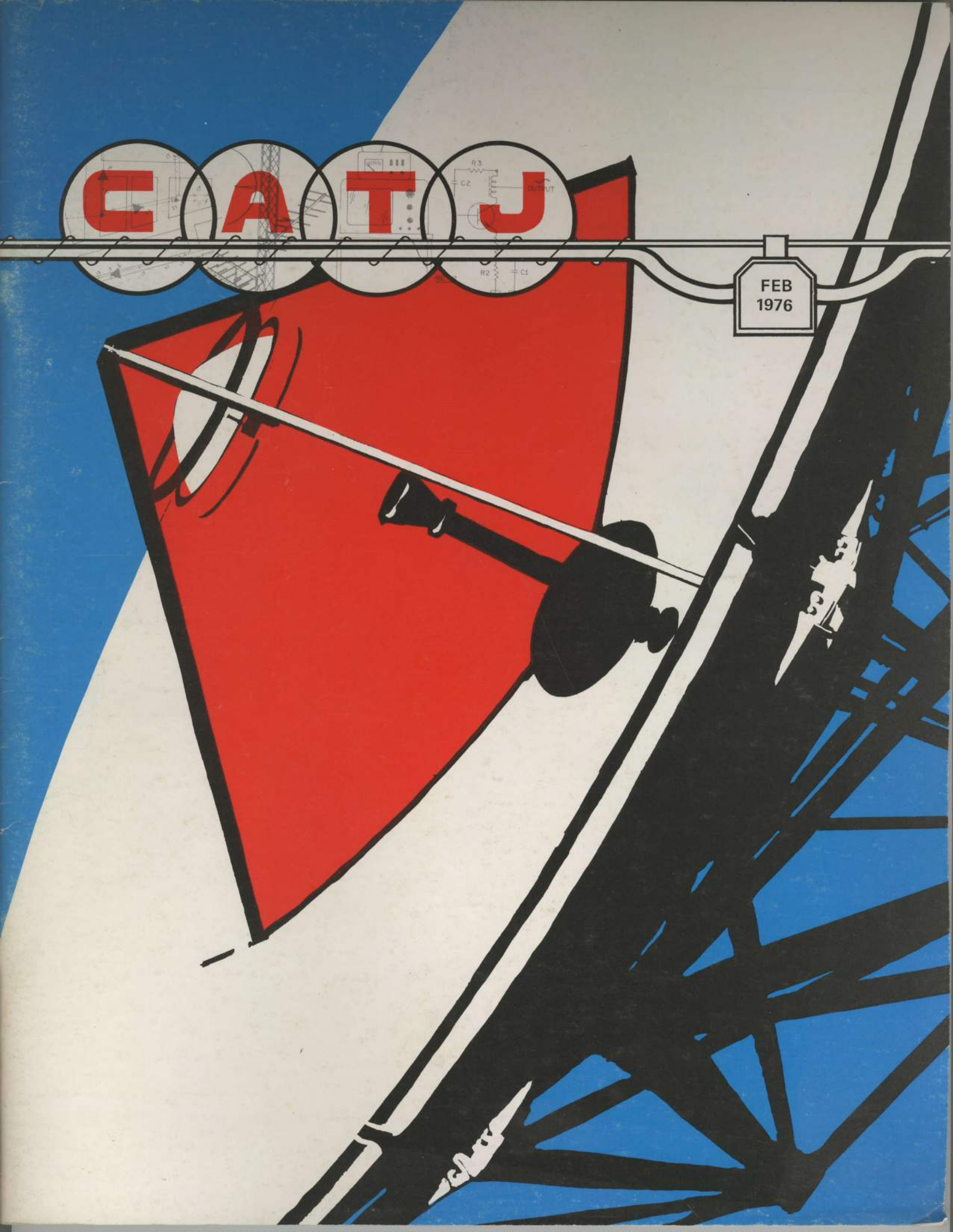
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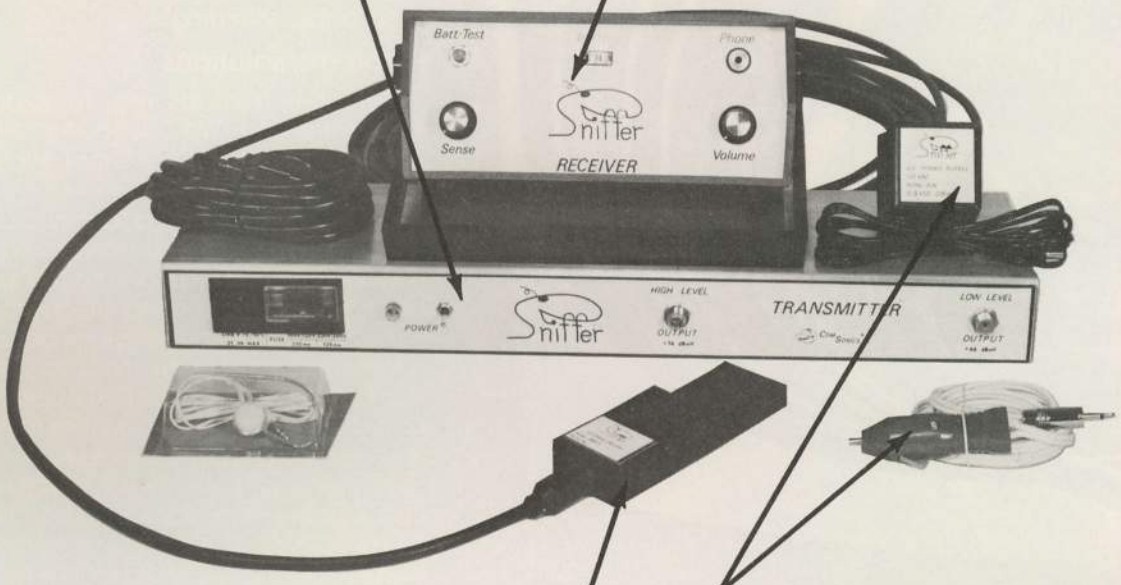

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CATJ

FEBRUARY 1976

VOLUME 3-NUMBER 2

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OFFICERS
Kyle D. Moore, President
Ben Campbell, V.P.
G.H. (Bunk) Dodson, Sec/Tsr

DIRECTORS
Peter Athanas (Wisconsin)
Warren Fribley (New York)
Jim A. Kimrey (Arkansas)
William Risden (Kentucky)
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Ben V. Willie (Iowa)

STAFF
R.B. Cooper, Jr. Exec. Dir., Editor
Richard L. Brown, General Counsel
Celeste Rule, Managing Editor
Richard Montgomery, Production Dir.
Peggy Jones, Editorial Asst.
S.K. Richey, Contributing Editor

OFFICES
CATA/CATJ
4209 NW 23rd, Suite 106
Oklahoma City, Oklahoma 73107
(405) 947-7664

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OUR COVER

What is it? It could be a patriotic approach to Valentine's day, but it is not. The Tulsa (Oklahoma) 10 meter Andrew earth terminal dish is this 25,000 subscriber system's link with first-run movies and "hockey from the Garden" via HBO. CATJ follows up its October (1975) initial report on CATV earth terminals with an in-depth report on where the industry seems to be headed with satellites; starting on page 10 here.

CATA - TORIAL

KYLE D. MOORE, President of CATA, Inc.

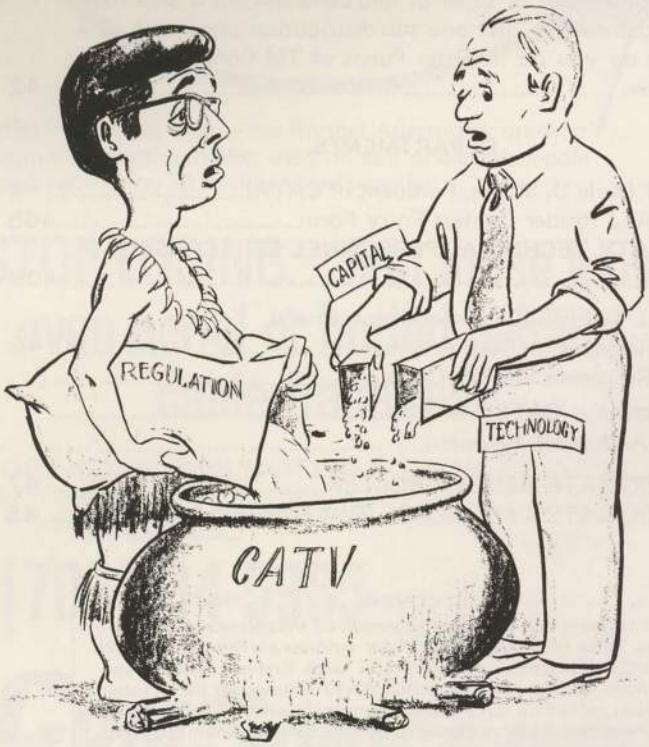
TEN YEARS OF FEDS

Generally speaking, there are three basic ingredients required for any concept to realize service potential. Sometimes, in the battle for day to day existence, one tends to lose sight of those ingredients and as a result we also forget how each temporary roadblock or obstacle enters into the overall play for success or failure of a project.

In a **completely unregulated** environment the success of the endeavor is largely bound up in the available technology and the available funding. Capital, and the technology which that capital can create, are two of the important ingredients in our three-ingredient mix.

Man set foot on the moon because President John F. Kennedy committed a sufficient amount of capital to the solving of the technological problems standing between the vision and the realization of the goal. The Atom bomb, and later the Hydrogen bomb similarly came about because the capital required to solve the technology problems between concept and realization was available. The Panama Canal was dug because President Teddy Roosevelt committed the capital necessary to do the job.

Not all projects or endeavors have such far reaching impact as the twin bombs, a man on the moon, or the Panama Canal. Consequently, in our everyday affairs, very few of us ever come into direct contact with an unlimited capital program; that is, one that sees only the end result of the creation of the necessary technology, **regardless of cost.**



REGULATION ~ JUST A LITTLE DAB WILL DO YOU!

In business, there are probably **never** any similar situations. Because business, unlike Government, must look at the ongoing costs of technology as a directly related function of capital return. At some point even the most optimistic returns, coming after technology has solved the problems, must be weighed against the going-in costs of the technology. A modern day company will pour research and development money into a project such as an economical (to produce and operate) electric car only as far as it sees the potential for direct financial return, in the form of profits.

There are therefore limits to the amount of capital, risk capital, which any prudent businessman is willing, or able, to pour into the development of a product or service. The cost of technology always has and always will relate directly to the potential rewards for the product or service. Similarly, it is often easiest to raise investment capital or research and development capital at the **very earliest stages** of a project; **before** any of the stumbling blocks become apparent. A man with a concept is often more capable of raising money to investigate that concept than another man with 50% of the work done; when the second fellow has a past history of cost-overruns and bad R and D cost projections going for him. **Optimism is the key to raising investment capital.** At the outset, investors are always more optimistic than they will be at the 2 year point of a project that was supposed to take one year and still shows no signs of nearing the home stretch.

Therefore, if you have a concept, one that says you have a dream of bringing 60 channels of television reception to Dallas, Texas, you would have no trouble finding all of the investment capital required to turn that dream into reality, **provided** the whole project had an air of optimism attached to it. Provided that there is no past history of cost overruns, partial completion, or known roadblocks standing between your concept and the completion of the R and D to turn the project into reality.

And this brings us to the third ingredient: **regulation.**

In the earliest days of CATV, the operator or would-be operator with a concept or dream had but two strikes against him; the limits of technology, and, the limits of capital available to fund the technology solution. Gradually, in the 60's the technology caught up with the dreams and concepts and by the middle 60's the limits were no longer technology. For a **very brief** period, or 1965-66, the limits were financial. This period lasted for such a brief span of time that few of us were even aware of its passing. Because before it got up a head of steam, the third key ingredient to the success of the concept entered our picture: regulation.

When an industry or a concept such as cable has **no regulation,** the industry is free wheeling, explosive, capital intensive, **and,** capital limited. Its bounds or limits are entirely internally set.

Now, regulations per se do not have to be restrictive. We are constantly reminded that our own national telephone

system has advanced very well and to enviable world-wide acclaim under a set of regulations. There are those within CATV who look at the regulations vis-a-vis the telephone industry, and who remark "that can't be all bad; look how well Bell has done". If one studies the Bell federal regulations closely, one finds that these are not the type of regulations CATV faces or has faced since 1966. Rather, they are in truth a protective form of regulation, designed largely to impact positively on telephone growth. Federal telephone regulations do not deter the growth of technology, nor do they discourage the flow of investment capital into the telephone R and D laboratories and system plants. **Rather, they actually encourage such investment.** Clearly, the type of regulation we are discussing when we discuss telephone regulation is a positive-impact regulation. This is not the type of regulation CATV faces or has faced.

On the opposite side of that coin is regulation designed largely to guide or control the development by **limited** advances; but always under the **guise** of public interest in a manner so that a **control valve** is always available to slow down or shut off any advancements which the regulators perceive to be detrimental to the best interests of the public. **This is regulation by balance.** When the regulator turns the valve too far in one direction, there is a negative impact on the regulatee; progress slows, and the public is adversely impacted. When the regulator releases the controls too much, progress speeds up, and **perhaps** the regulatee gets ahead of his ability to supply himself with capital to maintain a steady course.

Any form of regulation that has as its objective the control of progress is dangerous and often counter-productive. First and foremost, the wisdom of the regulator is largely interposed for the wisdom of the natural market forces. The regulator (whether one man or seven) replaces the natural forces at play in the marketplace. The regulator is much like the man who has a concept; it is easiest to sell regulation as a simple concept, as it is easiest to sell a simple concept in the marketplace when you are raising capital.

But down the road apiece, when the concept has failed to produce, it is difficult to raise additional R and D capital; just as it is difficult to raise enthusiasm for one-more-shot of regulation.

CATV has been on the short end of a regulator-controlled valve for ten years this month (February 1966 to 1976). The valve has been shut off on several occasions, and it has been allowed to flow ever so slightly on other occasions. And each time the valve has been shut completely off, the investors have said "see you guys later!" Each time it has been re-opened, a crack, a few of the investors have drifted back, and looked at the fluid trickling through the valve, and they have said "we like some of what we see coming through, but we are worried that someone may change the composition of the fluid at anytime; or shut it off altogether again without any notice."

And they have walked away.

Once burned; twice burned; thrice burned.

And so the financial community has largely been turned off by CATV. The valve has been turned on, and off, and off, so many times, they see little reason to drink out of our poisoned stream. Back in October at the White House Conference on Cable, one of the Government inquisitors asked the question, "And what would happen to CATV if **all** federal controls were lifted **tomorrow?"**

After a suitable pause, a cable spokesman responded, "It would probably take every bit of three years before the industry began to re-grow **even slowly**; the investment community has a very long memory...."

Of course all federal controls over cable are **not** going to be lifted. But given the hypothetical possibility, we wonder whether cable would **ever again** amount to anything approaching the promise it showed in February 1966. Ten years of sticky federal fingers on our jugular valve may have rendered the patient all but totally invalid with a terminal case of being too hot to handle.

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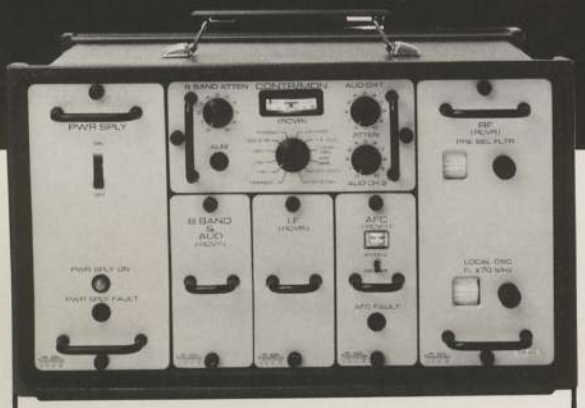

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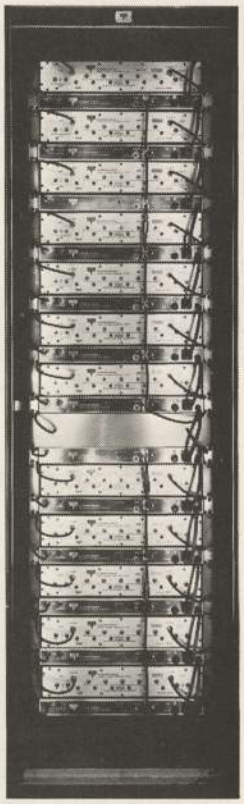

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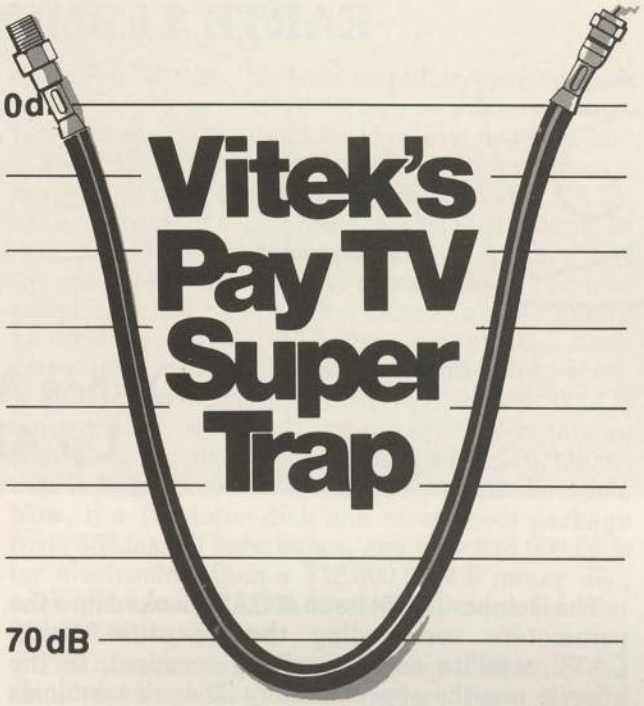

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*Patent Applied For

EARTH TERMINALS – PHASE II

Tulsa Cable Television

Dishes Are Popping Up All Over !!

The October (1975) issue of CATJ looked into the parameters surrounding the Scientific-Atlanta CATV satellite earth receiving terminal. In the interim months approximately 20 such terminals have been installed, and the number is expected to double by mid-April. The optomists in the crowd expect 50 CATV earth receiving terminals in operation by mid 1976.

The installations now in, those going in, and those currently between planning and installation all share one thing in common: *a 10 meter receiving dish-antenna aperture.* The 10 meter dish "fixture" is the "standard" installation primarily because to date everyone getting into the CATV earth terminal business has been in *too much of a hurry* to "fight city hall" over the dish size. City hall, in this case, is the FCC. The Commission has established some antenna receiving pattern criteria for all earth receiving terminals; criteria based, they believe, on adequately protecting the national resource known as the equatorial orbital belt. The "belt" is where satellites can be stacked, at some distance apart, and one day, in the not-too-distant future, the "belt" will be filled up; at least filled up based upon the present 4 degree longitude stacking (or orbit-positioning) increments now established. The FCC says that in order for an earth terminal to see signal *only from* a single "bird" and not have interference from other birds also in orbit and also operating on the same downlink (transponder output) frequency, certain antenna receiving patterns must be adhered to. To the best of our knowledge, the Commission has never previously: (1) licensed receivers that operate *totally separate from* the transmitters, and, (2) taken it upon itself to tell the receiving terminal the exact minimum parameters of the receiving antenna pattern.

There is more to this than simply being concerned about the FCC *licensing receivers;* there is cost. *A lot of cost.*

Normally, a man putting in a commercial receiver will build the receiver and antenna installation in such a way that he gets a signal which he can sell commercially. If he figures his customers want or will settle for a signal to noise ratio of say 45 dB, then he will design his receiving system accordingly. If he figures his customers must have a going-in signal to noise ratio of say 55 dB, then that is how the receiving system is designed.

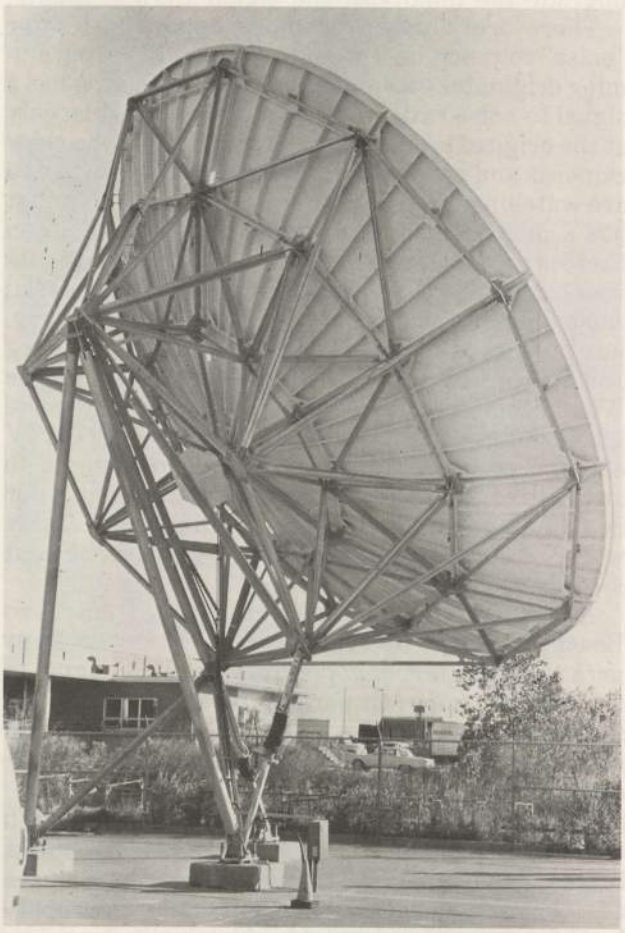
Alas, this is *not* the case with the *present* FCC procedure governing CATV earth terminals. The Commission has said semi-formally (through a "Notice") and informally that "no earth terminal receiving stations for the domestic service will be considered unless they have certain minimum antenna patterns" —patterns which largely seem achieveable only with parabolic antennas of 9 meter aperture or more.

A parabolic has two things going for it at 3.7-4.2 GHz: a pattern with control of sidelobes; and gain. The bigger the dish, the more the gain.

And, the bigger the dish, the higher the cost. The present ten meter dish family costs the user *around* $50,000.00 with mounting pedestal. This means a bare-bones $65,000.00 CATV earth terminal has around 77% of its total bare-bones paper cost *wrapped up in the antenna.*

10 meter Andrew dish as installed at Tulsa Cable Television.

Now here is another number to try on for size—*55 dB signal to noise ratio.* That is what the United Cable/Tulsa, Oklahoma Andrew installation we will be discussing here measured from Westar with the HBO signal received in Tulsa on the 10 meter dish. For reference, the FCC requires a 36 dB signal to noise ratio for any Grade B (or better) level signal carried on a cable system (76.605 [a] [9]). The Tulsa satellite signal is *19 dB better* than 36 dB. If you have a set of back issues of CATJ handy, look up the June 1974 issue and the report starting on page 29 entitled "True Meaning of Signal To Noise Ratios." Pay particular attention to the photographic essay on pages 32-33 where nine photographs show signal to noise ratios of from 0 dB to 40 dB. The same photos also appear on the CATJ Headend Wall Chart.



Rear of Tulsa 10 meter dish; note three-point support mount.

