CATJ

DECEMBER

1977

OFFICIAL JOURNAL
OF THE
COMMUNITY ANTENNA
TELEVISION ASSOCIATION

Increase Your Channel Capacity

with low-cost

Merrimac Power Dividers.

2-way...4-way...8-way.
3.7 to 4.2 GHz

MICROWAVE STRIPLINE POWER DIVIDERS 3.7 to 4.2 GHz

2-way Model PD-20-3.95G
4-way Model PD-42-3.95GA
8-way Model PD-82-3.95GA
50 ohms impedance
VSWR 1.15 typ., 1.20 max. • "N" type female connectors

• Terminations (Loads)

Model TN-6K • 50 ohms impedance
VSWR 1.30 • "N" type male connectors

• Precision Fixed Attenuators (pads)

Models: FAN-6-3K (3dB) FAN-6-10K (10dB)
FAN-6-6K (6dB) FAN-6-20K (20dB)
50 ohm impedance •"N" type male/female connectors

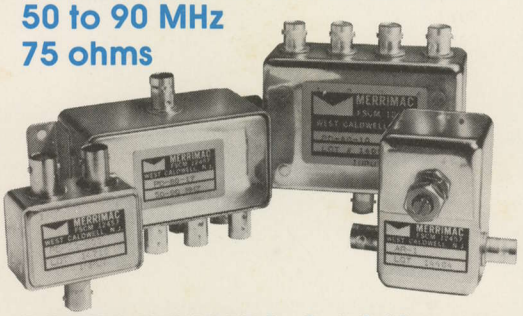
• Directional Couplers

Model C2-20-3.9G • "N" type female connector

Call or write for complete technical details and pricing.

Merrimac
now there is one...in signal processing
INDUSTRIES, INCORPORATED
41 FAIRFIELD PL., W. CALDWELL, N.J. 07006 • 201 575-1300 • TWX 710-734-4314

IF PROCESSING COMPONENTS: 50 to 90 MHz 75 ohms



POWER DIVIDERS; 2,4,8,16 way

2-way Model PD7-20-70;
4-way Model PD7-40-70;
8-way Model PD7-80-70;
16-way Model PD7-160-70.
75 ohms impedance
BNC Female connectors

CONTINUOUSLY VARIABLE ATTENUATORS

Model AB7-27-70
Attenuation range 0 to 20 dB
BNC connectors
75 ohms impedance

Superfit™ for a King

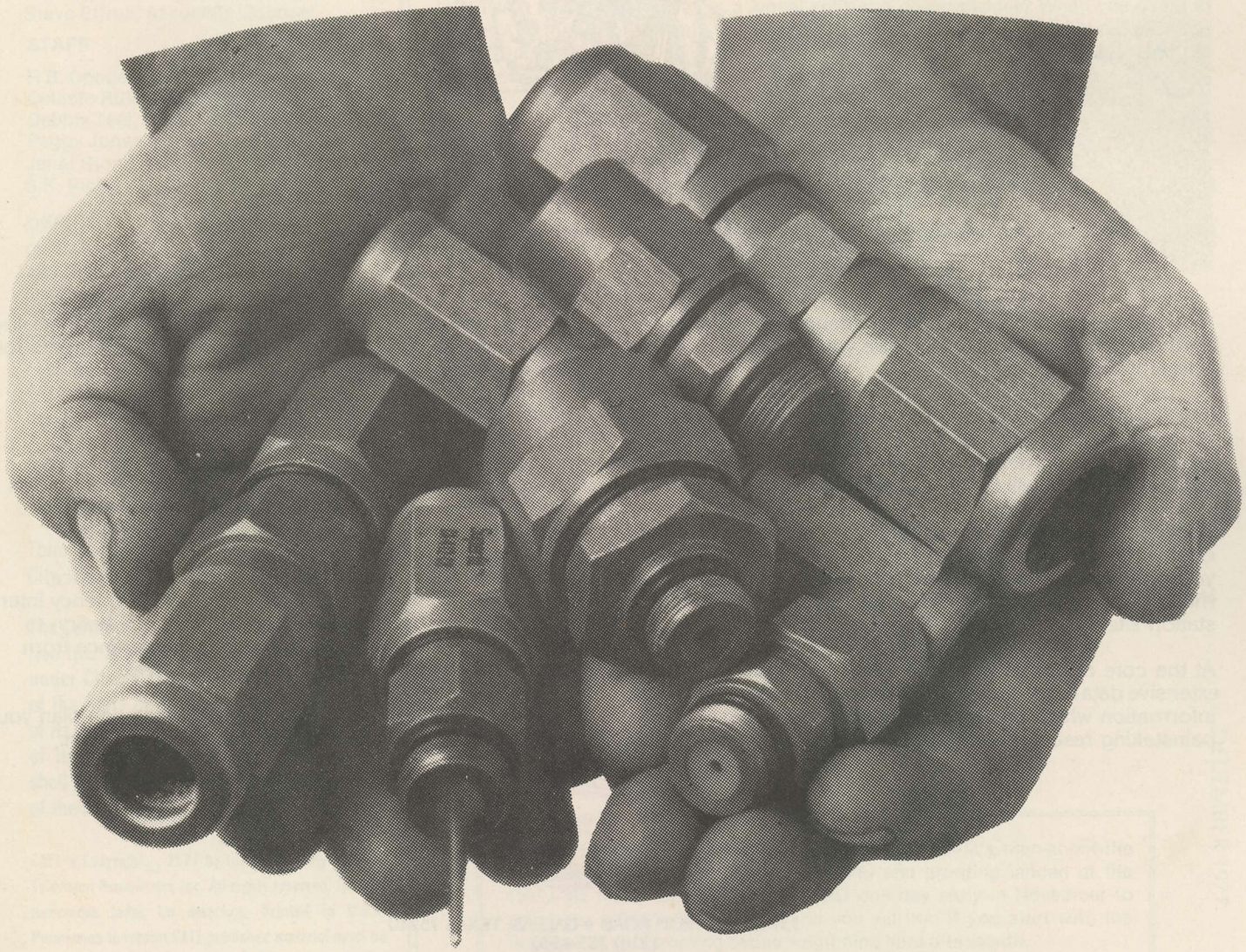
Or our Customers. At RMS they're one and the same.

1. RMS has put together the "SUPERFIT"™ line, the most comprehensive variety of connectors ever offered to the cable industry.
2. Most RMS "SUPERFIT"™ connectors are made from 6262T9 aluminum, the most corrosion resistant of all bar stock. To complete the markets finest connectors, each piece is carefully gold irridited for additional protection.
3. Each connector is labeled with the model number whenever possible, eliminating guesswork as to connector identification.

For additional information on this major new connector line, write or call collect.

RMS CATV DIVISION
ELECTRONICS, INC.

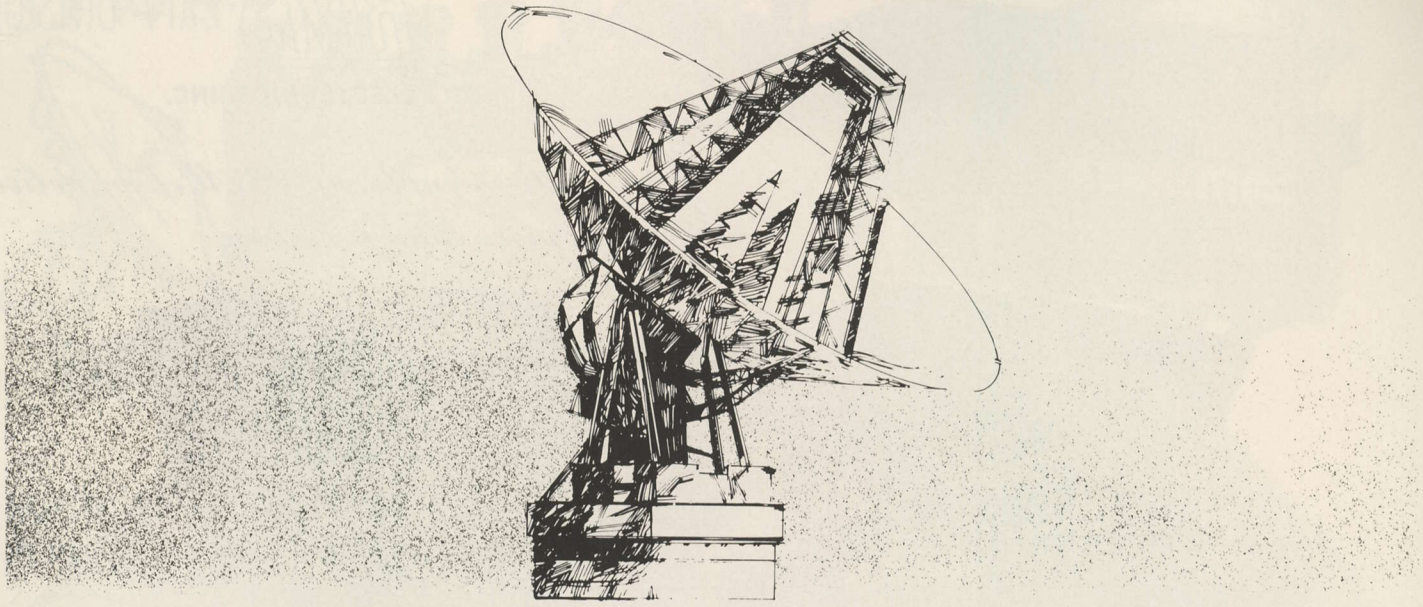
Remember, at RMS we deliver more than promises.



50 Antin Place, Bronx, N.Y. 10462 • Call Collect (212) 892-1000 • Canadian Representatives: Deskin Sales Corp.

A Word of Advice about Satellite Earth Station Placement:

COMPUCON.



As you embark upon your first experience with satellite earth station placement, let us give you a word of advice: COMPUCON.

That's the first thing you need to know. Deciding that satellite transmission was the best way for receiving programming was an important decision for you. Choosing a company to achieve this goal will be an equally important decision.

Compucon is a leader in the field of communication engineering services. We have complete facilities to help you with satellite transmission from initial planning for placement to frequency interference measurement at the earth station site.

At the core of our service to you is our accurate and extensive data base. Stored in its memory banks is complete information which has been compiled from years of painstaking research with clients, FCC filings, public notices, licenses, and prior coordination notices. With this specialized library our experts can guide you to the best placement for your earth station.

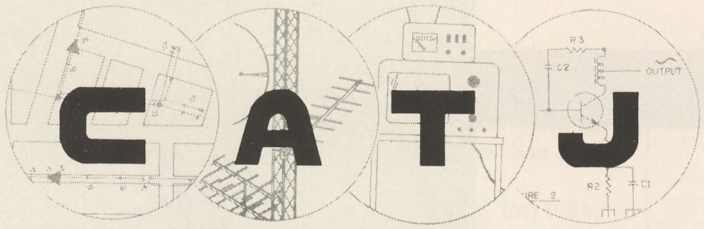
But that's not all.

Compucon provides all necessary technical exhibits in compliance with the frequency coordination requirements of part 25 of the FCC Rules. Additionally, we assist in the preparation of the FCC applications for approval and licensing. We perform technical analyses to ensure compliance with established design and performance criteria. Finally, we continue to monitor the frequency interference environment around the satellite earth station to detect and prevent potential frequency interference from new or changing terrestrial microwave routes.

So you see, all you really need to know when you plan your next satellite earth station is one thing: COMPUCON.

COMPUCON

13749 NEUTRON ROAD • DALLAS, TEXAS 75240
(214) 233-4380



DECEMBER 1977

VOLUME 4 – NUMBER 12

PUBLISHED MONTHLY, AS ITS OFFICIAL JOURNAL, BY THE COMMUNITY ANTENNA TELEVISION ASSOCIATION, INC., OKLAHOMA CITY, OKLAHOMA, AS A SERVICE TO ITS MEMBERS AND OTHERS PROVIDING CATV/MATV SERVICE TO THE TELEVISION VIEWING PUBLIC AND BROADBAND VIDEO/AUDIO DATA COMMUNICATION SERVICE.

OFFICES

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

CATJ subscription rates $12.00 per year for non-CATA members, $8.00 per year for CATA member-systems; $9.00 per year for industry employed personnel for at-home delivery. In Canada, $13.00 per year for CATV systems, $10.00 per year for system employees. Foreign rates upon request.

Third class postage rates paid in Oklahoma City, Oklahoma, U.S.A.

The Community Antenna Television Association Inc. is a nonprofit organization formed under Chapter 19, Title 18 of the Statutes of the State of Oklahoma. As such, no part of its assets or income shall be the property of its members; such assets and income shall be devoted exclusively to the purposes of the Corporation.

—FEATURES—

—DEPARTMENTS—

OUR COVER

LARRY LAWSON AT CATJ LAB—Scientific Atlanta's man-about-the world in TVRO system trouble shooting and proofing landed at the CATJ six meter Developmental TVRO one day early in November to proof our system. We passed, and you will too if you start with the first part of our 'proofing series' beginning here this month.

CATA-torial

KYLE D. MOORE, President of CATA, Inc.

The Strange Mind Of The Broadcaster

Ever since the copyright 'settlement' in the fall of '76 there have been very few instances where the cable people and the broadcasters have been out stalking the aisles of Congress in open hostility to one another. Copyright legitimized us in the eyes of the broadcasters, and it eliminated their most often repeated adjective (illegitimate).

Copyright, as we all know, did bad things to this industry. It tore us apart at a time when we had no business being divided and it left wounds which in some quarters will never heal. Because we were divided we spent too much time arguing internally about what we could or would accept and not enough time looking at the overall effects of the new copyright bill on all forms of American life. Had I to do it over again, much more emphasis would be placed on dealing with portions of the bill that have absolutely nothing to do with CATV; sections that will in the long run make everything from libraries to office copying machines more expensive to run and more difficult to administer.

Now if my memory serves me correctly, one of the proposed copyright changes which did **not** make the final bill was a section which would have made radio and television broadcasters liable for 'performance royalties' for any music they played. The music industry people wanted to have the broadcasters pay them so much per recorded tune aired; the fee to go to **the performers themselves** (as opposed to going to the record company which is already paid under music licensing arrangements).

The concept started late, and that was why it probably did not make the final cut of the bill. It hadn't been around long enough to be accepted and the broadcasters found it not difficult to deal with.

Well, the broadcasters are now afraid that during the next session of Congress this whole issue may come up again. NAB President Vincent T. Wasilewski is out campaigning for broadcaster support to 'kill this proposed legislation' before it even gets started. Wasilewski apparently has some good reason to be beating the drum or he wouldn't be out making all of the noise he is making.

The broadcasters feel, says Wasilewski, that **"requiring broadcasters to pay for the right to broadcast recorded music would be 'unwise, unnecessary and unfair'."** He also fees that if the concept was established it would cost broadcasters $15 million annually. The NAB President feels that it would be unfair for one **private** industry to 'subsidize' another private industry. He also feels that payment for performance rights is **"...totally unjustified and will destroy that delicate economic balance between the broadcasting industry and the music industry wherein both are the beneficiaries of a business relationship that has grown up through custom and practice."**

Well now, with the shoe on the other foot, the broadcasters seem to be having considerable difficulty making a very persuasive argument. When CATV said "requiring cable systems to pay for the right to cable-deliver off-air television signals would be 'unwise, unnecessary and unfair' " our pleas fell on largely deaf ears. When we pointed out that copyright would cost cable system **subscribers** $6-7 million annually, nobody really acted concerned. When we said it would be "unfair for one private industry to subsidize another private industry" the NAB called us thiefs and 'illegitimate'. We were told that 'use' of the 'property rights' of others 'without proper payment' was unAmerican, immoral and dastardly.

When we argued that the signals we delivered to CATV connected homes were in the airwaves for free reception and that our systems were merely extensions of the viewer's antenna we were told that unless we 'squared ourselves with the international copyright community' that we had no solid foundation to grow on.

Now the broadcasters **do pay** music licensing fees for the music they play. This is done **privately** through non-Government operated companies. But the bucks paid go from the broadcasters to the music licensing authority and then to the recording **companies** who typically own the full rights to the music. The performers, unless they also own the recording companies, see not a dime of this 'play' money.

In effect, the broadcasters run up to several dozen records per hour. They get this programming material almost for free (the licensing fees are actually very low). Around this **free** programming material they **sell** commercial time. So utilizing the free program material, **the broadcasters make money.**

Television programming differs in that the broadcaster pays for virtually everything he shows or transmits. He gets no (or very little)

free video material and that which he might happen to get is often unattractive for advertising sale purposes.

Now let's assume the music performers **are** successful in pulling off this bill; that they get a revision of the copyright law. How does that impact on cable?

If Congress should decide this bill needs to be passed, they might handle it as an act separate from copyright. It **could** go through without re-opening up the 1976 copyright act. **Or,** and this is what concerns us, it could also go through as a part of a general re-look or revision of the 1976 copyright act. If the act is re-opened, one of the things we would most expect is another attempt by Jack Valenti and the MPAA to get **cable** copyright **fees raised.** Valenti is reportedly concerned about the recent success of Atlanta's 'Super-17' and he wants higher copyright fees attached to such 'super-stations'.

And there is another concern. If the music performers can get the support of Congress for 'performance fees' on radio, what is to stop the television performers from getting 'performance fees' for television?

There may be no end to this in sight. The big mistake we made was ever getting so far along that we were forced to accept the concept to begin with. A CBS VP out of Washington said it over and over again during the 1975-76 era; **"The most important thing to be done with CATV copyright is to get the principle established. The fees to begin with are unimportant."**

That scared us to death in 1975; and it still does.

HBO's Successful Fifth

The Home Box Office group recently celebrated their fifth birthday with an announcement of some importance to the cable industry. After five years of trying, HBO finally got into the black.

HBO's beginnings were unspectacular. From a 365 subscriber base in Wilkes Barre linked to New York via terrestrial microwave in November of 1972 to profitable operation with more than 800,000 subscribers in 1977 has been a very long trek indeed. Today's HBO serves more cable systems (375) than it did subscribers at the outset, in 45 states.

