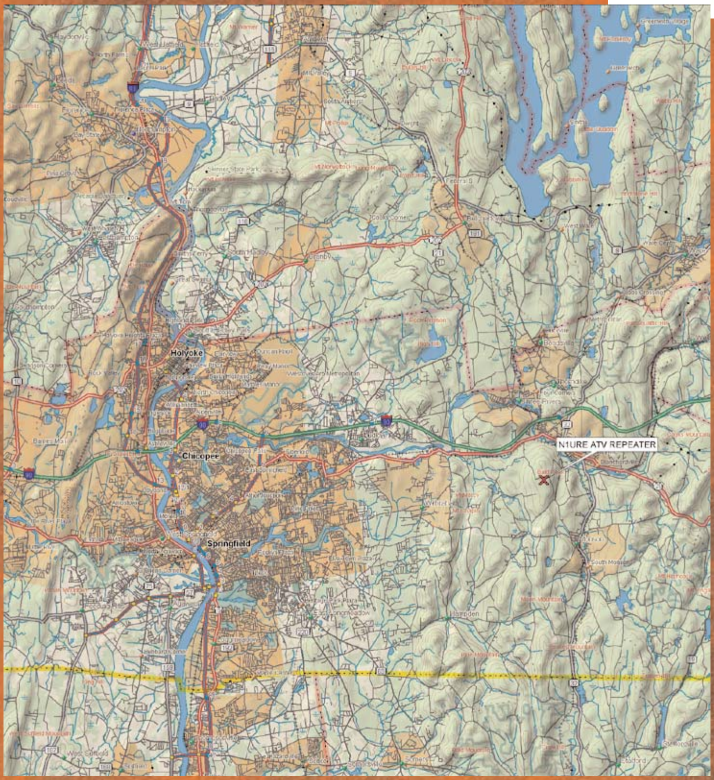
Amateur Television Quarterly

Great Local Coverage ATV For One Ham

This is a 1.2 GHz Filter?

N1URE ATV Repeater



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Published by
Harlan Technologies

Publisher/Editor
Gene Harlan - WB9MMM

Contributing Editors
Ron L. Sparks - AG5RS
Mike Collis - WA6SVT
Klaus Kramer - DL4KCK

Editorial Office
5931 Alma Dr.
Rockford, IL 61108
(815) 398-2683 - voice
(815) 398-2688 - fax

Internet:
http://www.hampubs.com
email: **ATVQ@hampubs.com**

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Amateur Television Quarterly

TABLE OF CONTENTS

We Have Mail!

RF Safety With Microwaves

Dear Gene,

I want to comment on one of the articles, "2.4 GHz 1 KW+ Mobile Station of WA6SVT", in the Spring 2003 issue of ATVQ.

The author makes no comment on safety. Remember microwave ovens run less than 100 watts of RF in the cavity. With this kind of RF radiating from an antenna at a height close to a person's head, he is asking for a problem. If he mounts the antenna on the roof of his car, I can see it now, he stops at a traffic light next to a bus stop and is transmitting. A person standing there gets a headache and then falls over unconscious or worse. Anyhow, you get the idea. I don't think that the mount he shows and talks about is far enough above people to be safe.

I think it would be wise to make a comment about safety at the very least.

One of my friends used to work at one of the UHF TV stations. Their ERP was five megawatts. He tells me that if a bird flies within 50 feet of the antenna, it dies. The antenna is over 1000 feet in the air, but an occasional bird does get fried.

I believe the danger from RF heating is very real and should be looked out for. I just wonder if the author of this article read my article, "Experiments in Hi-Power Microwave", in summer 2002 issue of ATVQ?

With pleasure, I remain.

Yours truly,

Heru Ra Walmsley - W3WVV

Thanks, Heru, for your comments about safety in regards to that article. I am sure that Mike is very aware and has even read your article, but we can not remind readers of safety too often.

I appreciate your writing and reminding us of the safety issue with the microwave frequencies as well as all the other articles that you have written for ATVQ. We are ready for another anytime you feel motivated!

All the best.

ATVQ

Gene Harlan - WB9MMM

Why 50 And 75 Ohm Coax?

By: Henry B. Ruhwiedel, AA9XW - Email A9XW@cs.com
5317 W. 133rd Street
Crown Point, IN 46307

Have you ever wondered why 50 and 75 ohm coax?

First, credit where credit is due, the sum of this was material presented by Beldon Wire at the Wisconsin Broadcast Clinic on 10-15-03, additional input was received from Andy G8PTH, and other historical references.

Did you ever wonder why coax is offered in mostly only 50 and 75 ohm versions? Why not 62 ohms, 38 ohms or 144.5559 ohms? It all started at the phone company! For those of us old enough to remember "telephone poles" vs. "utility or power poles" the pictures of these at the turn of the century were tall wooden poles, with numerous cross arms, and dozens or hundreds of glass insulators, each carrying a single wire. The phone wires were "hard copper" a term used to cover a vast number of materials including copper clad steel, iron, barb wire or what ever happened to be handy at the time the line was installed. The popularity of the telephone was growing to where there were just too many wires to cram onto a pole or loop into a switching office. Well you can thank the plumbing industry and a couple of Bell scientists, Lloyd Espinschieb and Herman Affel.

On May 23, 1929, these two bell labs employees were hard at work in their 1929 minds, to figure out how to get more signals down a wire. They knew of the radio transmissions and wondered how they might use the radio waves to go down a wire without radiating the signal into space before it got to the next switching office in order to carry more than one telephone conversation at a time on a single cable. Radio at the time was using open wire line. Shielded wire was unheard of, and the most ambitious method was to use a balanced feed to prevent the signal from leaking off line until it got to the antenna where it could leak into the directions desired.

Telephone wires were twisted pairs, but they didn't remain balanced, and if you moved them, they would untwist. Forces of nature would wrap them around each other between poles; they got wet, and didn't exhibit constant impedance because of the changing twists, rain, snow, wind, etc. There just had to be a better way. There had to be a way to wrap one wire inside another wire and keep the relationship constant.

It turns out there was a plumbing store near by and the store was selling copper pipe in various sizes. Lloyd and Herman figured that if they could get one pipe to fit inside the other and somehow keep them firmly in position, the relationship between the two "wires" would be fixed. So they tried it. Sure enough, with enough wood, screws and copper they were able to make short lengths of their new invention, coaxial cable. It was in fact what we call "hard line" today, not flexible. It was not good for long distances because the cost of copper pipe and the supports to hold rigid line and would be impossible to make a rigid coax go very far, but they did experiment with their new "cable" to ascertain the properties that would make it possible to manufacture a cable that would have constant impedance, be flexible and be able to go long distances.

Coax impedance is really chosen by the size of the center conductor. The center conductor is chosen for among other things, resistance, power handling, frequency, and physical strengths. Once the center conductor is chosen, the dielectric can be chosen. The characteristic of the dielectric then determine the diameter of the outer conductor to get the ratio needed for the impedance desired. This simple formula makes it possible to create a coax of the same impedance but of different sizes. A 75 ohm coax could just as easily be .1 inch in diameter as 9" in diameter as long as the ratio of the inner and outer conductors is the same, and the dielectric of the spacing material is the same. If the dielectric changes, say from air to some solid material, then the ratios change to compensate for the dielectric differences. But why 50 ohm and 75 ohm?

Being that his was an industrial product, Lloyd and Herman tried all sizes of copper plumbing they could get from the local store. They ran tests and measured the results to determine what the impedance of the coax did with regard to voltage, current and power handling and the velocity of the signal going down the coax. For each of these, they were able to graph the results and what they found was very interesting.

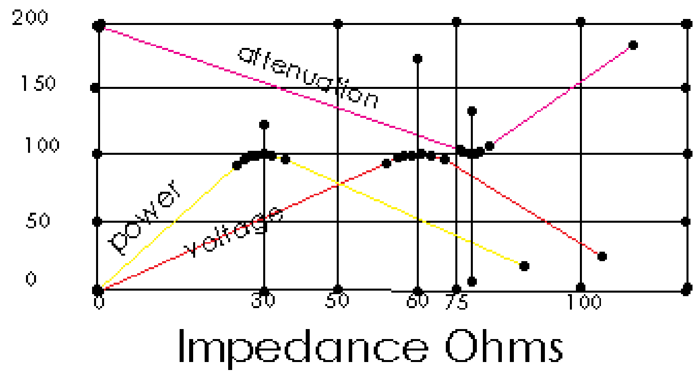


Figure 1

They plotted the various factors, power, voltage and current on a graph that compared loss to impedance. What they found was that the ability of the coax to handle power, voltage or current varied with the impedance, but not in the same ways. We are already familiar with ohm's law for AC, where we replace R, resistance, with Z for impedance. Simply stated a zero impedance line has no voltage since there is no resistance across which to develop a voltage, and theoretically we should have infinite current, likewise if R or Z is very high, the reverse. But there is an interesting relationship in coax cable that may not be so simple to visualize.

In their experiments, which are graphed in figure 1, you will see the loss value on the left side going from 0 to 200%, and the impedance from 0 to 100 ohms along the bottom. The first thing you should notice is that none of the curves is a straight line! As the impedance of the line increases from 0, you notice that the power transferred increases from 0 to a high of 100% (perfect power transfer) at 30 ohms, and then slowly decreases as the impedance goes up. This means if you want maximum power transfer, the coax should be 30 ohms! In fact one particle accelerator was built for 30 ohm coax between the RF signal source and the accelerating magnets. The problem was: it is very difficult to make very low impedance coax. The first attempt at making 30 ohm coax resulted in 90% failure, but fortunately, the government has big pockets and paid for not only the 10% good 30 ohm coax, but also the 90% failed product! Some 50 years later, with more modern wire making equipment, the failure rate is down to 30%! So if you want the maximum power transfer efficiency, order 30 ohm coax, and have a big wallet!

The voltage curve starts at 0 volts at 0 impedance, and rises more slowly. It reaches 100% at roughly 60 ohms. In fact, for any voltage driven signal, such as video, 60 ohms would be perfect. But we also need to look at attenuation. Attenuation decreases with impedance and is the lowest at 77 ohms. If we compromise between best voltage and best attenuation, we wind up at about 75 ohms. Thus, 75 ohms became the standard for voltage driven signals, such as video!

In transmission of radio, we have a bigger spread between best power, at 30 ohms, and lowest line attenuation, and best voltage you see that there is a cross over conveniently at 50 ohms. In fact the first coax made from copper pipe in 1929 has a characteristic impedance of 51.5 ohms. This is why some early broadcast coax, made from common copper plumbing pipe, came as 52 or 51.5 ohms! Only later was the size refined when the copper coax companies started to make their own pipe, to create a 50 ohm coax that is at the cross over point of the graph.

Now besides attenuation efficiency, there is just plain old attenuation loss with distance. We know that RG 58 is best used for short distances, and RG 8 for longer distances, and we like to thank the makers of semi-rigid lines, Andrew's trade mark Heliax being the common noun thrown around for these corrugated copper lines for longer runs. And of course for higher power and higher frequencies we want better coax.

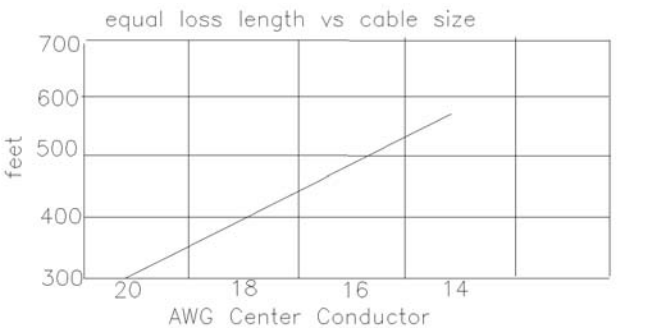


Figure 2

The common sizes for center conductors are AWG gauge sizes, 20, 18, 16, 14. Loss is always related to a specific frequency. Actually smaller coaxes have a better ability for higher frequencies than larger coaxes, if this seems counter intuitive; think of waveguide, which has a cut off frequency at both the low end and high end. Increasing the center conductor size by each AWG increases the maximum cable length. For a 3 GHz frequency, such as we use in digital video, a 20 AWG wire would be good for 300 feet, an 18 AWG about 400, 16 AWG about 475, and 14 AWG 560 feet. This is the specification for coax cable length for SMPTE 292M, for 75 ohm coax that has an 83% velocity factor, and a dielectric constant of 1.45 (the ratio is always to a vacuum).

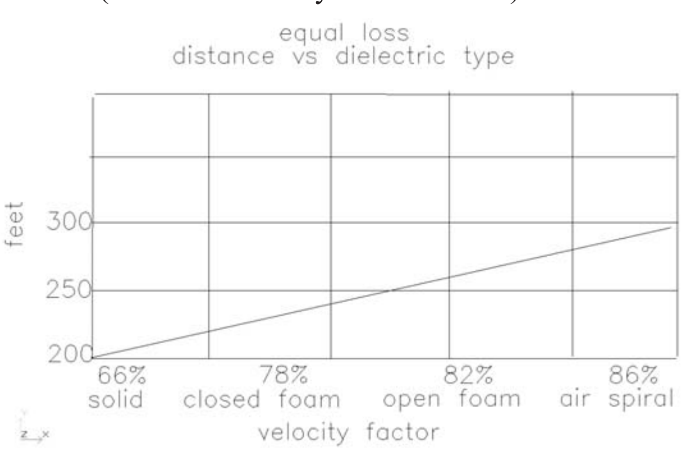


Figure 3

The second way to increase the distance we can use a cable for a particular frequency is to increase the velocity. The faster the signal gets there, the less loss there is! A solid dielectric material has a velocity of 66% (of the speed of light). If we had a cable with a rating of 200 feet for 6 GHz, we could go 270 feet by increasing the velocity to 86% which is low density foam. This is why RG8x is a little better than solid dielectric RG8. But low density foam RG 8 would be better, and of course 9913 which is a spiral dielectric and mostly air, is even lower loss.

Of course, the center conductor also determines the maximum power the coax can safely carry. How is that determined? The standard is the coax center conductor is rated at a maximum power for any particular frequency at 100 degrees C in an ambient temperature range. Yes, you can run more power, we have heard of those hams that like to brag that they use RG58 at a full KW, but if it's below 4 MHz, RG58 can handle up to 3500 watts! But not at 2 meters! Check the power vs. frequency charts for coax in the ARRL books, and you will see that power decreases with frequency for each type of cable. At AM broadcast frequencies I can handle 50 KW with some small coax, but at UHF TV, I better have 6" or larger copper hard line to handle the same 50 KW! I also want the larger coax for the lower loss at higher frequencies.

Now you may have heard of audiophiles that demand monster size cable, and there are cables with multiple sizes of wire supposedly for phase alignment, and equal power at all frequencies. Is this really necessary? Well, it depends. First, speakers may be rated at 4, 8, 16 ohms or so, and certainly the twin lead wires used for speakers do not have these impedances. But since the wires are much less than a wavelength, the line impedance is not all that important. But impedance changes with frequency! Again, our hero's documented this because as WWII arrived, we had an invention that the German's and English had called Radar. The principles were the same, send out a signal, and receive an echo. The trick was the higher the frequency, the better the resolution of the return echo signal and the greater distance that could be used to detect the same size object. In those days we

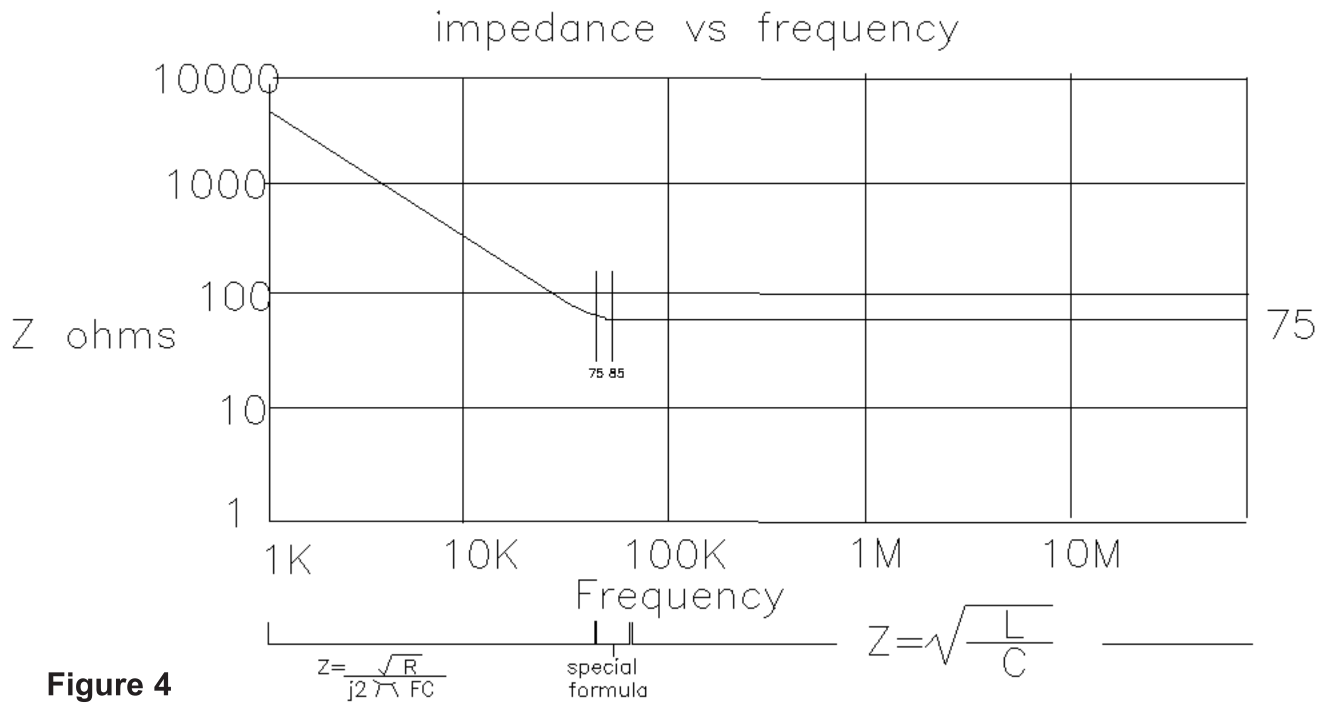


Figure 4

were exploring those stratospheric frequencies above 100 MHz!

At 400 MHz, radar really began to be a cool device, and small enough to put on a plane! But to handle high power and high frequency required a better coax than they could make using normal materials, not to mention the occasional high G force found as the plane dodges anti-aircraft fire!

Just as might happen, a couple of scientists were experimenting with hydrocarbon gasses trying to find better fuels. They happened to be using ethylene at the time and were attempting to test its properties under high pressure, abut 2500 atmosphere to be exact. They put the gas in the chamber, pumped up the pressure and waited. Nothing much happened. Come the weekend, they went away, and when they came back they found the gas pressure had dropped to near zero. Suspecting a leak they checked the equipment. When they opened the door to the pressure vessel, they found some flakes of material. There was no obvious cause; the metal canister was not painted, so they sent the flakes to be analyzed. The analysis showed, that there were simply longer molecules of ethylene, or poly-ethylene! When they tested the material to see what it might be good for, they discovered it was a great insulator. Even very thin pieces had amazing insulation qualities. Not only that, if you heated it, you could mold it into different shapes. Then re-heat it again and remold it. It was the first thermo-plastic, and today the most used plastic material in the world, everything from the thin bags at grocery stores to hold your fruit and veggies, to a wonderful coax cable dielectric! Now in WWII there were spies everywhere, and none more confused than the Germans spying on the plastic plant. Of course they did not know what it was until an English plane carrying a 400 MHz radar unit was shot down and the Germans discovered the plastic coated wire coax in the radar sets. They tested the material and immediately wanted to know how to make it. The spies of course were completely baffled, they could see the gas trucks going into the factory, and the plastic coming out, but no other materials. One of the best guarded secrets of WWII!

The electronics people seized upon this new material as the ideal plastic for coax. It held up to high power and at high frequencies, was stable, easy to mold to precise shape and was basically inert, safe to handle. Modern coax cable was born.

Now what about our Golden eared audiophiles? Those with the $10,000 turn tables and $50k speakers seem willing to pay any price for the best wire. The fact is very low frequencies are carried by very large AWG wire, mainly because of the current levels. At very low frequencies, we are in the near 0 impedance range, and as such, the maximum current range. Without getting into the complicated math of the variances in impedances of speakers and output circuits of amplifiers, where even negative resistance can occur, suffice it to say that the 0000 welding wires will carry that 6 Hz cannon fire in the 1812 Overture better than the 28 AWG phone wire simply because of the current and very low impedance, where the resistance of the small wire is a factor. The impedance is actually

$$Z = \frac{\sqrt{R}}{j2\pi FC}$$

This is true up to about 70 KHz. As such R is the major factor in the formula. The impedance decreases with frequency. Around 70 KHz, the linear change in Z begins to be altered by the skin effect of the wire. But this is well beyond the hearing range of any human. Above 100 KHz, the formula changes to Z= the square root of L divided by C and remains a constant 75 ohms in our cable. There is a special case formula that expresses the curve in the transition from "dc" to "ac" but is not of much use to us hams.

Lastly, coax impedance is expressed as the AVERAGE impedance of the coax over the frequency range. In fact, the impedance changes a few ohms up and down because of minute defects in every coax. An actual plot of Z vs. F looks more like Gaussian noise. However, the cheap coax can have nasty spikes at frequencies and well made coax has a much lower value change vs. frequency. Typically, a cheap coax can have as much as 10-12 ohms change in impedance at some frequencies, and a well made coax will have less than a half ohm change from 100 KHz to 6 GHz. In high power applications we actually measure the impedance and have graphs that show the variances with frequency and we tune these out with coax line tuners.