55 dB is a lot of signal to noise ratio. Understand however that this is at the headend, coming out of a demodulator at video (and companion audio), for system carriage via a headend located modulator. The actual *subscriber* signal-to-noise ratio some 10, 20 or 50 amplifiers away from the headend is going to be somewhat less than the headend signal to noise ratio. Plant signal degradation depends upon a host of variables, including trunk and distribution amplifier noise figures, the care with which amplifier inputs are kept at the minimum recommended values or above, the way amplifier spacings are handled and many more factors so numerous that no generalizations about their effects are possible.

Still, it is fair to say that very few, if indeed any, normal antenna-received signals at most CATV systems *begin* at the headend with a 55 dB signal to noise. Therefore, in theory at least, it appears that the satellite received HBO signals are going into the plant crisper and cleaner than any other antenna-received signals, Pehaps even cleaner than many, if not most, of the locally originated channels.

Now try on another number—$12,000.00. That is *aproximately* what a 4.5 meter satellite receiving dish costs on paper. Compared with $50,000.00, that is $38,000.00 *less* money, 24 percent as much. Now, if a 10 meter dish *and* electronics package costs $65,000.00 bare bones, and only $15,000.00 is for electronics, then a $12,000.00 4.5 meter dish with the same $15,000.00 electronics would cost $27,000.00 bare bones.

The question is, will a 4.5 meter dish with the same electronics as the 10 meter dish deliver a signal? And, if it will, what kind of signal will it deliver?

Up in Orland Park, Illinois, the Andrew people have a 10 meter dish and a 4.5 meter dish running on the HBO transponder channel from Westar. The 10 meter dish, running into the 8.5 dB noise figure TerraCom receiver barefoot (i.e. *without* any antenna mounted low noise amplifier) produces a 36 dB signal to noise ratio. More about that shortly.

The 4.5 meter dish, with the *same* low noise amplifier found on the present 10 meter dish family, produces a signal to noise ratio in the high 40's (call it 48 dB). Again, that is at the *output* of the demodulator. And if you had such an installation at your headend, your plant signal to noise at the end of your amplifier cascade would be somewhat degraded.

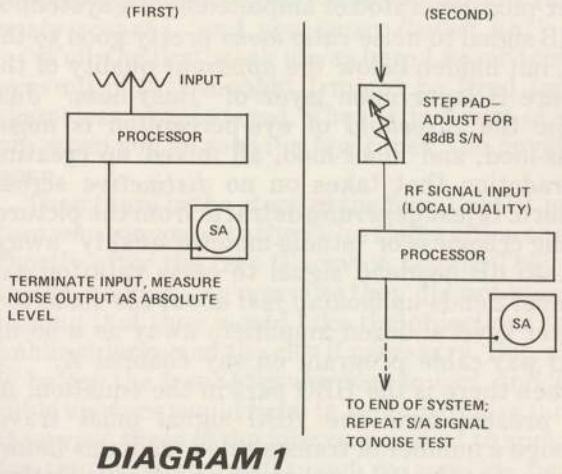


DIAGRAM 1

If your system has access to a Tektronix 7L12 or other quality spectrum analyzer, you can do some *comparison looking* on your own to see what a 48 dB signal to noise ratio *at your headend* would look like *at the end of your line.* Simply take a stable local signal and install a switchable attenuator between

the antenna and the input of the signal processor. Hook up the spectrum analyzer as shown in Diagram one and adjust the pad so your indicated output signal to noise ratio, on the channel at the output of the processor, is 48 dB. Now take the spectrum analyzer to the *end* of your longest amplifier run (i.e. most distant via amplifiers from the headend) and look at the channel in question on a receiver. Hook up the spectrum analyzer and measure the signal to noise at this point.

What you have just done is compare how a *48 dB demodulator output* from the HBO transponder signal source *would look on your system* at the *end* of the longest amplifier run. What you see and measure at the end of the line is what you could expect from the HBO channel on your system as received with a 4.5 meter dish (etc.), at this time. In short, *is it good,* or is it bad?

On the opposite side of the coin there is the *story* we heard recently about a CATV operator who flew down to Vero Beach to look at the pay-TV picture quality coming down through the first CATV satellite terminal installed there. This fellow left disappointed, saying "I came down here ready to go back and order an earth terminal for my systems; but the quality I saw there convinced me that I should wait. I was not impressed."

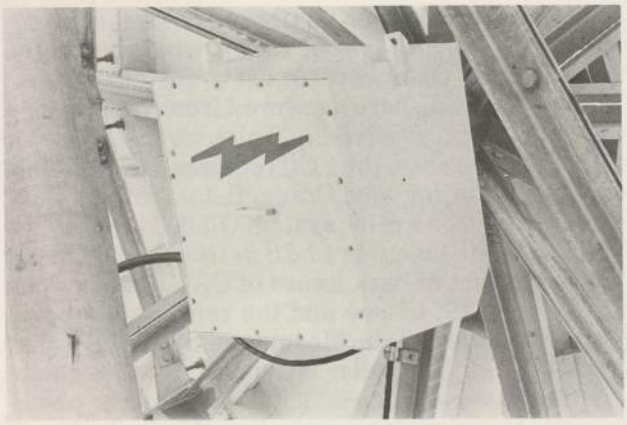
Fine Tuning S/N

With the kind of numbers Andrew measured in Tulsa when the 10 meter dish installation went in late in October, CATV systems are beginning to get their hands on some input signal to noise ratios which for the first time may begin to show up the *true fidelity* of the *CATV system itself.*

As long as we are down in the 40-45 dB signal to noise range at subscriber homes, quality is pretty hard to find; it is buried under noise, cross-mod and inner-mod generated or amplified by the system. A 40 dB signal to noise ratio *looks* pretty good to the eye, but hidden below the *apparent* quality of the picture is layer upon layer of "Busy-ness." Just *below* the *threshold* of eye-perception is noise, cross-mod, and inner-mod, all mixed up creating degradation that takes on no *distinctive* screen pattern. It just *generally* detracts from the picture, taking crispness or "studio-monitor quality" away.

A 45 dB headend signal to noise ratio on say channel 2 ends up *looking just about the same* to a viewer several dozen amplifiers away as a 55 dB HBO pay-cable program on say channel A.

Then there is the HBO part in the equation. At the present time the HBO signal must travel through a number of transmission mediums before it arrives at the RCA uplink transmitter at Gettysburg, Pennsylvania. This includes a few hops of microwave, a couple of miles of terrestrial cable, and numerous interface points. Even at the HBO video production facility in New York there is a new awareness of the potential problem; it is reported HBO is presently spending three million dollars to upgrade the quality of the signal they originate.



Close-up of equipment housing on rear of dish; twin LNA units plus LNA switching equipment inside.

There are a dozen or more opportunities for "noise" to creep in. The bulk of the HBO programming originates on video tape. The video tape has a signal to noise ratio *of its own,* determined largely at the original taping by the parameters of the color cameras and production facilities. If the movie you are watching via HBO starts out on a tape dub that has a *best*-case signal to noise ratio 55 dB, then there is *no way* that after the VTR signal makes its way out of the HBO studios, down the terrestrial cable link, into the microwave path to Gettysburg, into and out of the RCA transmitter at Gettysburg and finally through 22,300 miles of space to the Westar input/ out again through the output of the transponder and finally 22,300 miles to your CATV earth receiving terminal. . . that you are going to do any better than 55 dB signal to noise at your demodulator. In fact, you will do considerably worse. If *not* considerably worse to the eye, at least *measurably* worse.

And so the fellow who went home from Vero Beach unhappy with what he saw? Was he unhappy *with the earth terminal picture?* The HBO signal to noise *at the studio?* Or perhaps he was watching the signal through 10 miles of CATV amplifiers, on a receiver that preceded with a noisy converter!

Perhaps the pay-cable picture *should have* "crisp tones" and "snap to it." Perhaps it *should* "look a lot better than the regular channels"; but the chances are it never will, because the CATV plant is probably, in most cases, *not capable* of letting it stand out, no matter how good the earth terminal demodulator signal to noise ratio may be. The terminal is *not* the weakest link in the chain; in fact, with a ten meter dish, it may be the strongest "link" in the chain, especially if the 53-56 dB signal to noise ratios being reported by the first installations are any indication of where we are.

We'll come back to the 4.5 meter dish.

Tulsa — Andrew Number One

The October issue of CATJ concentrated on the

earth terminal package being offered by Scientific Atlanta. That report was prepared just ahead of the first CATV terminal installation in Vero Beach. Our look at an Andrew Corporation installation will take that next step; a basic discussion of the practical results of a *real* installation and some educated guesses as to where the earth terminal business may be headed.

Jactuator assembly for adjusting dish elevation

The Tulsa United Cable 10 meter dish installation and the companion receiver terminal is about as unpresupposing as one could wish. The dish is big, it is attractive, and it is obviously *not* a toy. In Tulsa's case, it is also tucked out of the way in the back southeastern corner of their parking lot along side several dozen half empty reels of trunk cable. With all of the excitement created by pay-cable, one almost expects to find a dish installed on the front lawn of the cable company, flood-lit at night and guided tours conducted daily between 8 and 5. To find the Tulsa dish, you have to know where to look; there are no lights at night. But there *are* guided tours (we saw two groups of local high school youngsters go through while we were there three hours early in December). Tulsa is obviously getting some good PR from their installation. They are apparently also getting some attention to their "Q Service" (pay cable channel) of another sort as well. Tulsa is in the aproximate middle of what is generally called the 'Bible Belt.' This is that great midsection of the United States where Baptists outnumber corn stalks and church membership (if not attendance) is much higher than the national average. Oklahoma is one of the last states where you cannot go into an open club or bar and buy anthing stronger than weak beer. The Baptists are very strong here, as are many other fundamentalist religious groups.

Because of the content-nature of HBO pay fare (largely R rated movies), Tulsa *expected* some problems with residents who *might* find R movies in their home upsetting. Tulsa placed the "Q Service" programming on channel A-2 (A minus 2 MHz) and for all non-subscribers, there are traps. But to *introduce* "Q" there was nearly a month of free service *to everyone.*

HBO programming begins around 12:30 or just after the noon hour, and runs to about the same point past midnight. The afternoon we were in Tulsa going over the installation with a representative of Andrew, one of those blockbuster biblical extravaganzas was playing. You know the type—a cast of millions, thousands of chariots racing across the country side, whole villages sacked and burned to the ground.

Out in the front lobby there is a large 25 inch console receiver running. "Q" is the service the set is tuned to, of course. After the initial shock of frontal nudity on television, a few words we had not heard via the tube, and our first experience with dis-memberment of human beings (arms and legs yanked from the body etc.), and our first *intimate* view of a gang-rape, we noticed the young lady sitting at the receptionist desk was not even the least bit interested in what was playing.

"Are you near sighted," we asked.

"You mean the pay-channel?" she asked.

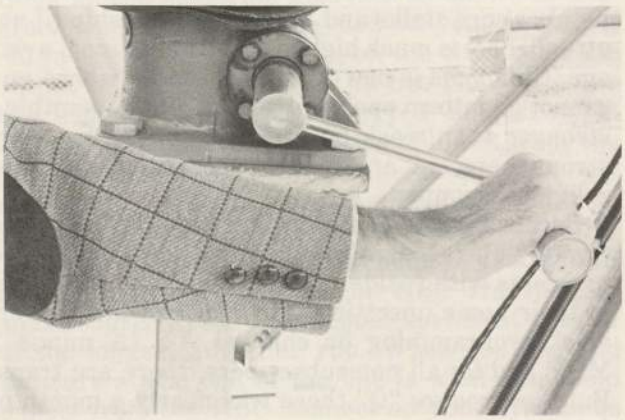
"How is it that you went through nudity, the sacking of a village, a gang-rape and various sundry nasty scenes...and you never looked up?"

"Well, the first week it was here I never took my eyes off of it. I thought I might be fired for the shameless way I stared. Then it just sort of wore off; when you've seen it a few times, the novelty is gone."

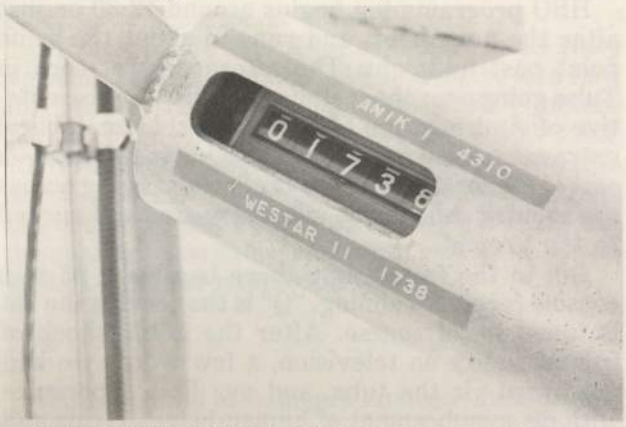
Then there is the story of the four Baptist ministers who convoyed to the Tulsa Cable office one day shortly after the free-Q service began. They protested, and left the message they did not approve, hinting that they would take the objections to the public at large and the city if necessary. But, shortly before the free-Q service *was to end,* and Tulsa cable viewers would have to *sign-up or lose* further Q service, three of the four reappeared to apologize for the prior complaint and *to sign up* for the optional $9.50 a month service.

If there is a message here, it is that *even in Tulsa,* where exposure to the more racy or graphic side of life is infrequent for the average person, the worries and fears of the cable company creating a public outcry have been largely unfounded. At least

that is the way it has been to date.



Hand driving jactuator control to adjust antenna elevation



Counter indicates adjustment position; note pre-measured counter numbers corresponding to two presently operating birds.

Jactuator handle removes and lock goes over stub to prevent unauthorized antenna adjustments.

For all of the unknowns relating to the reaction of the home audience, the engineering behind Andrew CATV installation number one presented few if any surprises. Operating from foundation drawings provided by Andrew, a Tulsa-based sub-contractor went to work to build a foundation. The dish structure requires a fifteen foot deep concrete pier foundation, and it must be approved in advance by a local (to the area) civil engineering firm. In Tulsa's case, the Andrew general specifications (which are for 4000 PSF clay and sand soil and sub soil) had to be redone; the Tulsa site sits on top of a sturdy rock outcropping. Core samples are drawn, and the foundation plans retro-fitted to accomodate the underground strata revealed by the core samples.

The dish framework bolts to three 1-½ inch diameter studs that go down into the piers approximately 6 feet. At the six foot mark below the surface they bend into an "L" to provide a "hard pull" against the balance of the pier itself.

The triangular structure (see photos) forms a combination support structure, and where a crane *cannot* be maneuvered into the site, *a lifting device.* This structure mount is assembled first. The dish itself goes together separately, on its back facing up, adjacent to the triangular support structure.

If there is a crane handy, it takes a couple of hours to lift the dish surface into position to bolt down to the triangular support structure. Lacking the use of a crane, the dish can be moved up to the mount from a position on the ground out in front of the support structure, using a combination of winches, come-along devices and several layers of smart. This takes about a day, so the crane is quicker and probably less taxing on the participants.

Heliax cable with downlink signal plus conduit for powering and control voltages are installed underground from antenna into headend location.

When the dish "skin panels" are in place, the truing procedure begins. Mats are laid down over the dish surface so work people can climb around on

the surface and a fancy *transit* called a theodolite is installed at the feed antenna focal point. The theodolite measures the distance from the dish surface to the focal point antenna mount, to within a few thousands of an inch accuracy. The magnification of the theodolite display makes 5/1000's look like feet to the man running the alignment tool and with his visual sighting of the distance from focal point to skin surface as instructions, the other man or two men proceed to work around the dish to tighten up on the nine threaded studs that make up the surface mount contact points for *each* of the 12 skin panels. In all there are 9 x 12 or 108 total adjustments to make. The panels float independent of one another, and adjusting the 9 threaded stud adjustments on one panel has no impact on any of the other panels of the antenna. The end result of all of this labor is an exotic antenna system, but the work required to do the job is more tedium than exotica.

The Andrew approach to the dish is of some interest. The dish mounts from three points to the rear. This places, they claim, the *center* of gravity low on the antenna itself, which according to Andrew people helps keep the antenna vibrations in heavy winds down or minimal. Andrew characterizes their dish as "extremely rigid" and if you are inclined to jump and grab ahold of the lower lip of the dish and swing around like a third grader, you will come down sure that at least with your own weight applied the dish does not move. Your hands will also hurt because the edge of the dish has some tough (although smooth) edges.

Way back before the foundation was planned or the core samples taken, the general location for the dish was picked. Seemingly anyone with a boy scout compass could find due south. Andrew suggests taking a "star shot" however before the dish is ready to mount or "bore sight" on the Westar (or whatever) bird.

The legs are outfitted with something known as "jack screws." The jack screws have *counters* mounted inside of weatherproof enclosures and as the jack screw handle is turned with a crank (the crank comes off and the entry point seals to prevent unauthorized dish-moving) the counter responds by changing readout numbers. Once the dish is in place and the theodolite adjustments made, the proper pre-calculated numbers are cranked into each of the jack screw adjustments. If the initial paper calculations were accurate, and the construction followed the paper design properly, the dish should be very close to the proper azimuth (left and right along the equator from east to west) and elevation (up and down from ground horizon to straight overhead) to produce a signal.

The 10 meter dish *pattern* is not dis-similar to your sticking your middle finger straight out, and then bending both fingers immediately left and right of the middle finger down to your palm. Hold your hand out in front of you and you see one *main* "lobe" and two equal-magnitude immediate side lobes. That is the *azimuth* pattern for the dish antenna. Now rotate your hand 90 degrees so your thumb is facing up. That is the *elevation* pattern for the dish antenna. When the antenna is "trued" both sets of adjustments (azimuth and elevation) must be taken into account. It is typically done by prov-

TERRESTRIAL INTERFERENCE TO EARTH TERMINALS

One of the often repeated **FCC concerns** over earth terminal receiving dish size is the fear at the Commission that dishes smaller than 9-10 meters will not have sufficient front-pattern resolution to discriminate properly between the intended satellite signal source and other non-intended (bird) sources 4 degrees or more off of the intended source beam heading. It is that old co-channel interference problem, only this time the sources are in the sky and not on the ground.

Well, that is **almost true.**

The downlink frequency region employed by transponders presently serving CATV earth terminals is 3.7-4.2 GHz. This same frequency range is being utilized by point to point terrestrial microwave circuits as well; largely common carrier services run by telephone companies. Sooner or later, somebody is going to want to install a CATV earth terminal smack dab in the middle of a point to point terrestrial circuit using the same frequency range.

When this happens, it will be the side lobe antenna resolution which will allow the CATV terminal to fly, or die, without or with terrestrial circuit co-channel.

The Europeans are already experiencing the problem, **and they apparently have solved it.** We hope the FCC is listening, because if it can be solved for interference between a terrestrial source and a bird-source, it can just as easily be solved for interference between two bird sources. Here is how it works.

An earth terminal located at Goonhilly Downs, England is looking at a bird located over the Indian Ocean. The satellite is low on the horizon for the Goonhilly receiving terminal and consequently the Goonhilly parabolic antenna must look just a hair above the horizon to "see" the satellite. In the process of looking just over the horizon at the bird, the big Goonhilly antenna looks across the English channel and over the countryside (beyond their **radio** horizon) of France. Now over in France there is a point to point microwave station operating in the same 4 GHz band. Now when everything is "normal" the Goonhilly earth terminal receives the Intelstat signals just fine. But when "anomalous wave propagation" conditions exist the French point to point signal may be as much as 30 dB **stronger** at Goonhilly than the Intelstat signal. The analogy in CATV is a co-channel VHF or UHF broadcasting station that normally does not bother your picture quality very much, but given the right kind (or wrong kind, depending upon your point of view) weather conditions, the non-desired station signals get right-potent.

The British have solved the problem by employing a system that readers of the September (1975) CATJ will recall with some glee.

(1) They have installed a small 6 foot auxiliary dish antenna which is purposefully pointed **directly at** the non-desired French microwave station;

(2) The amplitude and phase of the signal picked up by the small auxiliary antenna is fed into the downline of the desired Intelstat signal received on the big dish, and through a "phasor control box" the French signal is phased out.

This is the **exact** same technique CATV systems employing the Microwave Filter Company Co-Channel Eliminator (2903, etc.) device put to use. The British have refined **their version** of the 2903 box one step further however; it has **automatic phase** and **gain control** loops to insure that regardless of varying signal path conditions the French signal is kept "out of the picture".

CATV engineer Sruki Switzer has suggested from time to time that the ultimate CATV co-channel eliminator might well turn out to be just that kind of automatic tracking phase and gain loop system. Other CATV design engineers have added that with the modern family of phase-lock-loops now available, if somebody really wanted to build a CATV (VHF/UHF) version, most if not all of the component parts necessary are now available.

The British have proven that the technique **will work** at 4 GHz, and that fact should add additional fuel to the arguments beginning to build in favor of unlocking any FCC mandated minimum dish size requirements for earth terminal receiving systems.

ing the azimuth sighting first, moving from east or west of the predicted heading *through* the heading far enough that your signal level indicator (spectrum analyzer, or some carrier level meter operating at the 70 megahertz i.f.) indicates the *first* coming-up-on main lobe side-lobe; *then* the main lobe, and then *finally* the going-away-from side lobe. This is usually done a couple of times, recording the readings on the jack screw at say the 3 or 5 dB points *either* side of the maximum indicated level point. Then the *difference* in jack-screw-counter numbers is taken, split in half (i.e. averaged) and *that* is where the jack screws are re-adjusted to for the final "leave-it-alone" setting. This is repeated for the elevation adjustment as necessary.

As pointed out in the October (1975) CATJ, the future home of various satellites will be from 70 degrees west longitude to 135 degrees west longitude. Thus a CATV terminal, not sure what the future may bring in the way of satellite-signal-traffic or programming opportunities, should be *capable* of tracking the azimuth from the far eastern edge (70 degrees west) to the far western edge (135 degrees west). This means the initial planning for the dish mount is done in such a way that the antenna can be easily (or inexpensively if not easily) re-adjusted or bore-sighted on the additional "birds" if the need arises. Westar II, the present bird being used by HBO, is (for example) sitting at 123.5 degrees west longitude. The new RCA bird, which HBO will move to when all of the political and technical adjustments are out of the way, parks at 119 degrees west longitude. The present and planned bird locations are shown separately here in table 1.