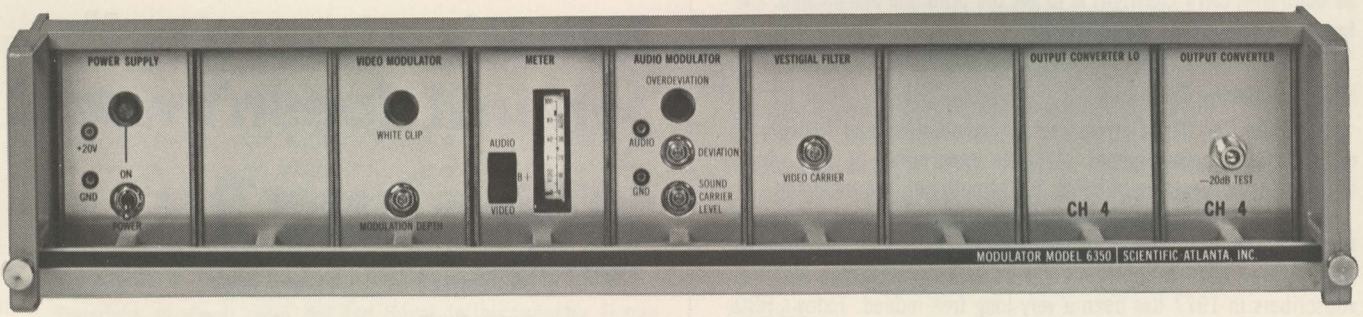
HBO is of course an operating subsidiary of Time, Inc. and there is a message there. Had it not been for the courage, guts and belief in the system which Time exhibited, HBO never would have made it into the black. Getting a pay cable network off the ground on **any** scale takes both imagination, determination and staying power. Lots of us have imagination and most of us are determined. But not many of us have the necessary corporate strength to provide the staying power.

Even at the 800,000 subscriber level, pay cable is still small peanuts in the entertainment industry. HBO's **total annual gross** is still but a fraction of the gross of single super-movies such as the current Star Wars success. So the bottom line, while a beautiful black now and growing, has been and will be a long time coming.

HBO's success is welcome because it should end those persistent rumors that Time, Inc. will one day tire of HBO and write the whole thing off as a grand experiment. We need the solid foundation that a healthful and growing HBO can provide us and we feel confident that their success will breed others who will offer similar packages. The announcement that Showtime will join HBO on SATCOM II 'early in 1978' is yet another indication that pay-cable programming may finally be coming into its own. We salute you HBO for having the faith to stay with this industry and we welcome all imaginative, determined and well financed alternate program sources that may be coming on board with HBO (and Showtime) in the coming years.

(Program) diversity is the name of the game and with more to offer to our subscribers, our own chances for survival can only improve with time.

Our new Modulator. It can be what you want it to be.



Even when ordered without frills, our new 6350 Television Modulator outclasses units selling for more. Its Surface-Acoustic Wave (SAW) device as the vestigial sideband filter reduces out-of-band emission to a level unmatched in the cable industry. But when you choose any or all of the optional plug-in modules, it's then that the 6350 turns into the modulator you'd want to design yourself.

For instance, the Video Switching option detects loss of primary video and switches to alternate video output with front panel lamp indication. And has remote activation capability.

An Audio Switching module provides for selection of alternate audio source and also permits switching to emergency override audio. When override is used, the audio response is shaped to enhance voice intelligibility and reduce telephone line noise.

The IF Switching option enables composite (picture plus sound) IF to be interrupted at a point just before up-conversion to the output channel, and may be replaced by an alternate source of composite IF.

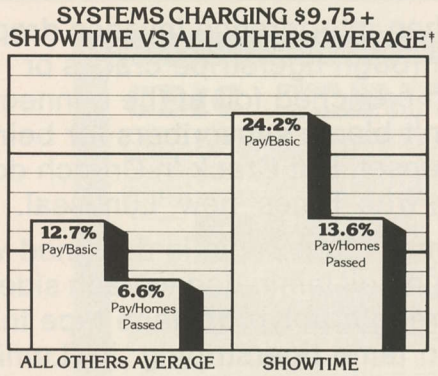
Or you can customize the 6350 with options for standby powering from positive or negative source. Audio modulation limiting. Phase lock. Video AGC and Alternate IF AGC control. Call Harry Banks at (404) 449-2000 or write us for your demonstration of the 6350. The modulator you've always wanted.

Scientific Atlanta

United States: 3845 Pleasantdale Road, Atlanta, Ga. 30340, Telephone 404-449-2000, TWX 810-766-4912, Telex 054-2898
Canada: 678 Belmont Avenue West, Suite 103, Kitchener, Ontario, Canada N2M-1N6, Telephone 519-745-9445, Telex 069-5239
Europe: 1-7 Sunbury Cross Centre, Staines Road West, Sunbury on Thames, Middlesex TW16 7BB, England,
Telephone Sunbury on Thames 89751, Telex 896015

WE'RE NO.1 WHERE IT COUNTS.

We may not be the biggest, but we are No. 1 where it counts. Profits for you. Once more Showtime has proven to be the leading performer in pay TV. We're the professionals. And once again, here's the proof.



HIGHEST SUBSCRIBER REVENUE. Cable operators big and small who offer Showtime can charge premium rates from as low as $7.00 up to $10.00 and still achieve record levels of subscribers. And when Showtime subscribers sign on, they stay on. Our average retention rate is over 90%.*

RECORD LEVELS OF SUBSCRIBERS. When the performance of Showtime systems is compared with other cable systems offering pay TV services, the results speak for themselves.

HIGHEST PROFITS FOR YOU. Showtime costs you less than other pay TV services. You get more subscribers, higher revenues and lower costs, which add up to one key thing. More profits for you.

AND NOW WE DO IT ALL ON SATELLITE. The hottest show in pay TV will be on RCA Satcom II Transponders Nos. 4 and 10. Now cable operators everywhere can have the best. That means every cable operator regardless of size or location can now get results where they count.

Showtime's incomparable performance is the result of programming know-how and marketing expertise. It all starts with our prelaunch planning where we work with you to create the best marketing plan for your individual cable system. And that's just the beginning. Our top quality programming, convenient scheduling, special promotions and customized marketing programs continue through launch and beyond. We're there when you need us and we listen to what you've got to say. Showtime gets you results where they count. That's why we're No. 1.

†The Pay TV Newsletter, Paul Kagan Associates Inc., Aug. 16, 1977.

*Retention = current subscriber levels ÷ number of subscribers at completion of marketing.

The professionals in pay cable.

SHOWTIME®

1211 Avenue of the Americas, New York, N.Y. 10036
Call toll free (800) 223-0646 or in New York (212) 575-5175.

If we didn't foil the horrors of crack 'n crunch, someone else might be number one.

When interference invades drop cable through tigerstripe cracks or through crunched foil at the connectors, you can't blame subscribers for being a little upset. But Crack 'n Crunch doesn't happen with Times' new 'Lumiseal.

Times' drop cable is designed with aluminum foil laminated to each side of high strength polypropolene tape in order to tame tigerstriping. In 'Lumiseal this composite foil is sealed directly to the dielectric. So it can't crunch up when you put on the connector. Rather, the connector slips on quickly and smoothly assuring maximum RFI integrity. Furthermore, by heat sealing the foil to the dielectric the possibility of moisture migration is practically eliminated.

'Lumiseal is available in RG-59 and RG-6 sizes; with either heavy or extra-heavy braid coverage. Try it. We think you'll agree it's the number one drop cable from the number one cable company.

For more information call Bud Desmond at (203) 265-2361. Or your nearest Man From Times.

New 'Lumiseal™ Drop Cable from

Times Wire & Cable
The #1 Cable Company

358 Hall Avenue, Wallingford, CT 06492
(203) 265-2361 · Phoenix, AZ (602) 278-5576
DIVISION OF TIMES FIBER COMMUNICATIONS, INC.

If the need ever arises...

MOVE FROM SATCOM-II To Satcom-I IN 60 SECONDS TIME

With Either

USTC (all steel) SAT/FLECT I Or USTC (all aluminum) SAT/FLECT II

It may never happen. But RCA is talking about moving all CATV 'traffic' to SATCOM-I. And because they are talking about it, you need to be thinking about the eventual day when you might be switching satellites with your terminal.

There is only one TVRO antenna mount designed for quick, accurate bird to bird change. That's the polar mount; a far faster, better system for quick/accurate tracking of TVRO terminals from bird to bird. It's so easy to handle even a child can do it. Accurately and exactly. Only the USTC SAT/FLECT I and II series antennas have the ease of a polar mount combined with the quick 'Hitch-em-Up' positioning tie-down system.

The polar mount and the exclusive-with-USTC 'Hitch-em-Up' tie down system are further proof that USTC thinks ahead. We manufacture the world's most cost-effective Six Meter TVRO antenna systems with advance features others cannot offer, for any price. So before you get tied-down to a big, over-engineered 'up and over' Az-El mounting system, think ahead. Think USTC. If you ever have to change birds, for any reason, you'll be glad that we thought ahead for you!

Step one—loosen two pressure bolts (15 seconds maximum).

Step two—unlatch the 'Hitch-em-Up' clasp and gently lift the perfectly balanced load arm off of the load ball (15 seconds maximum).

Step three—gently direct the load arm to the pre-positioned load ball for the new bird. Relatch the clasp and re-tighten the two pressure bolts (30 seconds maximum).

USTEC

United States Tower and Fabrication Company
P.O. Drawer 'S', Afton, Ok. 74331

Call Danny Weathers or Tony Bickel at 918/257-4257.

NOW... a low cost satellite TV receiver

New Model 1100-FFC Satellite Earth Terminal TV receivers.

Each is a fixed tuned, stand alone receiver specifically designed to reduce the cost of adding TV channels to existing or new CATV Receive Only Terminals. Yet, they offer the same video, audio and related performance specifications as Microdyne's widely accepted Model 1100-TVR(VT) receiver, including the standard 8.0 dB C/N threshold extension feature.

Minimum Cost

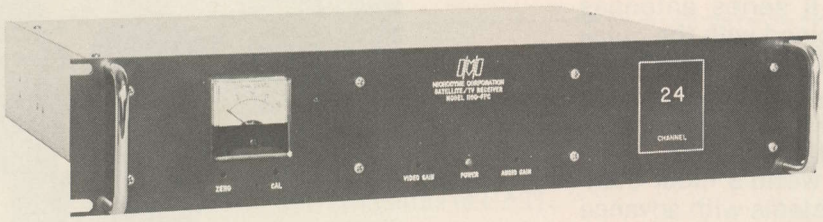
All current TV channels plus others to follow can be readily accommodated at minimum cost. Simply add a dedicated 1100-FFC Receiver for each channel as required. Total backup can be provided by using any compatible receiver capable of being quickly tuned to any dedicated channel.

Compact

Only 3½" high, the rack mount Model 1100-FFC is fully EIA and CCIR compatible. Options include the ability to quickly change frequency.

Custom Engineering Service

For those operators wishing to install their own systems, Microdyne Corporation will provide complete technical analysis and recommendations tailored to specific system requirements at no cost. Being one of the most experienced RF manufacturers, Microdyne's free Engineering Service will result in substantial cost savings for anyone installing their own system.



Microdyne Model 1100-FFC
Satellite Earth Terminal TV Receiver

MICRODYNE CORPORATION

P. O. Box 1527 - 627 Lofstrand Lane
Rockville, Maryland 20850
Telephone (301) 762-8500
TWX 710-828-0477
Cable MICRODYNE
Rockville, Maryland USA

Why not investigate Microdyne before you buy?

Don't let lightning put your system in the dark!

DBC offers:

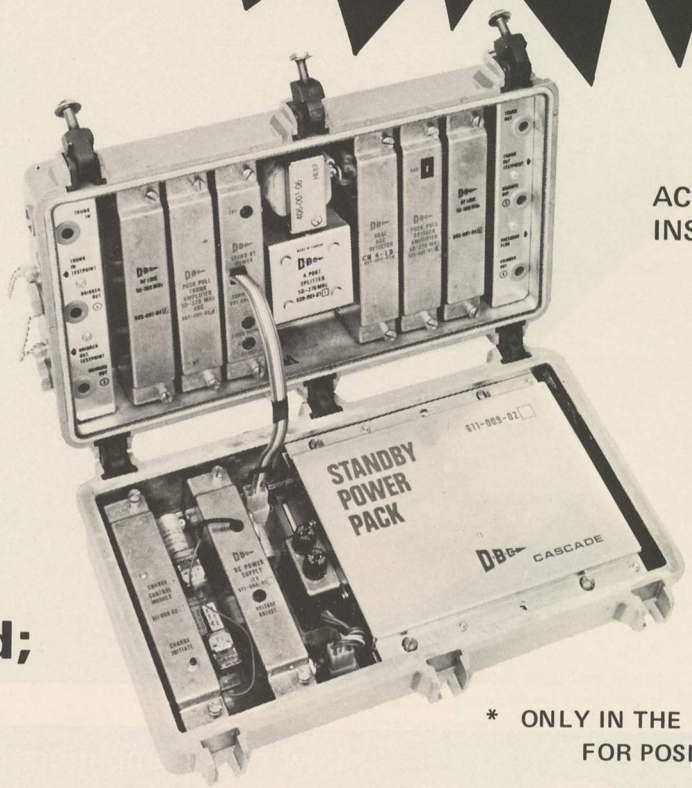
Standby Powering

REDUNDANT
POWER SUPPLY

AC TO DC
INSTANTANEOUS

COMPLETELY
RECHARGED
IN 48 HOURS

INSTALLED
IN MINUTES



It's all in the lid; no external connections.*

* ONLY IN THE 12 AND 20 VDC MODELS FOR POSITIVE GROUND SYSTEM.

Ask us about external standby powering adaptable to any system.

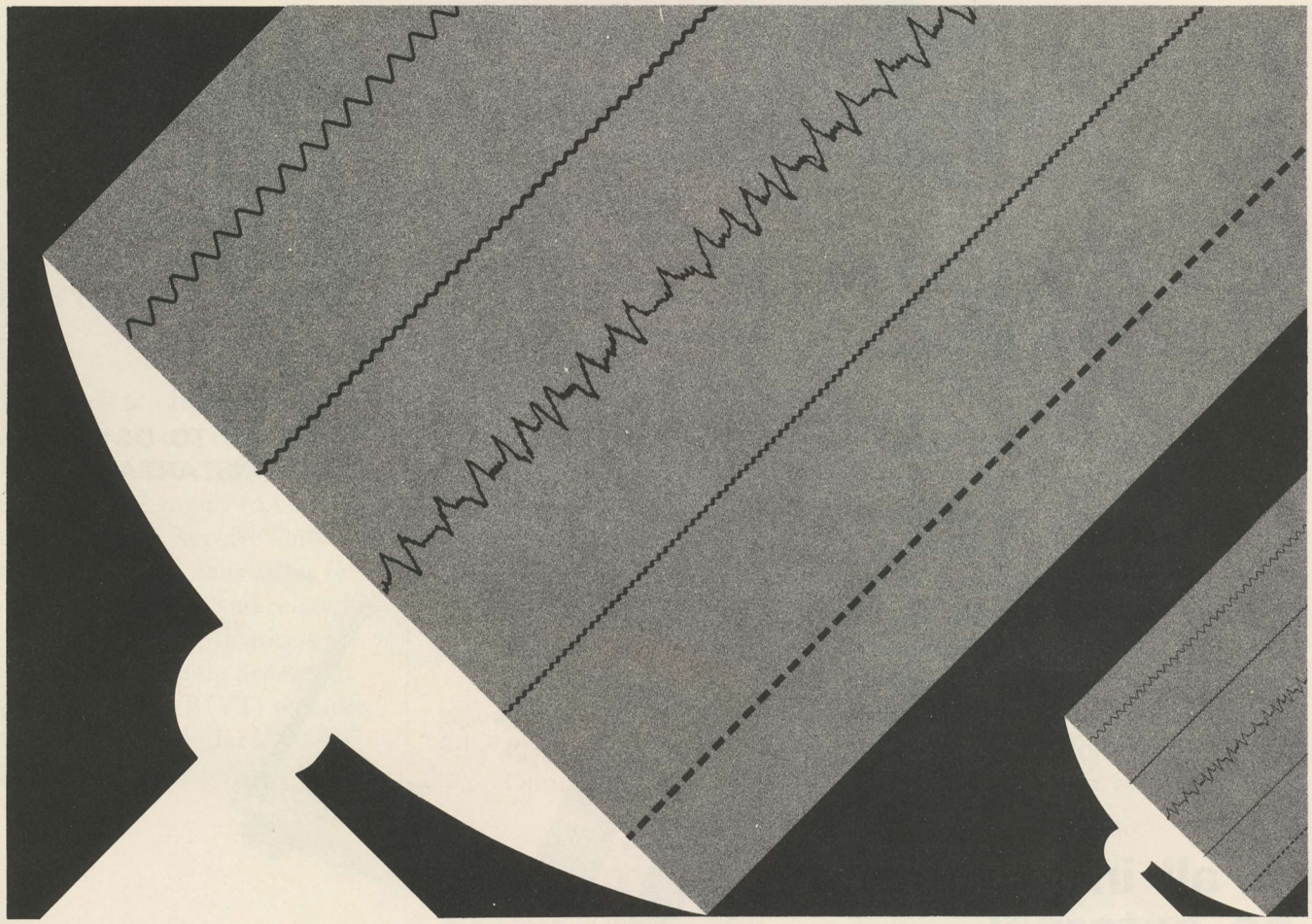
DELTA·BENCO·CASCADE

124 Belfield Road, Rexdale, Ontario, Canada M9W 1G1
Telephone (416) 241-2651 Telex 06-965552

CALL OR WRITE TO YOUR NEAREST OFFICE: Philip Allman, 4913-205th Street, Langley, B.C. V3A 5T7. Tel. (604) 534-3710: Ken Jones, R.D. 1, Box 69, Beaver Springs, Pa. 17812, Tel. (717) 658-2282: Wm. E. (Gene) Wampler, 1544 Warpath Drive, Kingsport, Tenn. 37664. Tel. (615) 246-6579: U.S. REPRESENTATIVES: Bruce Martin, Cablevision Equipment Co. Inc., 3838 Cavalier Drive, Garland, Tex. 75042. Tel. (214) 272-8551: Neil Phillips, Signal Vision Inc., 23932 Jarrow Lane, El Toro, Cal. 92630, Tel. (714) 586-3196: U.S. WATS LINE (800) 828-1016

A WISP OF SIGNAL

IN A UNIVERSE OF NOISE



SCI

Low noise amplifiers are vital to the rapidly expanding technologies associated with satellite communications, radio astronomy and many advanced radars. Scientific Communications has designed and built numerous standard and custom amplifiers to meet the most demanding requirements in these and related fields. Whatever your low noise amplifier needs, SCI has the capability and experience to provide high performance, cost effective amplifiers to meet them.