Lastly some historical perspectives. In checking my facts and research, Andy, G8PTH, provided the following items which I have edited.

Up until the 1970s at least German hams used 60 (or 62?) ohm co-ax for RF tx and rx. All the old ham textbooks and 'VHF Communications' magazines showed this. In 1930s magazines (at least in Britain) they called it 'concentric cable', not coaxial. We used it on the London-Birmingham trunk telephone and TV cable in 1936, which was a very early operational installation (about a year later than the USA). Concentric cable had been used for electric power distribution since the early 1900s, so in itself co-ax was not a new idea. In the fall 1998 issue of Invention & Technology magazine the following appears in an article about the inventor of Muzak: "And in 1937 AT&T's importance in broadcasting was reinforced when it developed super-high-frequency wire capable of delivering high definition television images - the familiar coaxial cable."

Dick Dillman , W6AWO, indeed, but perhaps the most interesting early use of coaxial (or concentric) transmission lines was to promote...goat gland implants! Yep, that's right. XERA, the famous 500,000W border blaster used by Doc Brinkley (after the FRC refused to renew his license for KFKB in Kansas - he showed *them*!) was designed and built by James O. Weldon, who later founded Continental Electronics. After reading the previously unpublished account of the design and construction of XERA based on Weldon's papers (in the Spring 1996 edition of the Proceedings of the Radio Club of America) I'm prepared to nominate him as one of the greatest high power transmitter engineers ever. Check it out: 500,000 *unmodulated* carrier output into a directional array with 3db gain... on 540Kc. On an occasion of particular spectacular corona discharge the Doc's voice could be clearly heard in nearby Villa Acuna - with out the aid of radio receiving equipment. As to the transmission line, I quote: "The output of the transmitter was connected to the phasing equipment by a 75 ohm concentric transmission line made of a two inch diameter copper inner conductor and a seven inch diameter copper outer conductor. Under normal operating conditions, the RF current in the line measured approximately 83 Amperes or slightly less than 520,000 Watts." Man! That gets me worked up better than any damn goat glad implant! Got a copy of RADIO WORLD 1935 Sept... Page 9... Titled RCA and Philco negotiating for Coaxial Television Line... This article had to do with the laying of a two tube coax from New York to

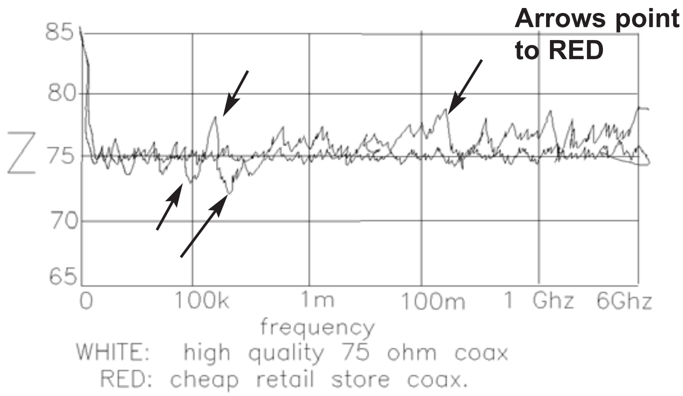


Figure 5 A close hand drawn approximation of an actual sweep test of a precision 75 ohm cable and a retail store 50' length of coax. Both rated at 75 ohms, and terminated in standard F connector. Note: If you analyze the previous charts, you will recognize that all coax has a high impedance at very low frequencies. This chart shows that the better coax maintains a much closer tolerance to the nominal value than the cheap coax. The cheap coax also had several severe impedance bumps. We would have had to to a TDR test to locate the bad impedance points in the coax, but there were no obvious defects looking at the outside jacket. Most impedance variances are caused by minute changes in the concentricity of the conductors caused by production machine mechanical changes, dirty ball bearings, vibration, etc. Of ten samples, this was the best of the cheap chain store RG 6. The worst had bumps over 10 ohms from nominal value. Five RG 8 samples were tested and all were even worse than the RG 6 samples. All cables were 50 feet long and terminated in a precision load resistor tested to 6 Ghz.

Philly. Naturally it has to do with Bell Labs, and the president of the labs at that time.. Dr. Frank Jewett stated that the experiment would last for a year... Cost was to be 580,000..

From 1934 German article: Der erste Einsatz eines Koaxialkabels in Deutschland erfolgte im September innerhalb Berlins. Man hatte erst spät erkannt, dass man für die Fernsehübertragung ein breitbandigeres Übertragungsvolumen (im MHz-Bereich) als für herkömmliche Kupferkabel zum Telefonieren (nur im KHz-Bereich) brauchte. Über dieses 11,5 km lange Kabel zwischen dem Reichspostzentralamt und dem posteigenen Fernsehlaboratorium konnten neben einer Fernsehsendung gleichzeitig 200 Ferngespräche übertragen werden. Translation: The first application of a coaxial cable in Germany took place in September 1934 inside Berlin. Ran 11.5km between Post Office headquarters and the German Post Office's TV lab, carrying one TV signal and 200 voice telephony channels simultaneously. ATVQ

Cable Sample	Tests Impedance	type	Ohms Worst Delta	Ohms Highest Z	Ohms Lowest Z	Mhz worst frequency
1	75	1505A	1	76.02	74.55	3.79 Ghz
2	75	RG6	3.8	78.82	74.17	217 Mhz
3	75	RG6	3.88	78.88	73.92	154 Mhz
4	75	RG6	2.7	77.74	74.78	1285 Mhz
5	75	RG6	6.2	81.26	72.44	404 Mhz
6	75	RG59	1.9	76.97	75.13	2.35 GHz
7	75	RG59	7.4	82.45	77.36	3.8 GHz
8	75	RG59	10	85.28	78.31	387 Mhz
9	75	RG11	3.6	78.64	75.33	107 Mhz
10	75	RG11	6.5	8l.50	75.74	690 Mhz
11	75	RG11	4.4	79.38	77.43	712 Mhz
12	50	9913	1	75.63	74.88	6 GHz
13	50	RG8	7	56.3	43.62	1490 Mhz
14	50	RG8	5	55.04	46.48	240 Mhz
15	50	RG8X	21	44.62	71.38	56 Mhz
16	50	RG8X	16	40	66	187 Mhz
17	50	RG58	4	52.68	46.36	4.25 Ghz
18	50	RG58	6	56.45	45.69	380 Mhz
19	50	RG58a	3	52.75	49.36	149 Mhz
20	50	RG8A	5	55.31	48.27	4.8 Ghz

23 cm In, 70 cm Out, Cross-Band ATV Repeaters, Beware the 3rd Harmonic Lock-up!

By Ron Fredricks, K8DMR - ronfredricks3@comcast.net
206 Foxboro NW
Grand Rapids, MI 49504

As we found out with the K8DMR ATV repeater here in Grand Rapids MI, there is a gremlin that one must avoid when operating a cross band ATV repeater with 23 cm input and 70 cm output. While our main input is also on 70 cm at 439.25 MHz we added a 23 cm input a year or so ago. With an in-line preamp connected to our 23 cm Comet top stick and using sensitive Bensat or TVHAM receivers we then started getting lock-ups, with the repeater ID bringing the repeater back up. The cause, of course, was the third harmonic of our 70 cm output on 421.25 MHz passing right through the 8 poles of 70 cm bandpass filtering at the transmitter output and putting out a tiny bit of third harmonic energy right in the middle of the 23 cm band on 1263.75 MHz.

The K8DMR ATV transmit rib cage is only 15' or so from the 23 cm receive antenna. Even though horizontally polarized and AM while the 23 cm input is vertically polarized and FM there is enough video sync buzz output from the 23 cm receiver to keep tripping the VOR with our ID. We originally tried 1280 MHz on receive but ended up moving to 1290 MHz to minimize the repeated burps occurring when an ID was forced up or when all users cleared the machine. However even at 1290 MHz (the FM equivalent of the 1289.25 AM ATV slot) the lock-up burps were still a nuisance.

Now it is well known that bandpass filters pass odd order harmonics. Thus the above problem was not unexpected. Maybe that is why most cross band repeaters are low in and high out. However we have always been an in-band 70 cm repeater and a 23 cm input was added only last year. Employing a bandpass filter at 23 cm might have helped sharpen our receive selectivity but the obvious way to get rid of any 3rd harmonic from the 600 watt ERP 421.25 signal would be to add a low pass filter directly in the transmit line with cutoff around 500-600 MHz.

While both 23 cm bandpass and 500 MHz low-pass filters are available from DCI, where we have bought most of our receive and transmit filters, these are not cheap. Before biting the bullet and shelling out hundreds of dollars to improve 23 cm receive performance we decided to try a couple of low cost solutions. First we took a narrow band single cavity "FM repeater" notch filter designed for 70 cm and simply put this in line with our 23 cm receive hard line ahead of the in-line RCA preamp. We tuned the notch for minimum received 3rd harmonic signal at 1263.75 using the fact that a notch at F1 is also a notch at 3XF1. The notch filter is made out of plumbing and was described in an ATVQ article from the Winter '92 issue of ATVQ. That got rid of any front end overload problems with the 23 cm receiver but still did not completely clear up the pesky lock-up burps. (Another approach to improved selectivity would be to build the 1280 single cavity bandpass filter described by WA8RMC in the Fall '94 issue of ATVQ. The bandpass looked a bit peaked for FM ATV however and so we didn't try it.)

The second phase of our two pronged attack on the 3rd harmonic was to build a "poor man's" 3rd harmonic filter and place it at

FIGURE 1: 70 cm 3-rd Harmonic Filter In-Line

the last point in our transmit line before the hard line feed left the radio room at our Red Cross site. Consider that a 1/4 wave open stub presents a short at its other end and that a quarter wavelength at 23 cm is only ~ 5.75 cm long. This seemed to us to be just about the length one would get with screwing a type N barrel connector into the tap port of a type N T-connector. The "bump" on the line seen by the 70 cm signal should be small we reasoned.

Well this turned out to be almost correct. When we actually tried the poor mans 3rd harmonic trap out we had to detune it ever so little to avoid seeing the SWR rise above 1.3:1 or so on the transmit line. Still the 3rd harmonic burps entirely disappeared. When the filter was removed they returned. We ran this way for the last year. Unfortunately when we pulled it out to take pictures for this article we must have slightly changed the tuning so that has to be redone again. Here is a picture of the 3 harmonic filter in-line at the 421.25 transmitter output. . (Probably we should use more than electrical tape to secure the barrel at the right tuning length.)

Next here is what the 3rd harmonic trap looks like with the tape removed. Pretty familiar components, eh?

FIGURE 2: 23 cm Trap

Below are some spectrum analyzer plots showing the 3rd harmonic as picked up on a stub duck antenna on our spectrum analyzer right in the radio room. We show before and after plots with the repeater forced up but the video removed so only the 1263.75 third harmonic of the video carrier and the upper and lower sound carrier harmonics appear.

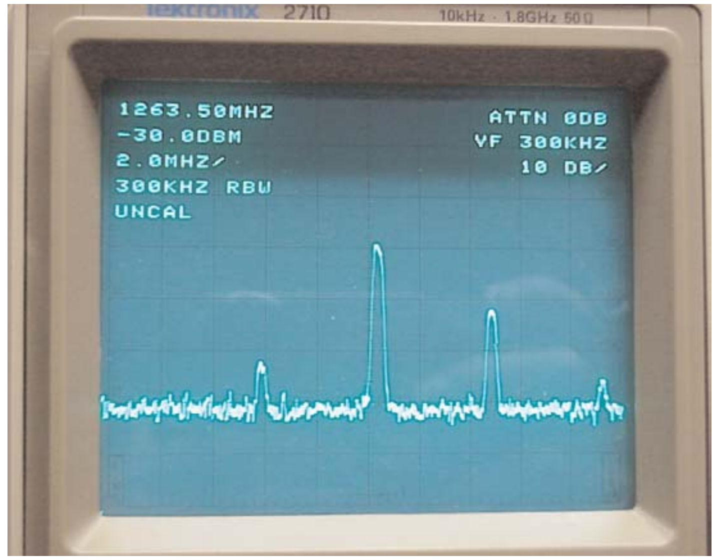


FIGURE 3: 23 cm Spectra Without Third Harmonic Filter Present.

Note that the upper audio subcarrier has an additional harmonic showing at 9 MHz above the video carrier. The lower audio subcarrier appears even more suppressed if we displayed the 70 cm band spectra. Additional comb outputs of the sound subcarrier are also present but are lower yet in amplitude.

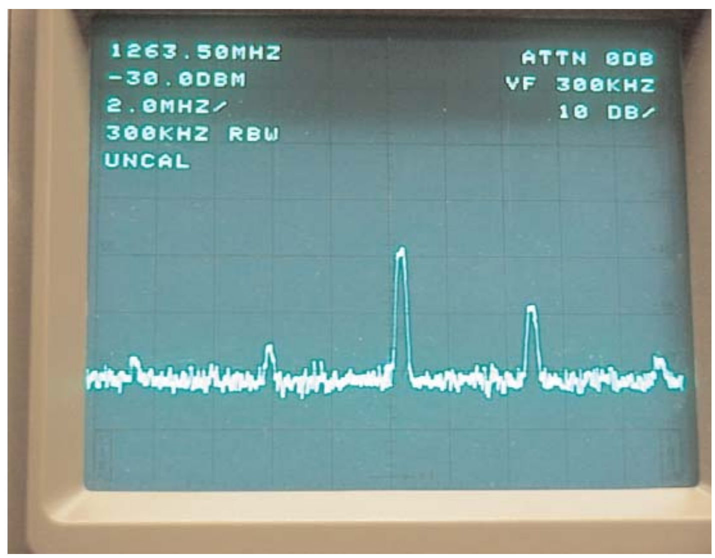
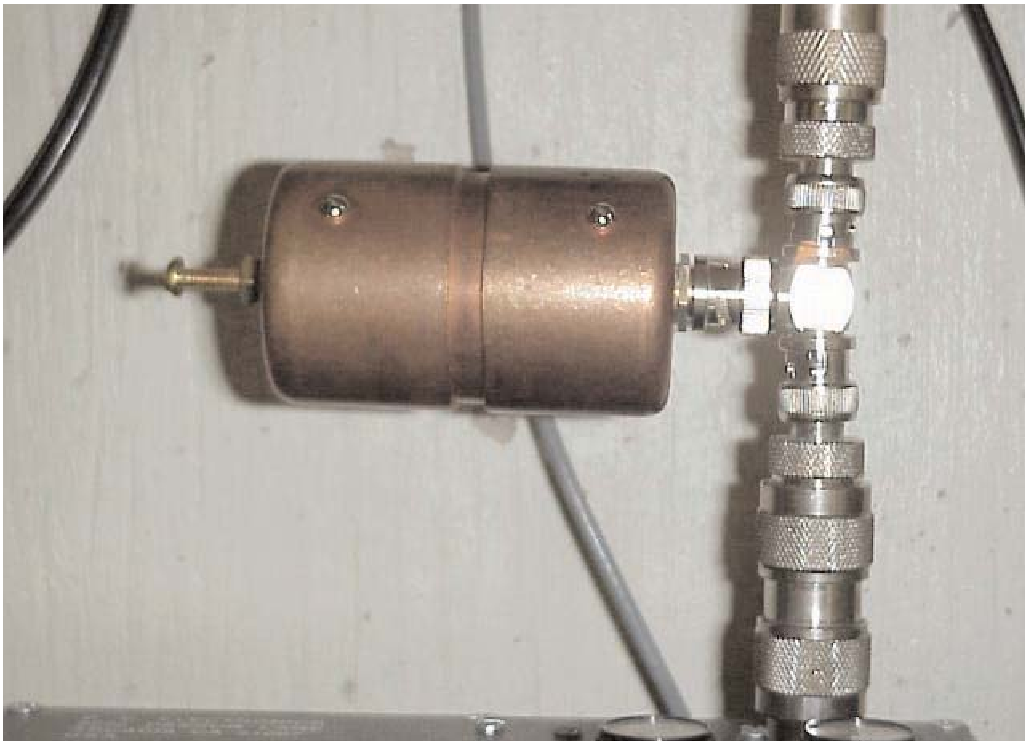


FIGURE 4: 23 cm Spectra With Third Harmonic Filter Present.

Due to the fact we used a stub duck for the spectrum analyzer input there was considerable burble on the experimental readings. The run above shows just under 10 dB relative attenuation was achieved by the poor man's filter. All the other screen-shot readings we took were even better, showing more attenuation.

Last, but not least, we show the 70 cm notch used to reduce both the 70 cm fundamental and the 3rd harmonic at the 23 cm receiver input It was in-line with the 23 cm receiver, not the spectrum analyzer, so its presence had no effect on the above



plots. The notch is very sharp and the filter is also very useful for getting rid of those low end FM repeaters in the 442 region. You can stack several of these in line as needed. Dig out your Winter '92 ATVQ for construction details.

Editors Note: Rather than have you dig back for the past issues, we are going to reprint both of those articles here starting on the next page. Enjoy!

FIGURE 5: 70 cm Notch used as 3rd Harmonic Notch on 23 cm Receive Input.

ATVQ Tests The 1.2 GHz Filter Theory

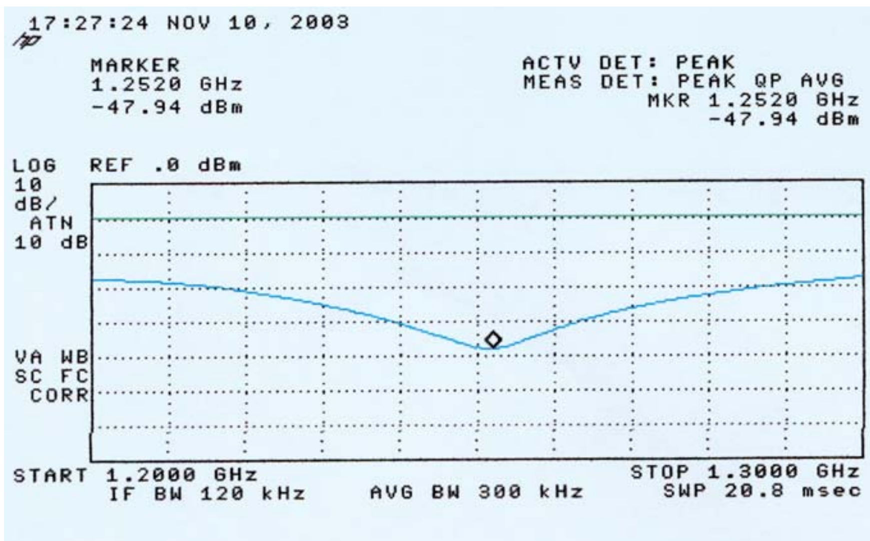
Since we have the same input and output that Ron has on their repeater, we have the same problem with the repeater trying to bring itself up again in an endless loop because of the 421.25 x 3 being close to where we receive. I like to "see" for myself so I visited the testing lab that we use for EMI testing and he allowed me to test the T with the barrel theory. The plots to the left show the response of the single T (top graph). It shows that it attenuated the signal by 47.94 dBa.

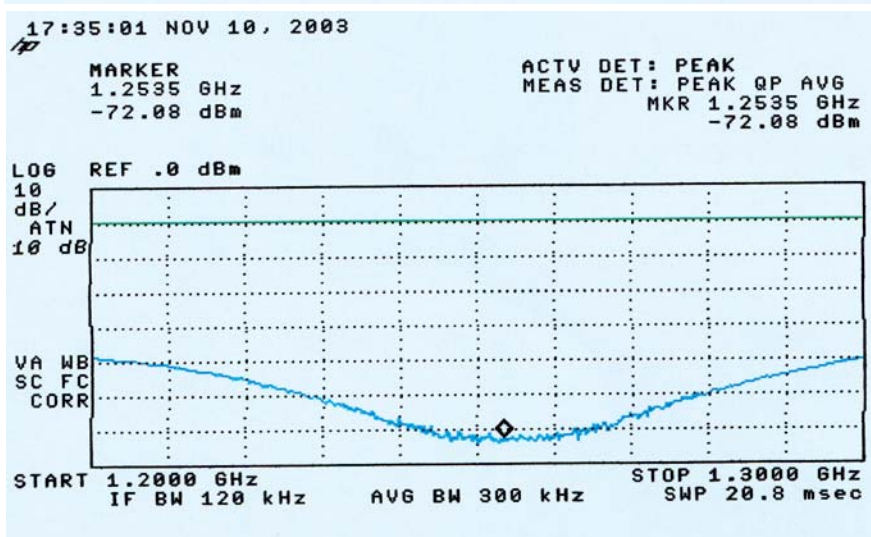
Then I wondered, if one is good, what would two in series do? The bottom graph shows that two in series would notch the signal by 72.08 dBa.

I am the first to say that I am learning while building the repeater here in Rockford, IL and am not the expert. When I passed my Extra test, I kidded that I would have to take up a new hobby as there were no more tests to pass. Well, I was wrong. I am still learning and having fun every day.

After learning about 1/4 wave open stubs, I took a spectrum analyzer with a generator to the local club meeting to show them how easy it is to build a coax filter.