TABLE ONE—BIRD LOCATIONS

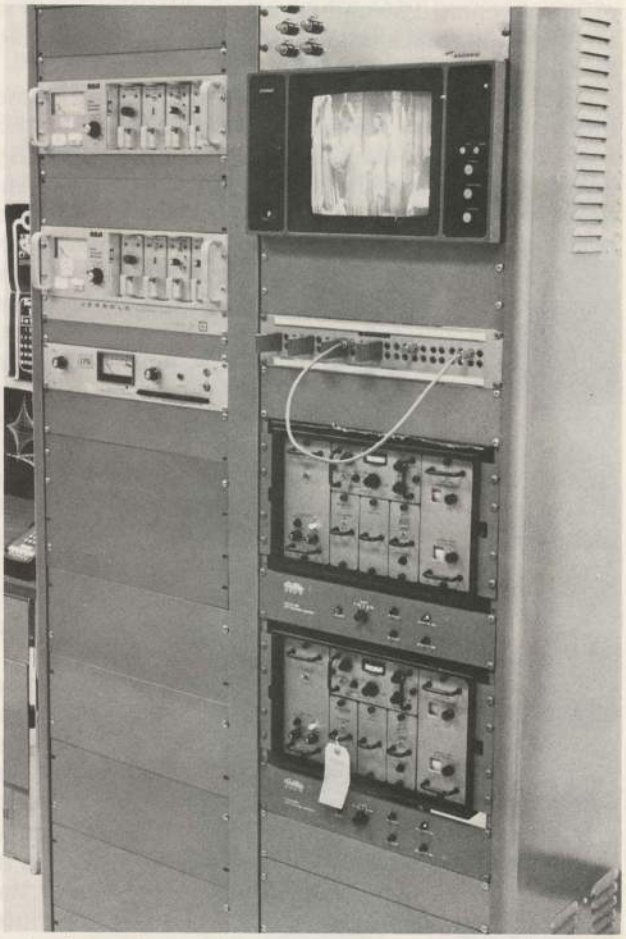
99 Degrees West	Westar I
104 Degrees West	ANIK III
109 Degrees West	ANIK II
114 Degrees West	**ANIK I**
119 Degrees West	RCA SATCOM-I
123.5 Degrees West	Westar II
129 Degrees West	RCA SATCOM-II

ANIK-I has three operating video channels; one for CBC-French network, one for CBC-English network, and one for CBC-Northern network (often audio is specialized for local Eskimo areas).

Elevation's for birds approximately due south of the receiving location are typically 40 degrees +/— 3 degrees.

The Andrew dish requires about two minutes cranking time to move from Westar to Anik-I. An optional remotely controlled motorized drive is available; there will be some remote, unattended sites, where this is more of a necessity than a luxury. For Tulsa, the walk from the office and headend to the crank is about 30 seconds time so a motorized remote control is a luxury there.

The present downlink satellite band is in the 3.7 to 4.2 GHz band (see October 1975 CATJ). There are twelve 40 MHz wide channels in the band. The Andrew antennas are equipped with a *dual-band* feed; using a device known as an "ortho-coupler." The ortho-coupler is really nothing more than a piece of waveguide designed in such a way that it acts like a bandstop filter. There are two spigots on the coupler—one for 3.7-4.2 GHz and one for 5.9 to 6.4 GHz. At the present time the 5.9-6.4 GHz spigot is sealed shut. However in the future it could be connected to its own transmission line, and the transmission line in turn connected to a 5.9-6.4 GHz *transmitter*. With that in place, the Tulsa terminal could transmit to the bird as well as receive. The focal point antenna is already dual-banded, covering the 5.9-6.4 GHz band *in addition to* the present downlink range.



Complete earth terminal headend electronics installation, including (right hand rack) video monitor, twin TerraCom receivers, (left hand rack) RCA Channel "A" modulators (on-cable and a spare).

Andrew has no must-buy package, but they *do* have strong *recommendations* to make to the buyer. For example, the Tulsa system has complete redundancy *after* the antenna proper. There are two LNA's (space talk for low noise [pre] amplifiers), and two complete receivers. See Diagram 2. If there is a signal failure at the terminal itself (i.e. at the receiver demodulator output) the automatic package immediately starts substitution procedures to look for a signal again. First it switches to the standby LNA. Then if that comes up zero, it

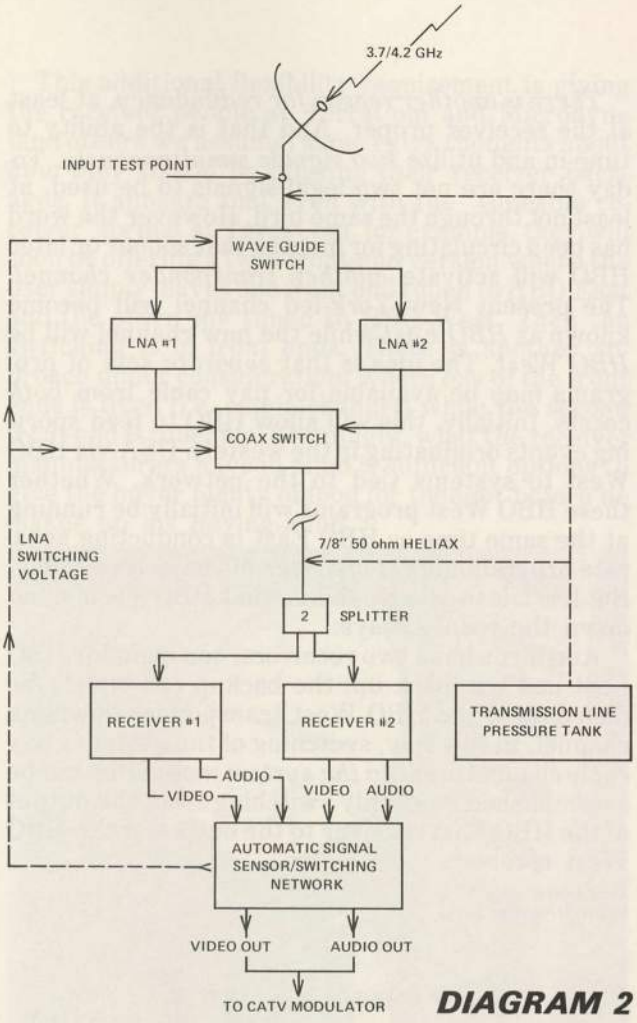
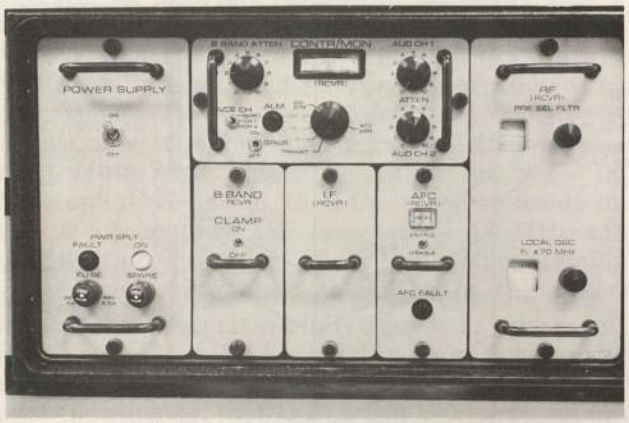


DIAGRAM 2

switches to the second receiver. The pre-amplifier subject was covered pretty completely in the October (1975) CATJ, and will not be repeated again here. Suffice to say that if one is expensive, two cost twice as much.



TerraCom 3.7/4.2 GHz receiver in use at Tulsa Cable Television.

Andrew does *not* manufacture receivers, but they have formed a liason of sorts with a California company that does. TerraCom has been producing microwave-range receivers for long enough to be *one* of the established leaders in the field. The TerraCom single conversion superhet receiver is discussed separately here. Of particular interest is the fact that the receiver tunes for the operator about the way you tune an FM or AM radio; that is, it has *a form of* "continuous tuning." Just crank on a knob (see photograph) and the giga-hertz spin by in the window. We are not certain why this is appealing, except of course you never have to worry about having the right crystal in your down converter oscillator at the receiver. Any of the standard twelve downlink channels are available at the twist of a knob. Actually there are two knobs; see separate report here.

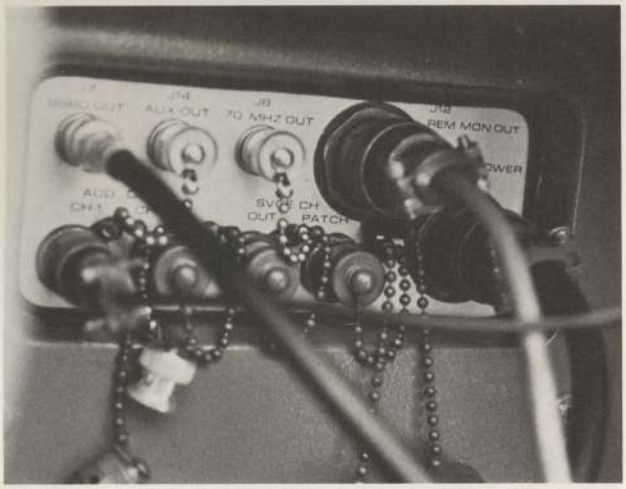
Top-portion TerraCom receiver with meter-reading functions and controls.

Tuneable front-end TerraCom receiver. Top knob adjusts RF pre-selection filter; bottom knob adjusts local oscillator (see separate receiver detailed report here).

Andrew allows the buyer to do his own thing just about any way he wishes. There is the *complete* Andrew responsibility package where they are responsible for just about everything but the foundation. This includes a complete package check out, and certification after installation. Then there is the Heritage (Des Moines) approach where the buyer buys all of the parts of the package and does his own installation and check out.

No two installations seem to be exactly alike. The Owensboro (Kentucky) installation, for example, has chosen the Microdyne receiver package (a competitor to TerraCom). There are several LNA suppliers, and of these Avantek is familiar to CATV types. What each has in common, is of course the Andrew antenna; approximately $50,000. of dish.

The redundancy area is getting alot of attention these days, *for a number of reasons.* First there is the "what happens if the equipment fails" concern. Shortly after Tulsa became part of the HBO satellite network, there was a 51 minute outage. After the twin LNA's did their automatic switching and the twin receivers swapped back and forth looking for a signal, it was learned that the RCA *transmitting station* near Gettysburg, Pennsylvania, had an AC mains power failure and was without juice to goose the uplink signal for that period of time. No amount of Tulsa redundancy would have solved that one—for now.

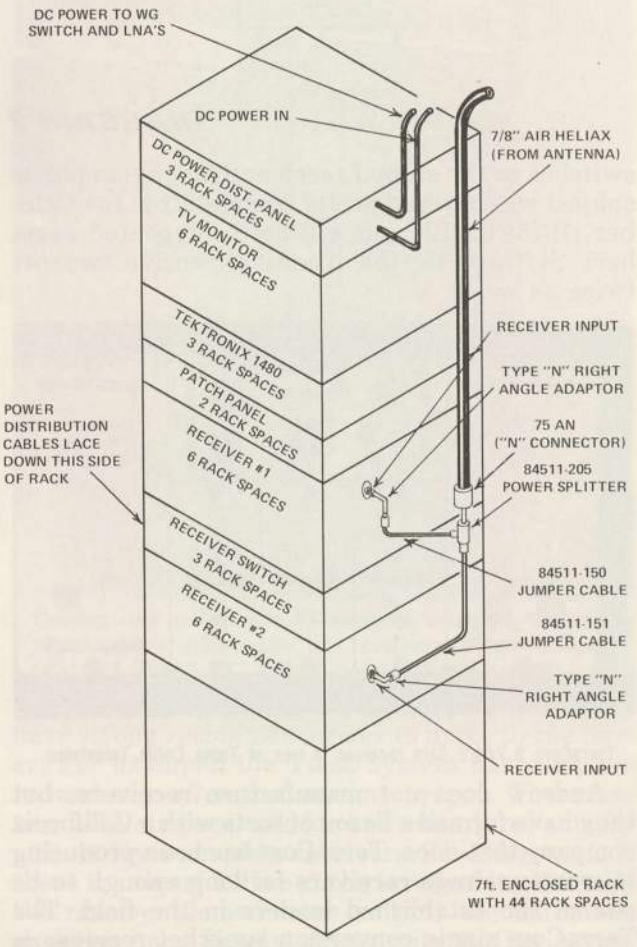


Rear of TerraCom receiver showing cable attachment apron.

It would take an act of an extremely unfriendly God to wipe out the dish itself, so redundancy *here* seems unwise if not impractical. The electronics is another matter. As pointed out in the October CATJ, the failure record of most suppliers and their units is enviable. Anyone who is willing to shell out the $50k plus for the dish seemingly would be not terribly concerned about backing up his passive antenna investment with some extra bucks for the electronics. In round kinds of numbers, the active components (via the Andrew "package") run around $8,500.00 for the receiver and $3,000.00 for the LNA. For an additional cost of either a receiver, an LNA or both, the total cost of the system has *not* increased dramatically.

There is another reason for redundancy, at least at the receiver proper. And that is the ability to tune-in and utilize *two signals simultaneously.* Today there are not two legal signals to be used, at least not through the same bird. However the word has been circulating for months that sooner or later HBO will activate *another transponder channel.* The present New York-fed channel will become known as *HBO East* while the new channel will be *HBO West.* The idea is that *separate* sets of programs *may* be available for pay cable from *both* coasts. Initially, this will allow HBO to feed sporting events originating in the western USA via HBO West to systems tied to the network. Whether these HBO West programs will initially be running at the same time as HBO East is conducting separate programming is a matter of conjecture today. But it is fair to *assume* this is what HBO has in mind down the road a ways.

And if you have two receivers, one main for HBO East and one back up, the backup can simply be dialed up to the HBO West transponder downlink channel. In this way, switching of the system's pay cable channel *input to the system modulator* can be accomplished by simply switching from the output of the HBO East receiver to the output of the HBO West receiver.



TYPICAL RACK CONFIGURATION

DIAGRAM 3

This additional flexibility requirement is giving the receiver people at TerraCom and Microdyne (and others we assume) some extra thoughts about *how* they should be offering their receiver packages. It appears that even with the "tuneable receiver" format at TerraCom, for example, they will soon be offering a twin-front-end version where the user simply leaves one front end tuned to HBO East and the other one tuned to HBO West. *Then* the switching is in front ends. There is another approach under consideration; where one of the front ends is fixed (i.e. single channel) while the second front end is tuneable. Seemingly, what the receiver manufacturers have in mind is sufficient options to give the buyer plenty of food for thought before he makes up his buying-mind.

Feedline pressure monitoring meter; pressure is in ounces.

There is one more variable worthy of note for the prospective receiver buyer; i.f. bandwidth. The 70 MHz i.f. center frequency is i.f. aligned in the receiver for a certain bandwidth. Typically, this is for +/— 18 MHz or a 36 MHz total bandwidth. As with a standard television receiver, the i.f. bandwidth *can be* narrowed for *some* improvement in signal plus noise to noise ratio and at some theoretical sacrifice in signal quality (read picture *resolution*). *If* the transponder passes the full +/— 18 MHz uplink deviation, then the receiver needs to see or i.f. amplify *the same* +/— 18 MHz i.f. bandwidth to recover *all* of the picture intelligence originating back at HBO. On the other hand, if the system is *not* fully deviated at any point from the HBO control central in New York up to and including the transponder downlink package over the equator, then the i.f. *can be* sharpened up *somewhat* and some improvement in signal to noise ratio *will* result.

For reasons best known to them, the Tulsa system ordered their receivers with a 30 MHz i.f. bandwidth. If our calculations are correct, this may result in an improvement in signal to noise ratio of say 0.5(0001) dB above the standard 36 MHz i.f. TerraCom and others *normally* utilize. (*If* you could take the i.f. bandwidth *down* to say +/— 9 MHz or 18 MHz *total* bandwidth, you *could* pick up 3.0 dB in *theoretical* signal to noise; *but* in doing that, you would *lose* much of the picture detail in the process.)

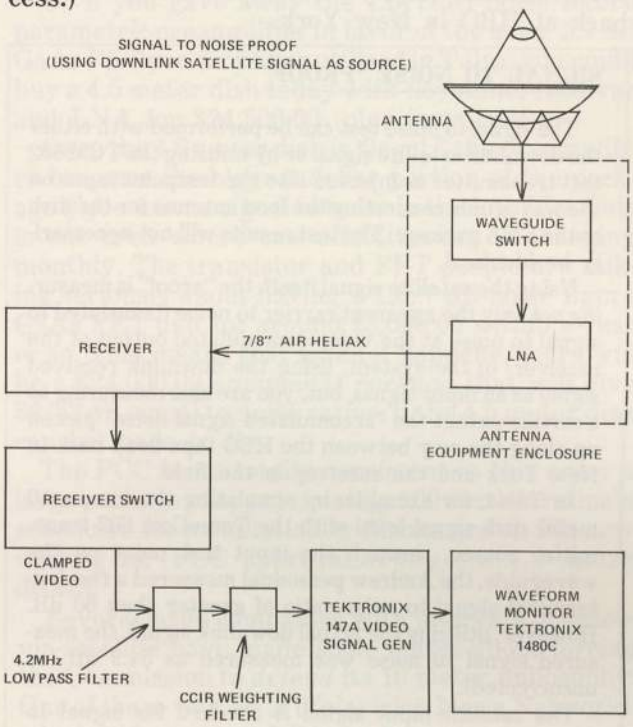


DIAGRAM (A)

System Check-Out

The system checkout is performed not only with the HBO signal through the bird, but also with a simulated test signal introduced into the package at the waveguide coming back to the 4-6 GHz orthocoupler. See Diagram A. The concept is this.

The antenna is separately tested for its trueness with the theodolite. The antenna has also been zeroed-in on the satellite by careful adjustment of the azimuth and elevation controls so that the installation crew feels certain they are dead on the bird with the antenna's main lobe, in both planes. The antenna gain is known to be 51 dB, +/— 0.5 dB.

Therefore if a test signal, originating at a signal generator test set, is adjusted to produce a signal of *identical level* as the *carrier* level of the bird transponder transmitter, at the *input* of the LNA, then the balance of the system can be checked out for signal to noise, phase delay and response flatness *without using* the signal proper.

The rational behind this is multi-faceted. For one thing, the *integrity* of the signal to noise of the *transponder's signal* is open to *some* minor question at this time; simply because the various links such as the uplink to the transponder, the microwave links between New York and Gettysburg, the landline link from HBO to the microwave transmitter, and the signal to noise of the video coming out of the HBO studio is not verifiable *out in the field.* If the real signal *alone* were utilized, the tests would be

limited to the transponder—on time for the bird, and would be equally dependent on the mundane things like the quality of the tape or tape head way back at HBO in New York.

SIGNAL TO NOISE "PROOF"

The signal to noise test can be performed with either the downlink satellite signal or by utilizing the TCM 602 test transmitter as injected into the testpoint input on the waveguide connecting the feed antenna for the dish to the LNA package. The test results will not **necessarily** be identical.

Using the satellite signal itself, the "proof" is measuring not only the apparent carrier to noise (translated to signal to noise at the video-demodulated output of the receiver) of the system, using the downlink received signal as an input signal, but, you are **also** measuring to a certain extent the "accumulated signal-noise" picked up along the way between the HBO tape head back in New York and the receiver in the field.

In Tulsa, for example, by simulating the **known** 10 meter dish signal level with the TerraCom 602 transmitter source, through the input test point on the waveguide, the Andrew personnel measured a receive-terminal signal to noise ratio of **greater than** 60 dB. However, utilizing the actual downlink signal, the measured signal to noise was measured as 54.9 dB (as uncorrected).

The satellite-input signal is checked for signal to noise ratio utilizing the test package shown in Diagram A.

The transponder signal is tuned in with the receiver tuning deck. A Tektronix 1480C waveform monitor (set for 1 volt peak to peak video display, with filters inserted) and Tektronix 147A Video Signal Generator are set up as shown. The video signal generator inserts a VITS signal to the waveform monitor, with ½ line noise. The known noise source (VITS) is compared on the waveform monitor against the video signal present and the signal to noise calculation taken from the ratio between the known and unknown noise level/signal level.

So the system is initially checked out *using a test set.* The spec deviation is +/— 0.5 dB from input port to the LNA to output port of the demodulator. The delay is speced at *25 nanoseconds* from LNA input port to demodulator output at video. The Tulsa system produced measured signal to noise ratios of 56/57 dB for the (real) Westar transponder and 54 dB for the (real) Anik II bird. The antenna level signal is assumed or measured to be 17.9 dB *carrier to noise.* This transcribes on paper to 55.1 dB signal to noise when the so-called *fm improvement factor* is added in, to determine *actual* signal to noise at video at the output of the demodulator. The FM improvement factor for a 36 MHz i.f. bandwidth is 37.2 dB.

The Andrew Tulsa installation was the first for United Cable. United used Tulsa as a training ground for their own (new) highly specialized satellite terminal installation (and maintenance) crew. The crew will do future United installations, some of which (i.e. Hayward, California) will be operational before this appears in print. United will also be purchasing their own terminal test set to check out their own terminal packages on a routine maintenance basis.

10 Meter Dish Future

Early on in this report we touched upon the matter of dish size. In our October report we noted that much of the Canadian interest in using their own Anik series of birds centers around utilizing the less expensive 4.5 meter dishes. For the cost differential, it is obvious why this would be attractive.

LNA INTERFACE

Typically, the CATV system purchasing an earth terminal is reasonably free to choose the component parts (i.e. devices external to the basic receiving dish) from the supplier he wishes.

The pre-amplifier (called an LNA in the satellite business) is a case in point. The primary supplier of LNA's for earth terminal service at this point would appear to be well-known-to-CATV supplier **Avantek.** As pointed out in the preliminary CATJ report last October, the earth terminal buyer has a choice of three pre-amplifiers; a bi-polar transistor device, a GaAs FET (Gallium Arsenide Field Effect Transistor) device, and a top-of-the-line (and bucks) parametric device. To date, the vast majority of systems have purchased the middle ground GaAs FET device LNA.

There are domestic GaAs FET (transistor) suppliers and foreign suppliers. Of the latter, apparently only Nippon Electric Co. Ltd. of Japan has made a substantial dent in the 1975 worldwide GaAs FET market of some $600,000.00 value. Nippon undoubtedly makes their own GaAs FET devices **and** manufactures total units (i.e. amplifiers) using their GaAs FET units; but their **primary market** seems to be outside companies who want the Nippon version to manufacture total units such as the LNA for CATV service.

Of the domestic suppliers, many, if not most, manufacture GaAs FET's primarily for use in **their own** brand LNA units and other amplifiers. Avantek is a good example of this. The tiny GaAs FET 'chips' are so small that it would take several hundred units just to cover the tip of your finger. They are manufactured with 1 micron gate leads (1 micron being a measurement of gate-lead size), using a gold metallization system. The ability of a GaAs FET to develop really low noise figures is partially a function of the gate lead size; if, for example, the device could be manufactured with a gate lead of 0.5 micron size, the noise figure yield would drop from the present 2.7 dB to around 2.3 dB. This is not a world for timid people, or big thumbs!

Standing **alone,** the GaAs FET has value. But when one or more are installed into an LNA unit for CATV, combined with a small selection of discrete parts and a power supply, the value climbs **considerably.** The Avantek AW-4226 LNA, covering 3.7 to 4.2 GHz, has a price tag of around $2,500.00. It consists of **one** carefully selected GaAs FET in the front end, matched to the 50 ohm antenna through a microwave type of "isolator" matching network (GaAs FET's have very poor 50 ohm match at microwave frequencies), followed by a cascade of bi-polar transistors for the rated total package gain of 49 dB.

As a manufacturer of the GaAs FET, Avantek is its own best customer. Where one division manufacturers the GaAs FET, another division "buys" the device from the manufacturing division and turns out the completed ready-to-plug-in LNA. This is called a "captive" or "internal market."

The present LNA devices function in an ambient kind of temperature environment. That means no special cooling or heating is applied; the unit cooks along in the air temperature where it mounts.