Scientific Communications, Inc.

PARAMETRIC AMPLIFIERS • TRANSISTOR AMPLIFIERS • SURVEILLANCE RECEIVERS • MANAGEMENT CONTROL COMPUTERS

3425 KINGSLEY ROAD, GARLAND, TEXAS, 75041 (214) 271-3685 TWX 910-860-5172

IF YOU HAVE ANYTHING TO DO WITH CABLE

The **1977 CATV & Station Coverage Atlas** provides instant access to the needs of cable system owners, operators and affiliated professionals who require authoritative information on the cable industry. The Atlas contains station coverage maps indispensable for applying FCC cable rules, which are also included. This is the industry's **only** reference work showing the relationship between TV station contours and locations of all cable systems.

- **35-Mile & 55-Mile Zone Maps** showing communities with CATV systems underscored in color.
- **Up-Dated Grade B contours.**
- **Color-Coded Gatefold Map** showing locations of (1) MDS Licenseees and CPs and (2) Domestic Satellite Earth Stations Licensees and CPs.
- **Latest amendments** and complete text of FCC Rules and Standards for Cable TV.
- **MDS Directory** Containing (1) Alphabetical listing of MDS operators. (2) Compilation of licenses, CPs held and/or primary service area in which MDS companies have applied. (3) Licensees, permittees and applicants alphabetically listed by cities and states. Also included are channel numbers, station locations, tariffs, power and program categories.
- **Television Stations significantly viewed** — county-by-county, state-by-state.
- **Directory of equipment manufacturers.**
- **CATV Industry Statistics** — showing growth since 1952.
- **Largest Systems and Largest Multiple system operators.**
- **Expanded Microwave Section** including list of CARS and Business Service microwaves and map of common carrier microwaves serving CATV systems.
- **Directories of significant CATV organizations** — NCTA, Regional and State Associations, FCC Cable TV Bureau.
- **U. S. Television Stations by call letters.**
- *Plus other essential data.*

Order your copy of this indispensable reference work today. ONLY $66.50 per copy (5 or more ordered at one time, $60.00 each).

Television Digest

1836 Jefferson Place, NW
Washington, D. C. 20036
Phone: 202 – 872-9200

You MUST *have this reference!*

When Your TVRO Receiver Quits. . .

EGADS - SUPER 17 IS OFF THE SYSTEM!

"Super-17 is off. . ."

The telephone rings and you first ignore it. It must be part of a dream. But it persists and groggily you open an eye and search the darkness for the bedside table alarm clock. **'My God'** you think to yourself 'it's 4 AM in the morning."

"17 is off and the phone is ringing off the hook!" It's the all night answering service. You mumble something about getting right on it and swing out of bed to turn on your own bedroom TV. Checking channel 7, where WTCG usually hangs forth 24 hours daily you confirm what the gal at the answering service has reported. After waking your wife and advising her that you have to head for the TVRO site/headend you muster up the possibilities. In addition to WTCG, you have HBO transponder service. But when HBO goes off for the evening you switch off that modulator; so you can't really flip to the HBO mid-band channel to see if the terminal itself is down. The mere thought that the terminal is down sends a chill down your backbone.

It's a ten minute drive to the terminal/headend site. You pass the time by considering all of the possibilities. First check the receiver itself, then the modulator on cable channel 7. Eliminate every baseband and CATV RF possibility first, simply because that is the part you are most familiar with. Then look at the receiver. Oh yes, before you do anything else, check to see if the HBO receiver is bringing in the twenty four hour per day color bars on transponder 24. That'll tell you if the LNA is on the fritz. And the dish—a quick visual inspection will tell you if that is working.

Suppose the dish looks OK, but there is no HBO on 24? What's that mean?

Well, the LNA could be bad. Or the 12 volt regulated supply that runs DC operating voltage to the LNA could be bad. Or the line that runs the DC voltage out to the LNA might have been damaged. Or the 7/8ths inch line could be bad between the LNA and the receiver power splitter. Or one of the two short chunks of RG-9/AU could be bad. You felt pretty good about the hunk of '9' at the bottom end of the 7/8ths line but the 12 inch piece at the top, between the front end of the 7/8ths and the output of the LNA always bothered you. Man, what a bunch of possibilities!

There it was, shining under the half moon. Six meters of steel and aluminum, just like it was supposed to be. And everything inside the headend looked normal to a quick visual check. No vandals anyhow.

Yup, there on the headend video monitor was HBO's color bars on transponder 24. OK, breath a little easier about the dish, the feedline and the LNA portion. It is working alright. That sort of says check out the Super-17 gear. The modulator is humming but its metering

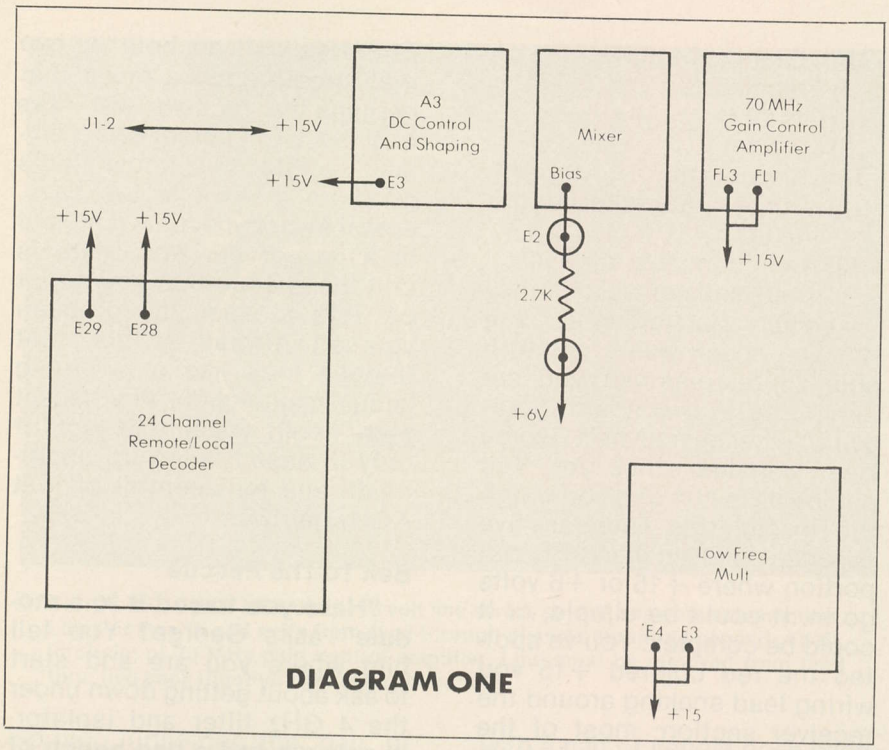
A RECEIVER DOWN?

This report was prepared after a CATJ Lab receiver went on the fritz following the first week of no-problems operation. We've moved the gender of the report from the CATJ Lab to a fictious CATV system. . .but the remainder of the facts are unblemished.

Data on receiver outages is scarce; largely because they are so new in the marketplace. CATJ encourages members of the industry who have experienced problems with TVRO receivers to submit the data to us for publication. It can be elaborately done in step by step portrayal, or, simply list:

1) The problem (i.e. the symptom)
2) The steps taken to isolate or pinpoint the problem
3) The corrective measures employed
4) The end result.

And we'll take it from there!



IDENTIFY the possible modules where the +15 or +6 volt supply lines could be shorted, producing the problem described in the text.

says it has no video input. Best to check that first. Patch the HBO color bars into the channel 7 monitor. There is video alright. **Maybe it would be a good idea to leave the HBO color bars on 7 for awhile.** That way people who switch to 7 for Super-17 will see something, and seeing the color bars they'll figure 17 is off testing or something. That could slow down the phone calls at the answering service. There is nobody madder than a late night viewer who has lost his one and only contact with the outside world!

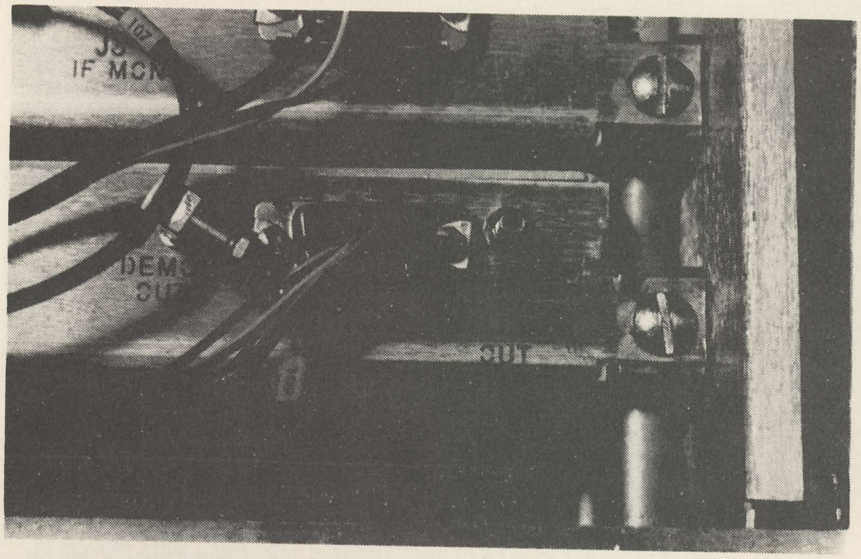
Now, that says either the Microdyne 1100 TVR-TV receiver is not getting RF into it, or, shudder, something has happened inside. Switching cables from the two-way power splitter, you find 4 GHz RF that had been going into the 1100 receiver makes the second receiver function just fine. So that says the problem is internal to the 1100. Now, where to start?

There are seven switch positions on the front of the 1100 receiver and it has always been your habit to leave the switch on the 'SIG' position, sort of to give you a rough visual of the amount of satellite signal going into the receiver. The other six positions are supposed to tell you when there is a problem with one or more of the low voltage supply lines within the receiver. That seems like a good place to start. You start switching clockwise, and when you hit +6V the meter needle swings left and stops. Hummm. **No 6 volts.** Then further clockwise you discover there is also **no +15 volts.** But the minus sides are OK. You have both −6 and −15 volts. Hummm again.

What does that tell you? First, break out the serial numbered manual that came with the 1100 receiver. The power supply has a regulator board, with current fold back protection. That means that if there is a to-ground short the supply won't burn up. That helps. It is one thing to lose a part, something else again to lose a whole power supply or major portion of same. That also means that the +15 and +6 volt lines could be shut down because of a short someplace along the line. Obviously the supply itself is good or there wouldn't be −15 and −6 still functioning.

The schematic tells you that anything shorting either the +6 **or** +15 volt line will most likely shut down the other line as well. OK, now to isolate the short.

The 1100 receiver uses a system of harnessed power cables to carry the operating voltages and control signals around the receiver. There are seven separate power plugs on several separate modules or sections. Seemingly, if you loosened the two screws holding the power plug tight as it plugs into each of the modules, you could remove one power plug-to-a-module at a time, and check the front panel meter for a return of the +15 or +6 volt supply. When you find the proper mo-



MODULE POWER PLUG—locate power plugs carrying affected voltage supply lines, remove twin tie-down screws on either side of plug.

dule where there is a short, lifting the power plug from the module should restore the +15 or +6 volt reading on the front panel meter. Starting with the video clamper module (because it is nearest to the power supply) you remove the two screws and pull the plug. No +15 volts. Then you walk counter-clockwise around the receiver moving through the video amp/de-emphasis module and finally you end up in the **one part** of the receiver that scares you to death; **the RF tuner.** Murphy said it all, if there is one section of the receiver where you most fear to tred. . .that's the place where the short will be. Yup, there it is. A positive 15 volts back again after you've pulled the plug on that module.

Only this module, unlike the preceding six, **is more than just one module.** It has all of the following operating off of one +15 and another +6 volt supply lines:

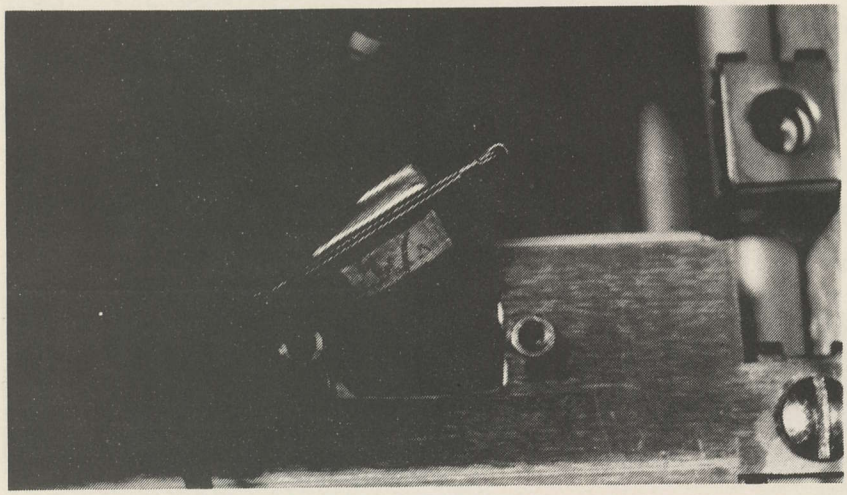
1) **DC control** and shaping board
2) **24 channel remote/local** decoder
3) **Mixer** (bias)
4) **70 MHz** IF/gain control amplifier
5) **Low frequency** multipler.

If that wasn't enough to be off of the same 'Christmas tree' string, **inside of the same compartment** of the receiver are the:

6) 4 GHz preamplifier
7) Preselector
8) Isolator
9) LO filter
10) Various pads
11) 4 times multiplier from the LO
12) And, bunches of pads, filters and control circuits.

The sun was starting to come off. The shack was a comfortable 65 degrees but you are perspiring. You wonder to yourself whether Microdyne's George Bell is in his office yet. You decide he is not, and you weigh the possibilities. There are five separate points in the 'RF Tuner' portion where +15 or +6 volts go in. It could be simple, or it could be complex. You've spotted the red colored +15 volt wiring lead snaking around the receiver section; most of the run is well out of reach from the top, and if you pop the grated screen from the bottom of the receiver, you still won't be able to reach all five of the points. Obviously, to even get at the push-on pins to disable some of those 5 points you are going to have to pull out some of the 4 GHz hardware. Those little SMSA connectors and that 1/8th inch hardline they use to wire 4 GHz around inside the receiver looks mighty easy to mess up.

So you decide to go into town for a cup of coffee and wait until Microdyne's George Bell is in his New England office. Better to wait an hour or two than create such a mess that perhaps the receiver will have to go back to Microdyne's Maryland facility. You know that's good for a week to ten days, even if Microdyne turns it around in a day or so. And there is still the chance that you might be able to spot the problem yourself. Afterall, at this point it does look like a powering circuit malfunction. Any decent tech could trace that out. If only it wasn't laced up underneath and between all of that 4 GHz hardware!

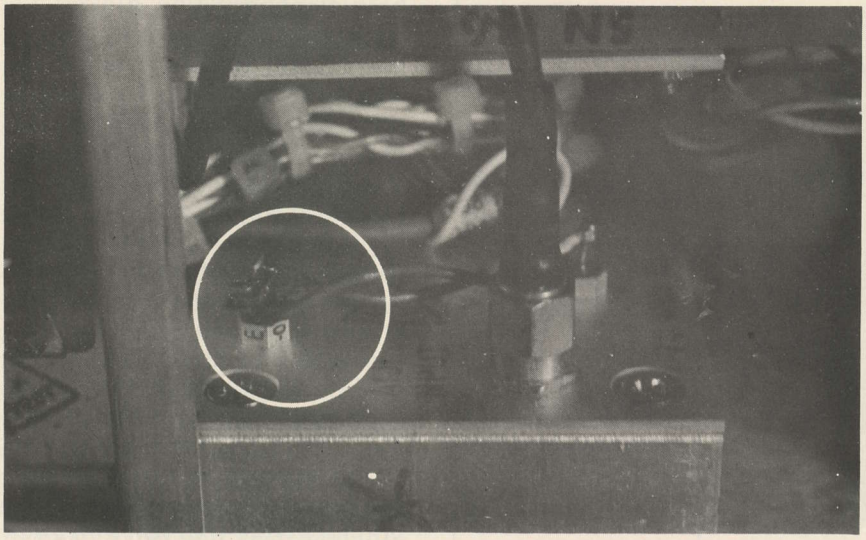


LIFT PLUG FROM SOCKET—and note performance of affected supply line on front panel meter. If meter shows power line is still shut down, move to next module.