Gene - WB9MMM
ATVQ





440 QRM Filter

Filter designed by Larence Oaks - WB9YAJ - loaks@comcast.net
Text by Henry Ruhwiedel - KB9FO now AA9XW - A9XW@cs.com
Reprinted from ATVQ - Winter 1992

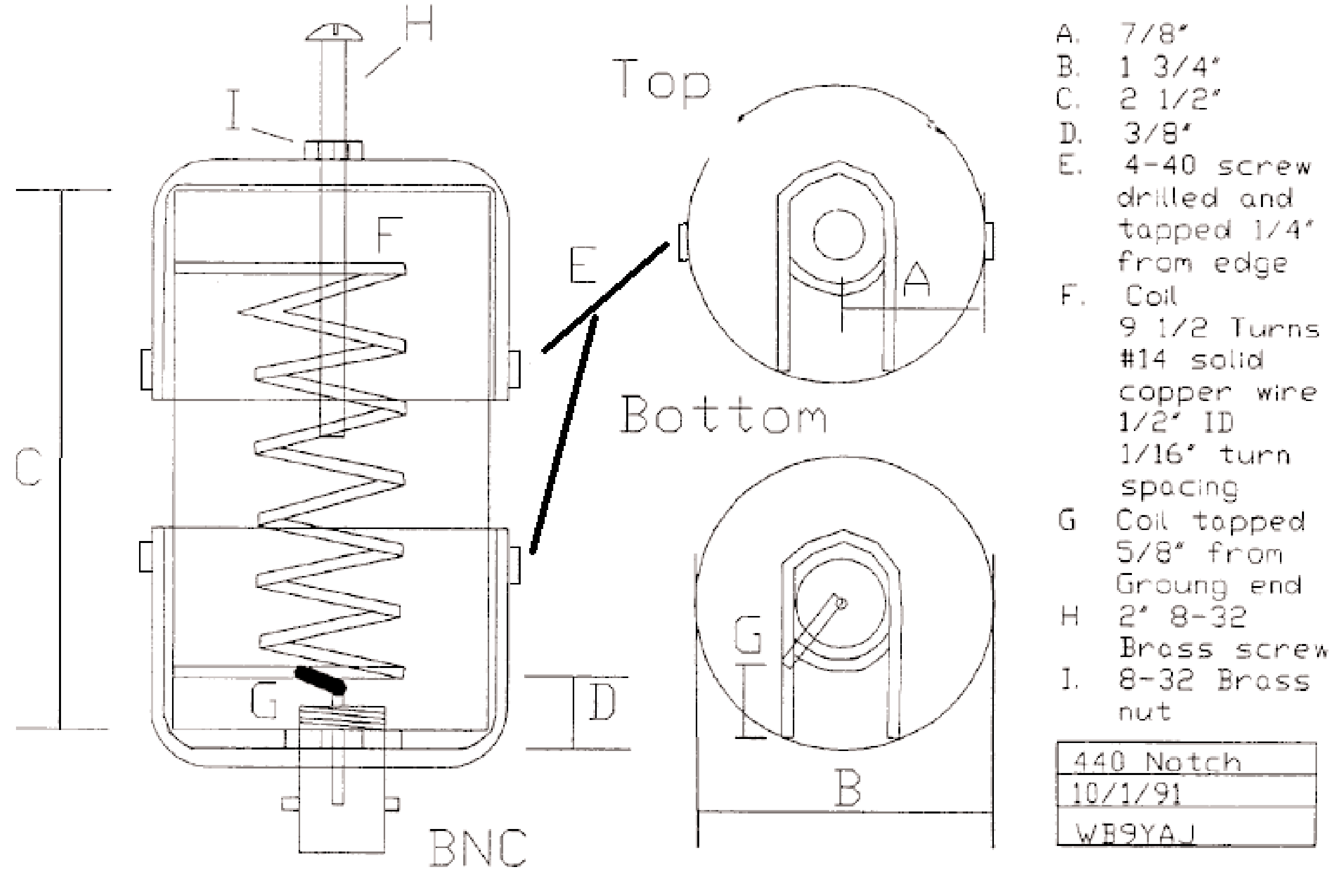
A simple to make filter to provide a notch to tune out QRM on your ATV receiver, or eliminate unwanted signals from your transmitter output.

The filter is a high Q helical design made from copper pipe, wire and a BNC connector. The diagrams show all the construction details necessary to duplicate this design. This diagram shows the use of short 4-40 screws to hold the end caps in place. Alternately the copper plumbing caps can be soft soldered after assembly and trial tuning is desired. The tuning screw does not come in contact with the coil inside the cavity. Connection to the receiver circuit is by a BNC T connector and should be located close to the receiver input.

The copper coil, made from 14 gauge copper wire is soldered directly to the sides of the copper pipe section. The BNC center conductor is soldered via a short straight jumper to the bottom of the first turn of the coil as shown. Dimensions should be followed closely for best results. Be sure to use a brass screw for tuning adjustment.

To remove receive QRM, the notch filter is tuned by watching the ATV receiver in the presence of both a desired TV signal and the undesired FM repeater or other signal. Simply turn the screw until the interference is minimized. Alternately, you can put the filter at the antenna jack of a narrowband receiver tuned to the interference frequency and while watching the S meter, tune the screw for minimum signal. Typically, 26-30 dB of rejection can be achieved. The Q of the filter is very high, so tune slowly. The notch is quite narrow, only a few kilohertz wide at the peak, so there is minimal effect on the video signal when in use. Several units can be made connected together with short coax cables to reject more than one signal as needed. Once tuned, the units are very stable.

The robust construction of the filter was designed to eliminate transmitter IMD products (such as the second harmonic of a sound sub-carrier) as needed to prevent interference to other stations. The second harmonic of the sound carrier of a 439.25 MHz video signal falls at 448.25, a repeater input. IMD products are created in all amplifiers as a non-linear distortion. This is why an amplifier can restore the lower side-bands of a VSB filtered exciter. To avoid accidentally notching your main carrier, tune the filter using a receiver and low power signal or tune to the undesired transmitter signal. Then connect the filter to the transmitter output and make any fine adjustment. ATVQ



BUILD THIS 1280 MHZ CAVITY FILTER

by Art Towslee- WA8RMC Email: towslee@ee.net
180 Fairdale Ave.
Westerville, OH 43081

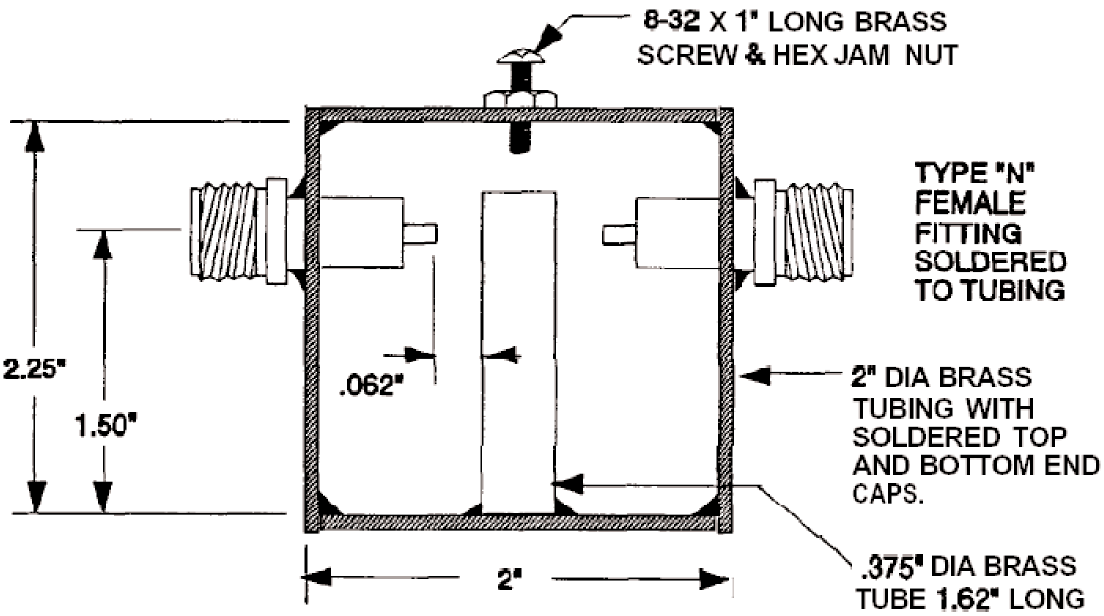
Reprinted from ATVQ Fall 1994

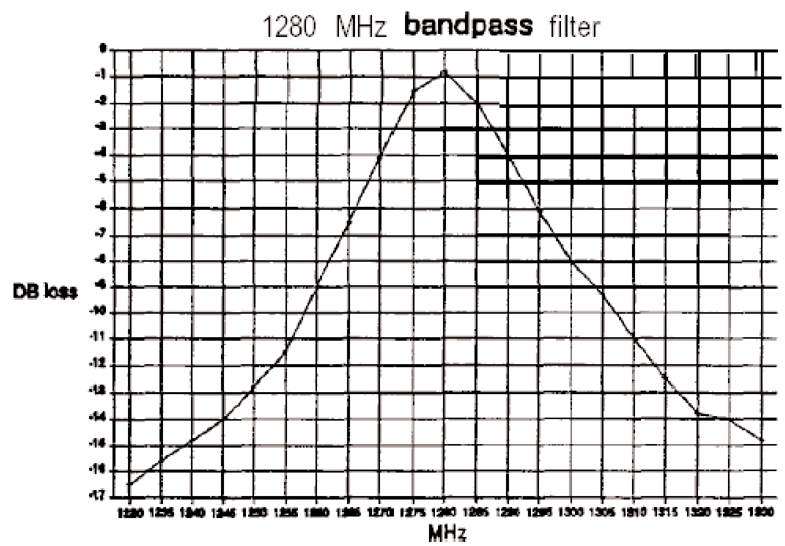
Here is a simple single cavity filter for the 1280 Mhz band The design is the result of a need to provide a front end tuned input for the Down East Microwave 1280 Mhz GASFET dual stage preamp. This preamp has no tuned input stage so its response is quite broad. To minimize unwanted interference from swamping and desensitizing the front end, this filter was born. Now I realize that many of you don't own a lathe that I used to construct this device so use this information to make do with what you have. For instance, a round cavity is not needed...a square one of similar dimensions made out of blank copper clad circuit board stock will also work I used what was available, which turned out to be a piece of 2 inch diameter silver plated brass tubing that I found at a hamfest disguised as some weird sort of RF filter. I look for items like this that can be used for these projects.

In any case, look at the input and output coupling of this design. Not very often will you find a cavity that is not link coupled on input and output. This design uses capacitive coupling to the center post provided by the end of each female "N" fitting. The spacing of about 1/16 inch seems just about right but leave room to be able to slide them in and out to obtain good coupling without reducing the Q too much. Closer provides more coupling and further away from the center post reduces coupling and raises the Q which will affect the sharpness of the bandpass. Also, and probably the most important, is that as coupling is reduced, the loss thru the cavity increases. With a little juggling a happy medium can be found where the coupling is minimized before the loss becomes noticeable. This is not a critical adjustment and "on the air" tests will be adequate but, in my opinion, nothing beats a good weak signal source and RF voltmeter so you can "play with the adjustments" longer.

Note: that even though the "books" indicate capacitive coupling steepens the lower frequency skirt of the curve, my tests show only slight differences. Oh well, it is better and it's easier to construct than link coupling, so..."go for it".

The diagram and graph should provide sufficient data to enable duplication. Happy building! ATVQ





Midwest ATV DX Report

By: Bob Delaney - KA9UVY - Email KA9UVY@hotmail.com
10630 N. Delaney Lane
Mt. Vernon, IL 62864

11/14/03 13:00z WB9PLR, Near Evansville, IN managed to make good sync but not quite a P-1 into Mt. Vernon, IL just under 100 miles. Bill just returned to the air after some antenna work and a couple of years off!

11/16/03 15:35z KC0HFL in EM17 had video from KC5NQ ATV Repeater 421.250 in Dallas, TX it was in for a good while and up to P-4 Color but Bob had no 900mhz to try and get into it

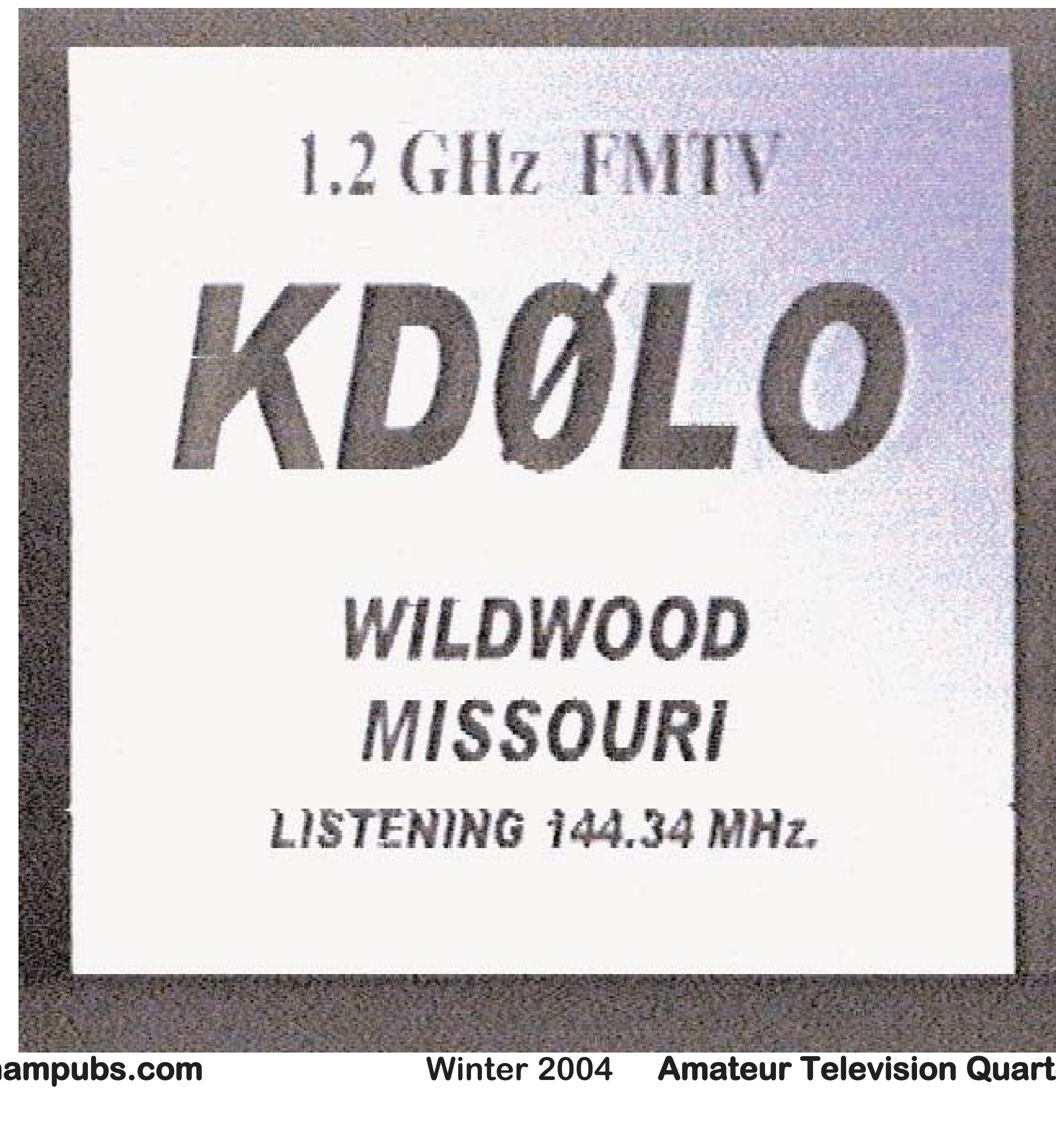
11/17/03 (no time specified) W0IL spotted the Kansas City ATV Repeater WR0ATV on 426.250 coming in at P-3 to P-4 level at his QTH in Pittsburgh, KS. 110 miles

11/17/03 ???? W0IL also worked KD0FW Mike in Independence, Mo. at P-3 signal levels a distance just over 110 miles.

11/17/03 ???? KC0HFL works KA0MR in EM18 approximately 40 miles with P-5 signals on 70cm. They then tried 1.2 GHz and after 2 years of trying KC0HFL makes his first 1.2 GHz 2-way contact with KA0MR with P-4 signals!

11/17/03 02:49z KC0HFL in EM17 spots another ATV Repeater, WR0ATV in Kansas City coming in on 70Cm..

11/17/03 I returned home from the ATV Banquet in Litchfield, IL and was rewarded with a fantastic 1.2 Ghz contact with KD0LO in Wildwood, Mo. John was able to hit P-5 here in Mt. Vernon, IL. It was very foggy here and clear on his end. The St. Louis radar was in clear air mode and showed a very pronounced Red area extending out from St. Louis for over 100 miles. I did manage a Screen capture of KD0LO after he dropped from S-9 to S-2 on the Bensat shown below.



11/23/03 07:00z- 08:00z Tropo did indeed form from here in S. Illinois to the S SE as predicted by Hepburn. UHF TV came in here with up to P-4 signals from Huntsville, Birmingham, AL and Jackson, MS. for about an hour. No ATV activity was found due to the timing and duration of the opening :-(

12/06/03 Some excitement was generated by the Suntracker IX Balloon launch over central Ohio. With ATV on 439.250 the package reached over 110,000 ft and could be seen all over the midwest. Since the packet beacon failed shortly after release you had to look for video only! The first report is my observation of the flight.

12/06/03 18:00-18:35z The video from the package was very stable even below P-1 staying locked from AOS till immediately after burst at approximately 18:35z. I had an incredible QRM like ignition noise on 439.250 but video peaked at P-2 and the callsign KC8MSY was visible along with some of the telemetry indicators.

12/06/03 18:25-18:34z NI0D, Dale of St. Peters, MO. managed to get locked P-1 video but had a hard time making out the text.

12/06/03 18:10-18:30z N9XHU, Leonard in Springfield, IL reported that the balloon made P-1 to P-2 video at his location for about 20 minutes and quickly disappeared after burst.

12/06/03 18:26z-18:30z WB8ELK, Bill in Huntsville, AL received locked P-0 video from the balloon for only 4 minutes

12/07/03 08:40z WB0BIZ/R Davenport, IA repeater output was seen here in southern Il by KA9UVY. It never made better than P-1 but came in and out several times .

12/26/03 No huge opening developed this Christmas but many 2-way video contacts were made from here in southern Illinois with stations in the 100+ mile range over the holiday weekend. Central Illinois stations K9KKL, N9XHU, KB9WLM were worked with up to P-3's and Missouri stations KD0LO, NI0D, K0FPX also were worked at up to P-3 with color and sound. Many of the contacts could have been accomplished on 10 watts or less. Best DX was KB9WLM in Canton, IL @169 miles.

DX Tip: SPOTTING SIGNS OF AN OPENING

One of the simplest facets of ATV DXing is being alert to enhanced band conditions that may come without warning. I can tell you from personal experience that band openings come and go all of the time and simply aren't caught by many of us. The best way you can be alert to these openings is by monitoring the UHF Television stations. With cable and satellite now the main way of receiving our dose of TV entertainment the outdoor TV antenna has become a bit rare.

If you do not have an outdoor UHF antenna or even if you do, I would suggest that you put one on the side of the tower you use for Ham Radio. You need not install a rotor or anything to make it the ultimate DX spotting device. There are many antennas on today's market that will work for this or you can simply get an old UHF loop from the back of the set and weatherproof it for an outdoor install. The key is after you install it you have to watch! Get an idea of what you always can see on it. Depending where you are you might not even receive any stations all of the time but when the band opens up you suddenly will! Most modern TV's and VCR's have a channel set feature and if you really don't want to watch you could simply run this feature every day for a couple of weeks and take note of what channels it grabs. Then when you are available for some DXing run the program again when you come into the shack and see what it grabs. If suddenly it is filled with UHF channels you should take a look and some time to find out where they are coming in from. Point your ATV and 2 meter antennas in that direction and start calling CQ. IF you do chances are a lot better that you will be sending me a nice DX report.

If you have internet available to you there are a couple of other things you could do to catch the next opening. Thanks to William Hepburn a long time TV DX'er and meteorologist, you can check his forecast for Tropo at **http://www.iprimus.ca/~hepburnw/tropo.html**. I have been using this free service that he provides for a good while and I can tell you from my own experience that many times he nails it! Obviously no one is right all of the time but if indeed Tropo develops it will usually follow his forecast map well and you will know which direction to look.

Another good tool available if you have access to the web is the Propagation Logger pages at DXworld.com. There are many pages set up for VHF and UHF work. Remember when using this type of service you should abide by the pages instructions and not abuse a great free service. The page that is used to coordinate VHF and UHF contacts all modes is at **http://dxworld.com/vhfqso.html**

I have coordinated many ATV contacts there since it is not just for prop reports or specific modes.

If you look you will also find the TV/FM DX logger this page is mostly used for posting E-skip loggings of FM and TV stations but you will also see some UHF TV loggings there.

If you make a good DX contact or see ATV DX be sure and post your prop report to the UHF logger page so others can see that ATV works!

Again the above web pages are free and carry no pop up's. They refresh every minute or two automatically or when you hit your refresh button so they are a much better way to coordinate than the ATV remailers etc.