In addition to the hope that .5 micron gate leads will bring the noise figure of a finished amplifier down, there is also the additional hope that through a process known as thermoelectric cooling, the noise figure of the GaAs FET amplifier may be **lowered** even more. It is known that under laboratory conditions when the GaAs FET **device** (as opposed to the **full** amplifier unit) is "cooled" that the noise figure drops. Through the combination of reduced gate lead size **and** cooling, the GaAs FET

LNA of the future, for CATV earth terminal service, will exhibit a practical operating noise figure of **less than** 2.0 dB.

Companies manufacturing GaAs FET's in addition to Avantek are Hewlett Packard, Hughes, Raytheon, TRW and Varian. However it is reported that all of these firms utilize their full GaAs FET productions for their own amplifier devices; ala Avantek. The only apparent supplier of GaAs FET's as discrete parts in the U.S., other than Nippon which imports parts, is Fairchild.

Finally, on the opposite end of the "stick" is Watkins-Johnson, a California firm of some stature in the microwaves area which manufactures LNA's (including some 'quoted' to CATV earth terminal users); but which does **not** manufacture GaAs FET's. W-J is reportedly largely dependent upon Nippon for its discrete GaAs FET's.

AVANTEK LNA SPECS

Frequency Range	3.7-4.2 GHz
Noise Figure	2.7 dB Max
Gain	49 dB Min
Delta Gain Over Temp	+/— 1.5 dB
Gain Slope	0.01 dB/MHz Max
Linear Group Delay	0.01 nanosecond / MHz Max
Parabolic Group Delay	0.001 nanosecond / MHz2 Max
Power Output/1 dB Comp	+15 dBm (+62 dBmV) Min
VSWR	1.25 Max in/out
Intercept Point, 3rd Order	25 dBm Min
Input	50 ohms, CPR-229G (pressurizable)
Output	50 ohms, N female
Operating Power	—24 VDC (180 mA)
Temperature Range	—40/+60 degrees C
Housing	Weatherproof

Manufacturer—
Avantek, Inc.
3175 Bowers Avenue
Santa Clara, Ca. 95051
(408/249-0700)

And as noted, the big bug-a-boo *seems to be* the FCC.

The FCC is not, in fairness to the Commission, immoveable on the subject. They simply *want to be shown* that a 4.5 meter dish *will* accomodate the long range goals of multiple satellites parked every four degrees of longitude; in such a way that one transponder does not create receiver interference for users of other nearby or adjacent satellites.

Seemingly, a 4.5 meter dish *could* provide sufficient signal to noise for many systems; *perhaps* for most systems, if *not* all systems. At the present time, a system can make up most of what he might lose of the near-perfect 55 (+) dB signal to noise measured in Tulsa by moving from the *standard* 2.7 dB noise figure LNA currently being utilized by most installations to the more expensive 1.6/7 dB noise figure parametric amplifier. Presently, the 2.7 dB noise figure LNA costs the user around $3,000. The exotic version, a parametric unit, costs around $18,000. Thus you can *expect* to see 52/53 dB signal to noise ratios *with a 4.5 meter dish and a 1.6/7 dB noise figure parametric amplifier today.* Or, you can settle for a 45/48 dB signal to noise today by using the 4.5 meter dish and a 2.7 dB noise figure pre-amplifier.

The 4.5 meter dish *plus* receiver *plus* downline *plus* 1.6/7 dB noise figure parametric amplifier will cost you today around $39,500.00 plus installation. That is for 52/53 dB signal to noise ratio. A 10 meter dish, *with* a 2.7 dB noise figure pre-amplifier, *plus* receiver and downline will cost you $63,500.00 plus installation. Today, *if 4.5 meter dishes were legal,* for 2-4 dB *less* signal to noise ratio *you could save $24,000.00.*

Or if you gave away the 1.6/7 dB noise figure parametric preamplifier in favor of the same 2.7 dB GaAs FET pre-amplifier utilized in Tulsa, you could buy a 4.5 meter dish today with downline, receiver and LNA for $24,500.00 (plus installation).

Once the 4.5 meter dish is "legal," the preamplifier becomes the biggest dollar portion of the package *if you want* a signal to noise in the low 50's. This is one area where cost-effectiveness is changing monthly. The transistor and FET people are talking seriously about having a 1.6/7 dB noise figure GaAs FET unit for around $3,000.00 within a year or so. That means that *when* it happens, there will be a $24,000.00 *equipment package* that will give 52/53 dB signal to noise ratios, if the 4.5 meter dish can be made to fly.

The FCC is not totally consistent in this area; a large package of approximately 100 earth terminals scheduled for installation in Alaska are on file now waiting for FCC approval. *They are 4.5 meter dishes.*

Several large companies with interests in video-via-satellite have made some noises about *forcing* the Commission to *defend* its 10 meter philosophy. One of these was TVN (Television News Network), which folded up last fall but whose members (made up largely of the *non*-network TV stations) are still pushing privately for a national "news" network tied together via satellite and 4.5 meter dishes. Another outfit looking at filing a formal "challenge" before the FCC is an MDS operator who sees the obvious benefits of tieing together the past growing MDS transmitters scattered from coast to coast; so his company could serve the MDS people much like HBO serves the growing CATV satellite pay-cable users.

There are other perhaps less influential but still potentially dramatic rumblings in the same arena. There is, for example, the CATV operator in Texas who is constructing *his own* dish from a concrete shell. Or the fellow in Kansas who is in the process of digging a ten meter dish out of the side of a well positioned hill. This is not as crazy as it sounds. The largest parabolic antenna in the world, at Arecibo, Puerto Rico, is constructed in a natural "hole in the ground"; and it is some 1,000 feet across (aperture). Then there is the story of the antenna supplier who showed *some reluctance* to sell a complete ten meter station to a private individual in west Texas. The individual traveled to the supplier's home office with a $50,000.00 deposit check in hand to place his order; he "wanted to give his Mom a nice Christmas present" according to the story. He wasn't in the cable business; he was in the oil business.

Finally, there is the fact that with a 10 meter dish connected to a *barefoot 8.5 dB noise figure* Terra-Com receiver at Andrew's Orland Park, Illinois

headquarters, the Andrew people have measured a 36 dB signal to noise ratio. The picture has some noise in it, but it is plenty watchable. In *theory*, a 4.5 meter dish tied to the same barefoot receiver would provide a 27 dB signal to noise ratio. That may not be commercially saleable on cable, but it is plenty of signal for someone to "fool around with." And the *ingredients* are there for "fooling around." Amateur radio publications frequently show home-constructed 12-16 foot parabolic antennas, which with some refining would be serviceable up to the 3.7-4.2 MHz range. And the receivers? Well, Tulsa chose the TerraCom receiver largely because the United Video microwave company largely utilizes TerraCom microwave equipment and is pleased with the service it has given. In other words, an enterprising half talented person with a small measure of test equipment could take an existing microwave receiver and put together a 3.7-4.2 package satellite receiver.

TERRACOM RECEIVER SPECS

Frequency/Tuning Range	3.7-4.2 GHz
Modulation	FM
Noise Figure	8.5 dB
IF (center frequency)	70 MHz
IF bandwidth	36 MHz
Preselector	Continuous tuning with direct frequency readout
Threshold (36 MHz i.f.)	—76 dBm (—29 dBmV)
RF Input Level	—20 dBm Max —35 dBm Typ
Frequency Stability	Tracking AFC system
Frequency Control	Solid state oscillator with direct-reading dial
Baseband Video—	
Impedance	75 ohms unbalanced
Level Control	10 dB range, 1 dB steps
Output Level	1 volt p/t/p
Square Wave Tilt	Less than 1%
Differential Phase	+/— .4 degree 8 MHz deviation +/— .6 degree 24 MHz deviation
Differential Gain	+/— .4 dB 8 MHz deviation +/— .6 dB 24 MHz deviation
Signal To Hum	58 dB ratio, minimum
Frequency Response	+/— .5 dB 10 Hz to 10 MHz without elliptical filter
Chroma Delay	25 nanoseconds maximum
Baseband Audio—	
Impedance	600 ohms balanced
Output Level	+10 dBm
CCIR Weighted S/N	55 dB minimum
Signal / Hum	55 dB minimum
Total Harmonic Distortion	1% max
Frequency Response (50 Hz/14 KHz)	1.5 dB
Miscellaneous—	
Input	Type N female
Output (video)	BNC
Output (audio)	MS (plug)
Temp Range	—10/+50 degrees C
Dimensions	16.25" W x 9.5" H x 12" D
Weight	45 lbs.
Video Clamper	30 dB min rejection of 1 volt p/t/p 60 Hz interference
Subcarrier (audio)	6.8 MHz

Manufacturer—
TerraCom, Inc.
9020 Balboa Avenue
San Diego, Ca. 92123
(714/278-4100)

Like it or not, and the equipment suppliers probably won't, the interest in receiving the HBO programming is extending far below the relative few *presently financially qualified* to shell out the $65,000.00 plus required to get into the act. And necessity is the mother of invention.

It is very unlikely that the present 10 meter package $65,000.00 figure will change very much. Too much of the package is wrapped up in the antenna; and too much of the antenna's cost is wrapped up in the steel involved, and the labor required to put it together.

So the next *logical* price dive, *if it occurs*, is going to be in the relaxation of the 10 meter or larger criteria of the FCC. The 4.5 meter configuration will, when and if approved, probably make satellite signal delivery feasible for 3-5 times as many CATV systems as the present 10 meter dish configuration.

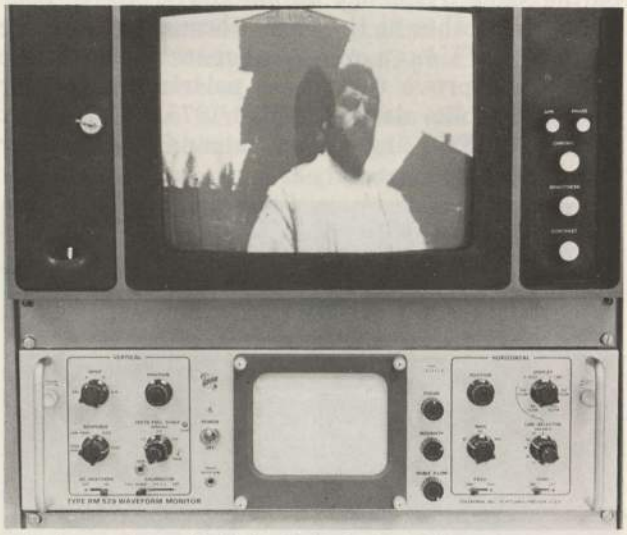
Somebody Else Owns Package

There is considerable joint-system-*interest* in combining limited resources to *jointly* construct an earth terminal. *There are many unanswered questions in this arena.* For example, must a joint-use terminal be equally cost-shared, or could it be *unequally* cost-shared? Can one person or company install a terminal, and simply "sell" service to other nearby systems? Suppose the terminal owner *is not* a CATV system operator at all; but rather just somebody who wants a terminal in "his backyard"; and who wants to help pay for his fetish with some others using the signals the terminal provides? *Is that a common carrier?* Or is it an *uncommon* carrier? The rules governing satellite terminals answer none of these questions *directly.*

RCA modulator carrying HBO signal on channel A (—2 MHz) to system subscribers. Modulation meter is on audio.

There are persistent rumors, usually denied, that at some point HBO will install its own receiving terminals at well chosen locations around the country; and then simply use terrestrial microwave to tie CATV systems in the region to the terminal. There is another rumor, denied *less* strenously by HBO, that they might purchase a terminal for a microwave common carrier operator to get their programming into *his* network of terrestrial link-

ups. If an existing terrestrial CATV common carrier serves say 30 systems, then one terminal would allow him to carry the HBO programming to all 30 systems. Seemingly, thanks to the satellite, HBO may well be in front of a couple of million already cable connected homes before another year has passed.



Back-up color monitor in headend showing HBO signal; waveform monitor below.

Finally, there is always the leasing route. Leasing companies traditionally pop out of the woodwork just about the time the cream is off of the cash-dollar market. There are signs that by mid-year this year that cream will have been skimmed, and with 50-60 terminals in operation, the *next big growth phase* may be a tight race between leasing companies and joint-system-efforts.

4/6 vs. 12/14 GHz

All of the present family of *birds* launched or planning to be launched within this calendar year for commercial purposes are operating in the 4/6 GHz range. That is, all receive the uplink on 5.9-6.4 GHz and come down on the downlink in the 3.7-4.2 GHz range. The cadre of space-communication people who are years ahead of the times have *already* written "off" the 4/6 GHz range. *Some* of these people are forecasting 12/14 GHz will *replace* 4/6 GHz in the years ahead. Others, who seem more realistic, view the 12/14 GHz range as a growth range, where additional users will one day be accommodated.

Generally speaking, 12/14 GHz is today where 4/6 GHz was eight years ago. A CTS bird (Communications Technology Satellite) will soon be exploring the unknown properties, and problems, associated with this new to satellite frequency region. Most of the money for the CTS program is coming from the government. AT&T and others are an-

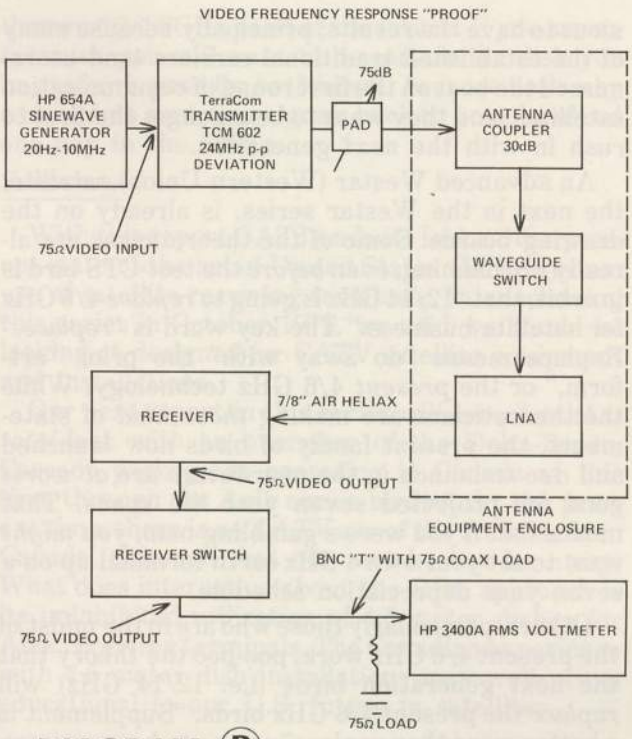


***DIAGRAM* (B)**

VIDEO FREQUENCY RESPONSE "PROOF"

A detailed explanation of the various "proof tests" an earth receiving terminal is put through would be a needless waste of valuable publication space. However, some **highlights** of the techniques employed by Andrew in making certain that a newly installed earth terminal is functioning properly, and the same techniques which will be later employed by CATV technical personnel to ensure the earth terminal is maintaining its operating parameters, is educational.

See Diagram "B" here. The equipment is set up as shown, with the TerraCom TCM 602 transmitter "source" coupled into the test point on the antenna coupler behind the dish proper. The TCM 602 transmitter source is driven (i.e. modulated) with an HP 654A sinewave generator, covering the 10 hertz to 10 megahertz range.

The "elliptical filter" (in receiver i.f.) is removed from the receiver, and the 6.8 MHz notch filter (audio is transmitted on a 6.8 MHz sub-carrier at the uplink transmitter) and 8 MHz Butterworth filter are removed from the TCM 602 transmitter source.

The sinewave generator is set for the proper input to the TCM 602 and adjusted to 762 KHz. The receiver output of the sinewave signal is read on the HP3400A RMS voltmeter and recorded as a **'reference value.'** Then the sinewave generator is run through the frequency range from 10 Hz to 10 MHz in 18 steps (output of HP654A is held constant) and the results compared against the 762 kHz reference level recorded. By recording the measurements for each specified frequency from 10 Hz through 10 MHz, the video frequency response of the system can be plotted. Variations of fractions of a dB are apparent, and the system integrity for the modulated waveform is apparent.

xious to have the results; principally because many of the established traditional carriers (and users) missed the boat on the first round of communication satellites, and they want to be amongst the first to rush in with the *next* generation.

An advanced Westar (Western Union) satellite, the next in the Westar series, is already on the drawing boards. Some of the theoreticians are already proclaiming, even *before* the test-CTS bird is in orbit, that "12/14 GHz is going to *replace* 4/6 GHz for satellite business." The key word is *"replace."* Replace means "do away with" the prior "art-form," or the *present* 4/6 GHz technology. While the theoreticians are making *those kind* of statements, the *present* family of birds now launched and due to launch in the near-future are *at worst* good for projected seven year life spans. That means that if you were a gambling man, you *might* want to set your own 4 GHz earth terminal up on a seven year depreciation schedule.

Others, particularly those who are in the midst of the present 4/6 GHz work, poo-poo the theory that the next generation birds (i.e. 12/14 GHz) will *replace* the present 4/6 GHz birds. "Supplement is a better word than replace" seems to be a common feeling. If the satellites turn out to be the best thing since AT&T spanned the country with terrestrial microwave back in 1951, then the demand for satellite transponder *time* will grow; far enough and fast enough, most believe, that there will be plenty of room and business *for both bands.*

HBO identification and introduction to feature film; photo taken from 25 inch color receiver in Tulsa Cable lobby, picture showed noticeable degradation from video monitors in headend.

There are still a few unresolved questions pertaining to the present 4/6 GHz birds. For one thing, there is frequency re-use, the RCA plan discussed in the October (1975) CATJ; wherein through frequency offsets and polarization diversity, channels will be used by adjacent and/or alternate-adjacent satellites parked at 4 degree longitude increments. The new SATCOM-I RCA bird is to be the first to explore the feasibility of this program. The objective is clear; and it has *a direct* bearing on the sub-argument over dish sizes. If a 10 meter dish (minimum) size *really is required,* when *all* birds on the same frequency are using *the same* polarization format, what happens if the polarizations are varied (i.e. alternate birds use vertical and horizontal polarization, for example)? Does that cross polarization ploy work *well enough* that users can install dishes of a 4.5 meter size and using alternately vertical and horizontal polarization feeds, separate two adjacent-in-orbit birds, and still maintain sufficient selectivity so that birds flocking together on the same frequency *do not cause interference* with one another at the earth terminal end of the circuit? *CATV has a great deal at stake here;* if the RCA tests prove that cross polarization and/or frequency-splits ala the October 1975 CATJ report works, the FCC arguments demanding 10 meter dish sizes evaporates.

HBO tends to fill between major features with "selected shorts", as one is introduced here.

The satellite owners also have a lot at stake here; and RCA owns SATCOM-I. The cost of the bird is one time. If it is used to feed *one* signal from *one* point to another *single* point, *the cost is the same* as if the transponder is used to feed one signal to *thousands* of separate points. But the value to the satellite owner is obviously much greater when the owner is able to feed thousands of customers simultaneously than when it can only feed a single customer at a time.

It is of interest to note that with FM (modulation) techniques, as employed by the downlink transponders, interference between birds on the same frequency manifests itself *not* as traditional co-channel interference, as we are accustomed to with AM transmission of broadcast stations; but rather as a slow *deterioration* of the apparent system signal-to-noise ratio. It is the nature of an FM discriminator (demodulator) that it responds *directly* only to the strongest FM carrier present. As they say in FM-land, the strongest signal captures the discriminator. This *is to say,* on the surface, that a primary-to-co-channel-signal-ratio which *on AM* would cause very objectional co-channel beat bars, does

not appear in an FM-FM system. This is *not to say* the FM system is *immune* from co-channel effects however. Because while the discriminator only demodulates *totally* the strongest carrier, it does demodulate to some extent the weaker signal as well. *Some* might say that both are demodulated *simultaneously.* The weaker signal modulation shows up as "noise" of a sort, and it degrades the *real* signal to noise ratio of the primary signal. So while the picture may *not* have traditional AM beat-bars in it, it does pick up noise that is another form of co-channel-signal degradation. The end result is the same; *people don't find the picture pleasing to look at.*

So the RCA SATCOM-I tests will be followed with considerable interest in CATV, for if the FCC refuses to budge off of the ten meter criteria *on its own,* the RCA test data may help them do it *if the tests turn out favorable for frequency re-use.*

Finally, if you are pessimist and you believe that the 4/6 GHz band *is doomed* someday seven or more years down the road, then you had better be certain the 10 meter dish you *buy today* has adequate skin-tolerances to make the dish useable on the *new* 12/14 GHz band of the future. If you are an optimist, you will want to be certain the dish you buy today is good for *both bands;* because both may well end up squirting signals back to your headend one day in the 1980's.

Summary

With this report CATJ ends its look at the present state-of-the-art of United States CATV system use of satellite receiving terminals. In announcing this series in October 1975, we said we would be looking at designed-for-CATV satellite equipment and installations.

Our *next* report in this series will *complete that total-look* with an overview of the Delta-Benco-Cascade package as operating in Canada at this time through the Anik series bird(s). At the present time, there is *no CATV use* of the Anik birds in Canada, although that may not be too far away. What does interest us about the DBC approach is its uninhibited utilization of 4.5 meter dishes for Anik receiving terminals. The Canadian experience with 4.5 meter dish installations may well prove educational to our U.S. future in satellites.

POLE BANDITS – PART TWO
How Utilities Run Up Pole Investments

The November issue of CATJ devoted considerable editorial space to the matter of a system setting its own poles. The general theme was that as long as you rent pole space from a utility company, you are at the mercy of their rate raises and of their own internal philosophies regarding "foreign attachments".

In the recent FCC contrived "pole attachment rate moratorium" put together between Bell system companies and the NCTA, a formula for calculating CATV *"fair"* attachment rates was presented. It is supposed to serve as a "model" for not only non-Bell telephone utilities but *also for* power companies.

One of the largest national power conglomerates is American Electric Power System, with headquarters in New York but with wholly-owned or substantially owned power affiliate companies throughout the eastern USA. One of these subsidiaries is Appalachian Power Company, which serves major segments of West Virginia.

Appalachian has been asking for some very healthy rate hikes of late, and for many years prior to their recent round of rate increases one of the things that Appalachian did as a matter of company policy was to allow CATV companies to assume full ownership rights *and responsibility* for power poles "abandoned" in place. Recently, the Appalachian Power Company office in Logan, notified West Virginia CATV operators that the previous policy of allowing CATV companies to take over abandoned poles was changing (see letter here). For such abandoned poles *now,* the CATV company is being asked to pay a fee for the pole, in place. To arrive at the fee charged, the power company uses a *48 year schedule of pole-life.* It assumes an original cost for the materials (i.e. the pole itself), adds to that a cost of the pole being installed, and arrives at the total cost of the pole, *installed.* Then on a 48 year schedule the value of the pole-in-place is depreciated. The operator wishing to utilize the pole after it has been abandoned notifies the power company of the pole he wishes, and asks the age of the pole. The power company has published a 48 year depreciation schedule from which the

CATV company is able to in turn compute the cost to the CATV company of the pole should he wish to buy it at that point.

American Electric Power System **APPALACHIAN POWER CO.**

Post Office Box 480, Logan, West Virginia 25601
Telephone: area code 304-752-5530

November 21, 1975

Owner
TV Cable Company
P. O. Box
W. Va. 25

Subject: Cost in place and value of remaining life for average Joint Use Pole.

Gentlemen:

Enclosed is a chart showing the value of poles that Appalachian Power Company may abandon and the CATV may wish to purchase in place. If Appalachian Power Company should abandon a pole and CATV would like to purchase it in place you can ask us to give you the age of said pole and then you can pick the value off this chart.