Bell To The Rescue

"Have you traced it to a module" asks George? You tell him where you are and start to ask about getting down under the 4 GHz filter and isolator. **"Look, we had a bad bunch of bypass capacitors last spring from. . ."** and he mentions a prominent component supplier. **"We didn't know about them until long after the receivers had gone out. They are like time bombs out there. . .sometimes they go in a week, sometimes in several months. Others may never go. They are little blue colored jobs, there may be one or two in there bypassing the +15 volt line off to ground where it ties on to a module or board"** suggests George. **"I've got to run down and send off a box, but if you have any problems call Dave** (Alvarez) **at the factory".** And there you are, on your own, looking for a little blue bypass capacitor. You never did get to ask him about removing the 4 GHz hardware. Oh well, if you draw it out carefully before you take it apart, and label everything that comes off, you shouldn't have too much trouble.

Two of the +15 volt entry points within the RF Tuner can be accessed either from the top or bottom with the cover plates removed. The entry into the 70 MHz Gain Control amp module is via a feedthru capacitor; the +15 volt red wire solders to the feed-through stud and then a second wire leads off into more of the RF Tuner.



INSIDE RF TUNER MODULE/+15 volt line serves several separate sub-modules. Lines comes to and exits from feed-through chassis mounting capacitor (left, in circle) of 70 MHz gain control amplifier. Line must be removed from feed thru, tied back together to check sub-module.

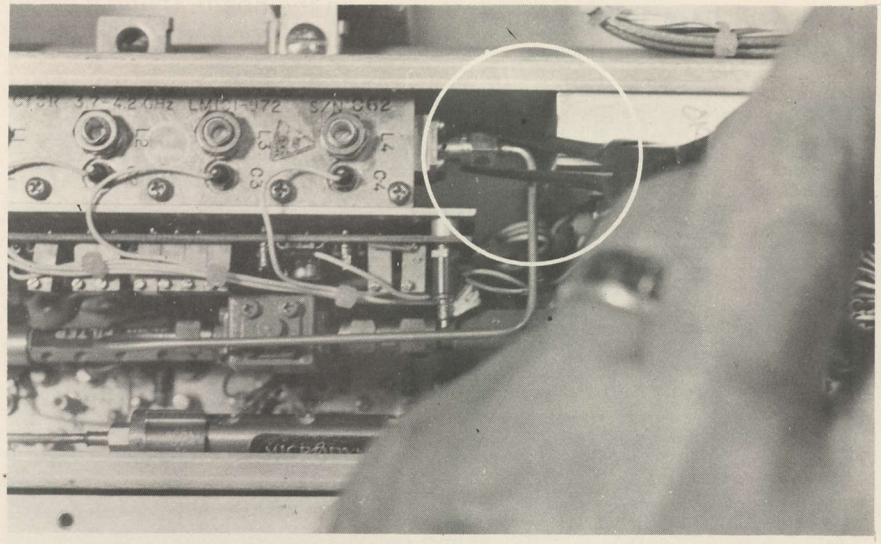
So you unsolder the pair of wires, remove them from the stud, and then tack them back together. That takes the 70 MHz amp out of the circuit. Nuts. The +15 volt meter reading stays at zero. 'On second thought' you muse to yourself, maybe it is just as well that it wasn't in there; how in the world would a person get that tightly buttoned up module out of the receiver to take it apart and look for a bad part?'. Then you go to the second 'easy' contact point; where the +15 volts heads into the 24 channel remote/local decoder. You get to this via the bottom of the receiver; the red wire pulls off of a terminal binding post. Apply power. . .and. . .still no +15 volts.

Humm. That leaves the +6 volt line going to the mixer. And the +15 volt lines into the low frequency multiplier and the DC control and shaping module. Time to re-look at the schematic. The only one of the three with a bypass capacitor close to the +15 or +6 input is the DC control and shaping module. There is a 47 microfarad 20 volt tantalum hanging across the input terminal to ground. But getting to that module, even to get the +15 volt line off is something else! Just getting down into the receiver with a pair of needle nose pliars to reach the snap-on terminal requires that you remove the isolator and a tubular 4 GHz filter. And that means you have to get some of that miniature hardline out of there by taking off the SMSA connectors. So you take a deep breath and tackle the job.

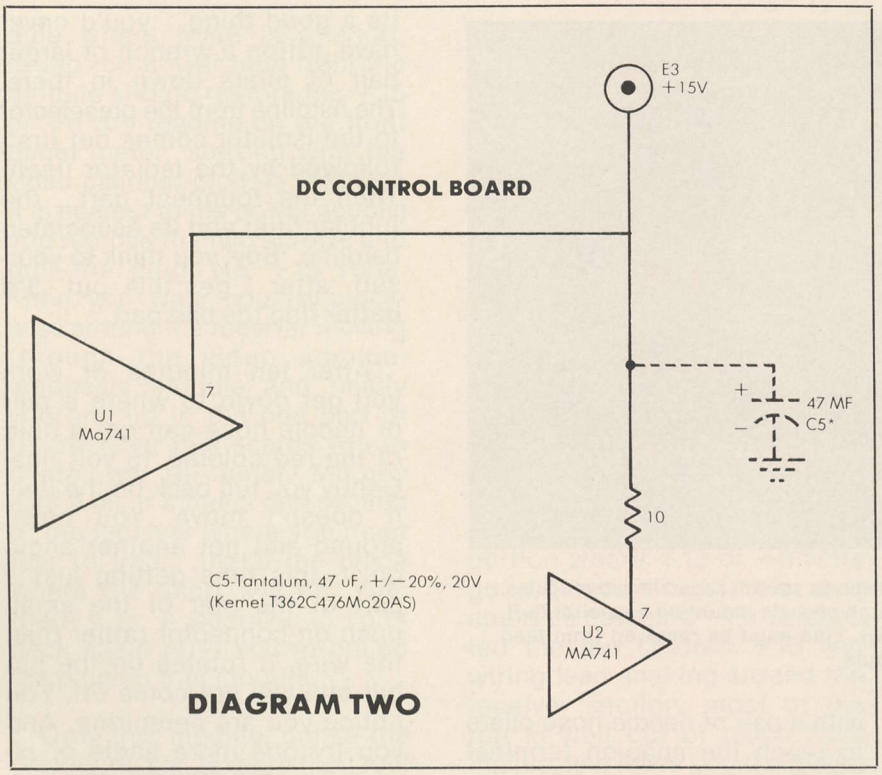
The hardline connectors are tight but not overly so. You discover, thankfully, that a pair of needle nose pliars are all the pressure you need to free up the tiny little connectors. And its a good thing. . .you'd never have gotton a wrench or larger pair of pliars down in there. The hardline from the preselector to the isolator comes out first, followed by the isolator itself. Then the toughest part. . .the tubular filter and its associated hardline. **'Boy'** you think to yourself 'after I get this out, **'I'd better** find the bad part.'

After ten minutes of work you get down to where a pair of needle nose can get a hold of the red colored 15 volt line. Gently you tug back on the line. It doesn't move. You move around and get another angle on it, this time getting just a part of the rear of the small push on connector rather than the wire. It rotates on the pin but still will not come off. You notice you are perspiring. And you try one more angle of attack. This time it pops off. You sit back and breath a sigh of relief for nearly thirty seconds, and then remember why you were taking the wire off in the first place. As the power switch snaps on you break out in a smile. Sure enough. . .there is +15 volts again. Switching to +6 volts you see that too is back. OK, now you have the problem isolated.

Finding the suspected tantalum is no problem; it's right



TAKING OUT HARDLINE—gentle pressure on SMSA fitting using needle nose pliars will start connector moving. Then use tip of finger to free up. Be very careful with introducing new 'bends' to hardline or starting connector cross-threaded on chassis mating connector.



THE BAD CAPACITOR sticks out like a sore thumb on the circuit of the DC Control Board. Across the +15 volt input line sits a 47 microfarad, 20 volt (+/— 20%) tantalum. . .which if shorted would shut down the +15 volt line, taking the +6 volt line with it.

there adjacent to the E3 terminal where the +15 volts came off. The DC control and shaping module is mounted on pillars on the side of the 3.7 to 4.2 GHz preselector board. You consider how much work is involved in getting the board separate from the preselector and decide that **if** it comes to that, the receiver **will have to go back to Microdyne.**

The leads on the tantalum are about 1/8th inch long, from the base of the tantalum to the top of the board. This is a two sided board with plated through holes; any soldering done will have to be done with great care since a glob of solder could easily fill in the tiny gap between the capacitor lead and the copper on the board. Using a small dental mirror and a tiny hand-held flashlight you picked up from the Toner Cable Equipment Company booth at CCOS-77 you move around getting a good look at the tantalum, the two plated through holes and the E3 voltage tie pin. For an instant it appears as if the pin is off center in the hole and that it **may be touching** the copper on the top of the board. **That would sure do it. . .**shorting the +15 volt line to the board surface ground. With the needle nose you move it gently towards the center of the etched area to be sure it is not touching the board ground surface. Then you snap the +15 volt line back on the pin and apply power.

Nuts.

Still a short. No voltage on the meter.

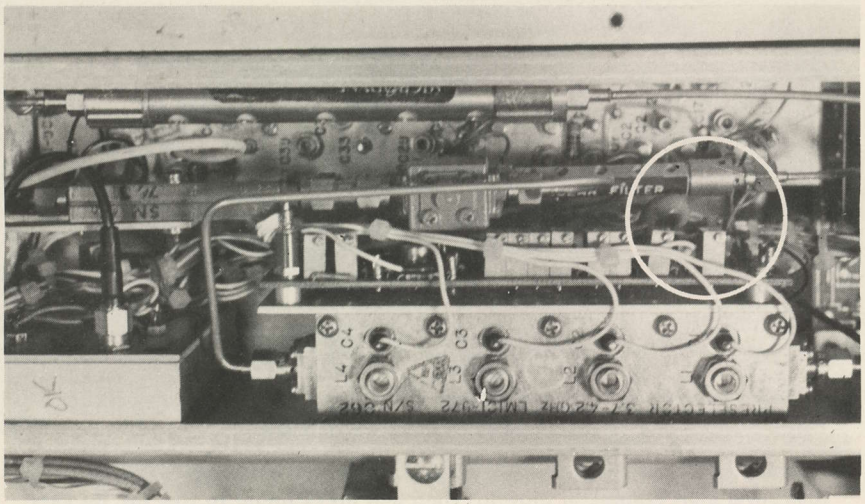
OK. . .the tantalum has to be cut loose. There is no way to get under the board to unsolder it, so the 1/8th inch leads will have to be cut, **as close to the base of the tantalum as possible** so there is something left of the leads to solder back to, from the top of the board, if need be.

'Clip'. One of the leads is cut loose. You reapply power and smile. With the capacitor cut out the +15 volt line is good again.

'Clip'. The other lead is cut and the tantalum falls down amongst the harnessed wires. Now the fun begins.

A quick study of the headend reveals no large value tantalums in stock. On the telephone you quickly exhaust every wholesale supply house and radio-TV dealer in town. The message from the largest 'area' wholesale supply house (a 90 minute drive) is not encouraging. **"We gave up stocking tantalums several months ago. There are more than 1,300 different values and sizes. And none are used very widely. Tantalums are a real pain in the neck".** You are beginning to agree. Then you remember seeing a small display of tantalums in the local Radio Shack store so you hot foot it into town.

After a 15 minute drive you find some tantalums. Small 10 microfarad, 35 volt jobs.

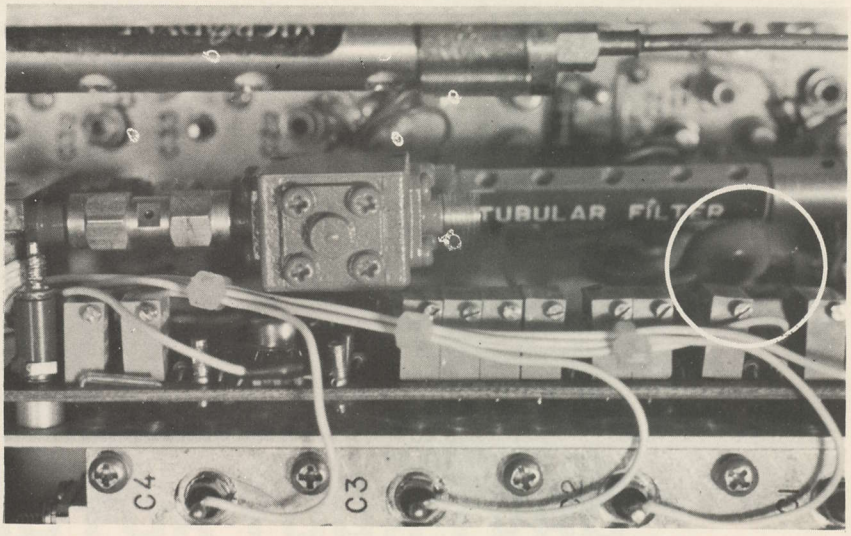


DOWN BELOW—the hardline, the isolator and the tubular filter is the suspected-bad 47 microfarad tantalum capacitor. Part is identified with white circle.

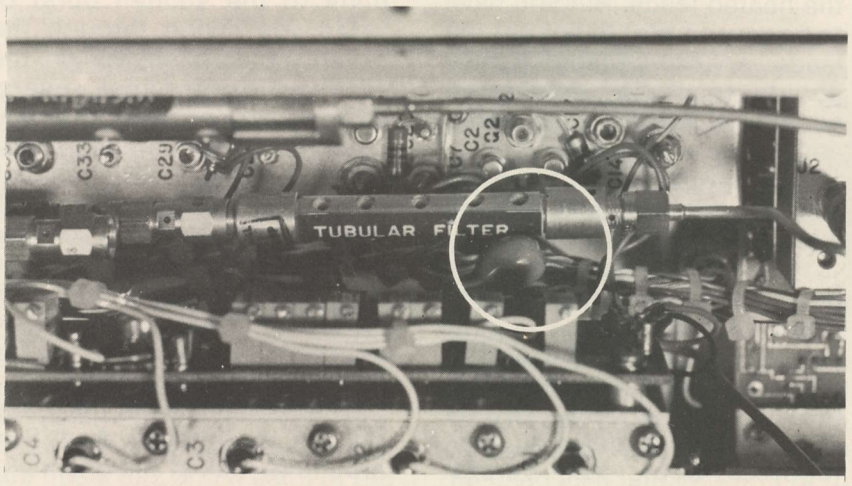
You like the voltage (the one that blew was 20 volt, +/−20%) but 10 mikes is a long ways from 47 mikes. You buy five knowing full well that paralleling five of them, even as small as they are, in the very limited space available, working against the side of a board where you can't see the connection tabs except with the dental mirror and the Toner flashlight, will take every inch of patience you possess. On the way out of town you pass by a hi-fi shop that sometimes has parts in stock. On a hunch you stop, and wonder of wonders, they have some 33 mike at 35 volt tantalums in stock. Well now, that's still not 47 mikes but one of them will be worth three of the small 10 mike jobs anyhow. That's only three parts to parallel rather than five!

Back at the headend you discover that even getting the bare 33 mike tantalum down where the 47 mike previously sat will be a chore. There is simply no way to get even one extra 10 mike paralled capacitor in there and still leave room to re-lash the tubular filter and hardline. Because you are working with 1/8th inch leads left over from the previous blown 47 mike tantalum, you'll have to cut the 33 mike leads to just the right length, bend them over at a 90 degree angle so that after the tantalum is mounted on the pig tail leads the new capacitor will lay over sideways. It will have to lay over on top of the +15 volt lead snap on point so you re-connect it and prepare the capacitor.

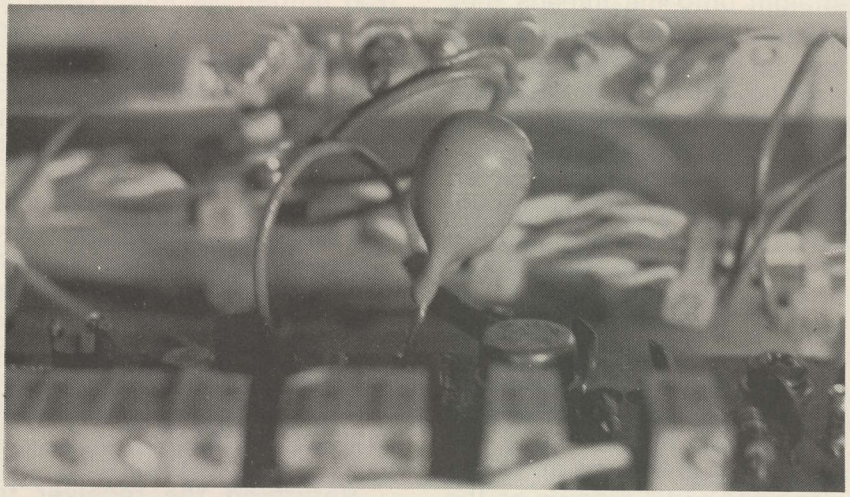
The first time down there with the 45 watt Princess iron you blow the whole exercise. You have pre-tinned the 1/8th inch leads protruding from the board and the formed ends of the new tantalum. They take, but when you push gently with your finger after tacking them together the tantalum falls off the 1/8th inch leads. So you start over, this time putting a little extra solder on the tantalum leads. You'll heat the 1/8th inch pigtails, using the mirror and the Toner flashlight, and



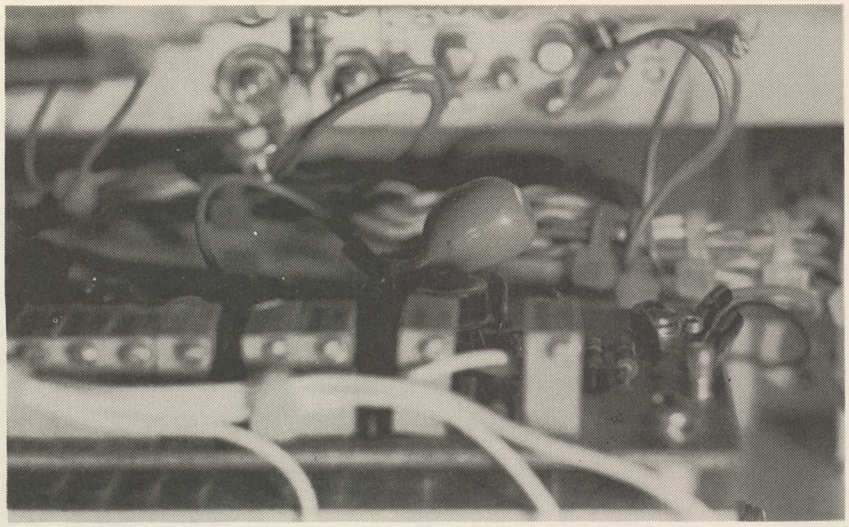
HARDLINE OFF—from 3.7-4.2 GHz preselector to isolator; double-ended SMSA fitting to left of isolator comes off next. We took ours loose at isolator end.