ATVQ

N1URE ATV Repeater
Western Massachusetts

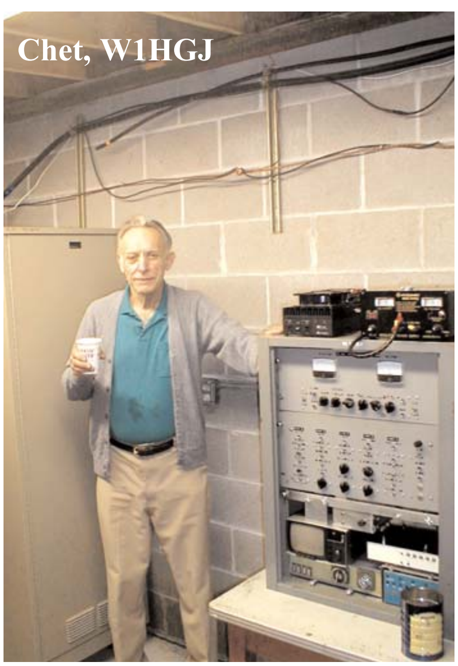

Our ATV slot antenna 200 ft.

ATV is back in Western Massachusetts. After two years of searching for a site, the N1URE ATV repeater is on the air. With the demise of the W1NI repeater in Connecticut, I felt that something had to be done to bring this interesting hobby back to the area.

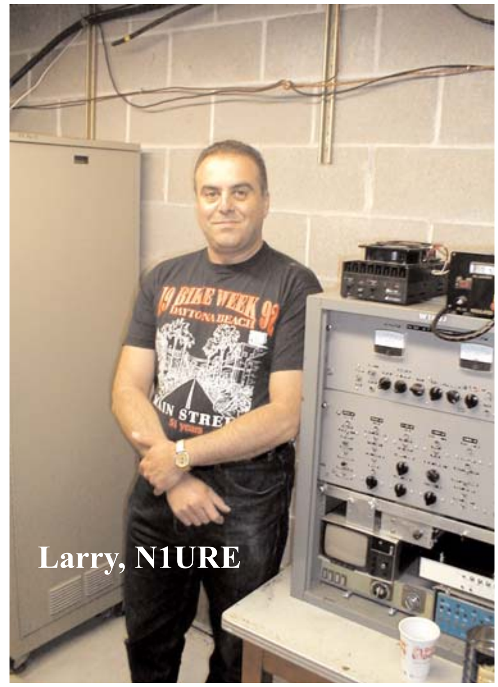
My Elmer and good friend Chet, W1HGJ, helped design a new repeater and antenna system. Sadly, Chet became a silent key last year. So, in the best spirit of ham radio, I completed the building of the equipment. Chet would have been pleased.

The system consists of a multi source controller from Intuitive Systems serving as the backbone. The receiver and exciter are from PC electronics. The ID is an old Elk board that I installed a new EPROM in. A digital voltmeter connected to the receivers AGC circuit provides on screen signal strength that displays as an overlay.

The original design had home made interdigital filters but they were only 6 pole. The 6 poles did not give the isolation and filtering that was required. So ten pole commercial filters from DCI were purchased. The local ham club, Hampden County Radio Assoc. helped with some of the cost. A low pass filter from Mini Circuits NLP-550 was installed on the receiver to remove feedback from harmonics.


Chet, W1HGJ

LMR400 was used for the interconnect cables. I also used some double-shielded coax to supply DC power to the various modules. My first attempt with Chet taught me that stray RF could come from any place you may have skimped on quality! All the DC lines have feed through capacitors. In addition, all video and audio feeds have 100pf bypass caps. The bypass caps work great, as they are very leaky for RF.


Larry, N1URE

The amplifier is a cannibalized 100-watt Mirage unit. I installed filtering caps in the DC line and replaced the DC connector with coax. The amplifier gave me fits at first. It leaked so much RF that the repeater went into a feedback loop! After much searching I found some fine mesh copper screen and wrapped the vent holes with that. Two fans were attached to the heat sink. One fan runs during operation, the second is a backup under thermostat control.

Antennas are rib cage slot design. They were chosen for the horizontal polarization and natural null at the ends. Most interference is vertical so this helps broadband TV receivers cope better. Dug up old ATVQ articles on how to make a slot. They are working without a radome, so far so good. I owe a note of gratitude to Hampden Communications Co. engineer Kurt Jackson. HCC provided the site at no cost. Asking only that I clear scrub brush and keep the site clean. Kurt supplied me with 400 ft of hard-line and connectors too! Thanks Kurt!

Here is the location information.

Amateur Television Repeater N1URE
Input 426.26Mhz Output 439.25Mhz (Cable TV channel 60)
Antenna polarization: Horizontal
Location: Hovey Road - Monson, Massachusetts
Latitude N42 8.35 Longitude W72 20.61 Elevation 880
Antenna elevation 1060
Talk back frequency is 144.34Mhz simplex

Topo maps and other info can be found at:
www.Larry-Steiner.net

also the Hampden County Radio Assoc.
www.hcra.org

Larry Steiner, N1URE
larry_steiner@comcast.net

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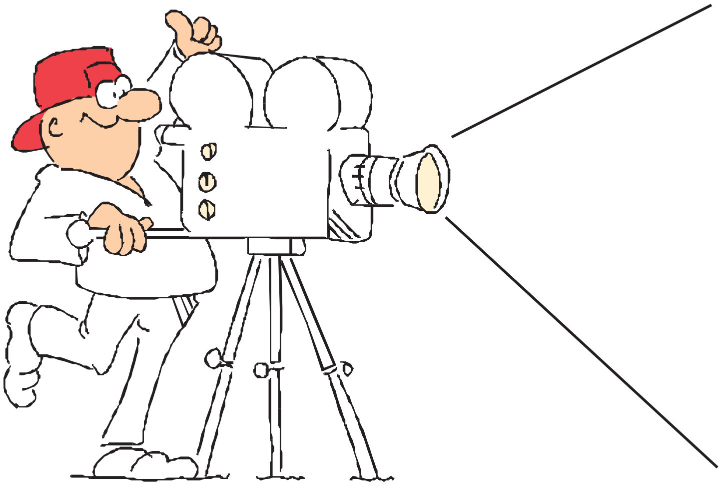

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Gene Harlan - WB9MMM - Editor/Publisher

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EIGHTEENTH ANNUAL ATV BANQUET 2003
LITCHFIELD, ILLINOIS - 11-16-03

Central Illinois/St. Louis Area ATV Club
Scott Millick - K9SM Email:smillick@wamusa.com
222 N. Jackson St..
Litchfield, Illinois 62056

It began as a foggy day but the sun broke through in late morning and a beautiful sunny 65 degree day prevailed for the Central Illinois/St. Louis Area Amateur Television Club's eighteenth annual banquet. Long drives do not deter this dedicated group of ATV operators for another night of renewing friendships and meeting new members. As in the past the annual banquet was held at the Ariston Restaurant in Litchfield Illinois, which is the central point for the club with members attending from the Bloomington, Mt..Vernon, Springfield, Peoria, Champaign, Illinois, Dyer, Indiana, and St. Louis, Missouri areas. There were 42 members present.

Happy Hour began with first arrivals K9KKL and N9XHU. As others followed talk about ATV openings, contests, and equipment reverberated throughout the room.

Scotty, K9SM, called the group to order at 5 PM for dinner. After a few announcements the clatter of dishes, glasses, and utensils and chit chat continued during the course of a great meal and delicious desserts.

Gene Harlan,WB9MMM and publisher of ATVQ Magazine presented certificates for the winners of the recent ATVQ Contest. Flip Minton, N9AZZ won 5th place and Bob Delaney, KA9UVY won 2nd place. Leonard McWhorter N9XHU was the first place winner and was also awarded a plaque for the countless hours he spent looking for contacts during the contest.

With a new traveling trophy the thirteenth annual Central Illinois/St. Louis Area ATV Operator of the Year was presented to Leonard McWhorter, N9XHU of Springfield, Il. Leonard is always looking for ATV contacts in central and southern Illinois as well as DX when the band opens.

Each area gave a report about the ATV activity in their location. This proved very interesting as some of the areas did not know about some of the happenings in other areas.

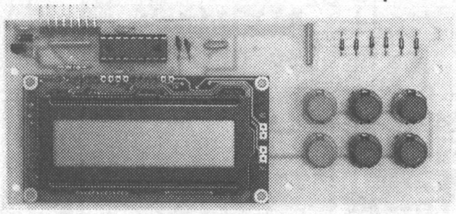
Gene Harlan gave a report about the new repeater that is being installed in the Rockford, Ill area. He also shared information about the problems they are having with 427 output and 1.2

input and by using tuned stubs how this can be dealt with. In addition he also showed maps and talked about the recent contest and the results that were posted in the last issue of ATVQ. He also shared information about BPL and the problems it will cause to amateur radio.

The prize portion followed with the random draw for prizes. Again his year when a person's name was called they picked the prize for the next person. Everyone left with at least two or more prizes. There were two grand prizes this year. A Bird wattmeter donated by Bird Electronics was won by Rick, WD9HRU of Bloomington, Il, and the 900 Mhz Yagi donated by Pacific Wireless was won by W9EX, Floyd Hofmann also of Bloomington. Lady Luck definitely favored the Bloomington area this year.

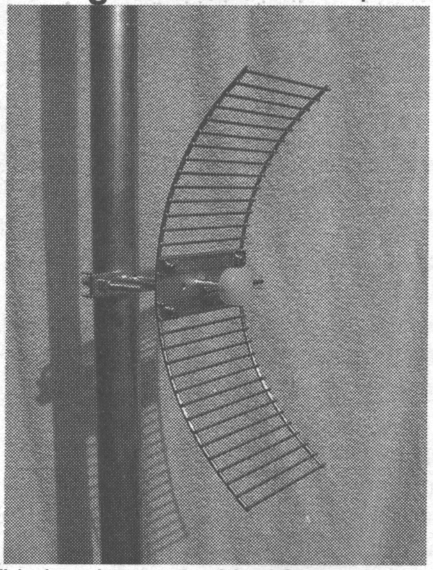
After the drawing more visiting followed and farewells were said. Everyone made their way home and were looking forward to the next banquet scheduled for November 2004. ATVQ

13cm LCD transceiver controller $89.99



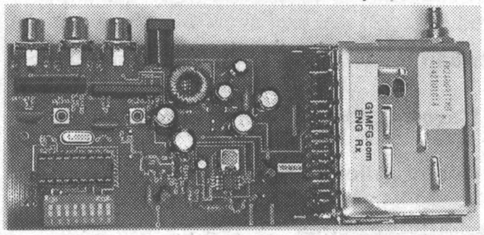
Connects to our Rx & Tx for pushbutton frequency control. Features like our 23cm controller but receives 2.200 - 2.700GHz. Built & tested.
Will not work a transmitter without a receiver.

13cm grid antenna $99.99



Wide band antenna, ideal for use with our transmitters and receivers *or wireless networking*. Transmits great across the **whole** 13cm band, OK for receive 2200-2700MHz! Approximately 13dB gain in 13cm band. Connection is via an integral SMA socket.

'ENG' FM TV receiver 2.20-2.70GHz $109.99



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RF input : SMA female | Video and audio outputs : RCA female
Minimum detectable signal: typically -94dBm (in 20 MHz bandwidth))

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Full review in the next issue of ATVQ!

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MA/COM (or equivalent) SMA plugs for 1671A (large qty available) ....$2.19 ea
Short cable SMA - N adapter....... $9.99 Short cable SMA-BNC adapter ..$9.99
3 metre (~10ft) SMA-SMA aerial cable (see web site for attenuation data) ..$21.95
As above 5 metre (~15ft) ....$27.95 As above 10 metre (~33ft)........$34.95
70cm (435.5 MHz) ATV Tx, crystal controlled, 100mW output, to clear........$99.99
70cm ATV power amplifier kit, 100mW in for 10-15W output, to clear..........$99.99
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TV Technology: Brought to you in Living Color

Peter J. Stonard - Email: pstonard@ix.netcom.com

Peter J. Stonard explains how TV cameras 'see' color.

In America, almost fifty years ago (1956) a colorful peacock cartoon graphic and the voice-over "The following program is brought to you in Living Color on N B C" (*sic*), introduced the earliest regular public broadcasts of color television.

Today it's hard to find a television program that's not in color – even while flipping through the dozens of channels made available by direct broadcast satellite or cable TV services.

The desire to have true to life color in photography, movie film, and later television, was a very powerful goal of each technology's pioneers. Like film before it, television images started off with the successful detection of light and dark (but not discrimination of color) and steadily improved in both sensitivity and clarity (tone, resolution, distortion-free images) before color techniques were attempted. For television broadcasters, (three in the USA: ABC, CBS, and NBC, which was owned by the mighty RCA), a race was on to find the best of several methods to add color to their fledgling black and white service.

Compatible With Black & White

The problem of delivering a robust affordable color television system falls into two tasks – capturing the color of the original production, and transmission of that color-enhanced signal to home viewers, most of whom already had black and white receiver equipment. Compatibility was a major issue. Sales of black and white TVs were very strong after WWII, and no one wanted to obsolete these sets or alienate the set owners, who were needed to create an audience to attract paying program sponsors. The cost and complexity of a duplicate system (one for color and another for black and white service) was quickly dismissed as not practical.

Over the past half century, national broadcast color television has arrived in most countries and due to the parallel development of technology (along with some national politicking and the NIH – Not Invented Here syndrome); the world has three major encoding and transmission standards. They are NTSC, PAL, and SECAM, plus more recent digital signal standards.

Consumer Demands

The way 'television' is used by the mass audiences has changed a great deal over the same period, and simple, cost effective, portable cameras and tape recorders have made 'home video' child's play.

For equipment manufacturers the consumer market is more valuable than serving national broadcasters, or building home receivers, so more development has gone into producing better "home video" products, many of which incorporate the technology originally conceived to meet the higher standards of broadcasters.

During the 1970s and 1980s many interesting home video cameras and recorders were introduced to a non-technical and untrained public. Only the strong and affordable products survived. Many of today's consumer cameras and recorders rival the performance of the broadcast kit in service twenty years ago.

As we will see here, the goals are the same for broadcasters and home systems – namely, good quality and faithfully reproduced color video. However, the consumer products also need to be simple to operate (better automation); and compact (small and lightweight), as well as affordable for the family budget.

Color Science

Color is a human perception, common to most but not all mammals, and likely the result of evolution for survival. Scientifically, color are in fact different frequencies of light waves, and the typical human eye responds most to green light, with less response to blues (shorter wavelengths), and reds, (longer wavelengths). By combining two (or more) components together, called Primary Color, any specific color can be represented.

Additive & Subtractive Color Mix

The two mixing methods give us "Additive Color" - the result of colored light emission (such as found in TV picture tubes), and "Subtractive Color", used in printing and photographic prints that remove (or absorb) specific wavelengths from reflected ambient light. Video monitors (and projectors) form the image by the additive mixing of three lights, namely Red, Green, and Blue. In video cameras, both additive and subtractive methods are used to separate the image into primary color.

Standard human visual response to color was defined by the CIE in 1931, as the Chromaticity Diagram. Figure 1.

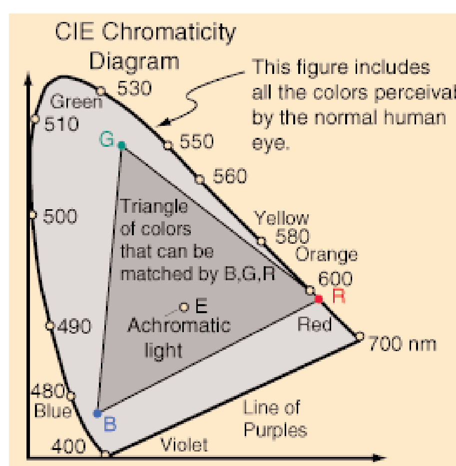

Figure CIE Chromaticity Diagram

Primary Color

The triangle connecting three specific color defines a color gamut or palette of possible color. Each can be synthesized by mixing portions of the three primary color, of Red Green and Blue, (shortened to just 'RGB') which are used in television and similar displays. At equal energy the primary color produce achromatic light (also called monochromatic light).

The reverse is also true. Any unknown color can be defined by the ratio of three components. This is the basis for all color detectors found in film or television cameras.

A limited gamut of color can be formed with just two components. The results are inferior, but two color film cameras hold an important place in history.

As of this writing there is a nice interactive online demonstration of the CIE Chromaticity Diagram, here:

http://www.cs.rit.edu/~ncs/color/a_chroma.html

A simple mathematical relationship defines the magnitude of the three primaries, and any one of the three can be derived by manipulation of the other two. This is a tremendous tool. It reduces the amount of data transmitted in any system (film or television). The basic formula is:

$$Y_{L\ (Luminance)} = 0.3R + 0.59G + 0.11B$$

Complimentary Primary Color

Combinations of any pair of Primary Color gives us three Complimentary Primary Color, which are also powerful tools in both film and video signal manipulation. See Figure 2.

Primary			
☐	R	Red	Y-M
☐	G	Green	C-Y
☐	B	Blue	M-C
Complimentary Primary			
☐	Y	Yellow	G+R
☐	C	Cyan	B+G
☐	M	Magenta	R+B

Figure 2 Primary Colors

The three primary and three complimentary color, along with white and black, form the very familiar TV color bar signal.

Film Pioneers

Before we shift to television camera hardware, let's review a little 20th century film history. The earliest use of color in photography is probably the hand tinting (painting) of monochrome print images. This is obviously not practical for many reasons. Thomas Edison in cooperation with George Eastman invented motion pictures (movies) in 1891; the images were black and white. It fell to Herbert Kalmus, Daniel Comstock, and W. Burton Wescott, who formed Technicolor Corporation in 1915, to invent a two-color film system by 1917.

The Technicolor system

System 1 used an additive color system with special theatre projectors that simultaneously merged a Red image with a Blue-Green one at the screen. Both color images are printed in frame pairs on the positive film stock.

It was replaced by system 2, also two-color, in 1922, a subtractive system that merged the two component images as a single stock film frame the same size as existing black and white movie film. The new Technicolor film could therefore be run in the same theatre projectors used for black and white films of the day.

Following refinements to another variation of the two-color system called system 3 (in 1927), Technicolor released system 4 (in 1932) a true three-color method. It was radically different, and ran three separate black and white films simultaneously through the camera to capture RGB images via colored filters. The three negative films were dye transfer processed (in other words each was colored to one of the complimentary primary color) and stacked to create a single subtractive positive film stock, which ran in standard projectors, but also provided the full gamut of color. These pioneer systems paved the way for color television, by establishing the color science of subtractive primary color mixing, and use of three primaries instead of two to get more realistic results.

Recall that the all-electronic television was still in its infancy at the outbreak of WWII, so color TV had to wait until the 1950s to reach development suitable for the general public.

Color Dissectors

White light can be tinted with colored filters. An obvious method of getting a camera to respond to one color is to fit a color filter over the lens. Do it three times, with three different color, and one will have a three-color camera, which generates the levels of, say, RGB sequentially in the scene.

The next problem is in knowing when to change the filters. If the scene is stationary, and there's time to do it, the filters could be swapped by hand. Not very practical, so the next step is to automate the filters by, say, a spinning disc. Or, by adding two more cameras and keeping one filter of each kind on each of the cameras. Both arrangements were pursued and can be defined as Serial (or Sequential Color) and Parallel Color methods**.** See Figure 3 and 4.

Both have serious drawbacks, not the least of which is incompatibility with existing monochrome television.

The CBS Sequential Color system

First attempted in 1940, and refined for demonstration to the FCC in 1949, the CBS Sequential Color system failed to win support due its lack of monochrome compatibility. However, it was thought quite good compared to contemporary parallel color efforts.

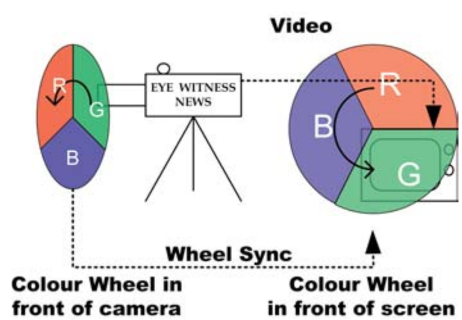

Figure 3 Sequential Color

The CBS Sequential Color system required scanning rates substantially different to monochrome, namely 29.16kHz horizontal rate, 144Hz vertical rate and reduction from 525 to 405 lines, all in an effort to suppress the flicker caused by the spinning filter disc, and also stay within the allotted 6MHz transmitter channel bandwidth.

RCA Dot Sequential system

The FCC evaluated two parallel color systems, both monochrome-compatible and without spinning discs. While the RCA Dot Sequential system avoided the flicker problem that cripples the Sequential Color method.

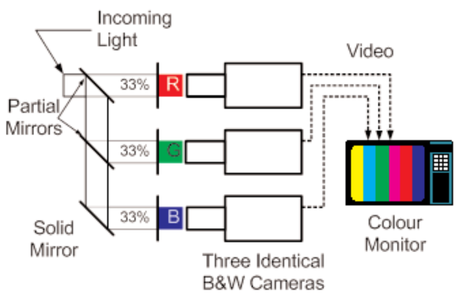

Figure 4 Parallel Color

It shares the single camera lens across three pick up tubes (3 inch IO tubes at the time). But making the images of three single camera tubes match and track proved to be very hard to do! Not to mention the complexity, power consumption, and bulk of the resulting camera system.

In the parallel systems color information is carried simultaneously with the brightness (or black and white) information, through the use of a subcarrier. Phase of the subcarrier determines color (hue) and amplitude conveys saturation. Colorless parts of the image result in no carrier energy. The subcarrier occupies part of the RF spectrum not used by harmonics of the monochrome signal. Perhaps this spectrum interleaving is the closest thing to a 'free lunch' in electronic communications?