In the past Appalachian has removed their facilities from some poles and the pole was left for CATV Companies. We can no longer do this. The pole will have to be purchased from us or it will be removed.

If you may have any questions concerning this, please contact me in the Logan Office.

Very truly yours,

F. E. Queen

F. E. Queen
Right of Way Agent

FEQ:sn

Enclosure

From these tables, which have been supplied by the power company, one can draw some very interesting observations.

(1) The actual *cost* of the pole itself, which Appalachian claims to be paying, is quite *close* to the CATJ quoted prices appearing on page 39 of the November CATJ.

Pole Size	CATJ Range	Appalachian Cost
30' /C6	$28.20/ $43.15	$40.25
30' /C7	$23.00/ $34.31	$33.01

Yes, CATJ prices are lower; at least on the bottom end. In fairness to Appalachian, CATJ prices are FOB the pole source while the Appalachian poles probably are landed at the pole site. The difference could amount to as much as $5.00 per pole. On the other side of the coin, one would suspect that the price the power company pays for the bare poles, in thousand / ten thousand / hundred thousand lot quantities has got to be *lower* for the pole itself than a CATV company would pay for a few hundred poles.

(2) The *majority* of the in-place cost for the power company is *labor* and other "undefined" factors. For example:

Just how much of this is *real labor* utilized to set the pole, and how much is amortized equipment used in setting the pole, planning and scheduling labor, and so on is not known. Because the actual cost of the pole can be easily verified, and therefore subject to close PUC *type* scrutiny, one would expect the power company to be fairly careful with *that portion* of the total pole installed cost. One would also expect them to be more "lax" with the way they assign costs to other pole - related - installation - cost areas. Still, if a CATV company spent nearly *4 times as much* for the labor-etc. area of setting a 30 foot class 7 as they did on the pole itself, the CATV company would be out of business in one big hurry!

(3) When the CATV company wishes to buy an in-place pole from the Appalachian Power people, the cost of the to-be-abandoned pole is determined from a table. That table shows declining "in-place" value over a 48 year period. The table itself is too lengthy to print here, but these *examples* will suffice.

Pole Size—30'/C7
Original Cost Installed—$143.28
To Buy In Place In...
One Year—*$135.83*
Five Years—*$116.77*
Ten Years—*$94.42*
Twenty Years—*$56.02*
Thirty Years—*$28.94*
Forty Years—*$11.89*
Forty-Seven Years—*$1.42*

(4) Appalachian Power calculates that it would cost $24.33 *labor* to *remove* an abandoned pole; at *anytime* after it has been set into position. Appalachian Power also calculates that the *salvage value* of the wooden pole (i.e. the value of the pole, as a re-usable item, *after* it has been yanked from the ground) is as follows: →

	30' /C4	30' /C5	30' /C6	30' /C7
Pole Cost	$174.47	$168.25	$151.49	$143.28
Wood Cost	60.51	55.03	40.25	30.01
Labor/ Etc.	113.96	113.22	111.24	113.27
Wood As % of Total	34.68%	32.71%	26.57%	20.95%

Pole Size—30'/C7
Original Cost—New—*$33.01*
One Year Old—*$30.80*
Five Years Old—*$22.02*
Ten Years Old—*$10.99*
Fourteen Years Old—*$2.21*
Fifteen Years Old—*$0.00*

Now understand these numbers come directly from Appalachian Power data sheets. So let us put together a couple of hypothetical examples, using our 30'/C7 pole.

The pole cost $33.01 itself, new. Installed it has a value when new of $143.28. Now, if *after one year* the power company decides to abandon the pole, they will sell it in place to a CATV company for $135.83. If the CATV company does not want the pole, then it will cost Appalachian *$24.33 labor* to take that pole *out* of the ground. And according to Appalachian Power, that pole by itself, out of the ground, after one year is now worth not the original $33.01 but $30.80. So if it is worth $30.80 and it costs $24.33 labor to take it out of the ground, the power company has just saved $30.80 minus $24.33 or $6.47, by removing and re-using the one year old 30 foot class 7 pole.

Now if the same pole was abandoned after 14 years, they will sell it in place to a CATV company for $77.94. If the CATV company does not want the pole, then it will cost Appalachian $24.33 to take the pole out of the ground. And according to the power company, that pole, now 14 years old, is worth $2.21 out of the ground. So the power company would spend $24.33 to take a pole that is worth $2.21 out of the ground!

Now if the CATV company does not want the pole, or if there is no CATV company in the area, the power company has no choice; they have to take away an abandoned pole. Even when it costs them money to remove the pole; more money than the "old" pole is worth. Now the power company at this point might take the pole back to their yard and either re-use it (unlikely since they cannot take a negative pole value on their books and depreciate it), or, sell it to somebody who walks in off of the street. Remember the pole is 14 years old, and according to the Appalachian Power work sheets, the pole itself, out of the ground, is worth $2.21 now.

Now—if a CATV company came along and wanted to buy that pole, laying there on the ground, Appalachian *should* be willing to sell it for $2.21. So seemingly the CATV company would have a choice.

(1) Buy the 14 year old 30'/C7 in place, for the $77.94 value that Appalachian has on the pole on their books; or,
(2) Let them spend $22.12 more than it is worth to them to remove the pole from the ground and truck it back to their yard, and then offer to buy it for $2.21.

Seemingly the CATV company could re-set the pole for less than the $75.73 difference between "in place" and "on the ground". Also, seemingly, if you made the deal to buy the pole *just as it came out of the ground*, you could simply "drop it back into the hole they left" on the

WHAT'S NEW?

A Brand New (and timely) CATJ Wall Chart!

The FCC Test Compliance Wall Chart—66 photographs (with explanatory text) displaying each of the following for subjective (i.e. eyeball) testing:

1) **Hum mod**
2) **Signal to noise**
3) **Frequency tolerance**
4) **0 beat co-channel**
5) **10 kHz co-channel**
6) **20 kHz co-channel**

This new CATJ Wall Chart will be available for shipment April 15th; With this wall chart and a SLM, you can make 90% of all FCC required tests in a typical system!

BUT—don't order one yet! Wait for the March issue of CATJ, which will contain a special "introductory price" order card. Oh yes—there is more to this wall chart than mere FCC compliance tests; it is the first two-sided dual-purpose wall chart ever created. (Now if you can figure out how to hang it so you can use **both** sides **simultaneously**, you've got it made!)

spot!

Who says there is no place left in this world for creative bookkeeping!

(5) Finally, there is the matter of pole rental rates. The Appalachian November 1975 Letter and Memo does not discuss this area, but from the figures they give, one can create his own set of rental rates vs. who pays for the outrageous initial cost of the pole. We will look at just one example, but they all follow the same pattern. We have chosen a 35 foot class 5 pole because that is a commonly utilized joint-use pole with Appalachian Power and area CATV companies. The table here compares pole rental rates of from $2.00 per year to $10.00 per year, against the number of years it would take for that pole rate to pay respectively for 100% of the pole, 50% of the pole, 25% of the pole and 12.5% of the pole. With a 35 foot pole, and 28 feet of pole above ground, the CATV company would be accorded respectively 28 feet of use, 14 feet of use, 7 feet of use and 3.5 feet of use in the 100 / 50 / 25 / 12.5% categories.

CATV Pole Rate

$ 2.00	90.185 Yrs	45.093 Yrs	22.546 Yrs	11.273 Yrs
$ 3.00	60.123 Yrs	30.062 Yrs	15.031 Yrs	7.515 Yrs
$ 4.00	45.093 Yrs	22.547 Yrs	11.273 Yrs	5.637 Yrs
$ 5.00	36.074 Yrs	18.037 Yrs	9.019 Yrs	4.509 Yrs
$ 6.00	30.062 Yrs	15.031 Yrs	7.516 Yrs	3.758 Yrs
$ 7.00	25.767 Yrs	12.884 Yrs	6.442 Yrs	3.221 Yrs
$ 8.00	22.546 Yrs	11.273 Yrs	5.637 Yrs	2.818 Yrs
$ 9.00	20.041 Yrs	10.021 Yrs	5.010 Yrs	2.505 Yrs
$10.00	18.037 Yrs	9.019 Yrs	4.509 Yrs	2.255 Yrs

In the area of the country served by Appalachian Power, the pole rates are presently $4.00 per pole per year but they are going to between $6.00 and $7.00 per pole per year. At $4.00 per pole per year, the CATV company pays for *ALL* of the pole in 45.093 years (which is 3 years *less* than the life of the pole), 50% of the pole in 22.547 years, 25% of the pole in 11.273 years and 3.5 feet of a 35 foot pole in 5.637 years. Even in the grandest *safety plan* the CATV company occupies less than 3.5 feet; or the present $4.00 pole rental rate pays for *more than* we use in 11.7% (5.637 years) of the 48 year pole depreciation period. At the new $6.00-plus rate, the CATV company will be paying for 12.5% (3.5 feet) of pole in around 3.5 years time, or 7.3% of the 48 year depreciation lifetime.

Even assuming a 50% use (which is *worst* possible case, where the CATV company is the only other pole occupant with the power company, and where the power company *can justify* CATV paying 50% of the total pole cost), the $4.00 rate pays for 50% of the pole in (as noted) 45.093 years and $6.00-plus pays for 50% of the pole in 30.062 years (62.6% of the 48 year pole life depreciation base).

Is there any viable alternative but getting off of utility company poles? *Really??*

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T.C. Masters
TV Signal Service
Mena, Arkansas

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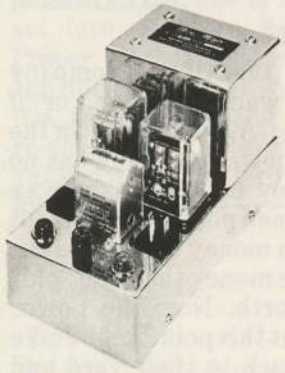

BROWN ELECTRONICS

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(606) 546-5231

WAVETEK 1051 REVIEW/UPDATE
CATJ February Reader Contest

In the May 1975 issue of CATJ, we reviewed the operational characteristics of the then-new Wavetek 1050 sweep generator. We noted at the time *"the 1050 offers something for virtually every system operation. For the small system* (and here we mean the system with 250 subscribers or less), *the 1050 offers you the opportunity to move into the signal/sweep era with a minimum outlay."*

At the introductory price of $495.00, the 1050 seemed to be the economical answer for any system still laboring along without sweep capabilities.

Still, as interesting as the 1050 was last May, it did have a few *minor* design faults, mostly in the way it translated to CATV uses. For one thing it had BNC connectors, and for another the vernier attenuation control was not calibrated. These and other features have been slightly modified this past fall as Wavetek introduced the 1051 version; a dedicated-to-CATV 75 ohm sweep that took a good idea and made it better.

The basic operating parameters of the newer 1051 75 ohm version are listed separately here. Because the original May 1975 CATJ review covered the unit in some detail, this re-visitation of the newer version will go immediately into some interesting new wrinkles the people at Wavetek have added as options.

There is an old adage in marketing that you can start off with a basic box, priced low enough that virtually everyone can afford it, and then offer options so that the more sophisticated buyer can "build" his own desirable box; *or*, you *can start off with a more elaborate box that has everything on it going in.* The VW is an example of the basic box; the Continental or Mark series an example of the latter. The basic 1051 is a VW; it is small, lightweight, covers 1-400 MHz, gets you where you need to go with basic sweeping for a minimum investment and a minimum amount of operating knowledge or operating cost. Standing alone, it is a very nice box that sure beats walking.

However, if you want to get there in a little more style, and in a little more comfort, and you want to do *more* things *along* the way, then the newly introduced options for the 1051 should be of interest to you. In effect, Wavetek has supercharged the basic 1051.

Some of the options to be discussed are available for the 1051 sweeper plus other sweeps in the Wavetek line (such as 1801A). Others are not available on the 1051, but are being covered here because they are interesting new wrinkles to the somewhat "staid" sweeper field.

1051 SPECS

Frequency Range	1-400 MHz
Dial Calibration	**50 MHz intervals**
Accuracy	5% calibration
Sweep width	**200 kHz to 400 MHz**
Display linearity	2%
Operating Modes	**Sweep and CW**
Spurious Sigs	down 30 dB
Residual FM	**under 20 kHz**
RF Output	75 ohms, "F"
Output Amplitude	**+57 dBmV max/ −13 dBmV min**
Output Flatness	+/0.25 dB
Attenuation	**+57 to −13 in 10 dB steps plus 0−20 dB vernier**
Attenuation Accuracy	+/−1 dB
Dimensions	**9" x 4-1/8" x 9-1/4"**
Weight	7 pounds
Powering	**115/230 VAC, 50/60 Hz; 15 watts load**
Price	$495.00

Options

1) Markers, up to six crystal controlled birdy-bypass; i.f. (see text);
2) Tilt Control (see text)
3) Pilot Carrier Notches (see text)
4) 63-30-(15) Sweep Rate (see text)

Manufacturer:

Wavetek Indiana, Inc.
P.O. Box 190
Beech Grove, In. 46107
(317/783-3221)

Dual RF Outputs

Suppose you would like to have dual sweep RF outputs. You could stick a good quality splitter in at the single RF output, but suppose you wanted to individually level or control the twin outputs. That could still be done with external attenuators, but it gets a little "hairy" and there are measurement errors bound to creep in when it is done externally. And because the measurement signal source (the sweep and equipment) is your standard or reference when making alignment checks or measurements, this is one place where accuracy is very important.

The 1801A offers as an option dual RF outputs. In addition to the standard front panel output, there is a second located through a fitting on the back apron; with a 0 to 20 dB PIN diode attenuator. Common applications would be sweeping a dual trunk system, or for comparing a known and unknown component using a dual trace scope. The cost of this option is $320.00 (1801A only).

Tilt Control

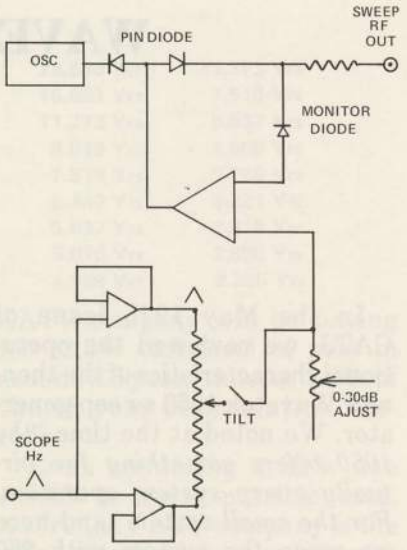
This is one of those "Gee what a neat idea" options. See diagram one. The idea is that rather than hit the amplifier or system

with a flat sweep input signal, you hit it with a *tilted* input. In this way you can simulate the *system tilt* for either system testing or individual amplifier testing. In the case of sweeping the system, this provides a handy check against the system's normalized cable equalizing tilt. In the case of having a single amplifier or a mini-cascade on the bench for set up and alignment, the built-in and adjustable sweep tilt can be set to simulate the affects of cable.

The unit works by sampling the horizontal ramp and feeding back the sample to the leveler circuit. The control voltage is 0 volts for no tilt and between minus 18 volts and plus 18 volts for tilt-up and tilt-down ranges of from 0 to 20 dB (plus).

The option (1051 or 1801A) will cost you $50.00; and that sure beats having a roll of cable several hundred feet (or more) long stuck under the bench!

The tilt section can also be programmed with external voltage dividers controlled by switches. Voltages can be summed so that at the throw of a switch you would have (pre-programmed) amounts of positive or negative tilt, as chosen, for additive steps



1051 OPTIONAL TILT CONTROL

DIAGRAM 1

of 1, 2, 3, 6, 10 and 10 dB.

Assume you have a 26 dB amplifier on the bench. Under the bench is a roll of cable with 12 dB of flat loss at channel 2 and an additional 14 dB of (tilt) loss at channel 13. By setting the attenuator to 12 dB (channel 2) and the tilt to 14 dB (channel 13) you have the proper 12 dB at channel 2, increasing to 12 plus 14 or 26 dB at channel 13.

"Flicker-Dicker" Scan Loss

Most sweeper units are standardized on 60 cycle per second sweep rates. When you are looking at some pretty narrow-frequency devices, such as a single channel pay cable trap, the sweep rate creates something known as "scan-loss" (1), which interprets to a loss of display screen definition for such narrow -frequency-range units. One way to compensate for this is to halve the sweep rate, which results in what amounts to a "3 dB *eyeball* improvement" in display accuracy for some very narrow displays.

At the same time there is the parallel problem with low level readings or displays with frequency-sharp discontinuities, such as return loss and impedance measurements. When the reflected signal, as seen by the detector, is very low level *and* the response change in frequen-

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cy is "sudden," the 60 cycle per second scan rate has definition problems displaying what is really there, *accurately.*

The 1051 has an option to improve this situation; it is the 60-30 (15) Sweep Rate, or "flicker-dicker." This modification adds a three position, rear panel switch providing sweep rates of 60 or 30 sweeps per second. Outputs are also provided for 1/2 of these two rates, or 30 and 15 sweeps per second, with opposite phase to operate external coaxial switches.

The cost of this (1051, 1801A) option is $150.00; see diagram 2.

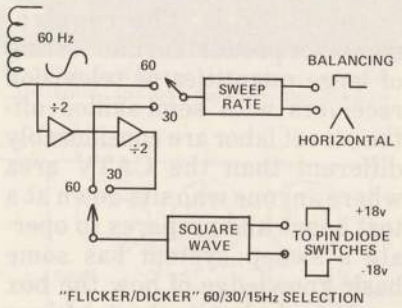
Pilot Carrier Notches

Some CATV plant amplifiers utilizing pilot carrier reference signals to raise and lower gain to maintain constant plant levels have very fast AGC systems. This is often desirable for the CATV plant, but it creates some problems for a system using simo-sweep transmitters or generalized sweeping techniques. The appearance of the sweep signal, at the pilot carrier frequency, drives the AGC into compensation.

Thus Wavetek has developed something that they call the "pilot carrier notch," which is really an adjustable method of eliminating the presence of the sweep signal for a (time) portion of the sweep cycle, at pre-determined frequency points within the sweep range. See diagram 3.

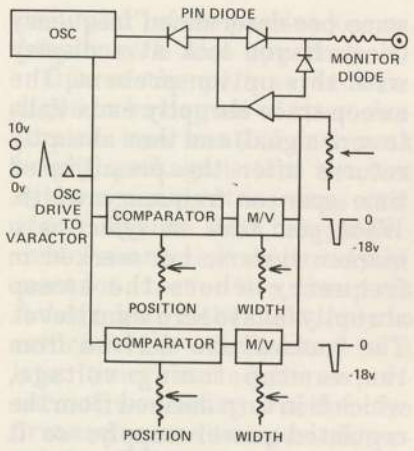
A comparator is connected to the sweep oscillator tuning ramp, and when the voltage to which the comparator has been set is reached, the comparator 'flips,' generating its own 18 volt pulse. This pulse shuts-down the PIN diode attenuator. The width of the pulse is adjustable in time from 0 to approximately 400 microseconds, so the sweep may be removed for *up to* 3-4 MHz at or around the pilot carrier frequency; at any sweep rate. This option, while part of the 1051 program, is also adaptable to the Wavetek 1801 and 1850 simo-sweeper units.

Now if you stop and think about this, what you also have here is an absence of signal at



"FLICKER/DICKER" 60/30/15Hz SELECTION

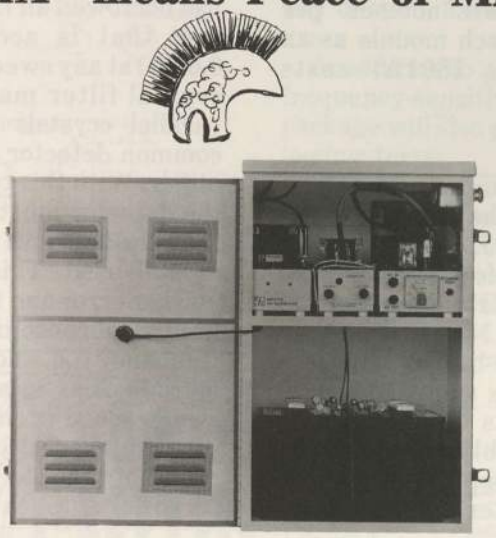
DIAGRAM 2



SWEEP NOTCHING 1801A

DIAGRAM 3

"PAX" means Peace of Mind



PAX is the name for Control Technology's family of Primary and Auxiliary Power Systems. The SP300 (shown) and the SP900 have been designed to be exceptionally compact and reliable. The rugged, heavy duty Pole Case permits easy installation and utility company approval.

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some pre-determined frequency (cies). If you look at a display with this option present, the sweep trace abruptly ends (falls to zero signal) and then abruptly returns after the pre-adjusted time span or frequency width. *What you have in effect is a marker system;* i.e. marked in frequency where the sweep abruptly falls to zero signal level. The "pulses" are derived from the varicap tuning voltage, which is in turn derived from the regulated power supply; so it should be a very stable system. And because you can set it in the field to the width and location you desire, it should be versatile as well.

There are two "notches" per module, and each module as an option (1051, 1801A) costs $100.00.

IF Markers

Previously the markers available for the 1051 have been the usual (your choice) mixture of 54, 50, 10 and 1 MHz (or others on custom order). Now there is also available a one-button i.f. marker set. There is slightly more to this than meets the eye. Wavetek is probably the leading world-wide supplier of TV receiver sweep test systems. The company has sold and installed sweep gear with appropriate frequency ranges and i.f. markers to virtually every country in the world manufacturing television receivers, including many within the U.S.S.R. The requirements for production line testing of large quantities of television receivers with semi-skilled off-the-street labor are considerably different than the CATV area where anyone who sits down at a test bench and prepares to operate a sweep system has some basic knowledge of how the box works and what its shortcomings are.

Out of the Wavetek TV alignment products line the company has borrowed an i.f. marker system that is accurate (+/— 0.01%) at any sweep width. Most crystal filter marker designs parallel crystals and utilize a common detector and pulse amplifier. With this type of system, the detector must be set higher than the spurious outputs of the crystal used. This results in a marker error and the crystal utilized is purposefully cut low in frequency (i.e. undercut) to compensate. Alas, as sweep width or sweep speed is changed, the error displayed also changes as a result of that old trouble maker "scan loss." Such a system has typical accuracy of +/— 0.05%.

In the Wavetek i.f. marker system that is an option for the 1051 and 1801A, each crystal has its own detector network. The detector level is set slightly above "zero" crossover at parallel resonance for the crystal. After the marker has "fired" the circuit is clamped to ground until automatically reset by the return of the blanking signal during retrace. This solves the scan loss problem.

The price of this option is $300.00.

The Test Set

For purposes of re-review, Wavetek sent along to CATV a new "custom" package configuration for the 1051; one that will probably find some quick interest from bench service people who presently have a myriad of individual boxes floating around the test bench in some patchcord configuration.

The unit we received has been to a couple of CATV shows (i.e. Anaheim in November) and has been seen and played with at various systems throughout the country such as Gill Cable in San Jose. Wavetek's Bob Welsh (Sales Manager, TV and CATV products) has been on the road a great deal lately getting operator reaction to not only the test package, but also to the many new options available for the 1051 and other sweepers in the line (i.e. such as 1801A).