DOWN TO TUBULAR FILTER—another double-ended SMSA fitting on one end, hardline on opposite end.



BAD FIRST SHOT—we got the 33 mike tantalum soldered to the left over leads from the bum capacitor but it stood out straight (in way of tubular filter) and proved to be a poor solder job.



BETTER SECOND SHOT—replacement tantalum went back in better second shot with leads pre-bent to allow it to lay over on side so tubular filter could go back in properly.

slide the tantalum up against the heated leads. But you have to be **very careful** to not get the leads very hot because **if** they decide to come unsoldered **on the backside of the board** you're dead in the water.

Thirty agonizing seconds later you are done. And dripping wet.

You lean back and apply power to the receiver. **Son of a gun. . .it works!**

Now to re-wire the microwave hardware and hardline. It takes you another twenty minutes time to get it all back together, being very careful not to bend the hardline except where it needs to go. The SMSA connectors go on straight and easy. If you keep them headed straight onto the threads they can be tightened part way with just the tip of your finger.

Oops. The isolator. It has two ports and **could** mount either way. One port is marked '1' and the other is marked '2'. You remember that '1' had been the input, but you are not sure. On page 39/40 of the manual you find confirmation of your recollection. 'There is a lesson here' you muse silently.

Finally it is all back together. And the real test. With the RG-9 input cable in place and the modulator re-hooked up to the video and audio outputs on the 1100 TVR receiver you apply power. The meter comes up to the +15 volt reference reading, and while the modulator adjusts to the sudden burst of video you swing through the seven meter positions on the receiver front panel. Everything looks normal. . .until you reach the SIG reference scale. Where the 1100 receiver normally shows the WTCG signal well into the black region on the scale face (or around 6.75 to 8.25 on the meter face) it now reads 4.5. 'Rats' you think to yourself 'I've messed up the RF path through the receiver!'

Then you glance at the meter on the modulator. And turn around to look at the channel 7 receiver monitor in the headend, fully expecting to see a noise laden picture with bunches of sparklies. **"What is this?"** you mutter out loud. There is Super-17 bright and clear **and no sparklies** at all. Yet the SIG scale on the meter is a full 3 points below the normal reading.

Spinning the receiver through CBN on transponder 8 and HBO on 20 and 24 you find they too are bright and clear. Obviously there is no lack of signal through the receiver. But somehow the meter is now no longer scaled properly. What had required a 6.75 reference reading to get **out of the sparklies** was now working well at 4.5.

Returning the receiver to transponder six you telephone the good word into the office. And button up the receiver while you think about the new problem.

The manual deals with Signal Level Meter Calibration (page 33) rather extensively. What bothers you most is that the relative scale reading should **not have changed** simply because you swapped out a tantalum capacitor. Unless. . . **unless** in the process of replacing the tantalum you got into something on the DC control board that had a direct bearing on the integrity of the SIG level reading. But that can be another problem for another day. For now, Super 17 is back on the system and you can return to your home for the remainder of your interrupted night's sleep.

After It All. . .

You recall that at a recent state association meeting you heard Dalton Counig from Hughes state that the **MTBF** (mean time between failures) for a TVRO receiver was in the area of 50,000 hours. That's 5.7 years. If Dalton was correct, it figures that somebody out there is going to run closer to ten years before a failure, just to average out your failure at the end of a couple of weeks of service.

If George Bell is any indication of the help you can expect from a receiver supplier, you suddenly feel much better about the back up support. You have the instinctive feeling that **if** the receiver **had gone back** to the factory it would have been turned around very promptly.

But most of all you feel much better yourself about tearing into the complex 4 GHz receiver. The manual 'worked' better than you had hoped. . .it really did get you through the problems and when you were faced with really having to figure something out, it was all there.

Of course the problem was a minor one. . .compounded only by the way the receiver had to be put together in layers. A power supply short is a power supply short, regardless of whether it appears in a TVRO receiver or your CB rig. The manual even suggests that

failures will most likely be power supply associated. And so your confidence level is markedly up. You know down deep that there would or could be problems associated with the RF and demodulator portion of the receiver that you probably would not care to tackle. But for now you've come through the first TVRO maintenance crisis with reasonably good marks. And after you get some sleep, you'll go back to the headend and tackle the instruction manual's step by step details for resetting the relative SIG level meter.

How Do You Know It Works?

PROOF OF PERFORMANCE TESTING FOR YOUR TVRO

INTRODUCTION

Proof of performance is a demonstration of the operation of a system versus its specification. Proof should demonstrate, for a TVRO, that received carrier levels and video performance are up to the standards which were agreed to at the time of purchase. Proof, while not essential, serves as protection for both buyer and seller. It is therefore a desired path to follow.

No standards have been established for TVRO proof. The tests that follow describe a procedure which we believe to be adequate yet not too elaborate.

DISCUSSIONS

Proof can be performed at any of several levels of complexity. All the way from

- Hey, we got a picture

to

- Full blown system G/T, VITS and full-field test signals with lots of test equipment

by
J. 'Duke' Brown
Earth Station Manager
Microwave Associates, Inc.
Burlington, MA. 01803

Actually neither of these extremes is appropriate for a cable system TVRO. A preferred technique involves a combination of factory and field tests with a minimum of equipment required in the field.

If we break the system down into its two basic parts, as shown in diagram one, we can attack them separately and conveniently. The odds are virtually 100%, if a few precautions to be discussed later are observed, and if each of the two parts separately meet specification, that the total system will play as expected.

The combination of elements contained in Part One of the system capture the signal and deliver a certain carrier to noise ratio (rf quality) to the receiver. This part of the system **must** be checked in the field. It verifies that

- the antenna is correctly aimed at the satellite
- the antenna delivers specified gain
- the LNA meets its noise figure specification
- the LNA gain and feedline loss are in the ball park
- interference from sources such as 4 GHz terrestrial relay and adjacent satellites are no higher than expected

Part Two—the video receiver is tested at the factory to an elaborate and detailed test procedure to confirm that it meets all of the manufacturer's specifications. We assume that it arrives on site still in one piece and still performing as advertised. The manufacturer should supply copies of factory test results. Any significant deviation from the final test data will most likely be catastrophic and obvious. The video receiver will be used as a test instrument to verify the performance of Part One.

LINK ANALYSIS

A few basic facts must be established before system tests of Part One can be performed. First, the basic engineering elements of the microwave link must be known. In order to avoid heavy calculations, a simplified version of the link equation expressed in terms of carrier to noise ratio is used and it is:

C/N = EIRP + G/T − 42.37

where EIRP = power radiated by the satellite toward the earth station

G/T = combined quality factor of antenna and LNA

BASIC TVRO SYSTEM IN TWO PARTS

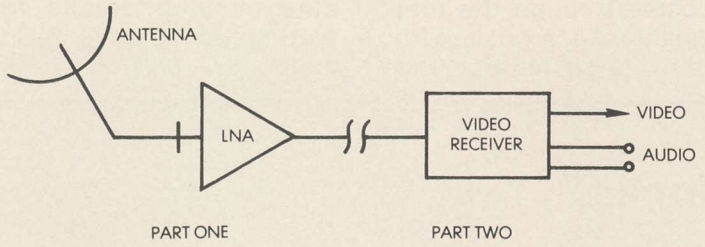


DIAGRAM 1

A Host Of Tests

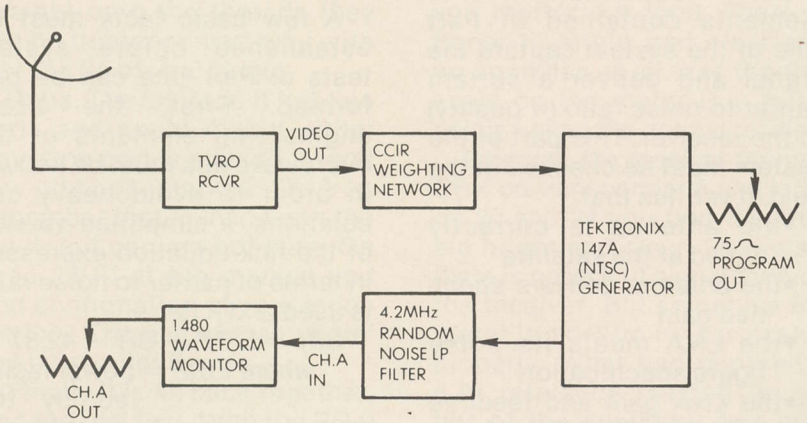
Television receive-only terminal tests are an exhaustive subject. As author 'Duke Brown' points out in this issue, they can run the wide range of looking at the CRT and deciding that the picture is acceptable, to a long series of tests requiring perhaps a half day of time, several years experience, and around $15,000 (+) in specialized test gear.

Of eight or nine possible tests which a system might wish conducted, two are within the reach of most system operators. And for most applications, these two tests will satisfy not only the FCC requirements but also the majority of your own concern as to whether what you bought is what you got. We will over the next several months deal in some detail with all nine test areas for TVRO's. We'll look at initial proof testing, periodic maintenance testing, and annual (or semi-annual) system testing. We'll also look at some plain-good-advice from various TVRO system installation engineers who have been through TVRO problems often enough to have picked up some specialized knowledge in this area.

To put this series of reports together for CATJ we have employed a pair of different disciplines. First we have asked some of the more knowledgeable people in the field to prepare material; **Duke Brown** in this issue for example. Then we asked **Larry Lawson** of Scientific Atlanta to come out to Oklahoma with a station wagon filled with test gear to spend a day with us 'proofing' the new CATJ six meter developmental TVRO installed this past fall. This gives us the best of both worlds to work from and we feel the completeness of the series, before finished, will bear this out.

(We'll give you the bottom line on our own terminal before we start; 13.82 dB carrier to noise ratio on transponder 24 [HBO east] of SATCOM II; and a video (weighted) signal to noise of 52 [.32] dB.)

CCIR WEIGHTED VIDEO S TO N



SIGNAL TO NOISE (VIDEO) IS NOMINALLY EQUAL TO THE MEASURED CARRIER-TO-NOISE PLUS THE "FM IMPROVEMENT FACTOR." FM IMPROVEMENT FACTOR FOR A 36 MHz WIDE IF IS 38.50 dB; FOR A 30 MHz WIDE IF 37.64 dB.

42.37 = a constant which takes into account all other parameters, all basically noncontrollable

C/N is the parameter which will be measured directly to verify Part One of the system. Part One verification is essentially an indirect confirmation of G/T and is based upon a known EIRP and certain allowances for interference.

EIRP is a measure (in dB above one watt) of power radiated by the satellite in the direction of the earth station. Its value is determined by referring to "footprint" maps. A typical example is shown in diagram two. These maps are available from earth station suppliers or from the satellite owner. The earth station builder must **design for the worst case situation**—lowest power transponder from the weakest satellite. He has no choice and must live with what the satellite provides. He also must depend upon the accuracy of the EIRP footprints when measuring C/N. If the footprint data is off by 0.5 dB, the C/N measurement will also be off by 0.5 dB.

G/T is a measure of the overall quality factor associated with the rf side of the earth station, or in other words, is a measure of how well the antenna and LNA "capture" the EIRP.

$G/T = G - 10 \log T_S$

where

G = antenna gain in dB

T_S = total system noise temperature in degrees Kelvin.

There are three things which contribute to T_S.

LNA Noise Temperature—Lower noise temperature equals lower noise figure. For reference, noise figure is:

$$nf = 10 \log 1 + \left[\frac{T}{290}\right]$$

Antenna Noise Temperature—The antenna noise temperature depends on the cleanliness of its side lobe pattern (horns are very low noise antennas), its look or elevation angle and sky

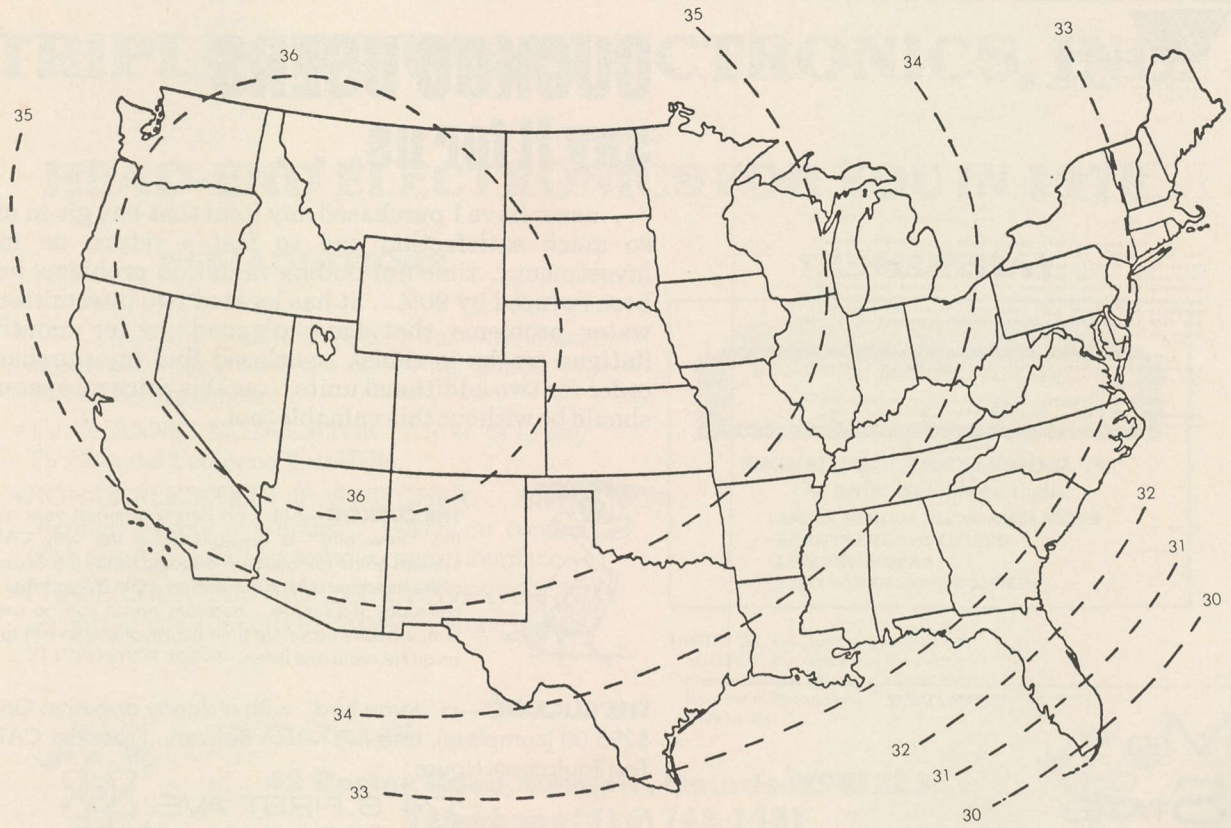


DIAGRAM 2
TYPICAL SATELLITE FOOTPRINT SHOWING EIRP IN dBW

conditions. Antenna manufacturers supply data which usually is similar to that shown in diagram three. If the antenna is a dish and meets FCC pattern requirements, there is little to choose from since for a given size antenna, they will all exhibit approximately the same noise. **System Loss**—Waveguide loss between the antenna feed horn and the LNA will add to system noise. This is usually not a factor in receive only stations where the LNA is coupled directly to the antenna. Coax and power divider loss from the LNA to the receiver is not a contributing factor since the LNA gain in all but the most unusual cases will overcome the cable loss.

The simplified version of the link analysis equation is not exact and should therefore be used only in those cases where buyer and seller agree that only an approximate verification is adequate.

CONTINUED TO PAGE 26

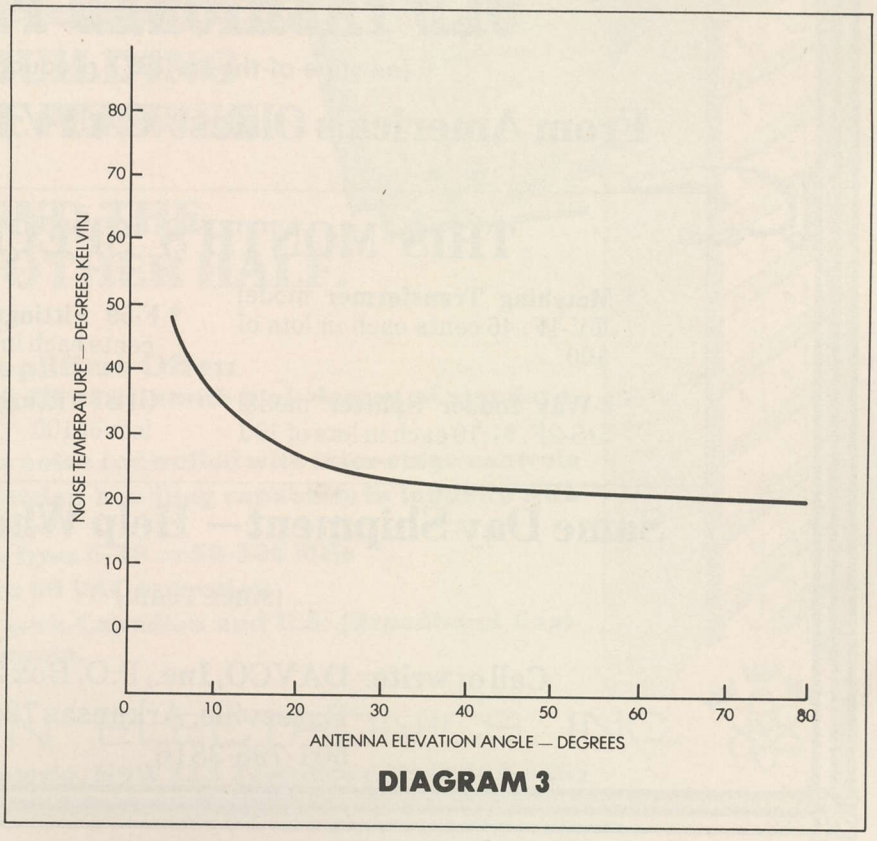


DIAGRAM 3

TRIPLECROWN ELECTRONICS, INC.