Why is it called Dot Sequential?

The color subcarrier may be visible on black and white sets, depending upon their bandwidth and the received RF signal strength. To suppress the visible dots, the subcarrier frequency was chosen to be a multiple of one-half the horizontal scan rate, thus making the dots interleave line by line and be less noticeable. Because the TV frame has an odd number of lines, the dots do not return to the same screen location for two fields, further masking them to the viewer. (On good quality modern video displays, the dots are indeed visible under close inspection, much less so at normal viewing distances).

FCC Rules In Favor Of CBS

The FCC (Federal Communications Commission) was pressured to pick a color standard, and formally adopted the CBS system on 11^{th} October 1950. RCA sued in Federal Court on 17^{th} October 1950 and lost. So RCA appealed to the Supreme Court, which issued a ruling on 28^{th} May 1951, in favor of CBS, allowing CBS to start regular transmissions on 25^{th} June 1951.

By then, 10.5 million monochrome sets had been sold, none of which could receive the CBS signal! The CBS system was stillborn, RCA winning in the end with what became the NTSC system, formally adopted by the second FCC committee of television industry peers in 1953.

How color cameras work

In each case the camera captures the brightness and color of the scene through a lens system, which can be controlled by the camera operator to bring the required scene to correct framing and focus. The camera generates an electrical signal that carries the information to a viewing system (a color TV set or video monitor) that in turn reproduces the same scene as a television picture.

High performance modern color cameras for broadcast service do in fact contain three sets of the parts compared with a similar monochrome camera, to process the RGB channels separately. Plus many extra parts needed to make the three channels work together.

Reducing the three channels to two or even one channel was very attractive, and as we will see, that is where we are today for most non-Broadcast applications. To understand how these work it's easier to start with a three tube design and reduce it to two and finally to a single tube (or CCD sensor) version.

Monochrome Compatible Video

Color data carried in a monochrome compatible color transmission must be ignored by monochrome TV sets. The transmitter channel bandwidth is already defined, so

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‘empty space’ inside the existing RF spectrum is used to carry two color signals in the form of a subcarrier.

Remember that we can find the third color signal by manipulation of two others, assuming we also know the total of the signal (which is the original monochrome signal corresponding to brightness only).

Each of the color-difference components (B-Y, R-Y) is encoded to a single subcarrier by quadrature modulation, which makes an algebraic summation of two subcarriers on the same frequency but spaced in time by 90 degrees – hence the name.

Color Encoding
Using a quadrature suppressed carrier signal (AM), which consists of harmonics that fall between the spectra of the existing monochrome signal, NTSC (and later PAL systems) encoded the color signals in a frequency division multiplex.

SECAM also transmits two color signals in the ‘empty space’ but these are sent by time division multiplexing of two subcarriers, each modulated by FM. Existing black and white sets receive a color encoded signal, but ignore the parts not needed to display the black and white version of the same picture.

The first generation studio cameras placed the signal-encoding task in the control room, as it took a lot of space, and that was in turn fed by three channel signals from the camera head representing RGB content of the televised scene.

Multi-Camera Sync
When more than one camera is used together, such as a studio with three or more, each one is driven by the master timing signals. Alternatively, cameras and other gear can be slaved to a master timing generator, a process often called Gen Locking. For consumer applications rarely do the simple cameras require (or allow) drive or slaving to external timing signals.

Modern cameras include the encoder circuits inside the camera, and the single composite output signal requires only one cable connection. For some applications (such as Chroma Key) the base band RGB signals are available, but for consumer cameras this is not needed.

The typical color TV camera block diagram now takes shape, as shown in Figure 5. The optical image is converted to an electrical signal, in the image dissector function. Depending upon the use of one, two, three, or even four tubes, the signal is processed to get RGB (and Luminance in the case of a four tube camera). Modern cameras further process the dissected color signals to produce composite video in an encoder function.

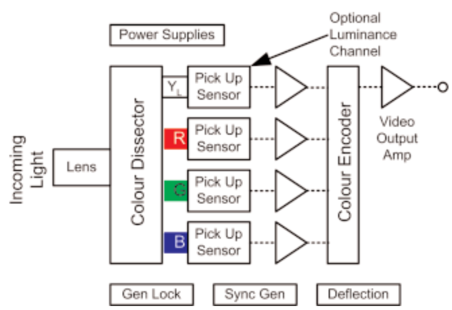


Figure 5 Typical Color Camera

Dichroic Mirrors
If oil is spilled on water a rainbow effect is seen, depending upon the viewing angle and the thickness of the oil. The oil film selectively reflects light wavelengths and acts as a color filter. The same technique is applied to mirrors that reflect only one specific wavelength and transmit all others. Instead of an oil film the mirrors receive several thin metal layers by vacuum deposition.

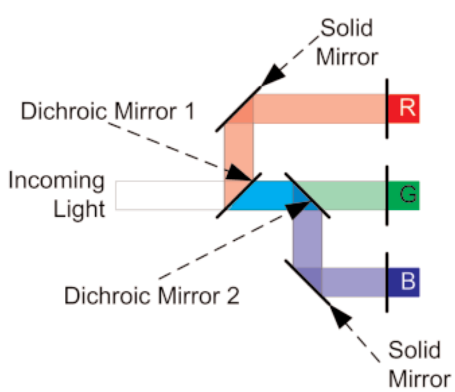


Figure 6 Dichroic Color Dissector

Two mirrors are used in some cameras to extract the red and blue parts of the spectrum. A further benefit is that un-reflected light is not wasted – it continues to the next mirror or finally reaches the green pick up tube - compared to plain mirrors and optical color filters that simply absorb the unused light. Dichroic mirror cameras are therefore more sensitive to light. See Figure 6.

Three (and Four) Tube Cameras
The earliest color cameras, such as RCA’s TK40 and TK41 (1954) used Dichroic mirrors to split the incoming light from the taking lens. (Later TK-41C models switched to prism optics). Each channel then fed a colored glass filter, so that each tube only saw a specific color of the same scene.

The three Image Orthicon tubes had to be matched by selection, and driven by stable scan waveforms so that the three images would overlap – or register – correctly on the display monitor.

The resulting cameras were huge! The Tk-41 four lens turret camera head and viewfinder, weighing 140kgs (310lbs) was about 500mm W x 690mm H x 1.5m Long (21 x 27 x 60 in.) The whole kit weighs about 450kg (1000lbs) including the studio pedestal. Figure 7A

Image quality suffered further by the loss of resolution (caused by those additional lens and mirrors) and the taking lens needed a long back focus to reach the tubes.

This inefficient optical process wasted a lot of light, forcing studios to greatly increase the studio lighting, and then have to deal with all the heat generated by lighting and valve (tube) camera electronics. A single TK41 camera chain required about 3.2 kW of power, and employs 270 valves (tubes)!

Figure 7A RCA TK-41 Three IO Tube Color Camera

Figure 7B RCA TK-42 Four Tube Color Camera

To address poor resolution RCA introduced the TK-42 (1965) with a fourth tube to capture the higher resolution luminance signal immediately after the first splitter mirror. Three color channels used smaller vidicon tubes along side the 3in IO tube for luminance (Y_L). See Figure 7B

Modern Parallel Optics

An advantage of the mirror system is that all three tubes are parallel, and the entire optical box can be sealed against dust and dirt. Relay lens in the optical path allows the use of the more flexible zoom taking-lens. Pick-up tubes can be impaired under the influence of stray magnetic fields, even those from the earth's field. Parallel tubes tend to track under these conditions, compared to prism optics (see below). Figure 8 shows the JVC KY1900 camera, of 1984 vintage. It was the first three-tube camera to sell in the USA for under $5,000.

Figure 8 JVC KY-1900 Camera with Parallel Optics

Unfortunately the performance of the Dichroic Mirrors varies from top to bottom of the picture. This is attributed to the approach angle of incoming light from the relay lens, which vary slightly off axis. Corrections can be made electronically, by modulating the gain of each of the RGB signals at the vertical scan rate.

Prism Optics

A further refinement of the camera color dissector was made with the introduction of a glass prism block. See Figure 9.

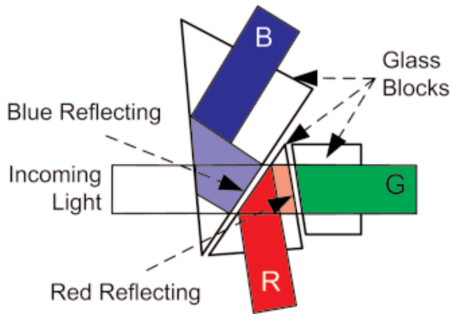


Figure 9 Prism Optics

The Dichroic coating is applied to glass wedges that in turn are cemented together and held in a metal frame. The prism has four facets, one for input and one each for the RGB tubes. Prism optics are superior to parallel optics, because less light is lost, the glass has a higher refractive index leading to compactness and photographic 'speed' of typically f1.4. Plus the system is inherently robust and free from dirt or dust contamination. Systems with three tubes and a prism outperform the four tube mirror optics cameras, allowing only three tubes to be used with prisms.

The prism system is more costly, and had the major downside of the three exit ports protruding at odd angles to each other. Prism cameras have a characteristic shape due to the fixed placement of the pick up tubes. Typically the blue tube is place uppermost, and more prone to tube damage (debris falling on to the target layer inside the tube). This is minimized by the fact that blue is only eleven percent of the total signal.

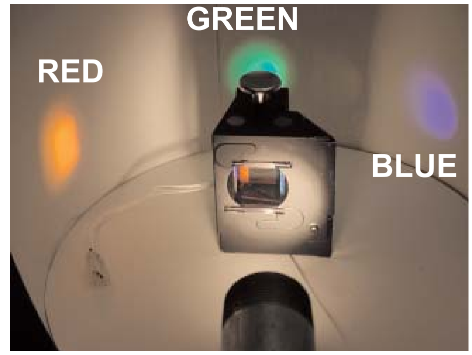


Figure 10 Prism Demonstration

A simple 'parlor trick' demonstrates spitting of white light from a lamp with a prism block removed from a tired RCA Tk-44 camera, and is shown in Figure 10. A contemporary prism block is shown in figure 11.

Figure 11 Sealed Prism Block, with three 18mm tubes

Prism optics is used by choice on modern three tube and three CCD cameras, such as the Ikegami ITC-730A and HC-200, shown in figure 12. The HC-200 has three 13mm (1/2 Inch) CCD imagers – no wonder the CCD cameras are much smaller!

Two Tube Cameras

Removing one (or more) tubes from a three-tube camera is highly desirable. It reduces the cost, complexity, and extends reliability substantially. So for non-broadcast cameras the goal was to operate with just one tube.

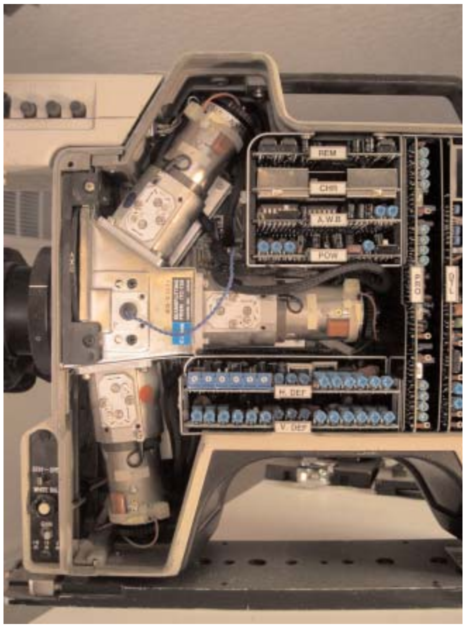


Figure 12A Ikegami ITC-730AP 3 Tube Prism Arrangement

Figure 12B Ikegami HC-200 3 CCD Prism Arrangement.

A step in that development and marketed during the 1970s was a two-tube design, where one tube is for monochrome and the other for the chroma or color signal.

In two-tube cameras the electronics are burdened with decoding the chroma tube's output, and mixing it with the luminance signal, before further encoding to an NTSC or PAL composite signal. Three tubes, and more importantly the precision mechanical and optical components, cost much more than the equivalent electronic parts found in two-tube cameras. So shifting to electronic color dissectors is not only good business sense but was also the area where even further miniaturization and power reduction with better integrated circuits was achieved later (1980s and '90s).

The AKAI VC-150 camera (1976 vintage) in figure 13 has is a simple 50% prism optical system that splits the image into two paths. As these are at 90 degrees to each other, one tube is on axis with the lens and senses the monochrome component, while the other one at a right angle, has a red-blue sequence striped filter. Both vidicon tubes are 18mm size but the north-south tube is hidden in the rather fat handle!

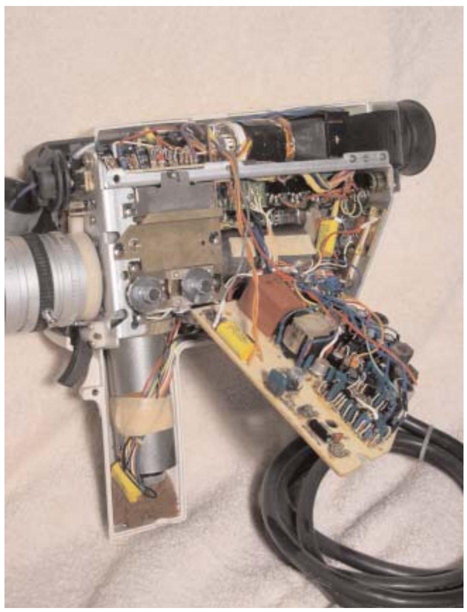


Figure 13 AKAI VC-150 Two Tube Color Camera with 18mm Vidicons

A different approach is taken by JVC, in the two-tube camera model GC-4800U shown in figure 14, also from 1976. The luminance vidicon tube is placed north and south above the splitter block. Did they forget that tubes should not be operated face down to prevent internal debris from landing on the rear of the target and ruining the tube?

The chroma path is fitted with a complex 4 color (clear/cyan/magenta/blue) vertical strip filter in front of the 18mm Vidicon tube. The optical chroma stripe filter requiring complex alignment if the tubes are replaced in the field.

So, if the chroma filter could be integrated into a single pick up tube faceplate, and still generate good resolution monochrome signals, one would have that single tube camera!

Single Tube Cameras

Before looking at the all-electronic striped filter cameras in detail, here is a couple of one of a kind oddball color cameras.

Figure 14 JVC GC-4800U Two Tube Color Camera

NASA Apollo Eleven TV Camera

Faced with limited TV camera technology in the mid 1960s, NASA revived the CBS field Sequential Color scheme to carry a color camera to the moon in 1969 aboard Apollo 11.

Figure 15 Field Sequential Color Camera used by NASA for Apollo

(Photo Courtesy of www.tvhistory.tv)

Inside the single tube camera a spinning RGB optical disc was used to collect video, see figure 15. There are no registration issues with the single tube, or any color channel circuit drift, even with the wide temperature and light level swings of the moon. Further, the camera was slow scan, with just a ten frames per second rate to conserve bandwidth and boost the signal to noise ratio for the quarter million mile (about four hundred thousand kilometers) transmission back to earth.

Great technical pain was endured by NASA to get the NTSC and PAL video signals that were seen live on worldwide television. The story can be found here, thanks to Tom Genova at TV History: **http://www.tvhistory.tv/NASA-Camera.htm**

JVC Graphics Capture Camera

In 1988 JVC announced a special purpose camera for the fledgling computer graphics and artwork market.

Figure 16A JVC TK-F7100U Field Sequential Color Camera

The JVC TK-F7100U used a spinning Dichroic color wheel in front of a 18mm Saticon tube to capture RGB sequence pictures at 1024 x 1024 resolution. The camera requires an external computer graphics capture card to operate. The original cost was $7,995 (about £4,800)! See figure 16.

Figure 16B Color Wheel Mechanism (JVC TK-F7100U)

Video Projectors with a Color Wheel

Also of note is the modern video projector for home theatre or office conference rooms that use DLP (Digital Light Processor) technology from Texas Instruments. A single DMD (Digital Micromirror Device) is coupled to a spinning color wheel light filter. More details are here:

Single Tubes with Vertical RGB Stripes

One simple method of getting a chroma signal from a single tube is to place a repeating vertical strip pattern on the faceplate. As the single scanning beam crosses the Red filter section the output is only for Red, then on to Green then Blue and so on.

However, if one forgets where one is in the sequence the resulting color will be wrong! A black index stripe was added to synchronize the gating of the video signal to three sample and hold circuits, each holding the R, G, or B signal until the next group of stripes are scanned, as shown in Figure 17.

These cameras were not very good by today's standards while the colors are accurate; they have a very soft image. Sony introduced a single one-inch (25mm) tube low cost studio color camera in 1974 (DFX-1000). The resulting resolution falls to just one quarter of that produced by the same tube in monochrome service, because each picture element is four times wider. Quadrupling the stripes and using a very fine beam was desirable but not possible at the time.

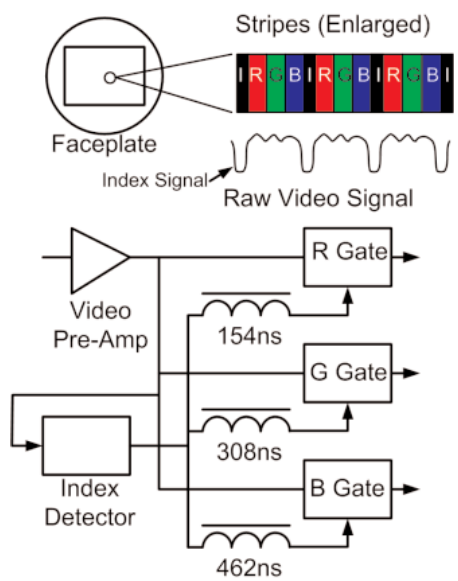


Figure 17 RGB Striped Tube Color Dissector and Decoder Circuits (Sony)

Sony Trinicon Tube

A further development of the vertical stripe filter was made on a vidicon tube, and called the Trinicon. The family of cameras was very popular well into the

1980s, with models DXC-1200 (one inch tube) for semi-professional studio use, and DXC-1820 (18mm Saticon tube). The Sony cameras performed better than those from JVC, Panasonic (and others) intended for VHS systems, so it was common to see a Sony camera connected to a competing brand VHS portable deck) for home video outdoors.

The Trinicon tube is very odd in that three electrodes are present at the faceplate, and an external AC drive signal is applied to two of these!

The reason is that the faceplate has a striped optical filter in RGB sequence, which overlaps two separate stripped target electrodes. An H/2 square-wave drive signal is added to the target's DC bias by transformer, and this selects either the odd or even lines. Also note that the Sony Trinicon tube is electrostatically deflected, and has zigzag electrodes etched into the glass.

A dissector circuit built around a pair of one-line delay brings the "line n" and "line n+1" data together to separate out the color-difference components. The Sony dissector block diagram is shown in figure 18. The circuitry of the day was somewhat limited, as only the modulators were ICs (integrated circuits) along with lots of discrete transistors.

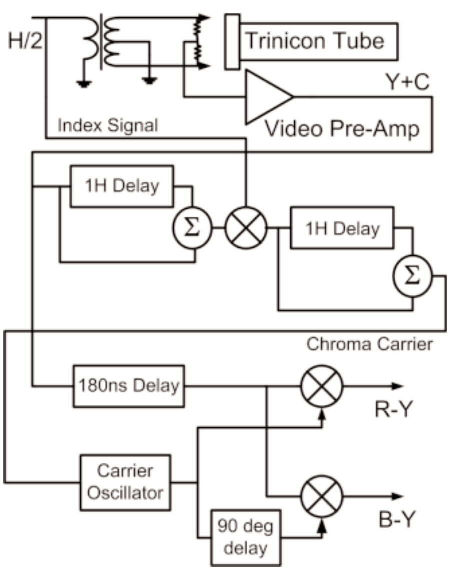


Figure 18 Trinicon Single Tube Color Decoder (Sony)

Hitachi Tri-Electrode Tube

One of the first portable single tube cameras to reach the market in 1976 (Hitachi GP-5, also branded as the Zenith KC-1000) took a slightly different approach to the problem. See figure 19.

Instead of a clever stripe scheme that places the chroma video components on a carrier signal, as described later, the tube has three faceplate target terminals, one each for RGB. This is possible because the one-inch (25mm) vidicon photoconductor layer (see the CQ-TV199 article for a general explanation of camera tube operation) is segmented into three stripes and aligned behind the RGB optical filters.

For the Hitachi tube there is no color dissector electronics! The triple channel preamp feeds directly into an NTSC encoder. (The author would like to know if a PAL version exists?)

Single Cross-Striped Filter Cameras

The most successful single tube technique is called "Single Carrier Frequency Multiplex Method" and it has outlasted all other single tube techniques due to simplicity and good performance.

Single pick-up color dissectors continue to serve us well today with a CCD replacing the tube, and DSP (Digital Signal Processing) replacing the analogue signal circuits first developed in the 1970s and '80s. Clearly, gains are made in both size and power consumption by eliminating the tube. See figure 20.

Figure 19A Hitachi GP-5U Single RGB Tube Color Camera (1976)

The Single Carrier Frequency Multiplex Method

A single tube is manufactured to include a fine pitch crossed diagonal stripe filter, directly on the faceplate. Other marks are placed to assist production at the factory and also generate an optical black mask (to constantly null the tube's temperature dependent dark current).

The stripes identify two color (red and blue) by the subtractive color separation method. The output is a monochrome DC coupled signal like any other tube, plus an AC component that is only present when either red or blue (or both) light is received.