The unit has no "official" name as of yet, so we simply call it the "Test Set." It is the 1051 sweeper, retrofitted into a rack mount configuration, with the following extra goodies added:

(1) Tilt control as detailed separately here;
(2) 30/60 cycle sweep rate selection;
(3) Three sets of external attenuators (0-70 in 10 dB steps; 1-10 in 1 dB steps and .1 to 1.0 in .1 dB steps);
(4) A pair of PECA switches

The ideal situation with any test set is to have a set of cables for connection to the device to be

Footnote Supercharged

1) *Scan-loss is really a shortage of 'writing speed' for the trace display as it appears on the CRT. In effect, the detector capacitor does not have sufficient 'charging time' for the frequency-sharp "hole" or "bump" presented to get detected* and *charged. The scan speed slips over it, just as your car with good shocks would slip over a deep chuck hole. There are three solutions to this: (1) reduce the sweep rate, (2) reduce the sweep width (i.e. pull the outer boundaries further apart so the display has more 'writing time' to drop into the hole and the hole becomes a larger portion of the scan), or (3) modify the charging constant on the capacitor across the output of the detector. Assuming the operator has already reduced the sweep width as far as he can (turn a knob), and assuming the charging capacitor is not easily switched about, the third choice left is reducing the sweep rate. That is what the 'flicker/dicker' 60/30/15 CPS choice is all about.*

WAVETEK 1051 TEST SET — standard 1051, modified for factory rack mount, addition of "tilt," with addition of test set attenuators, switching and comparators discussed in text.

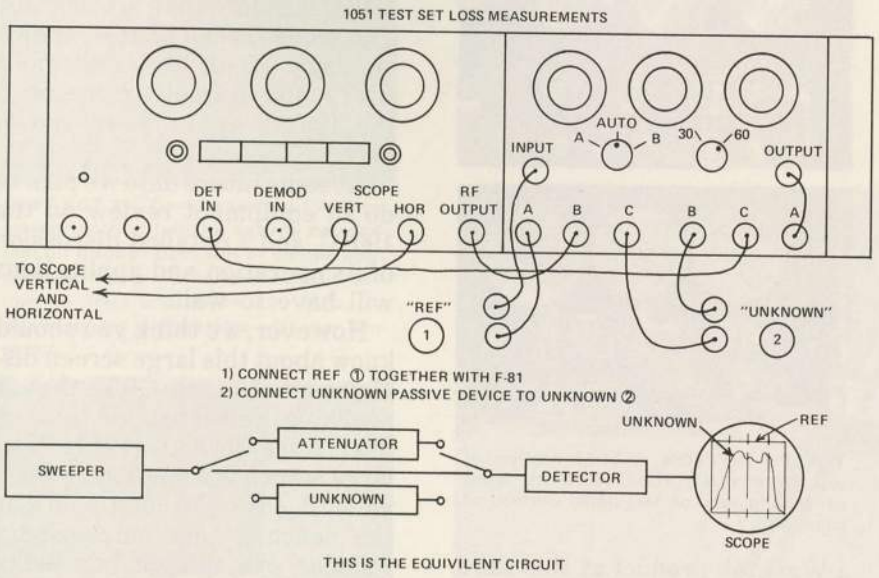

DIAGRAM 4

tested, and a reference signal or device to determine the gain, loss, tilt, match and so on of the unit/device being checked out.

Diagram 4 shows how the system goes into operation for a common measurement; passive loss measurements. Here a reference sweep signal is compared to the unknown signal which is routed through the passive unit being tested. By dialing up (or down) the attenuators on the right hand side of the test set panel (i.e. the external attenuators) the two traces are brought together on the display screen. The amount of attenuation added with the external attenuators is directly read for passive loss through the unknown. Because the display is also frequency selective (i.e. you see on the scope the passive loss over any part or all of the range from 1-400 MHz), not only are the characteristics of the device at its intended operating frequency known, but a visual (easily converted to paper) "plot" of the passive loss vs. frequency is also apparent.

One of the primary advantages to having all of these features in one small (5 inch rack height) package is that the test system parameters *stay constant.* Anyone who has patch - cord - connected similar equipment for a test or two, then torn it down for another test, only to return to the original test at a later time has had the experience of wondering whether the first and second test periods correlate. Different patch cord lengths, different equipment connection and inter-connection techniques always leave you wondering just how "traceable" any of the measurements really are.

In addition to passive loss and frequency-sensitive tests, the package will also perform the following tests:

(1) Gain measurements;
(2) Return loss (match) using comparator techniques (uses two [identical] coaxial delay lines with an external bridge), see diagram 5;

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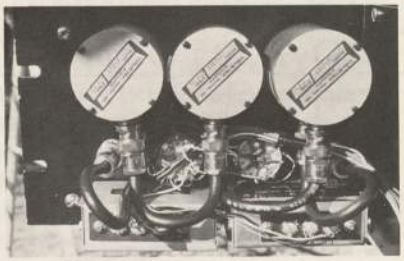
(3) Return loss (match) using a single delay line (also requires an external detector);
(4) Return loss (match) using a VSWR bridge (see upcoming March, 1976 issue of CATJ for 'CATV Match Box Bridge');
(5) Amplifier response measurements using the flat output of the 1051, or any combination of positive or negative tilt as previously discussed.

This "Test Set" package is *not* a Wavetek product at this time, but it could be packaged, as shown and would probably sell in the $1200/$1300 range as shown and discussed here.



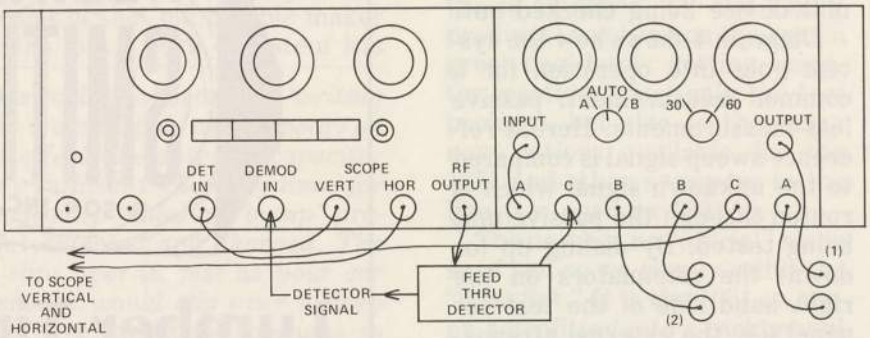
TOP TO BOTTOM — 1051 portion of test set, auxiliary attenuators, etc. front panel, and rear of test panel portion of package.

This would be an excellent place to drop in our own comments about a companion piece which as far as we know the CATV industry has to date shown too little interest in; the Wavetek 1901C display oscilloscope. Through the kindness of Wavetek, the CATJ Lab has been making borrowed use of an 1901C for more than six months. The scope screen photos, shown on page 30 of the December CATJ, for example, came from the 1901C; as do those shown here.

At some future date we plan to do an equipment review on the 1901C, and a detailed discussion of its operation and applications will have to wait.

However, we think you should know about this large screen display unit (12 inch CRT) that is available in either single trace or dual trace format (1910). The large screen is some kind of nice when it comes to long hours at the bench. It not only greatly reduces eye fatigue but being able to look closely and precisely at narrow band devices such as traps and bandpass filters is almost a joy when compared with

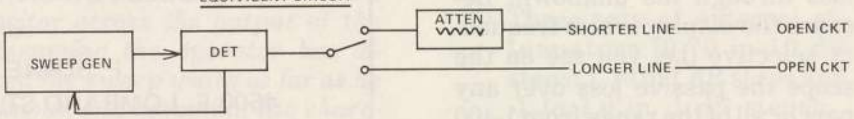
1051 RETURN LOSS MEASUREMENTS
USING COMPARISON TECHNIQUE



CONSTRUCT TWO IDENTICAL DELAY LINES USING RG-59/u. CUT TO 75 FEET. CUT 2nd 12" LONGER.

1) CONNECT A FEED THRU DETECTOR BETWEEN 1051 RF OUTPUT AND "C" ON COMPARATOR; CONNECT DETECTED OUTPUT TO 1051 DEMOD "IN".
2) CONNECT ONE DELAY LINE TO THE OUTPUT CABLE (1); CONNECT SECOND DELAY LINE TO INPUT COMPARATOR, SWITCH B(2).
3) SWITCH TO "AUTO" AND BOTH RIPPLE LINES WILL BE DISPLAYED.
4) SNIP OFF 1/4" or 1/2" PIECES FROM THE LONGER CABLE UNTIL BOTH RIPPLE PATTERNS ARE IDENTICAL. THE PAIR OF LINES ARE NOW MATCHED.

EQUIVILENT CIRCUIT



5) CONNECT UNKNOWN (MATCH) TO END OF LINE TO COMPARATOR "B" INPUT(2);
6) SHORT LINE FROM OUTPUT (1)
7) ADD ATTENUATION TO TEST SET UNTIL BOTH RIPPLE PATTERNS COINCIDE; THE RETURN LOSS IS EQUAL TO TWICE THE ATTENUATOR SETTING WITH PATTERNS COINCIDING.

DIAGRAM 5

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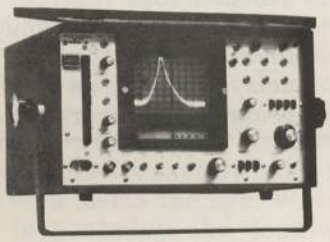

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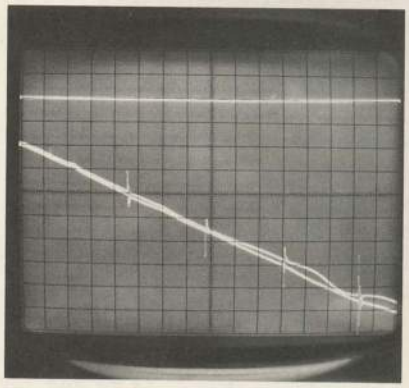
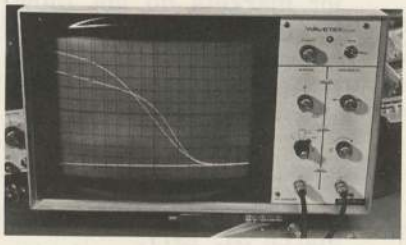


TEST SET TILT — The test set CATJ received had "flat" (that is **equally descending**) tilt through both legs of comparator, although there is a 'burble' evident below 50 MHz and above 225 MHz. Amount of tilt is adjustable with rear panel pot.



COMPANION 1901C — 12 inch CRT display scope is available for any CATV detected displays, displaying two competitive pay-cable trap 'roll-offs' on lower frequency side of channel 5 (see this month's Technical Topics).

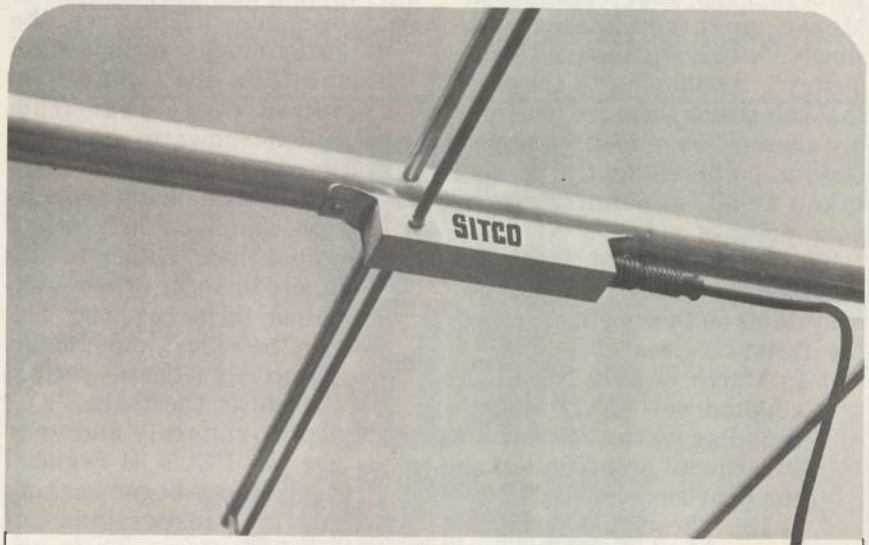
As Bob Welsh points out, a package of equipment, such as the Test Set package and the 1901C will run a system around $1700/$1800 (the display scope is $525). That *is* alot of money for a *small* system, perhaps, but with such a package plus a feed - through detector (see May 1975 CATJ, page 37 for a build-it-yourself feedthrough detector) or the 'CATV Match Box' described in the March (76) CATJ, a system would have just about everything it would ever need for complete head end and plant amplifier alignment and maintenance.

Summary

This is the year of test measurements and system technical re-appraisal. Like it or not, accept it or not, all grandfathered systems have but 13-14 months to bring their systems up to snuff with the technical requirements of section 76.605 (a) (1-12).

Before a system can update it's problem areas, it is going to have to locate them. This means testing, and, *this means* test equipment.

There *are* many-many measurements which can be performed with an SLM, or a combination of an SLM and a broadband noise source such as the Sadelco 260-A. But there are many other measurements which can be made only, *to the accuracy required by the FCC*, with adequate sweep and marker equipment. The Wavetek 1051 sweep, as updated here and with or without the options discussed here, is the least expensive way for a new-to-sweep techniques system to go. Like the VW, it will get you there, and it will do it with a minimum outlay and minimum on-going operating expenses.



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CATA TEST EQUIPMENT PROGRAM
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Reluctant Awareness

Reaction to the comprehensive CATJ two-issue series on 1975/76 FCC Test Compliance Measurements indicates that slowly, *but surely*, the CATV industry is awakening to the fact that *this year's tests* are not simply another set of foolish annual tests to be taken lightly, or not taken at all, depending upon your point of view.

To set the record straight (have we ever heard from dozens of systems on this one!), *here are* the facts:

(1) In March of 1972 the FCC adopted new CATV rules; including (with a few minor subsequent modifications) the provisions of 76.605 (a) (1-12). These rule sections, covered in detail in December and January issues of CATJ, establish a set of system operating parameters. Things like visual carrier levels, aural carrier levels, signal to noise ratios, and many more are set out in 76.605 (a) (1-12).

(2) Any system constructed, new, after March 31, 1972 had to live up to these specifications *from the day it was turned on.* Older pre-March 31, 1972 systems (so-called grandfathered systems) had five years to the day to comply.

(3) *The date for that full compliance is March 31, 1977.*

(4) Part of the five year period from March 72 through March of 77 was to be utilized as a "phasing in period" during which CATV systems were supposed to be making annualized FCC Compliance tests. The tests started out simply, but each year a new test or two has been added. This year, the 1975/76 tests, include all of the tests that will be required every year from 1976/77 onward.

(5) Because the tests were "trial" tests, many systems have chosen on their own to ignore them. Either totally ignore them, or, where individual tests required certain new test equipment, selectively ignore certain aspects of the tests.

(6) Approximately one year ago the FCC's 24 regional field offices began making routine inspections of CATV systems. Their primary interest, during such inspections, has been "seeing" a copy of the most - recent - year test results. The FCC field personnel have been asking for a copy of the tests to take with them back to their offices. In turn, they have forwarded a *copy of the copy* back to the Cable Television Bureau in Washington.

(7) Approximately 8 months ago the FCC announced that *certain* 1972 rule requirements were being put off, indefinitely. Among these postponed sections was the requirement that grandfathered systems operating on or before March 31, 1972, and operating in major markets, would have to have *more than 12 channel capacity* on their CATV plants.

Some people mistook *this* put-off for a put-off of complying with the hard technical compliance of 76.605 (a) (1-12). *The two are not related.* Systems that have grandfather status, operating today with fewer than 20 channel capacity in major markets do not (now) have to re-build before March 31, 1977. However, these systems, along with *all other* grandfathered systems, regardless of their lolocation, *still must comply with 76.605 (a) (1-12)* before March 31, 1977.

Now in some situations this may still require that a system rebuild some sections of its plant. In other situations, a system may be forced to update its headend, or its customer tap-off devices, or its drop cables, etc. But *this re-build requirement* extends only as far as complying with the requirements of 76.605 (a) (1-12); no further. For a full run down on these 12 requirements, see December 1975 CATJ.

Therefore,

(8) The tests to be made this year, on or before March 31, 1976, are of special importance because they not *only* satisfy the FCC requirement that you make annualized tests to measure the parameters of 76.605 (a) (1-12), but, this year's tests in particular have extra meaning; you will be able to analyze the results of the tests this year, and determine with a high degree of accuracy what it is your system must do to (in the way of rebuilding) comply with the requirements of

76.605 (a) (1-12) on or before March 31, 1977.

And once again, the tests you are to conduct this year, before March 31, 1976, are the *same* tests you can expect to conduct *next* year, and the year after and so on. Therefore, unless the FCC adds new tests, or somehow modifies the testing requirements, the test equipment required for *this* year should be the same test equipment you will still be required to have access to (say) five years from now.

Unpopular At Best

If the facts surrounding this year's tests, and the hard-compliance requirements of March 31, 1977, are slippery, the tests themselves are unpopular at best.

The FCC says there will be *no* extension beyond March 31, 1977 for compliance. This may well be so, but by the same token if the updating and changes and rebuilding required to make compliance by March 31, 1977 is massive, then there will remain the *slim* hope that some type of extension still *might* be gained. However, the Commission will not, we believe, be persuaded by rhetoric; only facts. And the only way that the facts can be gathered, in our view, is to set out to conduct the tests nationwide following universally accepted testing techniques. Perhaps we will find, under such a program, that the re-construction for compliance is not as massive as it might now appear to be. Or, on the flip side, it may be even more extensive than we now *suspect.* In either event, only hard tests, performed with known-quality testing equipment, following universal (if not ideal or universially accepted, *at least universally conducted*) testing procedures.

CATA Test Program

In a series of CATV system studies this past summer and early fall, CATJ learned there are three oft-mentioned stumbling blocks standing between most system operators and the successful completion of the tests required. They are, as follows:

(1) Reluctance to do anything the FCC wants or asks;
(2) A critical shortage, in the field, of the test equipment required, and conflicting views on just exactly what test equipment must be utilized to perform certain of the tests. This is further compounded by many smaller systems noting that they simply have no money available to rush out and purchase $5,000.00 (or more) in new test equipment.
(3) Various levels of mis-understanding (or non-comprehension if you will) of the *testing procedures;* especially as the generalized language of 76.605 (a) (1-12) relates *specifically* to a man's system.

To solve these three problems, CATA and CATJ have set out to create a testing program that has as its objective comprehensive response to each area.

To solve the reluctance to make the tests argument, we point out that like it or not, these

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are the rules. And unless the rules themselves are rescinded, by either Congressional action, court action, or by the FCC on its own volition, these will be the rules on April 1, 1977 as well.

Congressional action seems unlikely, if not impossible. Court action is a possibility, but even if there is favorable court action, it will probably affect only certain segments of the industry (primarily the very small systems). FCC action, *without some prodding*, is a million to one shot. The "some prodding" part suggests that only if there is irrefutable evidence presented will the Commission consider some modification of the presently-firm March 31, 1977 date. Testing, nationwide, under a planned and coordinated program *is one way* to develop that evidence. In fairness, it is also a good way to prove that there is *no need* for an extension of the March 31, 1977 deadline; that *is* a risk we run.

Moving on now to the critical shortage of test equipment in the field, there are many shades and variations to this problem. Some systems have sufficient equipment to run the tests with no difficulty; these are largely the bigger systems, and/or the newer (larger) systems. But we have run into dozens of smaller operators who *also* have everything required to run even this year's tests; there are still people in this industry who believe being up to date, modern, and employing all of the current technology is *still the best way* to keep customers happy.

By in large, many more systems *could* afford the equipment, if they *really* wanted it badly enough. Perhaps not all at one time, but had such systems started to acquire this equipment back in 1973, when the first tests began, by now they would have accumulated all that is needed for the full test series. However, this is water under the bridge and the FCC is certainly not faultless in this scenario because they themselves have changed position on the tests often enough to leave most of the industry numb and exhausted just trying to follow the scorecard at this point.

The fact remains adequate equipment is not in the field today. And that very few systems who do not yet have the equipment can afford to trot out *tomorrow* and plunk down the $5,000.00 required to do the job right.

There are solutions to this. One is for a state association, or a state group, or a regional group, to assess members and raise the money for a state-association or independently formed group test-package. Such a plan *is being discussed* in several-areas. One western group wants to purchase not only the equipment but the van to run the tests. Approximately ten systems, the plan goes, will kick in $1,000.00 each for the initial equipment and van, and then each will have scheduled use of the equipment. Other systems, not part of the initial group (the group will incorporate as part of their exercise) will rent or lease the van from the group. The group also plans to have the van available to follow around behind any FCC van that the Commission might

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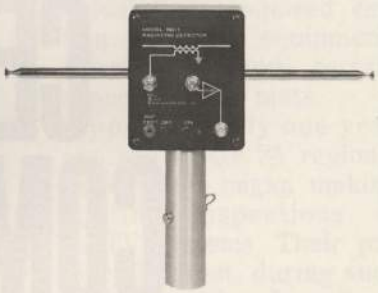

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one day field, as a means of self-help to try to keep the pressure off of systems the FCC might visit.

Other areas already have loosely-knit test equipment loaner agreements. One system has a spare/sweep, another has a spare calibrator, and so on; so that a system conducting tests borrows from *around his area* to marshall the proper equipment required to do his tests.

Still other systems call in consultants who bring their own equipment, and for fees *averaging $1500.00 nationwide*, the consultants run the tests for the systems and supply test compliance logbooks for the system's records.

The CATA approach to this problem is slightly different. First of all, we sat down and penciled out as many different *ways* to conduct *each* of the individual tests as we were familiar with, had heard about, or could learn about. Some tests can actually be done nearly a dozen *different* ways; some of these ways require very elaborate almost self-programming test equipment, while other techniques require very little equipment but a large dose of smarts and familiarity with all of the little-known idiosyncracies of a system, signal propagation, and so on. From *all of these techniques*, we compiled a list of tests where certain pieces of test equipment could be utilized over and over again, for the largest possible number of individual tests. We looked at several of the do-everything-test boxes; packages of commercial equipment which, within a single container, have all or most all of the basic test requirement functions. This was initially attractive, until we tackled the problem of having adequate back-up equipment on a nationwide basis to insure that nobody got half way through a test situation, had his box go on the fritz, and then got left hanging because it was such an expensive box that adequate spares could not be stocked for such an emergency.

From all of this study, from hundreds of discussions CATJ has had with operators concerning 1974/75 tests, some using the CATJ Test Compliance Booklet, others toughing it out on their own or with their own MSO-provided test books, we have come to a logical package of equipment which satisfies, we believe, all of the basic requirements. This test - equipment - package is spelled out in table one.

The intent with this package is multi-fold:

TABLE ONE—
Equipment Package

1) **Sweep generator** with built-in in markers and detector
2) **Variable frequency signal generator,** and SLM calibrator
3) **AC/DC coupled oscilloscope** with high vertical sensitivity
4) **Signal processor** to produce carriers clean of modulation for frequency measurement
5) **Frequency counter**
6) **Radiation detection** test set with dipole and amplifier
7) **Portable VHF FM** (151.625 MHz) business band two-set communications package
8) **Signal level meter**

Additionally, a summation sweep package will also be available as an optional extra to a limited number of systems; and a spectrum analyzer will likewise be available at a point approximately 60 days into the program.