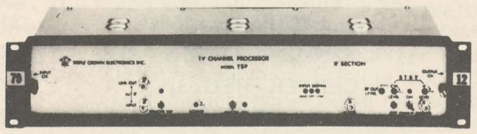
Presents

HEAD-END ELECTRONICS FOR YOU IN 1978

NEW ADDITIONS

- CO-CHANNEL ELIMINATOR. . .rack mounted interference suppressor for $250 that works. . . Money back guarantee.
- TV CHANNEL MODULATOR. . .to IF or to any TV Channel Sub-band thru UHF.
- NON-DUPLICATION IF SWITCHER. . .any 6 channels to any 6 outputs. . .switch on contact (sink .1mA at +5V) for remote control interface.
- PHASE LOCK CONTROLLED CONVERTER. . . accepts IF and converts to desired channel locked to reference signal.

THE MAINSTAY



SIGNAL PROCESSOR-MODEL TSP

Our full product range includes:

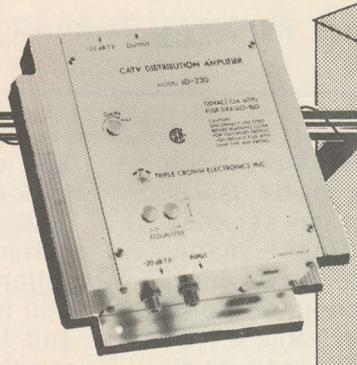
- **SMALL SYSTEM TRUNK AMPLIFIERS**
- **APARTMENT AMPLIFIERS**
- **LINE EXTENDERS**
- **FEED FORWARD AMPLIFIERS**

- NOTE: We also have a new SIGNAL SOURCE for systems simulation, composite triple beat tests, or just plain X-tal controlled marker. . .$4500 buys 36 channels.

Write or call:

42 Racine Road, Rexdale, Ontario M9W 2Z3
Telephone (416) 743-1481

GETTING CABLE *INTO*



AN APARTMENT BUILDING IS ONLY HALF THE ANSWER

GETTING IT *AROUND* THE BUILDING IS THE OTHER HALF.

Triple Crown Apartment Amplifiers Offer:

- **Verasatile Gain - from 14 to 56 dB of gain with high degree of standardization**
- **Performance - critical signal to noise controlled with inter-stage controls**
- **Capability — highest signal (carrier) handling capability in industry with optional feed-forward techniques**
- **Expandable - optional two-way from 5-30 or 50-300 MHz**
- **Multi-Powered - 117 VAC, 30 or 60 VAC operation**
- **Service - high quality backed with Canadian and U.S. (Broadband Engineering, Jupiter, Fl.) service depots.**

TRIPLE CROWN ELECTRONICS, INC.

42 Racine Road, Rexdale, Ontario, M9W 2Z3 Telephone (416) 743-1481

SAMPLE COMPUTER RUN

	EARTH ST LONG & LAT. (DEG)	91.12, 30.45	
WHICH SATELLITE OF INTEREST	**SAT. LONG.** (DEG)	119	*Satcom II (RCA)*
	ANTENNA ELEVATION (DEG)	43.3	*for* **that** *satellite*
	ANTENNA AZIMUTH (DEG)	226.2	*for* **that** *satellite*
	PAD CENTER (DEG)	192.4	*concrete heading relative true north*
FOR REFERENCE, TO INSURE CLEAR PATH FROM SELECTED TVRO location to possible satellites	**ELEVATION TO 70** (DEG)	47.7	*left end of range of satellite parking orbit*
	AZIMUTH TO 70 (DEG)	142.7	*left end of range of satellite parking orbit*
	ELEVATION TO 135 (DEG)	31.0	*right end*
	AZIMUTH TO 135 (DEG)	242.2	*right end*
	CENTER FREQ (GHZ)	3.95	
	PATH LOSS (DB)	195.9	
	WAVEGUIDE LOSS (DB)	0.0	*for info = S none in TVRO R/T will have 0.1 dB*
selected antenna	**ANTENNA SIZE** (METER)	6	
selected antenna	**ANTENNA GAIN** (DBI)	45.5	*G*
	E.I.R.P. (DBW)	33.4	*Read from "Footprint" maps*
terrestrial + adjacent satellite + internal distortion	**ANT. NOISE TEMP.** (DEG)	19.0	T_A *for selected antenna at required elevation angle*
terrestrial + adjacent satellite + internal distortion	**TOTAL C/I** (DB)	20.1	
	TEMP. L.N.A. (DEG)	170	*selected*
T_{LNA}	**SYS. TEMP.** (DEG)	189.0	$T_A + T_{LNA} = T_S$
	SYSTEM G/T (DB/K)	22.7	$G - 10 \log T_S$
	C/N (DB) DOWN LINK*	14.09	
	TOTAL C/N (DB)	13.1	
	VIDEO S/N (DB)	50.7	$C/N_{down} + C/I$ *calculated from C/N total*
	AUDIO S/N (DB)	60.5	$C/N_{down} + C/I$ *calculated from C/N total*

$$*C/N = EIRP - S + G/T - 10 \log BW_{cps} + 228.6$$

TABLE I

A more exact C/N can be derived manually or by use of computer program services available from most manufacturers. A copy of a typical Microwave Associates' program is shown in Table I. This program takes into account all of the previously discussed factors plus maximum acceptable interference levels. These interference factors degrade the simple C/N (C/N down link) to a TOTAL C/N which is the parameter that is actually measured. The interference sources, which appear as noise, are:

- **Terrestrial**-4GHz signals from AT&T or other carriers. The M/A program presumes them to be at least 25 dB down from the satellite signal at the output of the antenna. The F.C.C. requires that frequency coordination result in no less than -25 dB. The levels depend on many factors including the earth station antenna, location, its pattern, its azimuth and elevation, the terrain, the direction to the terrestrial source and its direction of transmission. All of these factors are taken into account by firms such as Compucon or Safe in their clearance study.
- **Adjacent Satellite**—other satellites in the orbit arc are liable to be transmitting on your frequencies of interest. These signals are discriminated by the earth station antenna to a level which depends on the size and pattern of the receiving antenna. The combined noise power output from adjacent satellites was discussed in detail in the F.C.C. ruling on small antennas. The accepted noise power levels for the various antenna sizes are included in the M/A program per the F.C.C. Ruling.
- **Internal**—the satellite is not perfect. Its internal interference into an FM/TV channel is assumed to be -26 dB.
- **Uplink**—We assume that the uplink is transmitting sufficient power to the satellite so that it does not degrade the overall carrier to noise ratio.

All of the above interference factors must be power added and included in the link equation. The **typical** system will have a total interfering noise level of -18 to -22 dB. This factor is referred to as total C/I (carrier to interference) and results in a degradation of the down link C/N of about 1 dB. The resulting C/N is now referred to as TOTAL C/N and is the C/N that the video receiver converts to video S/N. **Remember** that so long as the carrier is **above** receiver threshold, **each** dB change up or down in TOTAL C/N results in a corresponding change in video S/N.

MEASUREMENTS IN THE FACTORY

An essential part of the overall testing is the manufacturer's factory test of the video receiver. We shall blissfully assume that the buyer has been careful enough to select a reputable manufacturer which builds a good product and then runs it through a proper acceptance test procedure in the factory. If your supplier hedges on supplying test results, back up to square one. The tests should include, but not necessarily be limited to, the following parameters:

- **RF input** return loss
- **video and audio** S/N at some selected C/N level
- **differential phase** and gain
- **line time** distortion
- **field square** wave tilt
- **short time** distortion
- **chroma gain** and delay
- **frequency response,** video and audio
- **audio** distortion

In addition, the LNA and feedline must be tested at the source of supply to insure gain

flatness, VSWR, and VSWR flatness. On site testing of system C/N will quickly isolate any other deficiencies such as high noise figure in the LNA.

MEASUREMENTS IN THE FIELD

And finally, after all the foregoing, we are ready to perform tests in the field. The test to be performed is a measurement of C/N TOTAL which, as previously discussed, verifies Part One (G/T) of the system. The only test equipment required is a power meter such as the HP 435. Power levels of interest are from about +5 dBm down to −40 dBm.

First measure the rf power output from the receiver IF when aimed and peaked on the satellite. This power will include the satellite carrier **plus** system noise which passes through the receiver IF bandpass. We then delete the carrier, by pointing the antenna away from the satellite, and measure noise power alone. Then, by subtracting noise power from carrier plus noise, we derive a carrier power alone. The ratio of carrier power to noise power (converted into dB) is the desired result which is compared to the calculated C/N TOTAL. The illustrations of diagram four show what would be seen if a spectrum analyzer were attached to the IF output of the receiver.

Mathematically,

$$(\text{Carrier plus Noise})_{\text{watts}} - (\text{Noise})_{\text{watts}} = (\text{Carrier})_{\text{watts}}$$

$$C/N_{(dB)} = 10 \log \frac{\text{Carrier Power}}{\text{Noise Power}}$$

Sounds simple, and in principle it is simple. However, there are a couple of subtle points which must be taken into account.

One, you must insure that the video receiver is in **manual gain control** and that its IF amplifiers are not in saturation when measuring C + N, or down to the radio noise floor when measuring system noise power alone. See dia-

MAKING C/N TESTS—

This is a simple test to measure the direct difference between the total system noise and the total system signal (carrier).

Finding the actual amount of carrier present is straight forward. Adjust the azimuth and the elevation of the TVRO antenna for optimum signal; peak the feed antenna for the proper plane of polarization to match the incoming wavefront. This is all done by observing the output of the received signal at the IF range of the receiver. The TVRO receiver is placed in the manual gain control mode (AGC masks any signal level changes until it is too late to compensate) and a spectrum analyzer or SLM/FSM utilized to peak the antenna system. The final 'fine tuning' of the antenna adjustments can be done with a power meter (HP 435 or equivalent) substituted for or along side of the IF level reading machine. The carrier level is recorded.

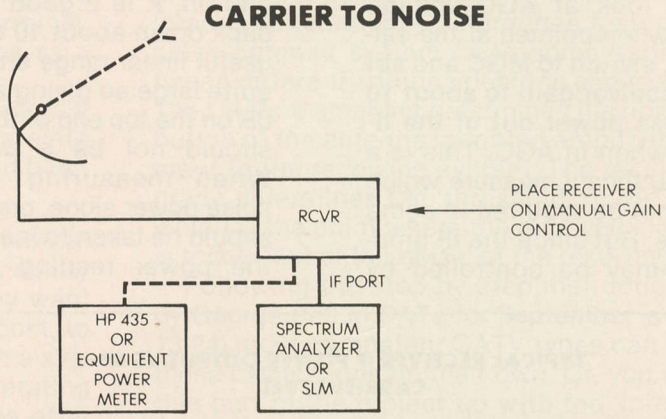
Now to find the 'noise'. The noise you will measure is the sum of your system noise (LNA, receiver, etc.) and the sky/earth/solar system noise picked up by your antenna. You want to find the **total** noise level present. Ideally, you would leave the antenna in place, and either move the satellite 'out of the way' or turn it completely off (not only on the transponder being measured but all others as well). Neither of these approaches is practical, so we do the next best thing; move the antenna off of the satellite and measure the noise present.

You have two choices in moving the antenna. Change the azimuth (left or right) or change the elevation. If you are utilizing SATCOM II at 119 degrees west you have a problem with most 4.5/5 and 6 meter antennas. You probably won't find the true no-signal-noise level moving left (east) before you move into the presence of ANIK at 114 degrees; or moving right (west) before running into WESTAR (II) at 123.5 degrees. A better choice is to move up (elevation).

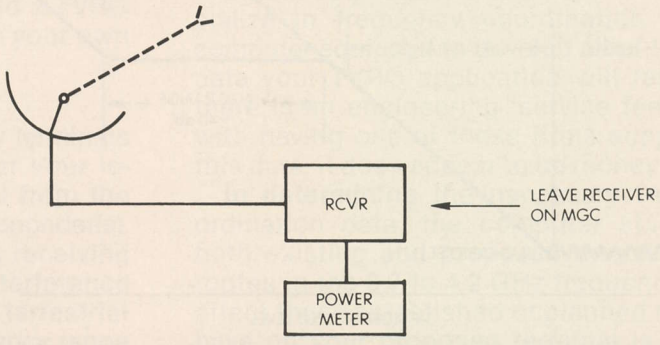
Moving up means **increasing** the elevation; if you go down you will start to pick up considerable earth thermal noise. However you need to be sure you are not performing this test at a time when the sun is above you in a position where bringing the antenna up will get the antenna into the region of the sky where solar noise is high.

Chances are your system had a pro-forma study prepared in advance of the actual installation. And you already know what type of C to N to expect. If you find your ratio is less than this, don't immediately suspect the equipment. It may well be that you are still getting **some** signal (which will make the C/N appear lower than it really is), or, you may be getting more noise than you actually have in the heading of SATCOM II (which will bring the same erroneous result).

CARRIER TO NOISE



#1—OPTIMIZE AZIMUTH, ELEVATION, FEED ROTATION FOR BEST CARRIER LEVEL. RECORD CARRIER LEVEL.



#2—RAISE ANTENNA ELEVATION UP UNTIL ALL INDICATION OF CARRIER DISAPPEARS. RECORD NOISE POWER MEASURED.

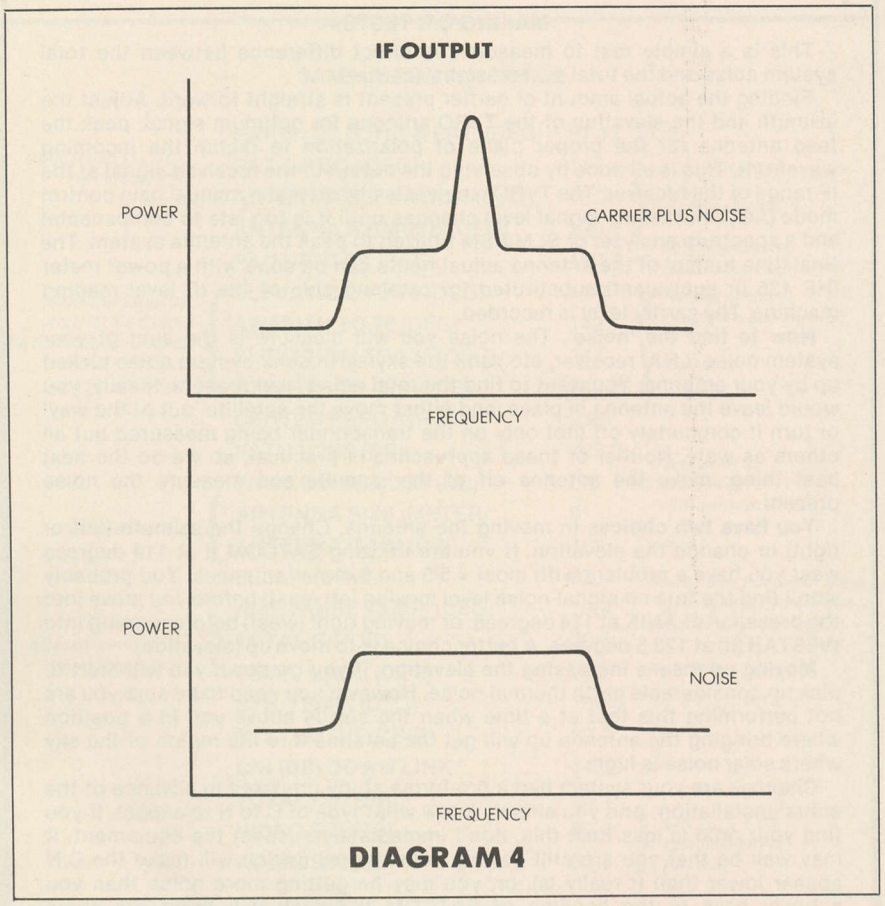


DIAGRAM 4

gram five. The usual technique is to look at AGC voltage level when pointed at the satellite, **switch to MGC** and **set the receiver gain to about 10 dB less power out of the IF** than when in AGC. This is a precautionary measure which may not be required in some radios. But since the IF amplifier may be controlled by AGC to some level near saturation, it is a good idea to back down about 10 dB. The useful linear range should be quite large so giving away 10 dB on the top end of the curve should not be a problem. When measuring system noise power alone, precaution should be taken to insure that the power reading is well **above** the noise inherent in the radio. This can be **verified** by disconnecting the rf input cable and noting that the measured IF noise power **drops** well below the point measured for system noise power alone.

Second, insure that when repointing the antenna away from the satellite, it is not aimed at another satellite, the sun, or down toward the ground. Move its pointing up (no satellites there) **a minimum of 4°** and **no more than necessary** to insure at least 4°. Limiting the move to 4° generates an off axis signal from the satellite that simulates adjacent satellite interference. More than 4° will reduce this C/I factor. Raising the antenna also reduces the antenna noise temperature but the difference for 4° or 5° change in elevation is not significant. See diagram three. If up 4° happens to boresight the sun, wait a few minutes until it passes—it is an unbelievably large noise source which will destroy the test.