JVC cameras used a slightly different technique, which required sets of three stripes of green, cyan, and clear. While Panasonic (and others) have sets of two stripes – one filter stripe is alternating cyan and clear, while the other one is alternating yellow and clear.

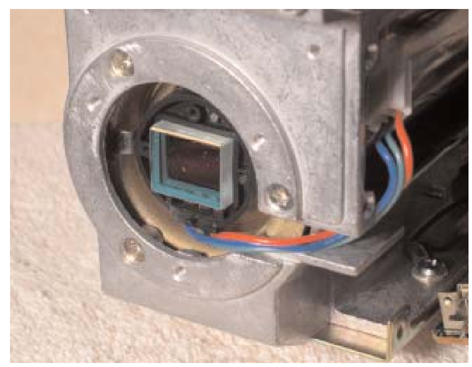


Figure 19B RGB Vidicon Tube with three target connections

Figure 0 One Inch Color Tube (1974) alongside an 8mm Color CCD (c1995)

As the beam crosses the filter stripes the signal is modulated with a carrier frequency that is determined by the scan speed (horizontal scan time) and the number of stripes per line scan length. Typically this frequency is higher than the system luminance video bandwidth, say 6MHz for the modern "High Band" (tubes and CCDs), so a low pass filter can remove it from the luminance channel without spoiling resolution. Because the two sets of stripes are at equal angles but in opposite directions it takes four lines for the sequence to repeat, see figure 21.

On the first line (N) the signal alternates B+G (the red is blocked by cyan filter stripe) and R+G (blue is blocked by the yellow filter stripe).

On the next line (N+1) where both filters cross both red and blue are removed, leaving only green. In the places where both filters are clear, red, blue, and green are all transmitted to the target.

On the third line (N+2) the red and blue are present but in opposite places, because the filters are placed on a diagonal.

The fourth line (N+3) is similar to the (N+1), but notice that the red and blue components are delayed by 90 degrees.

Line N+4 is the same as line N, and so on down the vertical scan. On each line the phase of the generated subcarrier is offset by 90 degrees of phase delay.

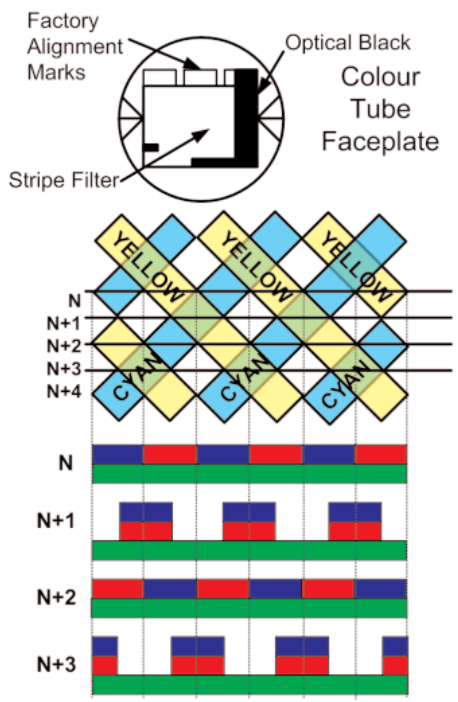


Figure 21 Single Tube Color Dissector (Panasonic)

In the color decoder circuit block diagram of figure 22 the chroma signal is delayed by two delay lines one is exactly one horizontal line (typically a glass block delay as found in PAL decoders), the other is 90 degrees delay at the tube's chroma carrier frequency.

Manipulation of both delayed signals is decoded to base band R and B, and further processed to standard color difference signal (R-Y, and B-Y), which can be readily encoded to composite NTSC or PAL video.

The early single tube cameras were often not very good because of the demands on the tube's focus and scan stability limited their performance. Often additional electronics were added to correct these distortions. Some of the early cameras used Vidicons, which have poor black level stability and noticeable lag that only effects the green channel, hence the murky green tinted scenes when the cameras were panned.

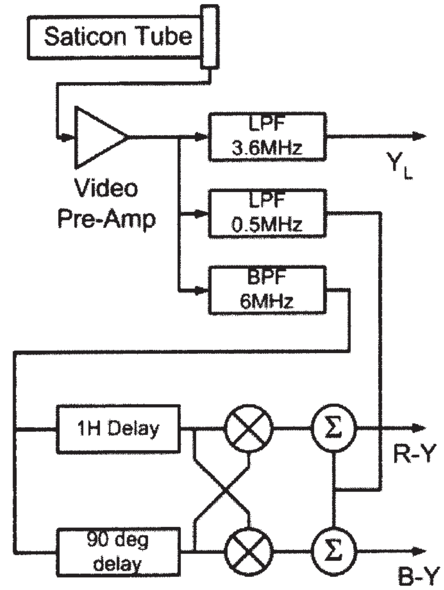


Figure 22 Single Tube Color Decoder (Panasonic)

Scan linearity and corner focus is critical too, as poor focus will reduce or eliminate the subcarrier altogether. There were many interactive analogue tweaks and adjustments to get one of these cameras tuned up! See figure 23.

Figure 23 Single Tube Set Up Adjustments

Note the array of pots that control shading and geometry of the single tube.

Tubes were later upgraded with Saticons and Newvicons, which resist burn-in and have almost no lag or smear. Decoder circuits were further improved with edge enhancement circuits.

As the manufacturing improved, the tubes were scaled from one inch (25mm) to 18mm, 12mm, and even a diminutive 8mm! See Figure 24.

Because processing the chroma signal requires an exact delay of one scan line, early designs borrowed components from PAL receiver technology that also requires a similar delay line for different reasons. Therefore the single tube camera designs were often geared to these parts, with resolution limited to about 330 TV lines. (Justified for home video use because the recorders weren't much better – Beta 300 lines, VHS 240 lines).

Later, higher resolution ("High Band" tubes) was made possible by the development of CCD delay lines that are smaller and cheaper than the glass block types used earlier. This resulted in a 18mm Saticon tube with "High Band" 6MHz chroma subcarrier found in the Panasonic S1 (a.k.a. WV-6000) camera (1985), shown in figure 25.

Figure 24 Family Of Color Tubes

(L to R): One Inch (25mm) vidicon with two stripes (unknown type). 18mm (2/3in.) Saticon (S4165), 18mm Trinicon (CT2554), 13mm (1/2in.) Saticon (S4161), 13mm Newvicion (H4183), 8mm (1/3in.) Newvicon (S4400).

This was probably one of the finest single tube cameras and also the last one to be manufactured. Better CCD devices had eclipsed the tube technology by 1990.

Single Tube Problems

In all single tube designs the horizontal scan amplitude is very critical, as it's size directly affects the frequency of the resulting chroma subcarrier.

When the scene has bright colored highlights the chroma component is often squashed by limited dynamic range of the tube reserve beam current and limits in

Figure 25 Panasonic S1 "High Band" Single Tube Camera

the video amplifier creating unnatural false color (usually greenish). Even CCDs have their problems, where bright overloads can cause streaking, even in three-CCD cameras.

To get around the false color error in single tube or CCD designs, the camera kills the chroma signal in highlights to leave just white. A dead giveaway is video of cars with 'white' brake lights! The video shot of fireworks is also disappointing.

Care is needed to remove high frequency optical detail from the scene that may interfere with the color dissector operation. This is most obvious when the camera sees a loud checker cloth jacket, which produces a wild color moiré error. The solution (apart from better fashion sense….) is to add a low pass optical filter before the pick-up tube, usually made of a quartz crystal.

All modern camera tubes are sensitive to long wave (red and infrared) light, so an IR cut filter is also added to the optical path. Even so, it is possible to 'see' the light from an IR remote control if it is pointed at the camera!

The author wishes to thank Tom Genova for the NASA camera information and PIX.

Further Reading

Video Cameras: Theory and Servicing
Gerald McGinty ISBN 0-672-22382-1

Handbook of Video Camera Servicing & Troubleshooting Techniques
Frank Heverly ISBN: 0-133-82789-5

Photos by the author, unless noted otherwise.

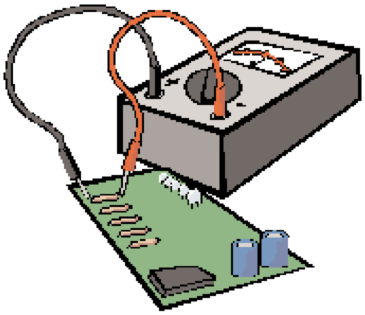
Robert S. Bennett, W3WCQ, SK

Bob Bennett, W3WCQ, of Baltimore, Maryland, died December 6. He was 67. Bennett was an ARRL Atlantic Division Assistant Director and, as president of the Baltimore Radio Amateur Television Society (BRATS), was well known within the Amateur TV community. "W3WCQ was our expert on ATV," said Atlantic Division Director Bernie Fuller, N3EFN. "He will be missed." Bennett also was an acknowledged expert on weak-signal VHF work and once served as the Atlantic Division representative of the now-defunct VHF-UHF Advisory Committee (VUAC). ARRL Vice President Kay Craigie, N3KN, was among Bennett's many friends. "I respected him not only for his technical knowledge and willingness to share it with others, but also for his good humor, common sense, candor, and ability to speak and write extremely well," Craigie said. "He was a valued advisor to several Atlantic Division directors, myself most definitely included." An ARRL member, Bennett also belonged to the Quarter Century Wireless Association and served as a local chapter president. A service was held December 10.

Loyce (Kip) Turner, W4KIP, SK

Loyce (Kip) Turner (W4KIP) passed away on December 17, 2003. Kip had brain surgery in September and passed away due to complications from that. Kip was an inventor, an engineer and a close friend to many ATVers. Kip was the inventor of the "Hawg Fence" antenna that allowed newcomers to have reasonably high gain for less than 5 dollars. Funeral arrangements will probably be Saturday December 20th at Carmichael Funeral Home in Smyrna, GA.

More information will be posted on **http://bsrg.org** as it becomes available.
Ralph, N4NEQ, ralph@ralphfowler.com



Sparks from the Bench

by Ron L. Sparks - AG5RS - Email: atvq@sparkles.com
P.O. Box 945
Katy, TX 77492

Getting Started in ATV
A Regular Featured Column!

The whole point of this column is to give anyone the ability to bypass the hurdles and jump right into having fun with ATV. If you already know your way around, then please copy this column and give it out when you do your Elmering. If you are a "newbie", then welcome – you will find ATV loads of fun.

The good news is that very few ATV'ers feel threatened by anybody and so getting started is really easy! Notice I said, "threatened". Our hobby is plagued by two problems which often make it unnecessarily hard for newcomers. This is particularly true for those who are unlicensed and looking for a reason to get their "ticket". Some will be offended by my assessment of these problems, but my objective is to make it easy and interesting for people to try out Amateur Television (ATV), not necessarily to try to be "nice". By being aware of the pitfalls, things will be easier for newcomer and Elmer alike.

Both these problems arise from our strengths so lets be honest about them. By doing this we can convert them from problems to strengths. First, the strength and reliability that comes from a spread out, redundant, self healing organization causes information to be scattered and disorganized. Second, the technical expertise and practical know-how that creates a unique membership often causes "outsiders" to be forced through barriers designed, subconsciously (I hope), to protect the "insiders".

If you want to test the second point, just pick a fight between the "outside" and the "inside" by honestly asking "Why?" Then sit back and listen. A simple equality can be used: The volume and duration of the ensuing argument equals the strength of the threat the "inside" defenders feel. Typically the more threatened they feel, the more arbitrary and difficult the hurdles to join will become. As you will see from the rest of the article, these are the only real problems. Once you get over them the rest is — well, easy.

Five Simple Steps

There are five simple steps to getting started in ATV. The secret of these five steps is that they are no secret. They are the same steps that you can take to solve anything. Here then, is the formula.

1. Develop Curiosity

The first step is to decide you are interested and begin looking at your options. The glossary in Figure 1 should help explain what ATV is and clear up some of the jargon. Just like deciding to become a Ham, what aspect of ATV to start in is very personal and depends on your desires. For example, do you want to help a specific charity or organization with your skills? Do you want to aid in emergency response? Do you want to create a different view of the world by seeing from the level of your pet, your radio controlled model, or the top of your antenna tower? Do you want to monitor some area remotely? Would you like to have a "looky talky"? Would you like to create a network of mobile cameras for traffic monitoring? Do you want an inexpensive way to experiment with microwaves? Are you wanting to try something really exotic like ATV via satellites? Do you want to see what the other ham is talking about? As the self tests often say, "If you answered yes to any of these questions you are a candidate."

2. Finding Where you Are

The next step is to find out where you are. I mean this from both a physical sense and an equipment standpoint. A list of areas with activity in ATV is easily found in the ARRL Repeater Directory. All of the areas shown to have ATV repeaters are listed there and the list is growing daily. If you are not in an area covered by a repeater, do not give up. There is plenty to do even without repeater access. While you are checking the activity in your area, do not forget your local ham clubs.

Most of the people in these clubs are willing to point you toward others with similar interests. There are even some clubs which are specific to ATV. In the Houston, Texas area the Houston Amateur TV Society (HATS) is active and devoted entirely to ATV. If you are already licensed you have probably made the necessary contacts through the testing process, existing club, or local repeater. You just need to ask these same people about ATV.

If you are not yet licensed, this is where the first principle I mentioned earlier has to be overcome. It is often hard to find a club if you do not already know of one. Most clubs have a limited budget and operate by volunteer efforts. As a result they have limitations on how much general publicity they can do. A way to find them without internet access is to contact the ARRL at 1-800-32 NEW HAM (1-800-326-3942) and ask them for contact information on Volunteer Examiners (V.E.s) in your area. These V.E.s will almost always be connected with a local club. They will also be interested in explaining how you go about getting licensed. By attending one or two club meetings you will make the contacts you need to find the ATVers in your area as well as other ham information you may be interested in.

If you are new to a club (even if you are not new to electronics or ham radio) be prepared for the second principle I mentioned

ATV	Amateur Television is often called ATV. Most often this means transmitting and receiving video and audio at normal speed. Sometimes called Fast Scan TV (FSTV).
Cable Box	A cable box is a set top converter which allows signals outside the normal broadcast band to be downconverted to channel 3 or 4 for viewing on any TV. These are usually not sensitive enough to be used in ATV.
Cable Ready	A cable ready tuner on a TV or VCR is designed to pick up signals outside of the normal broadcast band. See Figure 2.
Composite Video	A composite video signal is one which contains the base band video with the proper (i.e. NTSC, PAL, SECAM, etc.) synchronization pulses and color information. This will typically have a voltage peak of about 1 V and a bandwidth of 4.5 to 6 MHz.
Downconverter	In tuning the ATV frequencies on a regular TV some form of down conversion is required. While this may sound complicated to a newcomer it is probably built in to sets that are cable ready.
DSB	Double Side Band is an extremely simple mode used for most microtransmitters. It is also wasteful of band and power. In all but the least expensive or smallest transmitters the lower sideband is filtered out with a Vestigial Sideband (VSB) filter. Modern TVs will receive a DSB signal just as well as a VSB filtered signal due to filtering in their IF sections.
FSTV	Fast Scan Television is a synonym for ATV. It implies that the transmitted frame rate and scan speed are the same as those of an International standard.
NTSC	National Television System Committee is the group that set up the way TV is broadcast in America. Because of its phase ratio heritage, it is often jokingly taken to mean “Never The Same Color” from the way color is encoded without an absolute hue reference. The picture is transmitted at 59.94 fields per second with two interlaced fields of 262.5 lines making one frame. The line rate is 15.734 KHz.
PAL	Phase Alternating Line is the TV standard for broadcast in the U.K., Central Europe, Scandinavia, Asia, Australia, and much of South America and Africa. It comes in several “flavors” such as PAL-I which affect the way the sound subcarrier is transmitted. The U.K. uses PAL-I. The picture is transmitted at 29.94 fields per second with two interlaced fields of 312.5 lines making one frame. The line rate is 15.625 KHz.
SECAM	Sequentielle Couleur Avec Memorie is the French originated TV standard that is used in France, Eastern Europe, Russia and the former Soviet States.
VSB	Vestigial Sideband filters are used in the transmitter to eliminate the lower sideband component. As with Single Sideband (SSB) phone transmission, this is the most power and spectrum efficient means of transmitting the signal. The main difference between a VSB and a SSB signal is that the carrier is still present in the VSB signal while it

Figure 1 - What did he mean when he said ...?

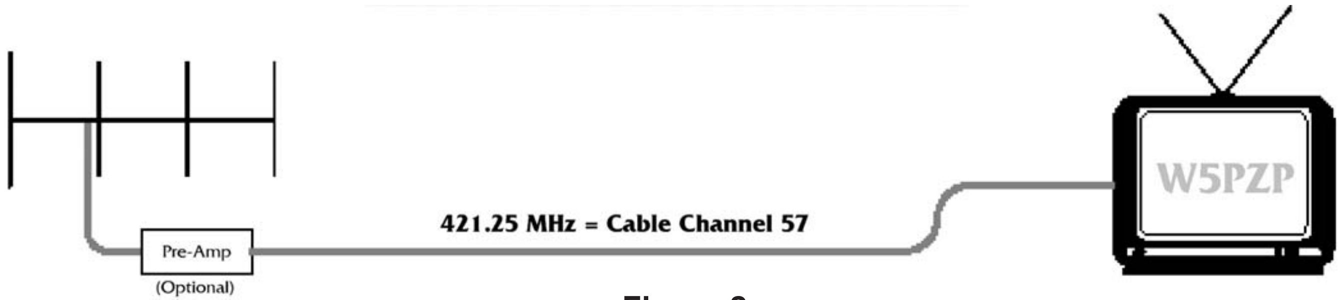


Figure 2

to come into play. Many club members have been in the organization for a long time and they forget how intimidating a room full of stony faced strangers can seem to a newcomer. Just keep in mind that they enjoy the same thing you do or they wouldn't be there. Don't take the "I thought everybody knew that" comments personally. They have been doing it so long, they really do think everybody knows. A few honest questions will almost always open them up. One final tip, a wise friend told me "Repeaters and ham clubs are a lot like your local bar or pub. Each has a different character of clientele. You should not be hesitant to move around until you find one that matches your personality. Make that fit and before long it will seem like a comfortable shoe."

Licensed or not another good way to find ATV activities is by an internet search. Virtually all clubs and individuals put up a web sites. The thoroughness of this resource is continually improving, especially since the phrase "To Google" has reached verb status. Two Uniform Resource Locators (URLs) that are good starting points are the HATS homepage at **www.hats.stevens.com** and **www.gthelectronics.com/link2tc.htm#USTC .** These pages have links to a lot of ATV information and activities. If you are in need of general ham information or lots of links to good ham related sites you might want to try starting at **www.clarc.org/**. There is also a wealth of general information available by going to the QRZ website or the ARRL website at **www.arrl.org** .

3. Planning Where to Go

The absolutely cheapest way to try out ATV if you live within 25 miles or so of a repeater site is with a Receive Only (RO) setup. Most of you probably already have all the equipment and know-how it takes. Figure 2 (thanks N5JXO) shows that the 70 cm ham band, often used for repeater output, can be received on cable ready TVs or VCRs. Also, most ATV in the 70 cm band is AM, just like your regular TV and VCR. Check the repeater directory or your local club that you found in the above step and see if they are on one of the channels shown in Figure 3. If so you can rig up an RO setup in 15 minutes. Just connect a good UHF antenna to the antenna input of your cable ready set but put it in the Cable Ready mode. Then tune to the proper Cable channel and you should see the repeater. Some people in the Houston area are even able to do this with "rabbit ears"! One note, however, cable converter boxes will usually not work in this application. They are generally designed for the high level signal from the cable and are not sensitive enough to work with an antenna.

You may need to experiment with whether to place the antenna horizontally or vertically. This depends on the repeater antenna polarization. Here in Houston the output is horizontal and the input is vertical. That may be pretty common because it allows yagi or TV style antennas to be placed normally (i.e. parallel to the ground) for receive. The transmit antenna back to the repeater can then be a vertical whip (great for mobile use).

But, what about the antenna you might ask. That is no problem either. If you are fairly "close in", the antenna can be a surplus UHF TV antenna. If you want to experiment and build your own antenna, Kent Britain, WA5VJB, has an excellent note on using wood beams and 1/8 inch welding rod to build a 12 dBi yagi for any of the ATV or AMSAT frequencies. I went this simple route for my first system and was receiving the HATS repeater for a total cost of $15. Assembly took 20 minutes and the antenna is only 4 foot long by 1 foot wide. It is gave me snow free pictures even though it was mounted inside my attic and located 24 miles from the repeater. That $15 was my total investment to get started.