(1) Rather than rely on a single piece of equipment, or perhaps two pieces of "do-everything-gear", we have gone the discrete-box route. This is largely to help insure that there is adequate backup equipment available in central locations should some piece of equipment fail out in the field. However, this is also to allow a greater degree of *test flexibility.* For each test there is a *preferred* test-technique, and as a backup, a *"fall - back - test - technique"* which employs a different set of test equipment should the first fail for any reason.

(2) Most of the pieces of equip-

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ment employed in the test package utilize carrier generator and carrier detection techniques that are well known to virtually all competent operators. This means, simply, that an operator will be able to go back into his own experiences in running his own system to draw out the knowledge necessary to operate the test equipment package. There are very few if any new skills to be learned for testing.

(3) Even with this simpler-than-complicated approach, many operators will have the opportunity to experience *new test equipment* boxes and new test equipment procedures. We call this the "exposure element"; wherein operators who have been reluctant to invest hard earned dollars in new test equipment, will, within their own testing period, have the opportunity to experience first hand test equipment boxes and techniques they have not previously been exposed to. In effect, an operator gets the opportunity to go to school while he conducts his tests.

Finally there is the real problem of operator interpretation of the testing requirements. As noted, *there are* several ways to conduct most tests. In informal discussions with the FCC and knowledgeable test equipment personnel in the industry, we have come to what we believe is a logical conclusion in this area.

The Commission is not nearly so interested in your conducting tests following precise, *tightly - spelled - out procedures, as they are interested in your performing the tests themselves.*

Now it will be easy for someone utilizing test equipment box Z to find "fault" with a system operator conducting tests with test equipment box Y. That is the natural prejudice we all carry coming out.

So in the *CATA 77 Certification Program*, each and every system will follow his own *customized* version of a *master* test-plan. All systems taking part with CATA in these tests will be following the *same test procedures*, conducting the same tests and utilizing the *same test equipment*. This is important, we feel, because this will establish a most important *common base* for all test results and allow us to compare test results for national conformity. *From this common test data base would come the* "evidence necessary" *to present to the Commission in advance of the March 31, 1977 deadline.*

How The Plan Works

Initially, five complete and separate test-equipment *packages* will be fielded throughout the United States. Each will be "stationed" at a regional center, which will be a volunteer CATV system operator.

Each participating system taking part in the program will have the test equipment for four full days. The equipment will rotate from system to system on seven day cycles, and will be transported where possible from system to system in operator vehicles, and where this is not possible, via commercial transportation. There are two "steamer crates" of equipment, and each unit has its own foam-protected "cell" to transport in.

Systems are being encouraged to find a *buddy-system in the area* so that two operators can buddy-up to conduct both sets of tests (i.e. on both systems) in the four day period. This reduces the expense to each system, as explained elsewhere here.

(1) Application is made to CATA to be a part of the test program. The full application form is quite detailed, and it is part of the preparation of a customized work booklet for each system.

(2) Upon receipt of the application form and check, CATA sends to the system a detailed questionnaire. The purpose of the second questionnaire is to solicit detailed data about the system's headend layout and distribution plant. This data in turn will be analyzed, and transfered to the *customized test workbook* for each system.

(3) Each system will have three copies of the custo-

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(Glyn Bostick, Chief Engr)

mized test workbook. The workbook spells out specific test points for *that one system* following the data the system supplied in the initial two questionnaires. This eliminates any system *interpretation* of the test procedures; *the test book instructions relate to his specific system.* All three copies of the test book are completed as the tests are made, and after the tests are completed, two copies of the book are returned to CATA.

(4) With the two copies returned, CATA goes through the log book/work book results to *verify* that the tests have been conducted according to the criteria set down in the workbook. One of these two copies is *"certified"* and returned to the system for its files.

(5) The certified copy becomes the system's permanent *FCC Compliance Test Book* for this year. The original copy, kept by the system, can be used by the system with the extra pages and instructions provided in it for the system to compute on its own the various changes which the tests indicate the system must make in order to be in *full compliance* by March 31, 1977. In effect, this particular copy is the system's *plan book* for the 3-31-77 deadline re-building work to be done.

An initial application form is included with this issue of CATJ, in the front of the magazine insert card between pages 8 and 9. Additional application cards, including the *detailed questionnaire forms*, are available directly from CATA at 4209 NW 23rd, Suite 107, Oklahoma City, Oklahoma 73107.

Who May Take Part

The program is open to all systems. There *are* special rate breaks for CATA member systems, and, where there is a conflict of scheduling, CATA member systems will receive preferential treatment for early shipments of the test equipment.

TABLE TWO—
Test Package Rates

There are two rate schedules, one for CATA-member systems and one for non-member systems. Each rate is for a four-day work period, allowing three transportation days between systems. Where systems can bicycle equipment in shorter periods of time, the four day work period can be extended accordingly.

(1) **CATA member systems—** $500.00 for four day period.

(2) **Non-member systems—** $600.00 for four day period.

Additionally, where two systems "buddy" the equipment and perform certified tests on two systems in the same period, there is an additional charge of $125.00 for the second system's customized test workbooks.

Therefore the charges for each system become $500. + $125.00 or $625. divided by two equals $312.50, and $362.50 under the respective rates above. **An initial application form is found between pages 8 and 9 of this issue of CATJ.**

However, any system that signs up for this test equipment program prior to March 21, 1976 will receive from CATA a letter acknowledging that your system is a part of this program; and this letter can be very important.

As is shown here, Cable Television Bureau Chief David Kinley has agreed to notify all FCC field offices of this program, and to alert these field offices that because of expected equipment bicycling schedules, *not all systems can be expected to have their tests completed prior to March 31, 1976.* Systems that have signed up prior to March 21, 1976, will be able to show their "sign - up - acknowledgement" letter to any visiting FCC inspectors after March 31, 1976 and receive an automatic extension in time for the current year

FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

December 31, 1975

IN REPLY REFER TO:
4300-A

Richard L. Brown
1523 O Street, N.W.
Washington, D.C. 20005

Dear Mr. Brown:

This is in reply to your letter of December 18, 1975, with respect to the Community Antenna Television Association's performance testing program for cable television systems. As you noted the scope of the program suggests that some systems may not have performed the required test measurements by March 31, 1976, and you requested that if a system has signed up to participate in the program it not be considered in derogation of the Commission's Rules if the actual tests have not been performed by that date.

Your request is reasonable and indeed I believe the testing program you propose may prove to be a significant method of acquainting many system operators with the methodology and knowledge needed to comply with the Rules.

I certainly hope your testing program is as successful in practice as it promises to be on paper. We are of course pleased to cooperate with your efforts.

Sincerely,

David D. Kinley

David D. Kinley
Chief, Cable Television Bureau

tests; *until their turn in rotation* actually brings the equipment to their system. This is a very important factor in this program simply because there is no way, with five equipment packages, that *all* of the systems who want to take part in this program, could otherwise do so *prior to* March 31, 1976. We are most grateful to the Commission for this assistance to this program.

Equipment Integrity

Finally, there is the matter of maintaining the equipment at proper certified operating parameters through a long series of stops from system to system. At regular intervals (approximately once per month) *each test equipment package* will bicycle back from the regional area it serves to the equipment supplier taking part in this program (Mid State Communications, Inc., Beech Grove, Indiana) for check-out and re-certification. Mid State will also maintain a "hot line" telephone to which operators in this program can go for instant assistance, advice or just plain help should the need arise.

Summary—

The CATA Certification 77 Program is a bold new step for the industry. It has dual goals; increased operator awareness of the requirements of March 31, 1977, and, a closely guided attempt to gather from the field *real life*, hard numbers and *facts* about the extent of difficulty and the degree of expense to be expected by the industry if it is in fact going to have full compliance with the provisions of 76.605 (a) (1-12) by March 31, 1977.

The program can be faulted for many things, and it will probably have its share of detractors. However, it cannot be faulted for trying to solve a very real problem which all grandfathered systems face, nor can it be faulted for taking the initiative to do something that has a definite goal in mind; a better CATV industry for not only the system operators, but the system customers as well.

DROP - A - CHANNEL
Eliminate One Signal Only

by
Peter A. Purvis
Manager Technical Services
TM Communications
Redondo Beach
California 90806

The need arises where a CATV system finds it should drop one channel completely, at a distinct sub-distribution point, or for a segment of plant. Such an occasion arises in metropolitan areas where a system serves a motel/hotel, and the system's movie channel normally carried on a secure or mid-band channel is desired on a *standard* VHF channel. For example, let's assume your movie channel is on channel E. The system offers movies as a separate additional service, and for those customers wishing the movie channel, a converter capable of tuning in channel E is placed in the home.

Now along the plant there is a motel that wants the movies in the motel's rooms; only they want it on a standard VHF channel, so the motel amplifiers do not require retrofitting for mid-band (or super band), and, more important, converters do not end up in the motel rooms. After the financial details have been worked out, the problem presented to the system engineer is simply this:

(1) Take one of the standard VHF channels, and "lose it," *for the motel only;*
(2) Replace it, for the motel only, with the movie channel on E.

One way to drop a single channel is to put a sub-headend into the motel and reprocess all system standard VHF channels and converting E to say 4 in the process); leaving the normal system-fed 4 off of the mini-head end reprocessing package. Unfortunately, that is a very expensive approach even though it is technically feasible.

As described to system engineering personnel at the November CCTA meeting in Anaheim, here is a technique TM Cablevision has worked out to solve this problem. The system shown is currently being employed in several locations and providing very satisfactory service in the process.

Reference is made to diagram 1. Our desired end result here is to take the movie channel (on channel E) and within the motel only, put it on channel 4. The normal channel 4 cable service is dropped for the motel to make room for the channel E converted to 4 movie channel.

Our first approach was to take a very large number (approximately 20) tunable Hi-Q traps and start to stack them up in series staggered across the channel 4 bandwidth. As noted in diagram 1, all of the channels are fed into the equipment configuration shown here just as they come off of the cable drop to the motel. We found, as others have found

before, that at some point greater than 3 or 4 series-connected Hi-Q traps, the reactive component of the traps becomes so great that the whole string becomes counter-productive, and difficult if not impossible to tune (1). We were headed toward separating the 6 MHz channel 4 cable drop bandwidth into a sufficient number of sections so that the overlapping band-trap segments of the individual traps would eliminate channel 4. And as noted, this simply will not fly with a large number of traps because of the inter-action between the traps.

In diagram 1, *four* traps are stagger tuned across channel 4, centered on the (a) picture carrier, (b) picture sideband, (c) color sub-carrier, and (d) the aural carrier. These four Hi-Q traps are mounted inside of a small metal container, in such a way that the coupling leads between the input

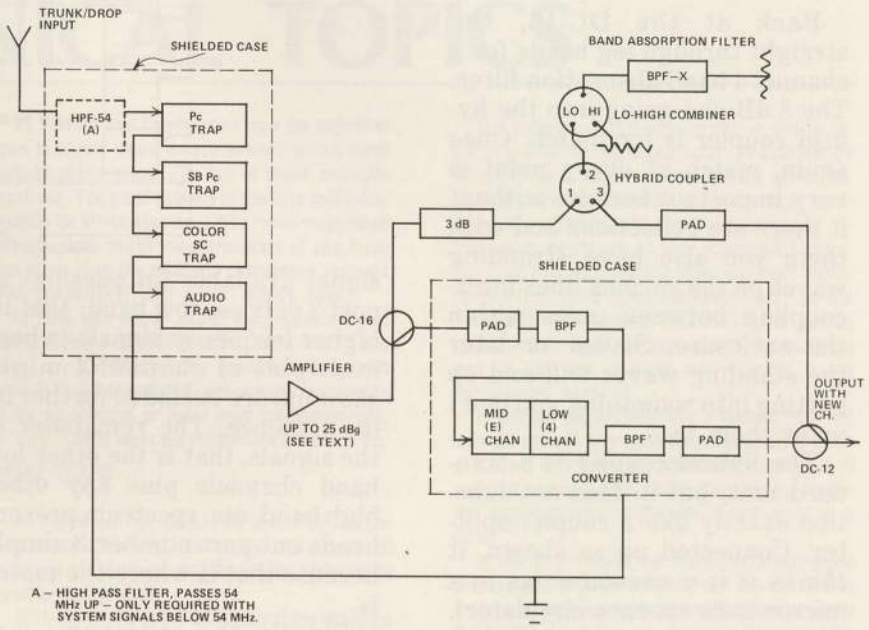

DIAGRAM 1

(54 MHz) high pass filter and the four Hi-Q traps are as short as possible. It is also *very* important that there be a good bond between the individual trap/filter cans and the metal sub-enclosure to keep ground loops at a minimum. Finally, it is also very important that the metal sub-enclosure have a good earth driven grounding bond.

Coming out of this sub-enclosure, the channel-stop range (i.e. channel 4 in example) should be quite uniformly down 65 dB or more.

The amplifier stage is required in order to ensure that the levels to the channel E to channel 4 converter (see diagram 1) are sufficiently high that the converter functions properly. By the same token, the selection of the DC-16 is based (for value) on determining a proper input to the E to 4 converter. The pad following the DC-16 on the converter leg is typically 3-6 dB to make certain there is a match at that point. The BPF following the 3-6 dB pad can be one of the miniature BPF's, as high selectivity is not usually required (2). The converter should typically see +5 to +15 dBmV. The BPF at the output of the E to 4 (in our case) converter is identical to the one at the converter input. However, the two mini-BPF's should be installed right on the converter by using one of the many double-F fittings available. The pad on the output of the output BPF is likewise to certify that the converter and its associated BPF's look into a good 75 ohm load and to match the 4 level to the rest at the DC-12. All of the conversion equipment (i.e. after 16 down port on DC-16 and up to the straight through port on the DC-12) should again be installed in a sub-enclosure for shielding. Everything in this enclosure (indicated by the dashed line) must be case grounded or bonded to the enclosure itself. Then the enclosure must have a purposeful *bond to ground.* There are fairly high levels floating around inside of the *master* equipment container and so-called ground (or surface) paths must be avoided if the original channel 4 is to be lost permanently.

---

(1) One way to improve the reactive inter-action between series connected Hi-Q traps is to insert a fixed pad (3 dB, although 6 dB is better) between units to help maintain a 75 ohm load on both ports of the trap. This also helps prevent inter-action in tuning between series connected traps (see diagram 2).

(2) The input selectivity of the converter may be a problem here. At the input to the converter the immediate adjacent channels to the movie channel (i.e. D and F with E for movies) will hit the converter at the same levels at E. This could cause some problems with D going to 3 and F going to 4 + 6 MHz in the process. If you find you have created co-channel problems on 3 and 4+ (i.e. into 5), a higher quality, more selective, set of filters around the E to 4 converter would be required. Also note in diagram 2 that at the DC-16 coupler going into the channel E to 4 conversion package you might substitute a modified hi-lo separator; modified so that it passes only mid-band (see December 1974 CATJ, page 11.)

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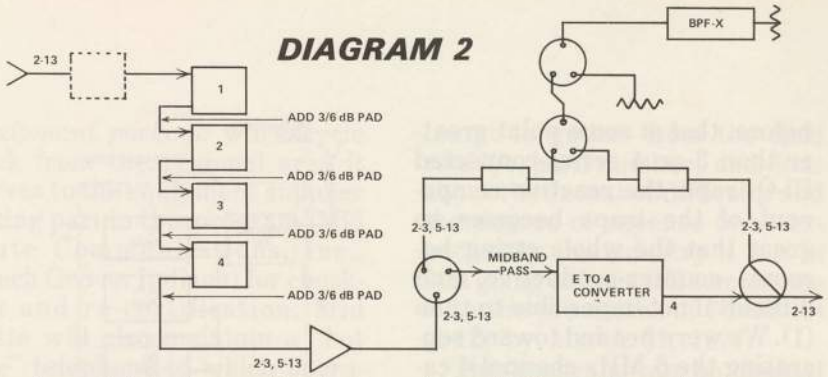
DIAGRAM 2



Back at the DC-16, the straight through leg heads for a channel 4 band absorption filter. The 3 dB pad going into the hybrid coupler is for match. Once again, match at every point is very important because without it there are reflections and with them you also have stranding waves on the various lines intercoupling between units within the enclosure. Sooner or later the standing waves will end up getting into something you don't want them in.

The hybrid coupler is a standard unit, but it does not function exactly like a coupler-splitter. Connected up as shown, it *thinks it is a circulator* (as in a microwaves rat-race circulator). The full spectrum presented at port 1 on the hybrid looks for a *low* impedance output port. At the number 2 port the spectrum sees a very high impedance load for all channels *but* 4. Consequently, channel 4 heads right into the absorption filter connected to the second port; where it "dies" by about 30 dB. The hi-lo coupler helps the full spectrum signal available (in passing) at port 2 only see low band; that is, higher frequency signals (where multiples of channel 4 might show up) are excluded further by its presence. The remainder of the signals, that is the other low band channels plus any other high band, etc. spectrum present heads out port number 3 simply because that is where the match is.

Finally the spectrum, *less channel 4*, is recoupled back in with the channel E to channel 4 single channel conversion at the output of the package with a DC-12 coupler.

Problems

If a channel 4 absorption filter is utilized at the input (in lieu of the stagger-tuned Hi-Q notch traps) the adjacent channels (channel 3 in the case of dropping 4) seems to suffer. As it is, there is overall a 3 dB channel 3 aural reduction in this system. This usually will not be objectionable for a motel distribution system.

The total package drops from input port to output port the nondesired channel 4 signal by approximately 65 dB. The absorption filter chosen requires some care.

The input to the box should be quite high, but as the input goes up, the amount of amplification required in the internal amplifier is reduced. Normal cross mod and inner-mod parameters must be watched with any amplifier chosen and levels utilized. Keep all leads as short as possible; jumper leads should be double shielded cable designed specifically for high-level headend applications. Make sure the fittings are put on properly and that they are cinched down tight.

To date, our company has installed three of these channel-dropper packages; and all have worked very well after the usual de-bugging (the first one worked so well so quickly that I was mislead into believing the problem was easily solved; the second unit was put together with less care and ground loops were a problem until the unit was returned to the sub-enclosures approach and good ground bonding employed.) Any low band channel can be the dropped channel; high band would present several unique problems probably not solvable with this approach, primarily because of the greater difficulty obtaining trap and filter "Q" in the upper frequency range. However, channels 7 or 13, with no immediate adjacents, *might work* in this application, but have not been tried.

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TECHNICAL TOPICS

FCC RESPONDS/TEST INSTRUCTIONS

We found your recent December issue article "Suppose you Measure It and Discover You Do Not Meet Spec? Then What!" very interesting and appropriate. The FCC tests are more than a bane to operators; they can uncover otherwise unnoticed performance anomalies and assist in providing continuous optimal service.

We wish to correct, however, an apparent misinterpretation of Section 76.601 of the Commission's Rules. It is stated in a note at the end of that section that:

'Requirements for performing tests to determine compliance with the standards of 76.605 (a) (9), insofar as it relates to the ratio of visual signal level to any undesired co-channel television signal, and, 76.605 (a) (10) are hereby suspended for all cable television systems, pending further study by the Commission.'

This note became effective November 23, 1973 and remains in effect today for **all** systems; grandfathered or not. We hope this will be communicated to the industry and allay any concerns which may have arisen.

David D. Kinley
Chief, Cable Television Bureau
Washington, D.C. 20554

David:

Correction noted and our apology for fostering this mis-information; not only this year but last year as well! Sometimes you people fail to get "notes" such as the quoted November 23, 1973 note, circulated to the proper channels, and as a consequence, the industry either never learns of changes, or learns of them second hand and incorrectly.

While we are covering corrections, let us make a few changes, which have come up since the December issue was printed.

1) CATJ never **said it . . . others have; the rules require a system to make** three **measurements** per **system. However, that is three measurements per CATV plant,** not **three measurements per political entity. If you have a headend serving Pudunk, Left Overshoe, West Left Overshoe and a rural area in between, each with 50 or more subs, that is not 12 measurements; that is three measurements.**

2) Now, where **do you make those three measurements? The rules say at** 'representative subscriber locations', **but you can expect an** 'editorial change' **from the FCC on this sometime soon. The Commission is about to** 'propose' **that the three measurements be at** (A) **the end of the** longest trunk cascade, (B) **at the end of the** longest trunk plus feeder cascade, **and** (C) **at the end of the** longest feeder-only cascade **(i.e. like through a bridger and seven line extenders, as some systems we know run). This is to be proposed, it is** not **solid yet. CATJ likes numbers** (B) **and** (C) **but has trouble with the significance of** (A). **A bridger amp does more to add noise and crud to a final end of line signal than a whole cascade of trunk amps. We would much rather see the third location be the system's office. In this way there is a hard set of measurements at a convenient location, which can be cross-checked throughout the year for signs of plant signal deterioration. And it usually is very representative of a typical drop.**

3) Finally, the Commission can be expected soon to clarify those measurements which need only **be made** once; **i.e. not at three separate locations. The most obvious of these is cable-frequency for off-air signals. CATJ** never **suggested anyone make these measurements at any location other than the headend (excepting systems with converters),** but again, **others have.**

In case you fail to grasp the significance of David Kinley's corrective letter, here it is. If you have any **CATV system, grandfathered, built after 3-31-72 or unlisted, you are** not **required to make co-channel or inner-mod measurements,** for now. **These tests are suspended** for everyone.

MORE TRAPS

In the November CATJ, we reviewed the basics of pay-cable trap technology, and discussed a couple of the units available in the industry to handle this problem.

With the arrival at the CATJ Lab of the Wavetek 1051 sweep system and Test Package (see separate report here) we took the opportunity to directly compare three of the various units offered today in the industry; **for bandwidth only.**

We had in the Lab three competitive units; one from Coral (600/5), Microwave Filter (3355-5) and Vitek. The Microwave and Vitek units were discussed at some length in the November (1975) CATV. The Coral unit is encapsulated, and is of discrete component design.

The purpose of this comparison is **not** to attempt to rate the respective units; this can**not** be done on the basis of trap bandwidth alone. In-channel match, out-of trap-channel match, environmental stability, and of prime importance . . . trap notch depth are all very important factors. Nor does this suggest that other units not represented (i.e. from other manufacturers) do not "rate a test"; it happens that of all of the various traps sent to CATJ for evaluation, the most we had on any **one** channel was channel 5, as represented here.

In photos shown here the Wavetek Test Set was set up with one-each trap plugged into each of the two "comparison" **channels;** to allow us to simultaneously display on the same scope screen the **apparent** trap bandwidth of two units at a time.

In the first photo, we have the stand-alone display of the Coral version; the marker at the bottom of the trap notch is on 78 MHz, or some 0.75 MHz **above** the visual carrier frequency for the channel 5 trap.

In the second photo we have the stand-alone display of the Microwave Filter channel 5 trap. In the third photo the Coral and Microwave Filter traps are simultaneously displayed.