Tests For The TVRO

While most new TVRO installations will run (and be satisfied with) a pair of tests (numbers 1 and 2 below) there are in fact nine tests which many systems do make as part of their 'proofing' package. They are:

1) (IF) Carrier To Noise Ratio
2) (CCIR) Weighted Video Signal To Noise
3) Reduced Amplitude Video Response
4) 'K' Factor (K_{2t})
5) Luminance-Chrominance Delay
6) Differential Gain
7) Differential Phase
8) Luminance Nonlinearity
9) Aural Carrier To Noise

In addition to these nine tests there are three other tests which might be considered as a part of the system package. However, they are seldom if ever run 'in the field' because of their special requirements. They are:

10) Antenna Gain
11) LNA Gain and Noise Figure
12) Video Test—'Closed Loop'

We'll look at the last three as well during the course of this series.

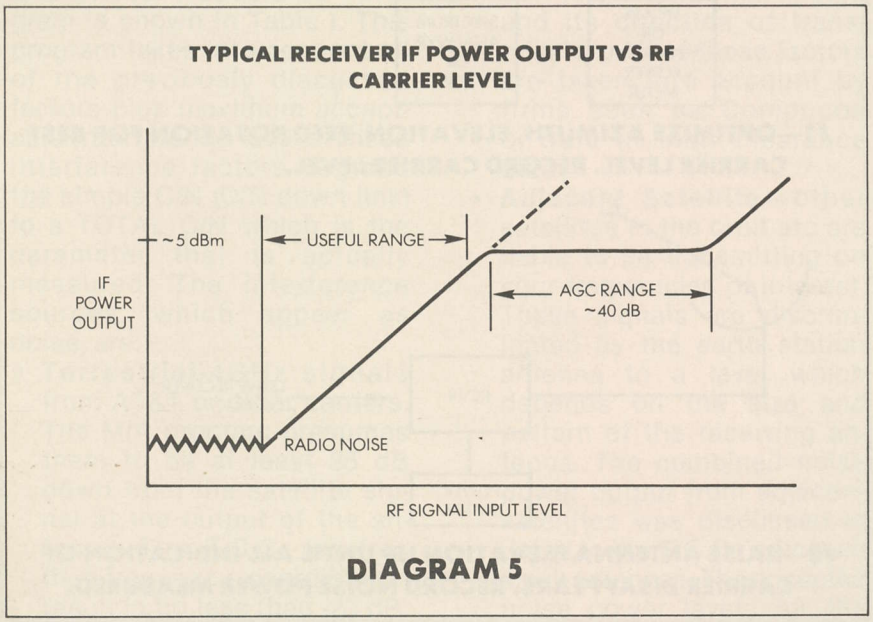


DIAGRAM 5

One word of caution. If the coaxial feedline is crimped, and the line is still operable, it can generate a VSWR anomolie which will not be detected in these tests. Depending on the magnitude and location of the crimp, it can cause picture distortion. Therefore, it is essential that good microwave practice be followed in the installation.

SUMMARY

We have outlined a proof procedure for small TVRO's which is simple and cost effective. If routine precautions are followed, it is virtually foolPROOF.

Step By Step With Illustrations. . .

PREPARING AND FILING YOUR OWN TVRO APPLICATION

Step One

Perhaps it need not be said, but the real first step in preparing a TVRO earth terminal application is to simply determine that you do in fact have a need for such a terminal. The FCC does not require that you **prove** your need (they leave this determination to you alone), only that you **are qualified** to own and operate such a terminal, and, that your proposed terminal qualifies as a 'licenseable' terminal in the service.

If you have convinced yourself that your CATV system does need one or more of the satellite offered services, then you can move to step two.

Step Two

On of the factors which the FCC will look at when passing upon your application is your ability to pay for (or afford) the installation. They want you to show how much the terminal will cost, to indicate your general ability to afford such a system, and to indicate the 'projected' operating costs for the terminal on an annual basis after installation.

When you have finished settling steps one and two, you will have the decision to build a TVRO made, and, the financing worked out in your own mind. Now the real work begins.

Step Three

Under the rules for CATV receive-only terminals you are required to determine whether your location can receive an adequate signal from the desired satellite(s) and the desired transponder(s). And, you are required to show that in receiving these signals you will not receive interference from either other satellites **or** from terrestrial microwave operating in the same frequency range as the satellite down links.

If this sounds like quite an undertaking, it is. To determine whether or not you will receive an adequate signal (carrier to noise at the input to the receiver and signal to noise at the output of the receiver) you must go through the process of designing, on paper, a receiving system. This means you must select **(1)** an antenna size, **(2)** a pre-amplifier (LNA) 'grade', **(3)** a receiver type or 'grade'. Antenna size determines gain of the receive antenna system (with some variation between different antenna designs and feed types). The LNA/pre-amplifier determines the noise contribution of the antenna mounted amplifying equipment to the receiving system. The receiver type/grade determines the 'threshold' of the receiver; which is the point where the received signal level is totally 'out of the noise' of the receiving system.

Following the step by step instructions given by George Bell in **CATJ** for **September** (see pages 13-24) most competent CATV types can work out these calculations on their own. Or, you can wrap this part of the project up with the 'interference survey/coordination' portion of the project.

COMPUCON, SAFE and other firms that specialize in frequency coordination studies are computer-equipped to develop **all** of the technical data your TVRO application will require. While there is an engineering 'service fee' connected with having one of these firms supply you with this data, it does appear to be money well spent.

In determining the necessary frequency coordination data, the computer study looks at both existing **and proposed** microwave service routes in the 3.7 to 4.2 GHz frequency band. The affect these established or planned routes might have on your proposed terminal is analyzed to determine whether your proposed terminal at the site you have chosen and using the antenna you have chosen, will receive acceptable (interference

free) pictures from the desired satellite(s) transponder(s). This material comes back to you in the form of several "Certifications" prepared by the frequency coordination company, and a multi-page set of computer derived data sheets that relate to your specific terminal application. These certifications and data sheets not only tell you whether your chosen site and antenna will 'play' but also they become a **part of** your formal application to the FCC for your terminal.

There are two possible bottom lines in this phase of the project:

1) The site you have chosen (typically at the headend of your system), and the antenna you have selected will function without any problem (more than 90% do), or
2) Some problem is present at the site, almost always related to existing or planned terrestrial microwave paths, necessitating that you select either a new site, a different antenna, or that you create some type of 'shrouding' for the antenna.

If your proposed antenna/site combination does appear to have potential interference problems (i.e. terrestrial microwave paths will cause interference with your projected reception), you have to rectify the problem **before** you can file your application with the FCC. The Commission has established guidelines for carrier to interference ratios (C to I) and your site must attain at least the minimum C to I in order to be licensed. The Commission feels it is **your** duty to **prove** in **your application** that your terminal will produce the minimum C to I ratios (or better), and they leave it to you to show this. The studies done by COMPUCON, SAFE and others in this area meet this need. This is why the frequency coordination studies are 'certified' by the company doing the work.

Can you do this work on your own? We've been told that it is possible to do an acceptable job if you can gain access to all of the necessary raw data. This would include knowledge of **all** existing **and** proposed 3.7 to 4.2 terrestrial microwave paths in your area, a mathematical analysis of how each might impact on your system, and a certification by a qualified person that based upon the studies done the proposed site will meet or exceed the interference requirements. Very (very) few systems have elected to do this on their own.

Step Four

Once you have your frequency coordination engineering work completed, you are now free to prepare your application. You know the proposed system will work, and the 'certifications' by the frequency coordination company will provide the testimony required to convince the FCC that you have a 'viable plan' to install the system.

However you still need some more outside work done. You need your agreements with the respective program suppliers to indicate to the Commission that your earth terminal will be an

'authorized user' of satellite relayed point-to-point signals.

The FCC considers the geo-stationary orbit **belt** (and all of the satellites located therein) to be 'dedicated to point to point transmission (relay)'. In other words, the 'belt' is **not** considered a **'broadcasting belt'** (in the sense that broadcasting is intended for unrestricted general reception by the public). Under the Commission's rules 'point to point' communication systems have **both** FCC authorized transmitters **and** (common carrier served) FCC authorized receivers.

The various program suppliers (HBO, WTCG, Showtime, CBN, etc.) contract with authorized point to point common carriers for the satellite relay of their programs to authorized receiving points. You deal either with the common carrier (such as Southern Satellite Systems for WTCG) or with the program supplier who acts as an intermediary to the common carrier (such as HBO which utilizes RCA) to obtain the necessary written agreements to become an authorized reception point. Copies of these agreements, between you or your cable system, and, the program supplier/common carrier must be attached to your FCC TVRO application. So **before** you can prepare and complete and submit your TVRO application, you need written agreements completed with the appropriate suppliers of programming.

Step Five

Now, finally, we are to the point of sitting down and preparing your complete application.

There are three primary elements to the application. They are:

1) **A cover letter** which sets forth certain facts concerning your proposed installation;
2) **Engineering attachments,** as prepared by the frequency coordination company or by yourself if you elect to go this way;
3) **Non-engineering attachments,** relating primarily to your authorization to utilize satellite delivered signals and your ability to construct the 'station'.

A well constructed 'cover letter' can handle many of the aspects of the application data required by the FCC. You will also complete FCC form 403 (Application for Radio Station License/Under Part 25) and FCC form 430 (Common Carrier and Satellite Radio License Qualification Report). The FCC forms are but a minor portion of the full application, however, as we shall now see.

The Cover Letter—

A 'sample' cover letter is shown here. This is a real world cover letter prepared by **Mike McKee** of **Cablevision of Chickasha** (Oklahoma). McKee's system was licensed this fall with no hitches. Note the following text format followed by McKee:

1) He listed in item by item format the various attachments to the application, and assigned an 'Exhibit Number' to each;
2) Under the 'Public Interest' heading he referenced the FCC's own decisions regarding use of WTCG programming, and his

Before The
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C.

In re Application of:

Cablevision of Chickasha, Co. File No._____

For authority to Construct,
Own and Operate a Domestic
Communications Satellite
Receive-Only Earth Station
at Chickasha, Oklahoma

To: Common Carrier Bureau

APPLICATION FOR RECEIVE-ONLY EARTH STATION

Cablevision of Chickasha, Co., operator of a cable television system at Chickasha, Oklahoma, submits its application for authority to construct, own and operate a receive-only domestic communications satellite earth station to be located at Chickasha, Oklahoma. The purpose of the station is to receive the pay television programming of Home Box Office, Inc. for distribution to pay cable subscribers of its cable television system and to receive the independent television programming of Television Broadcast Station WTCG (channel 17) Atlanta, Georgia via satellite transmission facilities of Southern Satellite Systems, Inc. for distribution to the general subscribers of its cable television system. The earth station's points of communication will be with the space station satellite facilities of RCA SATCOM I (KS30) and RCA SATCOM II (KS31).

I. **GENERAL INFORMATION**

A. Applicant: Cablevision of Chickasha, Co.
P.O. Box 770
500 Country Club Rd.
Chickasha, Oklahoma 73018
Telephone: 405/224-1224

B. Radio Service, Class of Station: Fixed communications satellite earth station receive-only

C. Application is for a new facility

II. **EARTH STATION SITE DATA**

A. Station Location: Chickasha, Oklahoma (Grady County)

B. Coordinates: 35° 00' 58" N. Latitude
97° 56' 15" W. Longitude

C. Ground Elevation: 1170 feet AMSL

D. Antenna Centerline: 15 feet AGL

*Attached as **Exhibit No. 1** is USGS topographic map of the propsed site

*Attached as **Exhibit No. 2** is a vertical sketch

III. **EARTH STATION PERFORMANCE SPECIFICATIONS**

A. Antenna

1. Manufacturer: Scientific-Atlanta, Inc.
2. Model Number: 8008 5-meter
3. Size: 5-meters
4. Antenna Data:
   a. Gain 44.5dB
   b. Half-Power beamwidth .86° 15 dB beamwidth: 2.0°
   c. Feed Type Dual Reflector
   d. Section 25.209: Antenna performance meets the requirements of Part 25.209 of the Commission's Rules
   e. Radiation Pattern:
      *Attached as **Exhibit No. 3** is a Radiation Distribution Envelope
5. Antenna Orientation: The antenna shall be capable or horizontal operation over the satellite orbital range from 70° to 150° west longitude and vertical angle from 15° to 60°.

*See **Exhibit No. 3B**

6. G/T (4000 MHz at 33° elevation) 22.7 dB/°K 120°K preamp
7. Antenna Noise Temperature: 30° elev-19.8°K *See **Ex. 3C**
8. Antenna Wind Resistance: .05° rms pointing accuracy in 30 mph winds gusting to 45 mph .11° rms in 45 mph winds gusting to to 65 mph. Survival 125 mph in any direction. 87 mph with 2" radial ice.

*Attached as **Exhibit No. 4** is a Block Diagram of the Station

B. Receiver
1. Preamp: Amplica, Inc. 120°K
2. Receiver: Scientific-Atlanta model 414
3. Threshold of Receiving Equipment: less than 10 dB.
*See **Exhibit No. 5**
4. Calculation of overall system noise temperature, identifying all relevant noise contributions.
*See **Exhibit No. 6**
5. Link calculations of video and audio signal-to-noise ratio.
*See **Exhibit No. 6B**
6. Statement of desired carrier-to-interference ratio objectives for terrestrial and intersatellite interference.
*See **Exhibit No. 7**

IV. **FREQUENCY COORDINATION DATA**

Interference analysis and frequency coordination was successfully conducted by Compucon, Inc., 13749 Neutron Road, Dallas, Texas 75240.
*See **Exhibit No. 8,** Frequency Coordination Study

V. **CERTIFICATION OF ENGINEERING INFORMATION**

I hereby certify that I am the technically qualified person responsible for the preparation of the engineering information contained in this application; that I am familiar with Part 25 of the Commission's Rules; that I have either prepared or reviewed the engineering information submitted in this application; and, that it is complete and accurate to the best of my knowledge.

By: _____ Date: _____
Michael J. McKee

VI. **SITE AVAILABILITY**

A. Applicant owns the proposed earth station site.

VII. **ENVIRONMENTAL IMPACT**

A. The proposed earth station is not a "major" action within the meaning of Section 1.1305 of the Commission's Rules relating to environmental considerations.

VIII. **PUBLIC INTEREST**

A. The purpose of the proposed station is to enable the applicant to provide pay cable programming to its pay cable subscribers as well as provide broader, more diversified television programming to its general cable subscribers from independent television station WTCG, Atlanta.

The pay cable service will be provided persuant to an agreement with Home Box Office, Inc. *1 which provides programming for pay cable distribution. The proposed pay cable satellite programming includes current release motion pictures, live sporting events and special interest programming. The proposed operations are fully consistent with the Commission Rules governing both domestic communications satellite and pay cable policies.

own (then pending) CAC application for the addition of WTCG to his system.

The application tells a 'story', it places everything the FCC requires in coherent form, and it becomes its own form of 'check list' against the enclosures required. There is no reason why others preparing applications could not utilize the same cover letter format and attachment procedure, substituting your own 'local data' for the Chickasha data where applicable. Of course if your equipment line up differs from McKee's the appropriate antenna/LNA/receiver data will also need to be modified to fit your situation.

The Exhibits

The exhibits carry the meat of the application, providing the FCC with the necessary data to be sure that you do in fact know what it is you are doing.

Exhibit one is simply a section of a USGS (United States Geological Survey) map identifying the location of your proposed received site. We are not including this exhibit here as an illustration; if you've seen one USGS map, you've seen them all. Simply mark it as 'Exhibit One' and indicate **where** the TVRO will sit on the map.

Exhibit two is a vertical sketch of the site as well as a 'look down' view from above. This tells the Commission where everything goes on the site. See illustration here marked 'Exhibit Two'.