If your local repeater is on a 1.2 GHz frequency and uses FM –

Cable Ready Tuner Channel (MHz)	Lower Edge of Band (MHz)	Upper Edge of Band (MHz)	Video Carrier Frequency (MHz)	Color Subcarrier Frequency (MHz)	Sound Subcarrier Frequency (MHz)	Cable TV Band Name
57	420	426	421.25	424.83	425.75	Hyper
58	426	432	427.25	430.83	431.75	Hyper
59	432	438	433.25	436.83	437.75	Hyper
60	438	444	439.25	442.83	443.75	Hyper
61	444	450	445.25	448.83	449.75	Hyper

Figure 3 - Cable Channels in the 70 cm. Ham Band

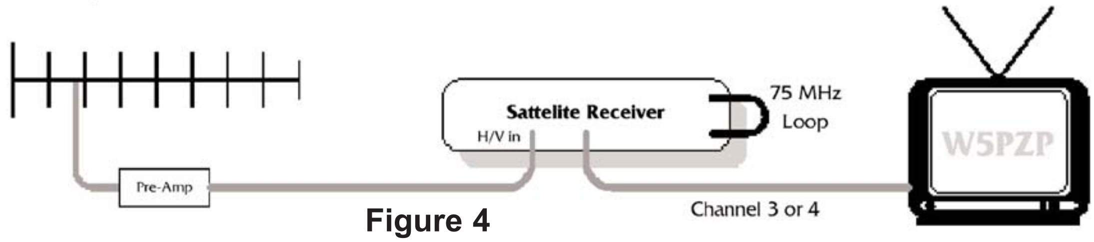


Figure 4

don't despair. An older "C Band" satellite dish receiver with a 70 MHz IF loop will often work as a downconverter. Figure 4 (thanks again N5JXO) shows the hookup.

4. A piece at a time

The thing to remember is that this is a hobby. The fun is in the doing and not so much in the finishing. ATV is a great way to enjoy this because it lends itself to little steps. For example, once you are receiving the local repeater you will want to participate in any nets held there. This will usually take only a 2m Handy Talky (HT). There are now quite a few of these priced under $200 new. The local AMSAT Net is held here in Houston on 2m and you will often find such nets simulcast on the local ATV repeater. It is a real improvement to get to watch the net rather than just listen.

The addition of the 2m rig sometimes even allows access to the control functions of the ATV repeater. This lets the newcomer experiment with switching cameras, changing audio input, etc. Once you are comfortable with this you will want to get on the air. A cheap way to experiment is to locate a source for the Wavecom transmitters that were frequently offered at discount department stores.

These units operate in the 2.4 GHz ham band and will allow you to experiment with different antennas, camera types, audio mixers, titlers, and other aspects of ATV. A camcorder is a readily available input device. Many of the older camcorders, especially ones with broken tape mechanisms can be found at garage sales, pawn shops, and repair facilities almost or completely free. Photo supply mail order firms often have very good prices on simple titlers.

When you feel comfortable with these aspects you can jump up to repeater input. Things may be a little different for those repeaters with 420 MHz input, but the principles will be the same as what you need for the 1250 MHz repeaters. The only thing to remember is that typically below 1 GHz the ATV signals are AM (like your TV) and conversely above 1 GHz they are usually FM (like the input to a satellite receiver). One of the big advantages of the higher frequency inputs is the smaller size of the antennas required. A favorite setup here in the Houston area is a 3 watt 1.2 GHz FM transmitter that was sold by HATS. Other transmitters are available from P.C. Electronics (**www.hamtv.com** or 2522 Paxson Lane Arcadia CA 91007-8537 USA Tel: (818) 447-4565 E-mail: **tom@hamtv.com**). The transmitter is then connected to an antenna. At 1.2 GHz a convenient antenna is the "cantenna" consisting of two 3 lb. coffee cans welded together. The feed is a 2 inch long brass rod soldered to an N bulkhead connector. One local ham is putting a clear picture on the repeater from over 25 miles with this cantenna at 50 feet and fed with the HATS transmitter.

But what if you are not near a repeater or you just do not want to go that route? Then try the "looky talky" approach. By using the Wavecom transmitter you can make very small units for mounting on your favorite mobile thing — dog, remote controlled car, antenna rotator, balloon, bicycle, motorcycle, marching band, runner, rock climber, or skydiver. You get the picture (pun intended). In today's security conscious world, loads of low power transmitters are available and tiny also. If you want to step up in this area there are any number of mail order suppliers selling 9 volt Black & White cameras for under $70. These little jewels are the size of a postage stamp and weigh less than 1/2 ounce. You can follow the links already mentioned to any number of suppliers of ATV equipment for better transmitters. If you can get started for free and make simple upgrade steps for the price of a pair of top end basketball shoes, what are you waiting for?

5. Keep it Up

The last step is the real key. As you can see from step four the possibilities are limited only by your imagination and desire. As with any new endeavor you must keep looping back to the curiosity step and progressing forward with a new aspect or component. This loop is the source of the fun and amazement that ATV can generate. Nothing keeps you from going down several paths at once either. This is one piece of the hobby where I can officially close with the cliché, "I will be seeing you."

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ATVQ

Ham Gets Great Local Coverage For ATV!

from the Desert Leaf

Bil Munsil, W7WKM, from Tucson, AZ, was able to promote our hobby to the local newspaper and a good job he did. We do not have room for the whole article but it starts out:

When the Aspen Fire took a fiery scimitar to the top of Mt. Lemmon last summer, it also did a job on Bil Munsil's special brand of TV reception. He hopes earnestly to recover it soon, when heat-ravaged communications towers are rebuilt on the mountain.

Munsil, 59, is one of a relatively rare breed (fewer than 10,000) of electronic gadgeteers in the United States known as amateur TV (ATV) or ham TV operators. Their much more familiar brethren, ham radio operator, number more than 700,000.

The two have much in common, including a common if sometimes perhaps unfair characterization as brainy techno-geeks who sport pen-clustered plastic pocket protectors, spend much of their time hunched over chattering widgets in small equipment-packed rooms and converse in scientific jargon incomprehensible to most of mankind.

In its defense, ham radio, in addition to being fun, has proved invaluable in providing communications links during emergencies when normal telephone/radio/ TV have been knocked out of commission by natural or man-made disruptions. The late Sen. Barry Goldwater employed a formidable ham radio station operation in Phoenix for decades. During the Vietnam War. in-the 1960s and '70s, Goldwater helped relay radio conversations between troops in Southeast Asia and their families back home.

Ham TV enthusiasts believe they can augment the effectiveness of such unusual communications.

Munsil contends a prime difference between the two hobbies/pursuits is that, "hams should be seen as well as heard." He and other ATV'ers accomplish their visual goal essentially by adding a video camera and TV monitor to the basic equipment utilized by their amateur radio relatives.

Once their gear is hooked up and activated - and it may be contained in a moving automobile, at a remote hilltop campsite or a hotel convention center - the ham TV crowd can send and receive video signals from almost anywhere they wish, with certain limitations.

From his home in east Tucson, with a 10-watt, 12-volt direct current system, Munsil can transmit/receive video for a maximum range of about 15 miles. Intervening hills, mountain ranges and other competing airwave transmissions can act as barriers.

However, with the assistance of communication towers and signal repeaters, like those he utilized on top of the Catalinas before the devastating fire, Munsil often could boost the range of his signals at least 100 miles (to areas northwest of Phoenix).

Article ARTICLE

Ham TV

by Bill Norman

Ham TV enthusiast Bil Munsil holds a small antenna that can be used to transmit live TV images from mobile and sometimes remote locations.

When the Aspen Fire took a fiery scimitar to the top of Mt. Lemmon last summer, it also did a job on Bil Munsil's special brand of TV reception. He hopes earnestly to recover it soon, when heat-ravaged communications towers are rebuilt on the mountain.

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And the article goes on in fine style with good information about amateur TV.

ATVQ

ELECTRONICS

P. C. Electronics 2522 Paxson Lane Arcadia CA 91007-8537 USA ©2004
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: Tom6ORG@hamtv.com
Web site: http://www.hamtv.com

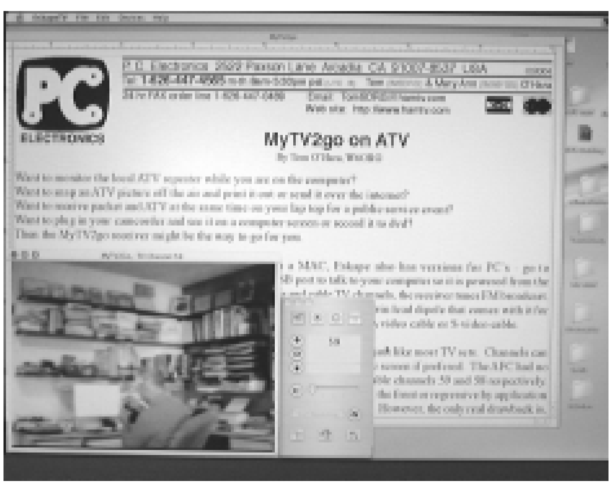
MyTV2go on ATV

By Tom O'Hara, W6ORG

Want to monitor the local ATV repeater while you are on the computer?
Want to snap an ATV picture off the air and print it out or send it over the Internet?
Want to receive packet and ATV at the same time on your lap top for a public service event?
Want to plug in your camcorder and see it on a computer screen or record it to dvd?
Then the MyTV2go receiver might be the way to go foryou- price is under $100.

While I bought the MyTV2go receiver to work with a MAC, Eskape also has versions for PC's - go to www.eskapelabs.com for MAC and www.hauppauge.com for PC's on the web. The receiver uses a USB port to talk to your computer so it is powered from the computer which makes it more portable. Besides off the air and cable TV channels, the receiver tunes FM broadcast. F connector jacks are on the end of the unit, one for TV and the other for a twin lead dipole that comes with it for FM broadcast. You can also plug in a video camera with the composit RCA video cable or S-video cable.

Channels and functions are mouse clicked on the on screen Remote Control just like most TV sets remotes. Channels can also be typed in from the keyboard and the Remote Control removed from the screen if preferred. The AFC had no problem locking on +/- 1 MHz so 434 and 426.25 can also be received on cable channels 59 and 58 respectively. You can change the screen size from full to any proportion as well as always in the front or regressive by application use. Sensitivity is quite good, a TVC-4G downconverter only beat it by 3 dB. However, the only real drawback is, like many digitized video systems, it doesn't like noise and the picture will freeze some where around P2 to P3. But for strong signals, it does a nice job but not as good as a downconverter and TV set for DX and weaker signals.

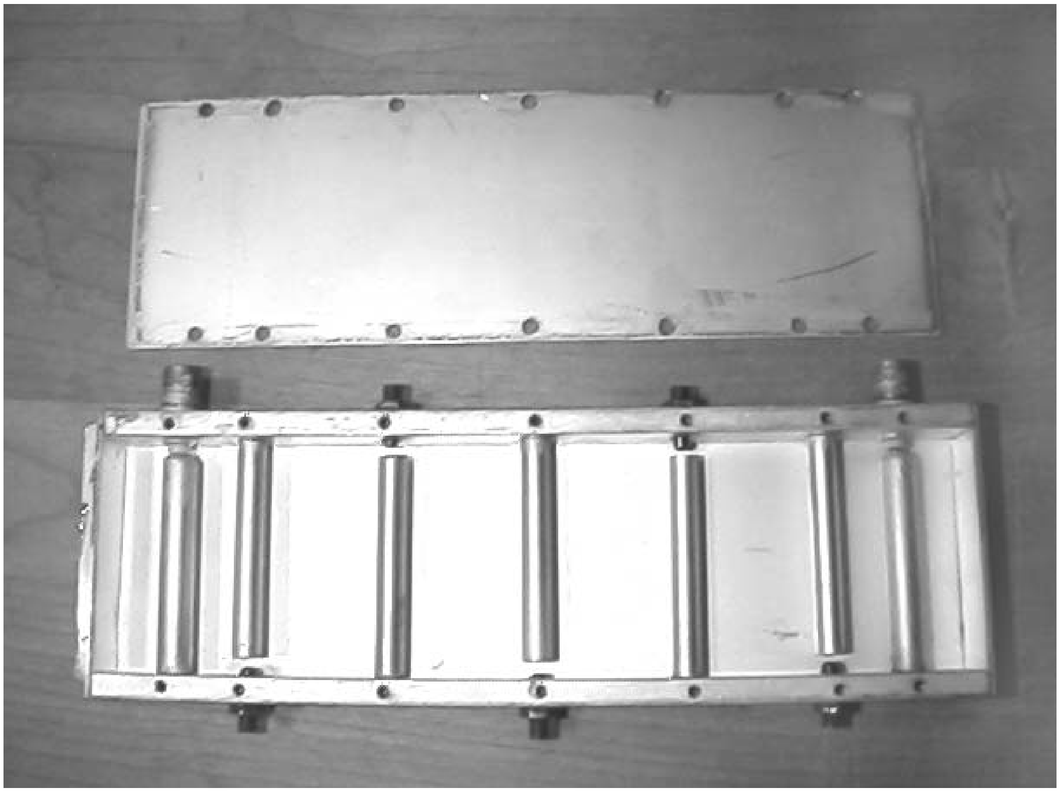


I put a clip lead on the antenna input to easily receive the 434 video from the hard hat cam pointed at me sitting at the computer taking the photo to the left. On the side of the MyTV2go box are the audio and video input and output mini jacks and S-video jack. The USB output cable is on the other end.

Photo above is off the iMAC screen with the MyTV2go 434 (cable channel 59) video placed in the bottom left corner on top of this article being composed in Pagemaker. The video screen size can be anything by dragging a corner with the mouse and also placed anywhere.

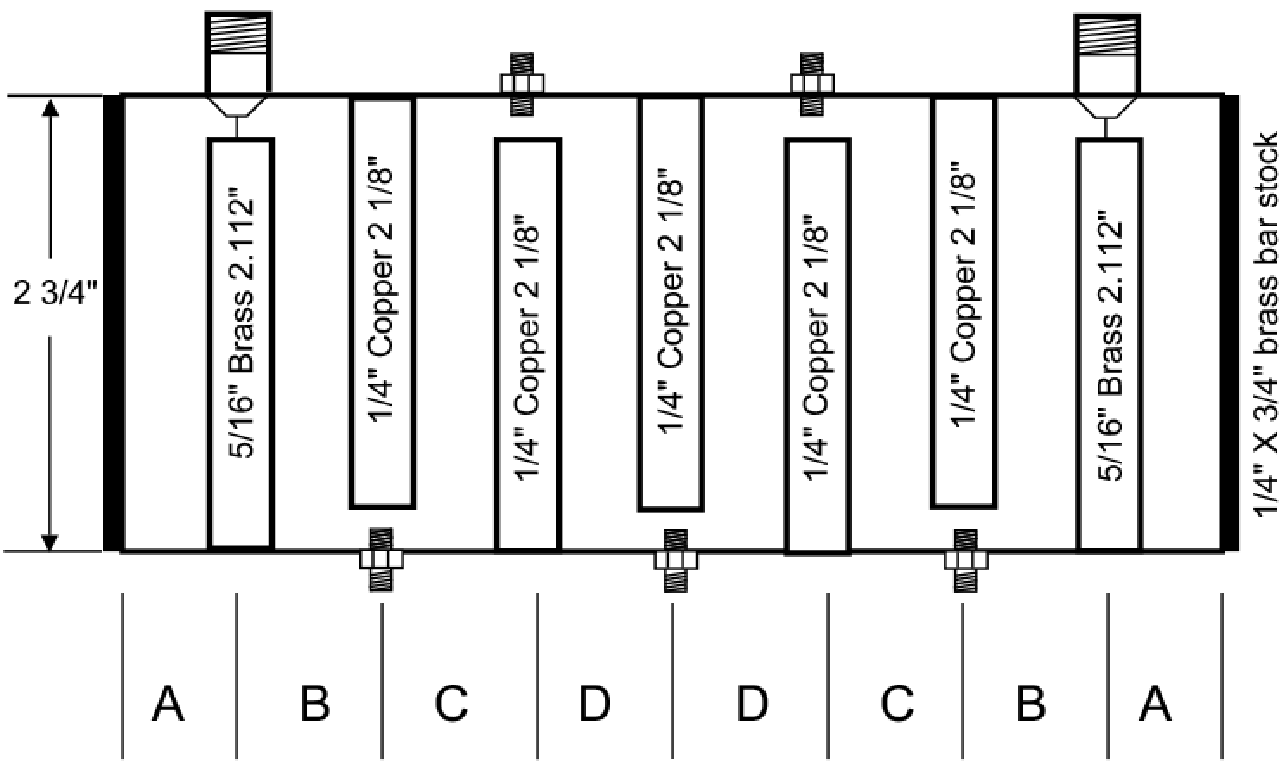
ATV Channel Filters

by Mike Collis - WA6SVT Email: WA6SVT@aol.com
POB 1594
Crestline, CA 92325



Channel filters are used with ATV transmitters to remove most of the lower sideband to convert DSB ATV signals to VSB and insure a clean VSB signal from VSB transmitters after amplification though class AB linear amplifiers.

Channel filters are used in FM ATV to remove secondary side-bands from the transmitter. Channel filters are used with ATV receivers to improve front-end selectivity and prevent overload from out of channel signals from nearby stations. At repeater sites the use of channel filters are almost always needed and in



Total length depends on dimensions of A, B, C & D many cases required by the site landlord to reduce QRM between clients at the site.

In this issue of the "Q" we will feature the interdigital channel filter for the 1240-1300 MHz band. I designed this filter out of necessity about 15 years ago when no one manufactured a 1240-1300 VSB channel filter for the amateur service and the 1240-1300 MHz band was filling up with FM repeaters and links nearby to ATN's Santiago Peak ATV repeater. I took the filter featured here to Dayton Hamvention to show the filter to John of Spectrum International who manufactured interdigital filters for 420-450 MHz and 902-928 MHz bands. Several months later, Spectrum International added 1240-1300 MHz interdigital filters to their offerings. Over the last few years I have not been able to contact John or see his filters advertised anymore. I would like to know if he is still in business.

Our featured filter uses 1/4 wave long, 1/4" diameter resonator rods that are a few percent shorter than true that 1/4 wave to allow tuning to frequency with a tuning screw and lock nut on the edge of the filter. Interdigital filters are loaded with a 1/4 wave rod grounded on the far end and the free end is connected to a 50 ohm quality connector. Five Hi "Q" resonators mounted with the first Hi "Q" rod's grounded end opposite that of the input loading rod. The next rod alternate from the last and this continues till the output loading rod.

The filter is built using brass rods, 1/4" x 3/4" brass bar stock, and a brass top and bottom cover plate (see the drawing and photo for details). The spacing of the rods is important for the bandwidth, match and smooth bandpass. The wider the spacing, less coupling between resonators will give narrower filter bandpass and higher insertion loss. The spacing has to be done in the correct amount of spacing to achieve a smooth bandpass and good impedance match.

The chart lists bandwidths for 6 MHz for VSB, 7 MHz for Euro VSB or DVB digital ATV, 10 MHz for narrow FM (3 MHz deviation and 4.5 MHz subcarrier). 17 MHz for standard FM (4 MHz deviation with up to four subcarriers).

The resonators can be fabricated from solid brass rods with one end drilled and tapped for 6/32 threads to allow mounting. Another method is to use hollow tubing available from most hobby and hardware stores. The hollow tubing would need to have a brass nut inserted into one end of each rod and soldered in place, it may be necessary to file or grind the nuts somewhat to fit into the tubing. File the end of the hollow tubing with the nut for a flat surface.

In fabrication of the brass bar stock, it is recommended to use a drill press for drilling and a miter box as a guide for cutting to length. The mounting holes for the rods can be counter sunk to allow flat head screws to be used for mounting the rods. The narrow edge is drilled and tapped for 4/40 screws to hold the top and bottom plate during assembly. I would recommend a plate mounting screw hole above each rod mounting location.

Top and bottom plates are fabricated from 1/16" thick hobby brass stock. The bottom plate can be 3/8" longer on each end to allow for mounting the filter. The tuning screws should be 8/32 stainless steel set screws with locking nuts. The brass bar stock is drilled and tapped for 8-32 threads above each Hi "Q" rod. One of the bars is drilled to accept a BNC, SMA or type "N" connector with the small flange (Pasternak, should have the special small flange "N" connectors) on each end above the input and output 3/8"diameter loading rods.

It is recommended to assemble the filter to insure the filter rods are in good alignment and all the hardware fits correctly. The filter is then taken apart for cleaning all parts with a good metal polish or cleaner. In the final re-assembly it is recommended to use cotton gloves so oils and acids from your fingers will not contaminate the brass with corrosion setting in over time.

The filter can be used in its brass form with fair to good results or plate with copper or silver for lower losses. In the case of the 7 MHz wide filter the brass filter had 4 dB insertion loss, copper plated at 5 microns the loss was 3 dB and silver was 2.8 dB. The silver plating ran me $75 and the plating house said I could have plated 4 times the material than was done for one filter. I have copper plated filters myself using a copper sacrifice electrode, glass tray, and variable low voltage power supply, solution of water, sulfuric acid and copper oxide.

Tuning is easy if you have a spectrum analyzer with tracking generator or network analyzer. Start with the center rod and work back towards the input and output connectors for a smooth flat bandpass in the desired part of the band. Typical losses for plated 1240-1300 MHz filters for the following bandwidths are 3.2 dB for 6 MHz, 2.8 dB for 7 MHz 2.5 for 10 MHz and 2 dB for 17 MHz. Next issue of the "Q" we will cover 420-450 MHz band interdigital channel filter and a duplexer version.

B/W	6 MHz	7 MHz	10 MHz	17 MHz
A	13/16	11/16	11/16	5/8
B	3/4	13/16	1 23/32	1 7/32
C	1 7/16	1 3/8	1 3/8	1 9/32
D	1 1/2	1 7/16	1 7/16	1 5/16

Good luck with your project!

73,
Mike WA6SVT

ATVQ

Balloon Notes Of Jan 10, 2004

On January 10th, I had a meeting here at the house with Wayne, KA9IMX, and was interrupted by packet sounds on the radio on 144.34 MHz. Since this is unusual to hear, and it did trigger a memory that there was to be a balloon launch that morning, we both stopped talking about our subject and we dove for the radio.