In the fourth photo we have the stand-alone VITEK trap. In the fifth photo we have replaced the Coral trap with the Microwave Filter trap and this is a two-up simultaneous display of the

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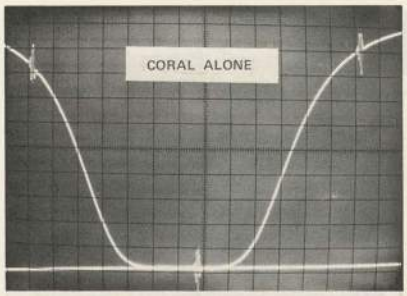

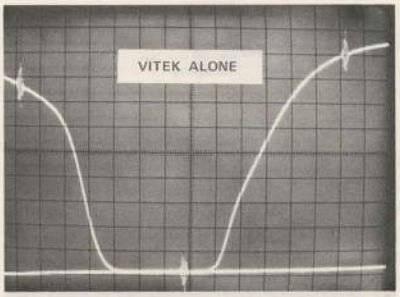

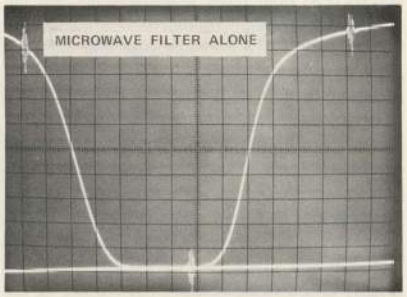

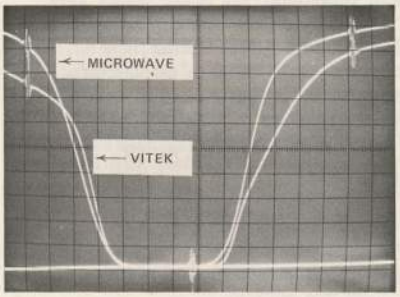

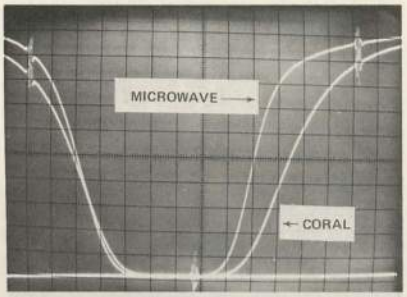

VITEK and Microwave Filter devices.

Remember this is the **top** of the trap notch; that is, that portion closest to zero attenuation. It is therefore the widest portion of the trap (3 dB down from zero attenuation is approximately 25% down from the top of the display screen).

Photos were taken on a Wavetek 1901C display scope.

Corrections / CATEL

The January issue of CATJ listed CATEL as a source for various WeatherAlert associated headend equipment including a "modulator" for 162.4 or 162.55 MHz.

Frank Genochio, President of CATEL advises CATJ that his firm is "several months away" from having a 5 kHz deviation FM transmitter for this service; but that they will attempt to satisfy the demand as quickly as possible.

The address given for CATEL in the January listing of suppliers in this field was incorrect, so for the record CATEL can be found at 1400-D Stierlin Road, Mountain View, California (94043) and there telco is 415-965-9003.

Mark-A-Channel Revisited

We would like to utilize the CATJ Mark-A-Channel (July 1974 CATJ) in conjunction with our forth coming FCC tests. Is this CATJ kit still available? If not, how can we find a Mark-A-Channel unit?

Richard Romine
ATC-CATV
Fallon, Nevada 89406

Early CATJ issues contained do-it-yourself construction articles for several pieces of test equipment, including the referenced Mark-A-Channel (a multiple channel marker generator). The kits turned out to be a big pain to us and the supplier, Steve Richey of Richey Development Company. When you have to document kits for 5-20 "customers," Steve found out that at these low quantities he lost his shirt (and lots of sleep) in a hurry. Consequently, Steve has been supplying only wired and tested units and he can be found at Richey Development Company, 1436 SW 44th Street, Oklahoma City, Oklahoma 73119.

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cata ASSOCIATE MEMBER ROSTER

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Avantek, Inc., 3175 Bowers Avenue, Santa Clara, CA. 95051 (**M8**)
Belden Corp., Electronic Division, Box 1327, Richmond, IN. 47374 (**M3**)
BROADBAND ENGINEERING, INC., 850 Old Dixie Highway Lake Park, FL. 33403 (**D9, replacement parts**)
Burnup & Sims, Box 2431, W. Palm Beach, FL. 33401 (**S2, S7, S8**)
Cable Dynamics Inc., 501 Forbes Blvd., So. San Francisco, CA. 94080 (**S8, equipment repair**)
CABLE NEWS, 2828 N. 36th Street, Phoenix, AZ. 85008 (**S6**)
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COMM/SCOPE COMPANY, P.O. Box 2406, Hickory, NC. 28601 (**M3**)
CORAL, INC., 400 Ninth Street, Hoboken, N.J. 07030 (**M1, M4, M5, M6, M7, D3**)
DELTA BENCO CASCADE INC., 40 Comet Ave., Buffalo, N.Y. 14216 (**M4, M7, M8, D3, S8**)
Jerry Conn & Associates, 550 Cleveland Ave., Chambersburg, PA. 17201 (**D3, D5, D6, D7**)
C-COR ELECTRONICS, Inc., 60 Decibel Rd., State College, PA. 16801 (**M1**)
DAVCO, Inc., P.O. Box 861, Batesville, AR. 72501 (**D1, S1, S2, S8**)
DEVINES Trailers & Accessories, Grantville, PA. 17028 (**M9, cable trailers**)
ENTRON, Inc., 70-31 84th Street, Glendale, NY. 11227 (**M4, M5, D4, D5, S8**)
GAMCO INDUSTRIES, INC., 317 Cox St., Roselle, NJ. 07203 (**M5**)
JERROLD Electronics Corp., 200 Witmer Road, Horsham, PA. 19044 (**M1, M2, M4, M5, M6, M7, D3, D8, S1, S2, S3, S8**)
Kay Elemetrics Corp., 12 Maple Avenue, Pine Brook, NJ. 07058 (**M8**)
Microwave Filter Co., 6743 Kinne St., Box 103, E. Syracuse, NY. 13057 (**M5, bandpass filters**)
MID STATE Communications, Inc., P.O. Box 203, Beech Grove, IN. 46107 (**M8**)
Pro-Com Electronics, P.O. Box 427, Poughkeepsie, NY. 12601 (**M5**)
QE Manufacturing Co., Box 227, New Berlin, PA., 17855 (**M9, tools & equipment**)
RMS CATV Division, 50 Antin Place, Bronx, NY. 10462 (**M5, M7**)
Sadelco, Inc., 299 Park Avenue, Weehawken, N.J. 07087 (**M8**)
SITCO Antennas, P.O. Box 20456, Portland, Oregon 97220 (**D2, D3, D4, D5, D6, D7, D9, M2, M4, M5, M6, M9**)
Systems Wire and Cable, Inc., P.O. Box 21007, Phoenix, Az. 85036 (**M3**)
TEXSCAN Corp., 2446 N. Shadeland Ave., Indianapolis, IN. 46219 (**M8, bandpass filters**)
Theta-Com, P.O. Box 9728, Phoenix, AZ. 85068 (**M1, M4, M5, M7, M8, S1, S2, S3, S8, AML Microwave**)
TIMES WIRE & CABLE CO., 358 Hall Avenue, Wallingford, CT. 06492 (**M3**)
Tocom, Inc., P.O. Box 47066, Dallas, Texas 75247 (**M1, M4, M5, Converters**)
TONER Cable Equipment, Inc., 418 Caredean Drive, Horsham, PA. 19044 (**D2, D3, D4, D5, D6, D7**)
Van Ladder, Inc., P.O. Box 709, Spencer, Iowa 51301 (**M9, automated ladder equipment**)
WAVETEK Indiana, 66 N. First Ave., Beech Grove, IN. 46107 (**M8**)
Western Communication Service, Box 347, San Angelo, Texas 76901 (**M2, Towers**)

NOTE: Associates listed in bold face are Charter Members.

Distributors:

D1—Full CATV equipment line
D2—CATV antennas
D3—CATV cable
D4—CATV amplifiers
D5—CATV passives
D6—CATV hardware
D7—CATV connectors
D8—CATV test equipment

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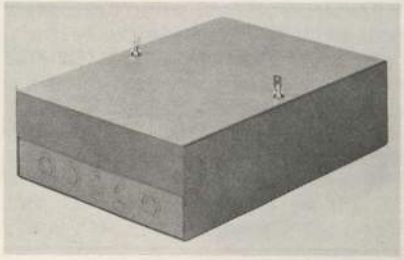
Service Firms:

S1—CATV contracting
S2—CATV construction
S3—CATV financing
S4—CATV software
S5—CATV billing services
S6—CATV publishing
S7—CATV drop installation
S8—CATV engineering

ANTI-THEFT CABINETS

Toner Cable Equipment, Inc. (418 Caradean Drive, Horsham, Pa. 19044) has announced a new line of CATV equipment cases suitable for apartment house amplifiers and other enclosure requires. The line of cabinets is called the "Super-Secure" cabinet line.



The cabinets feature flush mounting, cable entry knockouts, with two separate vending - machine - type locks with non-reproduceable keys. The cabinets are available in a variety of customized sizes, have a 3/8 inch plywood mounting surface and are constructed of painted, heavy-guage steel. Bob Toner says "Super-Secure cabinets require so much time, noise and work to break open that they should stop any thief except a determined and experienced safe-cracker." Have you field tested them in Hoboken yet Bob?

ZINC GALVANIZED TOWERS

Western Communications Service (320 W. 26th Street, San Angelo, Texas 76901) is factory building and assembling CATV towers up to 600 feet in height, with hot-dipped zinc galvanizing.

All towers are designed for 125 mile winds with no ice, and 95 mile winds with ½ inch radial ice loading. The towers are open face and of triangular configuration. Anchors of the tower, weighing 150 pounds per square foot, are custom designed for each location with the exact parameters dependent upon the soil conditions, frost line and loading conditions taken into consideration.

The towers are manufactured in standard 21 foot sections and weigh approximately 500 pounds per section. Towers are lighted following FAA specifications and are plumbed to within 1 inch per 100 foot of height. A ladder is provided on one face of the tower for climbing.

NEW CALIBRATOR

Sadelco, Inc. (299 Park Avenue, Weehawken,

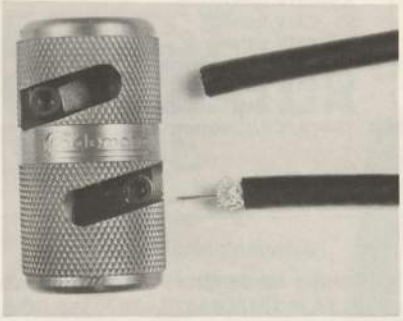
N.J. 07087) has announced the availability of a new spectrum calibrator; the 260-B.

The new calibrator uses a patented system of white noise with a CW reference signal. The unit also has built-in pulse capability for measurement of detector efficiency of SLM units in the field. The frequency range of the unit is 4.5 to 300 MHz with a flatness of +/— 0.25 dB over that range. For a CATJ review of the predecessor unit, the 260-A, see June 1975 CATJ, page 29.

The 260-B provides the CATV system with a method of measuring gain, loss, and flatness without utilizing an oscilloscope. It has an internal re-chargeable Ni-Cad battery pack, and weighs 9 pounds.

COAX CABLE STRIPPER

Anixter-Pruzan (district offices in Atlanta, Pine Brook, N.J., St. Louis, Santa Ana and Seattle) announces the availability of a newly developed Cablematic Coax Cable Stripper tool, available at A-P and designed and produced by Utility Tool Corporation.



The new tool is said to be faster to use and smaller in size than previous models. The tool uses two or three steps to clean the cable (RG-58, RG-59 and RG-6) and prepare it for attachment of an "F" series fitting. Either solid or foam dielectric cables can be prepared with the tool.

FIRE ALERT SYSTEM

TOCOM, Inc. (3301 Royalty Row, Dallas, Texas 75247) has had its first brush with a real two-way alarm situation, and the system passed the test with flying colors.

In the Woodlands, Texas TOCOM equipped two-way system, a home wired with the TOCOM fire alerting system experienced an overheated attic-located central heating unit. The heat build up was detected by the TOCOM fire sensor, and within 20 seconds of detection the Woodlands Emergency Service had the message to the fire department.

Actually, this was the second brush with fire at the same residence. Just days prior to the overheated attic furnace unit, an overheated washing machine motor burst into flame and a smoke detection alarm brought in instant response from the local fire department.

IMPROVED TDR

Avantek, Inc. (3175 Bowers Avenue, Santa Clara, Ca. 95051) has announced a new version of their CA-100 cable quality analyzer; the CA-100A unit.

The CA-100A will detect high or low cable impedance faults in cable runs of up to 4,000 feet in length. It will detect shorts, opens, frays and crimped cable as well as faults in splitters. The unit can also be utilized to check the integrity of new rolls of cable with the cable still on the rolls prior to installation.

Low and high impedance faults are detected and their presence is displayed on indicator lamps. This advance removes the requirement that the system operator evaluate his TDR system using an oscilloscope or chart recorder. The 100A unit differs from the previous version in the following ways: (1) It provides a greater distance measuring accuracy of +/— 1 percent (+/— 3 feet) over the entire distance range; (2) It provides a greater selection of cable velocity of propagation factors (.66, .81, .91, .93, .94 and .95); (3) The cable compensation circuitry has been improved (0.4 dB — 2 dB per 100 feet at channel 13). This eliminates any calculations on the part of the TDR operator.

JERROLD EXPANSION

Jerrold has announced a pair of developments largely in reaction to the growing interest on the part of CATV system operators in the pay-cable area.

A new single-channel converter-descrambler, the DST-1C, will be available from Jerrold in February. This field-retrofittable unit allows the CATV equipped home to receive system carried pay cable programs on either channel H or I, through set top conversion to channel 3. A system could expand from 12 to 13 channels using this technique, where plant amplifiers are capable of the additional channel, and the set top converter provides frequency conversion plus scrambling security to the system operator.

Jerrold has also announced that the recently installed Owensboro, Kentucky, CATV earth terminal, utilizing the program services of HBO via Westar, is using the Jerrold SDS (scrambler) equipment to provide a "hard security" for the new Owensboro pay-cable operation. The Owensboro system charges a $20.00 pay-cable installation fee and $9.95 per month for the HBO service. At the time of pay-cable installation, the system collects $29.95 plus the signing of a service agreement with the subscriber.

A traditional system in a unlikely spot in the world has been recently completed by Jerrold's international marketing and installation division. The location of the system is Tortola, in the British Virgin Islands, just east of Puerto Rico and the American Virgin Islands. The owner and operator of the new 8 channel plus weather service channel system is Cable and Wireless Limited, one of the world's largest (British) operators of closed circuit and CATV type systems.

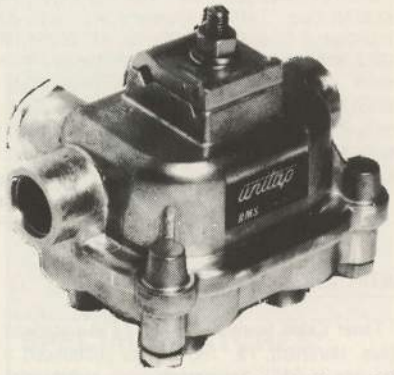
The new Tortola system utilizes Channel Commander II headend equipment and Starline 20 single ended amplifiers. The cable plant is 22 miles in length. Stations carried include Puerto Rican Spanish language stations, and an FM broadcast service which carries English language synchronized to the Spanish language of the program being carried by the Puerto Rico TV station. In this way English speaking cable subscribers enjoy their programs in English while the Spanish speaking residents enjoy the same program in Spanish.

As a footnote, CATJ also welcomes the Tortola system as a subscriber to CATJ; this brings our international circulation up to 19 countries!

RMS MULTI-NEW

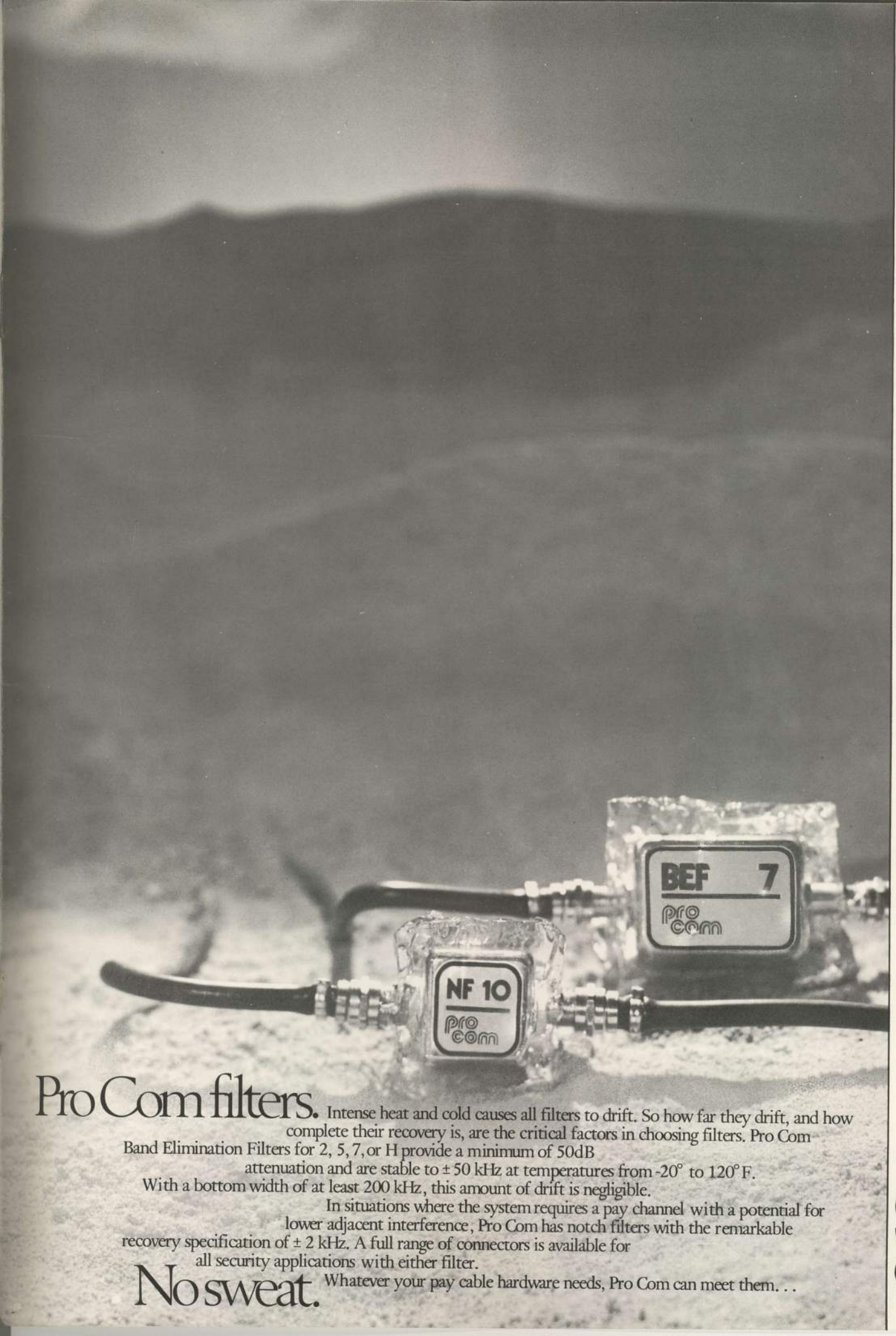
The R and D department at RMS has been working overtime if the number of new product news releases received by CATJ is any indication. Two of these are covered here this month.

The new **UNITAP** is an inline multi directional tap for aerial or underground installation. An interchangeable tap plate allows either 2 or 4 way outputs at each tap location.



Power passing is accomplished with an "air coil," an important point for systems concerned with "DT Hum Mod" (see pages 25-28 December 1975 CATJ). Another feature of the new tap is 100 percent metal to metal contact at all ports and entry points for "100% RFI integrity".

The new **CA-1122VA VARIABLE ATTENUATOR** covers DC to 900 MHz, with selectable (switch) attenuation levels of 0, 3, 6, 9, 12, 15, 16, and 24 dB. The accuracy of the unit, which is suitable for headend level control adjustments or test bench applications, is +/— 0.5 dB from DC to 300 MHz and +/— 1.0 dB for 300-900 MHz. The die-cast aluminum case measures 3-¼ x 2 x 0.5 inches.



Pro Com filters.

Intense heat and cold causes all filters to drift. So how far they drift, and how complete their recovery is, are the critical factors in choosing filters. Pro Com Band Elimination Filters for 2, 5, 7, or H provide a minimum of 50dB attenuation and are stable to ± 50 kHz at temperatures from -20° to 120° F. With a bottom width of at least 200 kHz, this amount of drift is negligible.

In situations where the system requires a pay channel with a potential for lower adjacent interference, Pro Com has notch filters with the remarkable recovery specification of ± 2 kHz. A full range of connectors is available for all security applications with either filter.

No sweat.

Whatever your pay cable hardware needs, Pro Com can meet them. . .

pro com
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July 25, 1975

Gary J. Balsam, Executive Vice President
Gamco Industries Inc.
317 Cox Street
Roselle, New Jersey 07203

Dear Gary:

I have never written a letter like this before, but I think it is appropriate to let you know that your Terma-Lok B.M.T.-75 ALHS terminators are just about the greatest thing I have ever used.

Our Columbus System has over 27,000 customers with approximately 10,000 of these customers being in apartments. We are in the process of audit on these apartments, and using Terma-Lok on all non-used taps. To date we have found over 400 bandits in less than 2,000 units. Our recovery rate has been approximately 70% of these bandits to paying customers. This is entirely due to Terma-Lok. Terma-Lok is making us money, not costing us money.

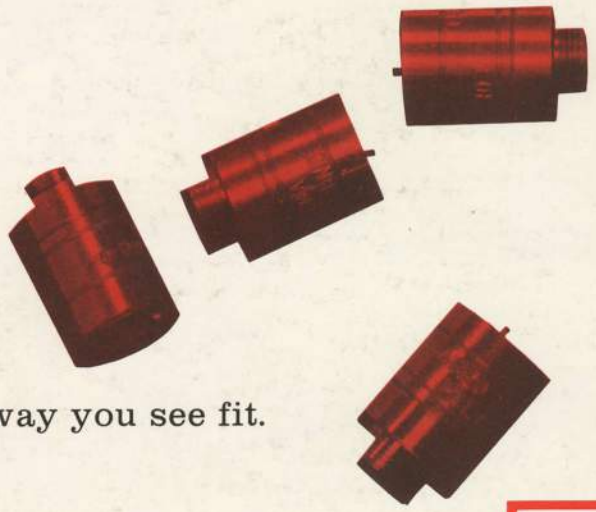
Keep up the good products.

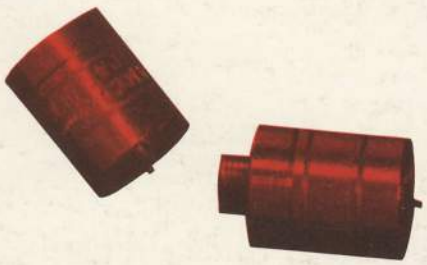
Yours truly,

David F. Neiman
Construction Manager

P.S. You may use this letter any way you see fit.

DFN:jak





GAMCO
INDUSTRIES INC.

291 COX STREET, ROSELLE, NEW JERSEY 07203•(201) 241-7500•TELEX 138-005