As usual, I was not ready with the packet radio set-up and it never fails as I was not ready the last time this happened either. As a matter of fact, I did nothing between the last time and this time to rectify the problem. I seems that I may have a bad serial port and/or a bad TNC. I gotta get that fixed!

So, I dug quickly into my emails that I saved and found the 40 meter frequency that was to be used and started to listen. Yes, they were there, so I checked in and reported that we were hearing the balloon from Kansas in Rockford, IL!

Wayne, at the same time got in the Internet, since I could not copy packets, and fount the web site maps.findu.com/wb0drl-11 and we tracked it there. We "watched" it go from around 80,000 feet to the peak around 112,000 feet, burst and go back down, loosing it around 80,000 feet again. It was a fun afternoon and Wayne and I enjoyed tracking the ride and being part of the event.

Here is a short write-up from their viewpoint.

Gene Harlan - WB9MMM - ATVQ

A Quick Report On The January 10, 2004 Balloon Flight At WB0DRL

The SSOK (Sky Science Over Kansas) group, which is a loosely knit group of hams in the Salina, KS area, got back into ballooning after a 4 year hiatus. This flight had two goals, one was to reach 125000 feet and do it using hydrogen for the lifting gas. We had partial success.

Payload consisted of a Motorola M12 GPS unit, Alinco DJ-11 handheld (stripped to the bare board, 340 mw), tone decode for cut down, 1600 ma hour 9.6v battery, ¼ wave antenna, and a 24" diameter parachute. Package weight with chute, 2 pounds, 8 ounces.

Balloon number one was a 3000 gram with hydrogen gas, filled to 3 pounds, 8 ounces positive lift. Just before release, as we were playing out the load line, a gust of wind snapped the load line that ran though the cut down squib. It was a sinking feeling watching the balloon rise and still have the package in hand. I had 2 spare balloons that were over 3 years old and decided to get one ready quickly. Out of hydrogen necessitated a drive to Salina for a tank of helium. Un-packed the 2000 gram balloon and started inflating, we had release just after 10 am, one hour after the failed first attempt. We also inflated to 3 pounds, 8 ounces positive lift. Kaymount said that using a balloon this old might have a success rate of 50 %, we were in the right side of the 50%.

Using hydrogen for the lifting gas is not all that difficult. Yes you do need different regulators and fittings for the cylinder and static could be a problem. To reduce any static problems we kept ourselves at the same potential as the balloon while filling and avoided any un-necessary handling. But for 6 % more lift per volume over helium and a little cheaper, I will probably use hydrogen from now on. One goal achieved.

Launching from 10 miles West of Salina and having the 'hill ham shack' near by and manned by CKRC (Central Kansas Amateur Radio Club) members, makes things go much easier. Mark, KB0MQX and Eric, N0YET had the job of informing the launch crew of all payload status before release and running the 40 meter net. Other members of the group would rotate in and out to help out. At this site we were capturing raw GPS data and also showing the track on a moving map display. If you would like to see the hill go to www.petesias.com.

With a pound of positive lift the 2000 gram balloon had good ascent rate, approximately 500 feet per minute average. We settled in for several hours of ascent time. Chase teams were already down range and waiting for a predicated landing point in SE Kansas.

Dirk, N0KSC and myself had been planning on chasing using an aircraft fitted with a 2 meter receiver and laptop running a map display. We also had a 2 meter handheld for liaison communication with the hill and other chase crews. I had used a plane before and found it to be a nice supplement to the ground based chasers. It has good speed, no real line of sight problems, and can coordinate chasers getting to the package after touchdown. So at package height of 70000 feet we took off from the Salina airport headed for Chanute KS.

This is where the learning curve starts, there is another 'jet stream' above 100K feet and this is the second time our package has got caught in it. The first time the package traveled to Ohio, a distance of 703 miles. Now it looked like a repeat but going to Tennessee. (This will be a good discussion topic on the group to get some data on this and figure out how to either predict where it is or a way to get though it.) Our first thoughts 4 years ago was to have a faster ascent rate. Anyway this is another day's topic.

At the Chanute airport I called the hill and told them to issue the cut down command. The command was received by the package but no decent. Post flight analysis showed the squib fired but the cutter did not sever the line. Going to a different cut down mechanism next flight. Decided to met Zack and crew at Iola KS airport and discuss the situation. So it was a quick flight to Iola and see Randy, Zack, Jon, and Brad. No more than out of the plane and was informed of burst.

Zack, W0ZC, has a great account of the final chase with pictures and I won't try to add to it.

The next goals are to figure out the 100+ K feet winds and use a better cut down system. Of course, see if it can reach 125 K feet.

Many thanks to all that participated and helped. From the initial reports it sounds like everyone had a good time. Looking forward to the discussions on the KNSP mailer about future flights and how to solve some of the problems.

73' Pete, WB0DRL
petesias@yahoo.com

From left to right: Dirk (N0KSC), Pete (WB0DRL), Randy (WA0D), Jon (AJ0NR), Brad, Zack (W0ZC)

GPSL 2004

GPSL 2004 will be in Hutchinson KS on Friday and Saturday, July 2 and 3, 2004. It's about 5-6 hours and 300 miles from Omaha.

The launch will be on Saturday the 3rd at 8am, with a backup date of Sunday the 4th if the weather doesn't cooperate. I believe the plan is to have a handful of launch sites picked out so that we won't be constrained by upper-level wind forecasts for our landing projections. But poor weather at the surface could still delay us.

My tentative plans are to leave mid-morning on the 1st and arrive there late afternoon (there will be a dinner for anyone arriving on the 1st). Friday will have several sessions given by the different balloon programs (lots of neat video). Friday evening will include a tour of the Kansas Cosmosphere, which is a nice space museum.

After the flights, we'll meet up for lunch before heading out of town.

73 de Mark N9XTN - n9xtn@cox.ne

TV Antenna Pointing Info

Here's a web site to get azimuth heading and antenna size info for terrestrial tv reception. Just enter your zip code and get a list of all active analog and digital channels along with a map. Sponsored by CEA. Sorry, US locations only!

www.antennaweb.org

Mark Albert - MSAlbert@aol.com

Sun Bowl Balloons Go Cross-Country January 5, 2004

What Dean Wittstruck found in his field looked to be the leftovers of one very happy New Year's Eve party. What it turned out to be were balloons from a college football game — some 900 miles away.

Wittstruck came across the mysterious deflated balloons Thursday midmorning. Two yellow balloons were still floating, their strings caught on soybean stubble.

"Go Team" was emblazoned on one balloon. Another said "Go Ducks!" in green writing and was stamped by the University of Oregon's alumni association.

Yellow and green are the colors of the Oregon Ducks, which played Minnesota in the Sun Bowl in El Paso, Texas.

National Weather Service meteorologist Brian Smith said that trip was possible. He says the helium-filled balloons could have been carried by the jet stream, 6 miles high, at speeds between 90 and 120 mph.

The Sun Bowl started at noon Wednesday. Wittstruck found them 22 hours later. It was more than enough time for the journey.

Oregon, by the way, lost to Minnesota in a squeaker — 31 to 30.

If You Move

Please send us your NEW ADDRESS! We pay 70 cents for each returned ATVQ. And we are usually nice and send another copy to your new address which costs us $1.29. Please help us from having to do this. Thanks!

First Digital-ATV Delivered

First DATV units were tested and delivered to buyers.

Some students and volunteers in Wuppertal University have completed the 100 exciter boards, loaded the software and did the alignment, while the matching 4-layer MPEG-2 coder boards have been produced by the company near by. The units can produce a narrow GMSK signal (2 MHz bandwidth with video and 2-channel sound on 434 MHz, the matching GMSK receiver is in preparation) or a wider QPSK signal with higher video quality for use on 23 cm and above. For technical details see www.datv-agaf.de

DATV Up-Converter 70/23
Meantime the re-design of this up-converter is finished, and just readily available components are used now. Schematic diagram and layout may be found at www.datv-agaf.de/converter.htm. A small scale production is planned by AGAF early in 2004.

The attached picture shows the output spectrum with QPSK

73 Klaus, DL4KCK
DL4KCK@t-online.de

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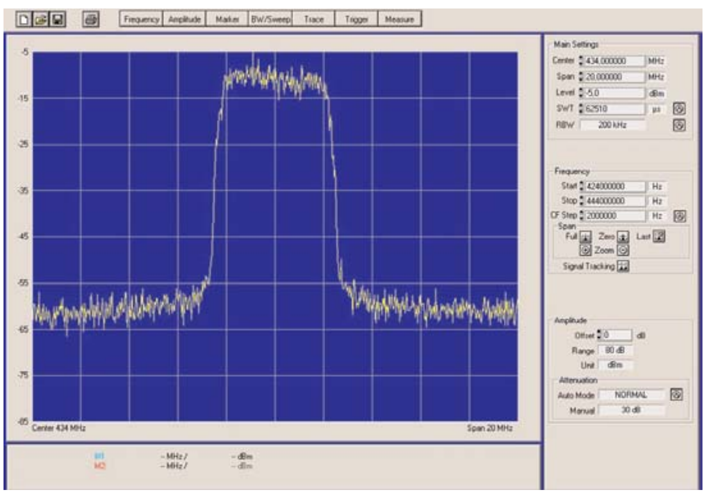

After The Banquet

Gene,

I certainly enjoyed the ATV Banquet (Litchfield). It was a lot of fun. Scottie always does a good job.

Afterwards, the St. Louis group met on 1265 MHz and worked Bob, KA9UVY and Flip, N9AZZ. The "fog" that evening enhanced the propagation. KD0LO sent and received P4-P5 signals to Bob! It was 1:30 AM before we all signed off!

Thanks for being at the banquet. It was good to hear from you and ATV Quarterly.

73 Mel, K0PFX

ATVQ

ATV & Amateur Television Quarterly

Hello Gene,

I would like to see your publication. I just recently became interested in ATV for public service. After a lot of research, I purchased a TC70-20S transceiver from PC Electronics, now for the hard part, I have to learn a little more than I thought I would to use this thing properly.

To see my mobile setup, go to:
http://community.webshots.com/album/79050860jrGEmj
My truck with 35' telescoping pole and 11 element beam is on page 2 of the field day photos.

Gaylen Gage, KD5KIZ **ggage@tyler.net**
Public Service Coordinator;
Tyler Amateur Radio Club,
East Texas Emergency Communication Service Inc.
http://www.tylerarc.com/ http://www.qsl.net/kd5kiz/

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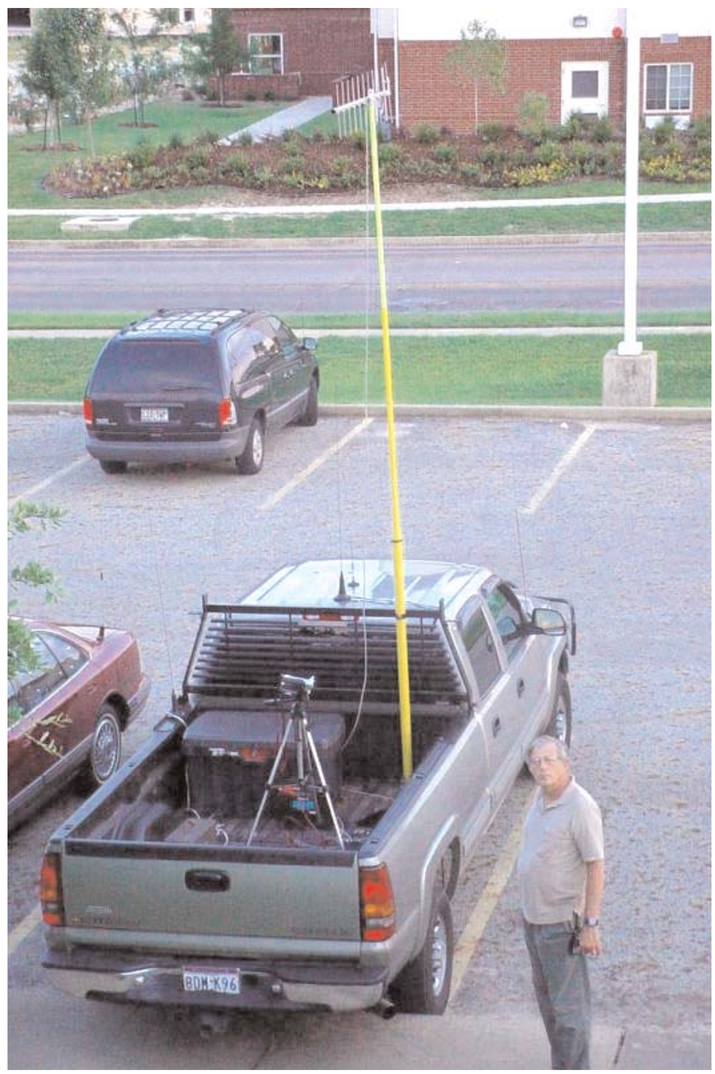


KD5KIZ/ATV remote to the Tyler Red Cross. 11 element Cushcraft on 35 ft. telescopic, fiberglass pole. PC Electronics, 20 watt transmitter. N5OAR photo

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, 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 I do not want to discourage this type of article, the article itself is an advertisement 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!

CONTRIBUTORS 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 FASTSAVE OFF 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 email address: **atvq@hampubs.com**
Also note our web page address: **http://www.hampubs.com**

HDTV with 1080 lines vertical resolution ante portas!

The high resolution version within the MPEG standard is already commonplace in USA, Asia and Australia - for Europe the door to really cinema-like TV quality live at home opens on first of January 2004. From that day on the Belgian TV producer "Alfacam" will transmit via Astra satellite (19 degr east) under it`s brand "Euro1080" two channels: a daily 4 hours' program to the European households, free-to-air with a mix of sports, music, shows and film / documentaries - in Dolby surround sound 5.1 of course. Part of the content will be acquired through an exchange pool with other HDTV channels around the world. At least twice a week an EVENT channel will distribute event programs (live or delayed live) to so-called "event cinemas", equipped with electronic projection and 5.1 surround sound systems.

A demo transmission is running since IBC Amsterdam on 12168 MHz vertical, SR 27500 Ms/s, FEC 3/4 under "MPEG2HD" in format 1080i (1920 x 1080 pixel at 50 Hz interlace). At least two compatible settop-boxes for the home are announced for end of 2003, and real HD screens (not 720, but 1080 lines vertical resolution) are already available from several vendors. But - clever programmers have developed means to decode that high bitrate (19 Mb/s) live with software in a modern desktop PC! Luckily most computer monitors are already fit for HDTV.

What else is needed?

1. An inexpensive digital Sat-TV PCI card without embedded MPEG-Decoder (i.e. Technisat SkyStar2 TV) and the according software "DVBViewer" version 1.99 up. The older TE version included by Technisat does not work for HDTV, but a full version download from the developer`s homepage costs only about 15 Euro and includes free updates.

2. Fast processor and memory, at least 2 GHz Athlon XP or 2,6 GHz P4 and 166 MHz FSB, graphics cards must have MPEG2 hardware acceleration. This way TV-Sat-DX enthusiasts can view special transponders with studio feeds in full quality MPEG 4:2:2! With normal digital Sat-TV channels CPU load is only around 20 percent, and then at the "MPEG2HD" channel the optimum television pleasure can start (after having tweaked all and every software parameters, i.e. Enhanced, priority "highest").

The last hurdle within my installation routine was to declick "autom. audio detect" in the essential sub program "Marfi`s filter", and wow - a high resolution slow motion became a brilliant HDTV movie with about 50 percent CPU load. My cheap Geforce FX5200 graphics card does the job without problems (no jerking) in 1024x768, but would be able to show 1920x1080 on a high res display. The demo loop broadcast by "Euro1080" deploys a very broad range of different content: classical music performances, operas, jazz festivals, pop & rock concerts, shows and sport events besides the technical background like Panasonic D5 HD recorders and some HDTV OB vans.

Really exciting is it to view this on a TV projection screen of at least 150 cm width - you seem to be able to read the sheet of music in front of the musicians in the orchestra...

Klaus, DL4KCK
DL4KCK@t-online.de

Links: **www.euro1080.tv**
www.dvbviewer.com
(with a helpful forum, mostly english!)
www.rdkleinpowerb.de/computertrend/html/hdtv.html
(with XVid HDTV-Clips 1280x720p, mostly german)

ATVQ

Thanks to all the fine stores that carry Amateur Television Quarterly

Amateur Accessories
PO Box 7333
Champain, IL 61826

Amateur Radio Toy Store
117 West Wesley Street
Wheaton, IL 60187

Burnaby Radio Comm Ltd.
4257 E. Hastings St.
Burnaby, BC Canada V5C 2J5

Ham Radio Outlet
1939 W. Dunlap Ave.
Phoenix, AZ 85021

Ham Radio Outlet
6071 Buford Hwy
Atlanta, GA 30340

Ham Radio Outlet
224 N. Broadway
Salem, NH 03079

Ham Radio Outlet
2492 W. Victory Bl.
Burbank, CA 91506

Ham Radio Outlet
933 N. Euclid St.
Anaheim, CA 92801

Radio City
2663 County Rd I
Mounds View, MN 55112

Texas Tower
1108 Summit Ave. Suite 4
Plano, TX 75074

The Radio Place
5675 A Power Inn Rd.
Sacramento, CA 95824

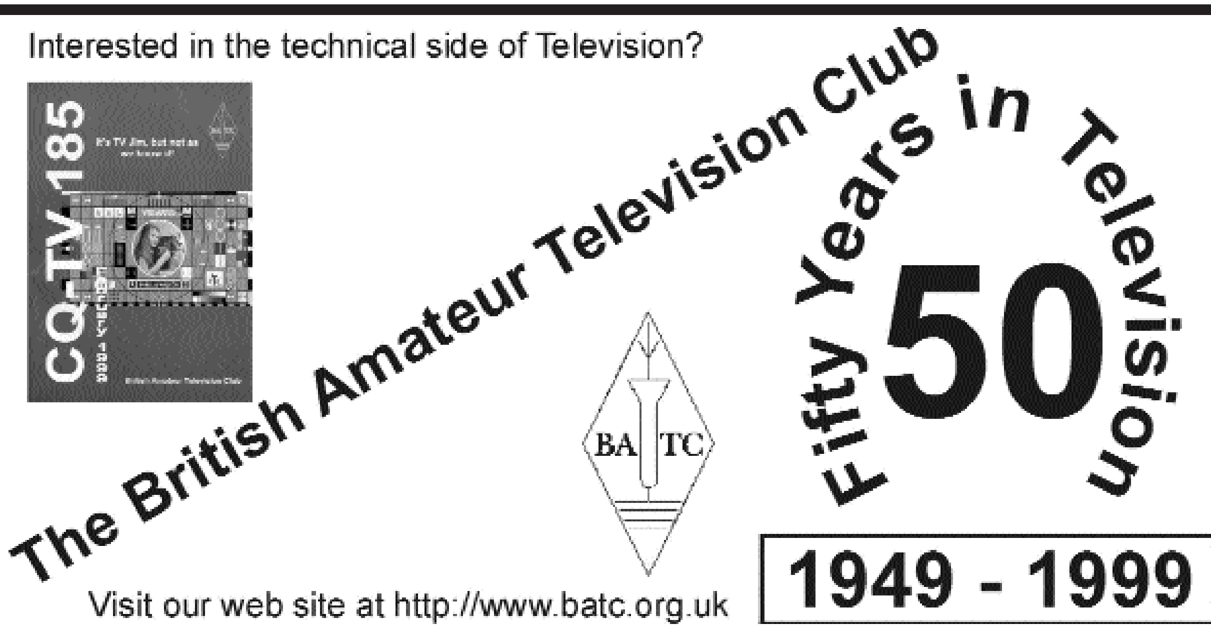
Do you know of a store that would like to carry ATVQ? Please let us know and we will contact them.

ADVERTISERS INDEX

Please mention that you saw it in
Amateur Television Quarterly!

ATVQ on the Newsstands

If you find a store willing to carry ATVQ on their shelves, we will extend your subscription by one year. In the case that two people turn in the same store, the first one wins! Offer subject to change at any time, but not likely to!



IC-R3

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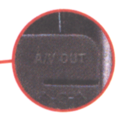
TELESCOPING ANTENNA. With BNC connector.

PC PROGRAMMABLE. For quick and easy setting of RX frequencies, memory names, and more. Requires optional cloning software (CS-R3) and cloning cable (OPC-478). Works with Microsoft® Windows® 95/98 & Microsoft® XP® (Home & Pro versions).

2" COLOR TFT DISPLAY. Amateur TV without the hassle of wiring! Monitor amateur TV frequencies at 420-440, 902-928, and 1240-1300 MHz, as well as broadcast TV and wireless cameras. The display can also be used to show operating status, incoming signal strength and much more!



AUDIO/VIDEO OUTPUT. Conveniently located output jack allows you transfer images to a TV monitor or recording device.

BACKLIT MONOCHROME LCD. Displays frequency, battery voltage, and other operating conditions. Auto off timer helps conserve power.

MULTI-FUNCTION JOYSTICK. Quick & easy access to operating band, AF volume, LCD settings, and more.

DESKTOP RAPID CHARGER (Optional). BP-135 For rapid charging of the battery pack. Approx. charging time: 2.5 hours.

12V ADAPTER/CHARGER (Optional). CP-18A/E For 12V operation while charging.

SUPER WIDE FREQUENCY COVERAGE. 0.495 - 2450.095 MHz*

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*Cellular frequencies blocked; unblocked versions available to FCC approved users. **Optional equipment required.

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