Note: The TVRO antenna must be capable of 'looking at' the full geo-stationary orbit belt from 70 degrees west to 135 degrees west **without** looking **through** any local blockages. Looking

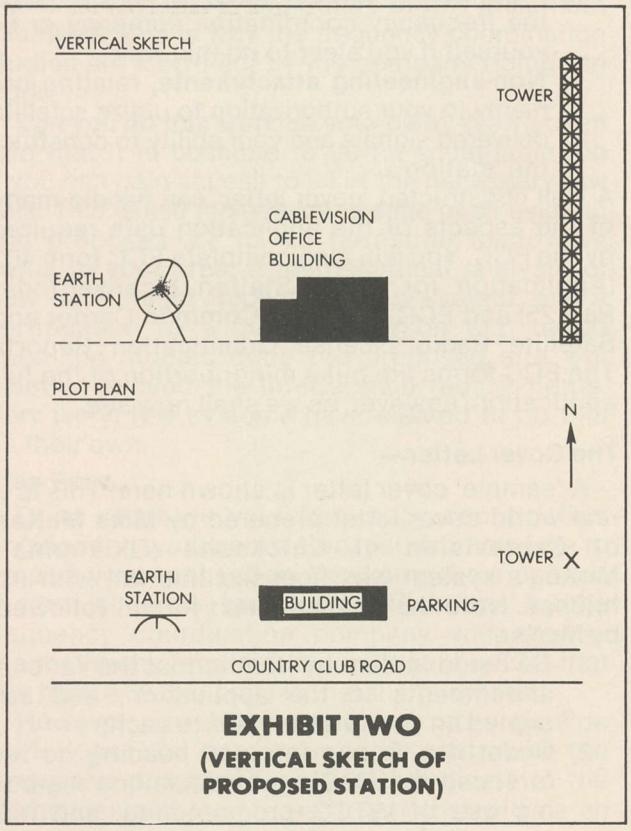


EXHIBIT TWO
(VERTICAL SKETCH OF PROPOSED STATION)

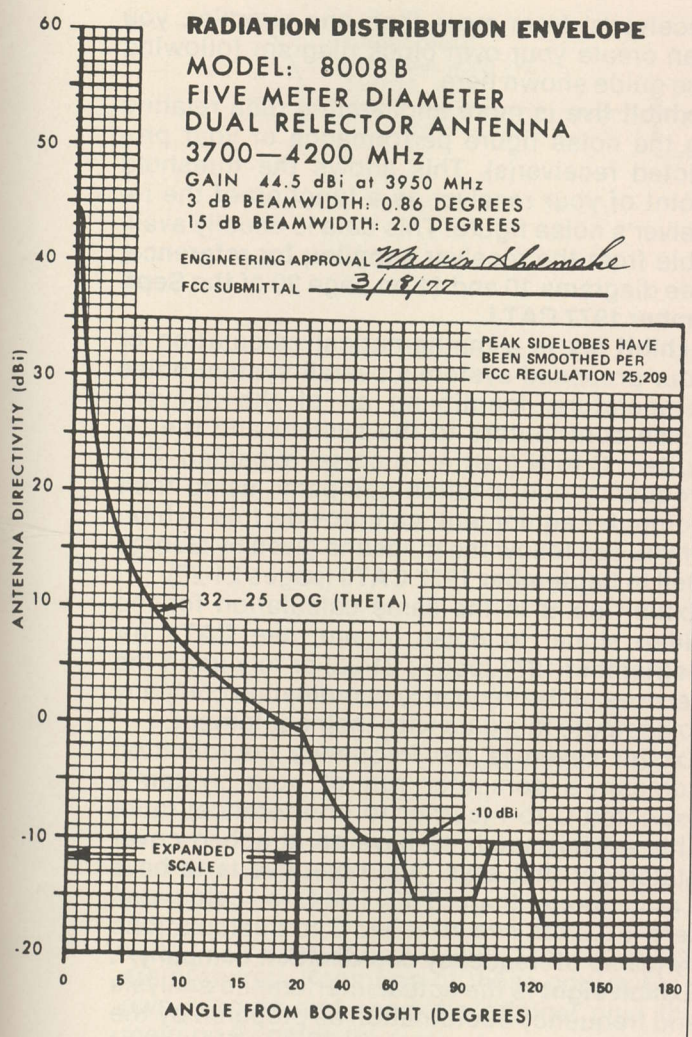


EXHIBIT THREE

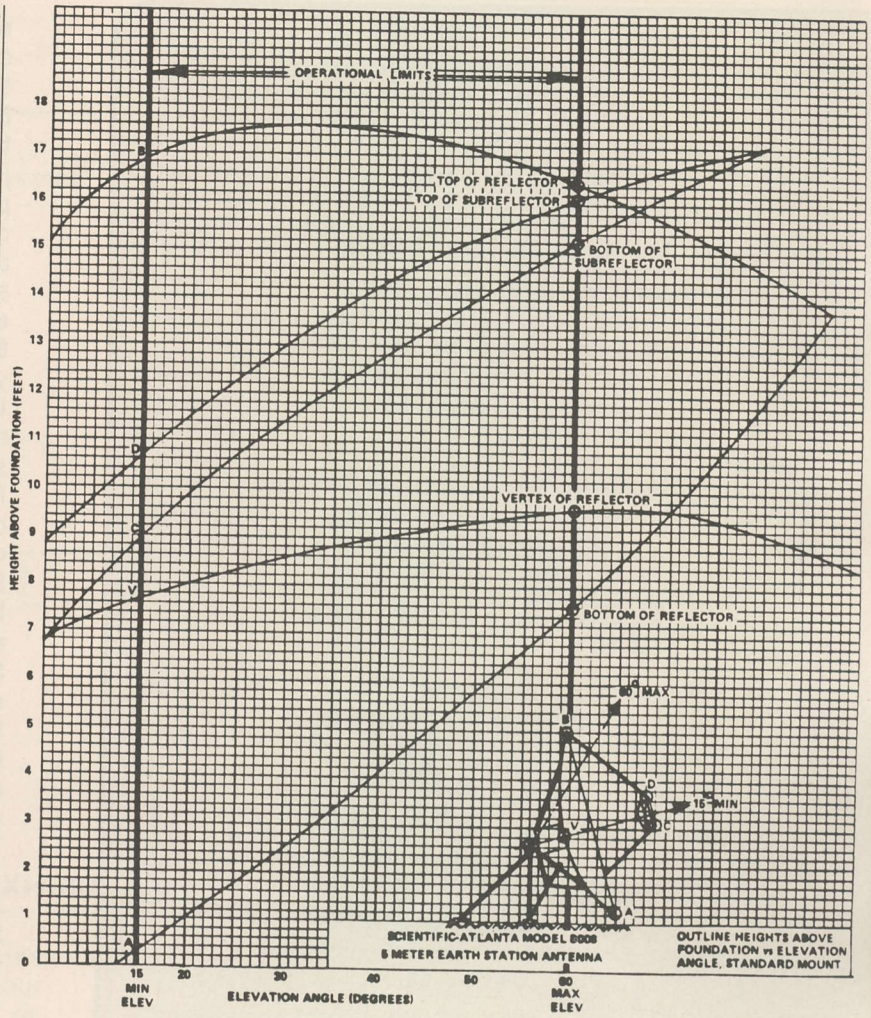


EXHIBIT THREE-B

through your headend or office building, or your tower, to 'see' any portion of that belt is a 'no-no'.

Exhibit three is the antenna manufacturer's radiation distribution envelope for the proposed receive antenna. The illustration here, a Scientific Atlanta 8008B antenna, was supplied to the applicant by the antenna supplier.

Exhibit three-B is the verification that the antenna, when installed according to the manufacturer's specifications, is capable of being adjusted over the full azimuth (left and right or east/west) range of the geo-stationary orbit belt, and, over the full elevation range required to track the specific location of the geo-stationary satellites from your location. Again, this data is supplied to the applicant typically by the antenna manufacturer.

Exhibit three-C is the verification that your receive antenna's noise temperature agrees with the mathematics supplied by your engineering data. This data sheet is typically supplied by the antenna supplier.

Exhibit four is a block diagram of your basic receiving system. If you are making up a 'composite' installation utilizing antenna, LNA and

The additional television broadcast signal carriage to be accomplished by this application is persuant to and agreement with Southern Satellite Systems, Inc. *2, which presently provides independent television broadcast programming from station WTCG (channel 17) Atlanta, Georgia. The proposed carriage of WTCG via Southern Satellite Systems, Inc.'s satellite transmission facilities is consistent with the Commission Rules governing both domestic communications satellites *3 and cable television signal carriage. *4

The availability of both pay cable programming and the programming of an additional independent television broadcast station will increase the diversity of television programming available in Chickasha, Oklahoma. Thus, the grant of the proposed receive-only earth station will serve the public interest.

*1 See Home Box Office agreement **Exhibit No. 9**
*2 See Southern Satellite Systems agreement **Exhibit No. 10**
*3 See Southern Satellite Systems, Inc. FCC 76-1149
*4 See Applicant's application for certificate of compliance filed March 15, 1977 CAC-08286.

IX. **STATION MAINTENANCE**

A. Station records will be kept at applicants offices 500 Country Club Road, Chickasha, Oklahoma 73018.

The immediate supervision of maintenance will be Michael J. McKee, holder of FCC Radiotelephone First Class License No. P1-10-23176 which expires October 26, 1978.

Engineering personnel of Scientific-Atlanta will supervise the initial installation of the earth station and will be available for consultation and engineering assistance on an emergency basis 24 hours per day.

X. **STATION CONSTRUCTION COSTS**

A. The estimated costs to construct the earth receiving station as proposed are as follow:

(1) Antenna, preamp and receivers	$30,000.00
(2) Antenna foundation and electrical	2,500.00
(3) Installation	2,500.00
(4) Freight	500.00
(5) Miscellaneous (engineering fees, etc.)	1,750.00
TOTAL	$37,250.00

Annual operating costs are not expected to exceed $2,000.00.

XI. **FINANCIAL ABILITY**

A. A current balance sheet of applicant is included as **Exhibit No. 11** together with applicant's ability to finance the project.

XII. **LICENSEE QUALIFICATIONS**

A. FCC Form 430 with exhibits is being filed concurrently with this application as a demonstration of license qualifications of applicant.

XIII. **CONSTRUCTION PERIOD**

A. Applicant will complete construction, installation and proofing of the proposed terminal within 90 days of receipt of the construction permit sought in this application, and therefore requests that the station license be granted simultaneously with the construction permit.

EXHIBITS

The following exhibits are attached and made a part of this application:

1.	Exhibit No. 1	USGS Topographic map of site
2.	Exhibit No. 2	Vertical sketch of station
3.	Exhibit No. 3	Radiation Distribution Envelope
4.	Exhibit No. 4	Block Diagram
5.	Exhibit No. 5	Threshold of Receiving Equipment
6.	Exhibit No. 6	Receiver Noise Calculations
7.	Exhibit No. 7	Interference Ratio Statement
8.	Exhibit No. 8	Frequency Coordination Data
9.	Exhibit No. 9 & 10	Agreements with program suppliers
10.	Exhibit No. 11	Current Financial Data

CERTIFICATION

Cablevision of Chickasha, Co. waives any claim to the use of any particular frequency or of the ether as against the regulatory power of the United States because of the previous use of the same, whether by license or otherwise, and requests a construction permit in accordance with this application. All statements made in the attached Exhibits are a material part hereof and are incorporated herein as if set out in full in this application. The undersigned, individually and for the applicant, hereby certifies that the statements in this application are true, complete and correct to the best of my knowledge and belief, and are made in good faith.

CABLEVISION OF CHICKASHA, CO.

By: _____

By: _____ Date: _____
Michael J. McKee

CATJ

receiver(s) from more than one supplier, you can create your own block diagram following the guide shown here.

Exhibit five is more engineering data relating to the noise figure performance of your projected receiver(s). This shows the threshold point of your receiver as a function of the receiver's noise figure. This data is usually available from the receiver supplier; **for reference,** see diagrams 10 and 11 on page 20 of the **September 1977 CATJ.**

Exhibit six is a mathematical calculation of your proposed system's overall system noise temperature, identifying all of the relevent noise contributors to the system and the resultant C to N (carrier to noise) expected. The frequency coordination company, using their computer equipment, can provide this exhibit or you can follow the guideline given by George Bell in **September 1977 CATJ** (pages 21-23).

Exhibit six-B is the same calculation for the **video** signal to noise. Again, see **CATJ** for **September 1977** (pages 21-23) or rely upon the services of the frequency coordination company to compute this data with their equipment.

Exhibit seven is the frequency coordination company's computer run of your system's expected C to I (carrier to interference) ratio. This exhibit needs to have an attached cover statement that says "the objective is to have a ratio greater than 18 dB. The C to I calculated here is ___dB; see attached C to I calculations by **(name of frequency coordination company)".**

Exhibit eight is the actual interference analysis and frequency coordination as prepared by the frequency coordination company. This must include several 'supplemental showings' prepared by the frequency coordination company relating to their having formally advised existing terrestrial users of the proposed TVRO site (under rule sections 21.100 [d] and 25.203 [e] and 25.256), a statement as to the bottom line of the frequency coordination study (under 25.203 [c-5]) and a certification of the 'Person Responsible For Preparing The Engineering Data'. This exhibit ran to 34 pages with the example Chickasha application and for that reason is not included here as illustrative material.

Exhibit nine is a copy of your agreement with (in this case) the pay-cable programming supplier. Again, the actual exhibit is **not** shown (it is both lengthy and it contains private material between Cablevision and HBO).

Exhibit ten is the agreement between you and the common carrier for your other (WTCG in this case) satellite delivered signal. It is not shown here.

Exhibit eleven is your financial ability proof to afford the system. This should consist of a current balance sheet and some written indication that you have secured financing (if not funding out of existing liquid assets) for the project. Again, this is not shown here.

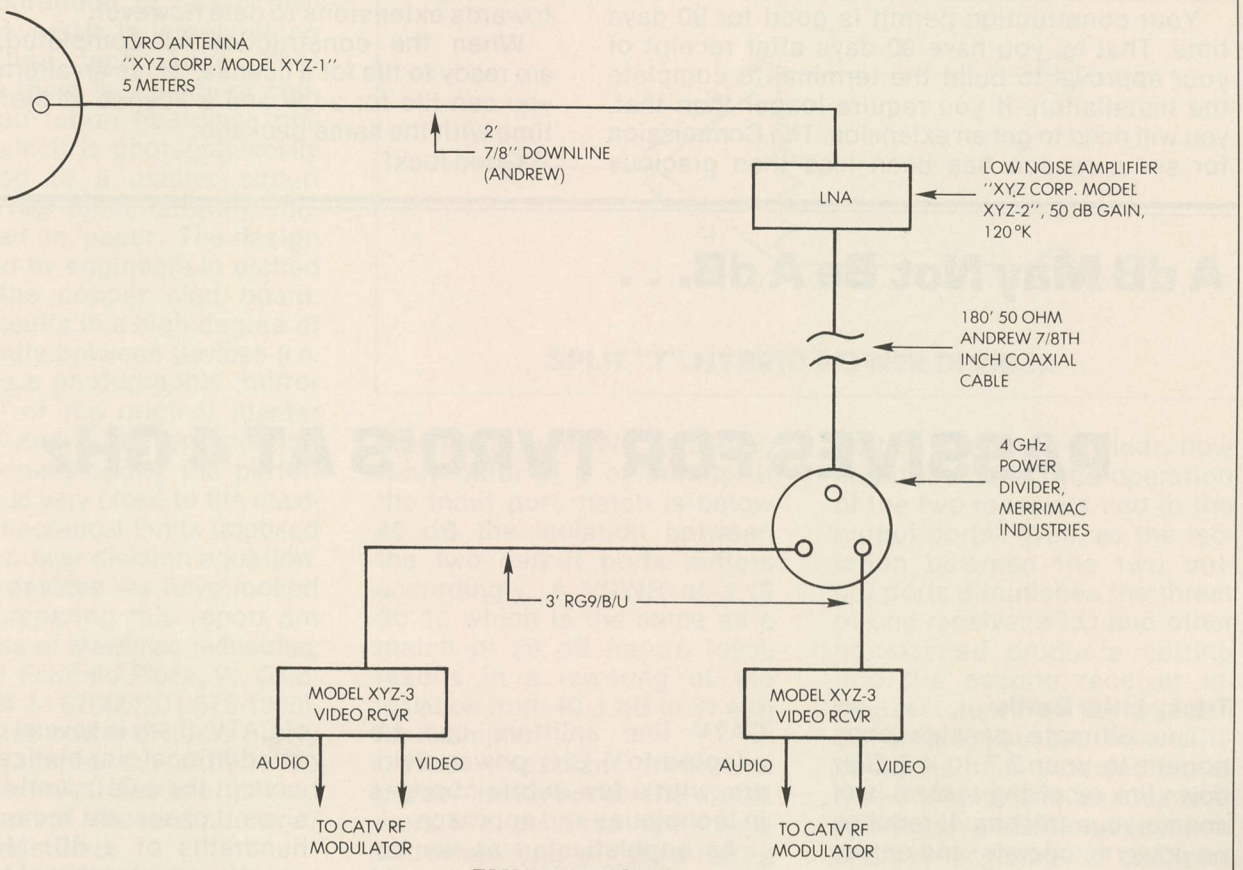


EXHIBIT FOUR

All of this material is bundled up and 10 copies are prepared. Keep **one** of these copies for your own records and send the **original** plus the remaining 9 copies to:

Common Carrier Bureau
Federal Communications Commission
1919 M Street NW
Washington, D.C.
20553

Step Six

Submit and wait.

Your application goes through two distinct phases. First it is placed on Public Notice by the frequency coordination company. This is a 30 day public notice phase during which anyone who might have cause to wish that you not install the terminal has the right to object. To the best of our knowledge there have been no such objections filed in the history of TVRO terminals to date. When it gets through that 30 day notice phase, you are ready to prepare your full application and send it off to the Commission. When it arrives at the Common Carrier Bureau it receives a 'quick check' for completeness, and then is put on the 30 day public notice required by that Bureau.

Then the longest wait begins. While they work down to your place in the pile. When eventually your application does pop to the surface the FCC personnel assigned to process these applications go over all of your material and assuming that they find nothing disturbing, your CP is granted.

Your construction permit is good for 90 days time. That is, you have 90 days after receipt of your approval to build the terminal to complete the installation. If you require longer than that, you will need to get an extension. The Commission for some reason has been less than gracious towards extensions to date however.

When the construction is completed, you are ready to file for a license. Or, as an alternative, you can file for a CP and a license at the same time with the same package.

Good luck!

A dB May Not Be A dB. . .

PASSIVES FOR TVRO'S AT 4 GHz

Tricky Little Devils

The ultimate passive component in your 3.7 to 4.2 GHz down link receiving system is of course your antenna. It requires no power to operate, and unless you stretch your imagination it has no gain (in the sense that an active device does). The best grade of passive parabolic reflector at 3.7 to 4.2 GHz actually has around 55/56 percent efficiency (i.e. 55/56 percent of all TVRO energy intercepted by the dish surface ends up at the feed antenna output flange) and the best grade of optimized horn antenna has around 60 percent efficiency.

The feedline is a passive device. In fact it is a loss-conscious passive device which means you always get less out of the far end than you put in at the near end. A connector is also a passive device; at 4 GHz no matter how good the connector is, it has some (measureable) loss.

And then there is the power divider (or splitter in CATV lingo) which you place on the end of your downline to allow you to feed or drive two or more receivers simultaneously with the 3.7-4.2 energy. Our concentration here will be on acquainting you with the design and use parameters of the power divider family of devices at 4 GHz. Much of what you know about CATV line splitters can be adopted to 4 GHz power dividers, with a few subtle changes in techniques and approach.

As sophisticated as we believe we are in the passive world of CATV, there is several degrees of additional sophistication at work in the 4 GHz world of passives. Losses are measured in hundreths of a dB. Match is specified in tenths of dB and isolation values (between ports of the same device) runs into the infinite range near 40 dB. MTBF's (mean time between failures) are routinely rated in the 150,000 to 300,000 plus hour ranges (there are 8760 hours in a 365 day year) and passives are rated to sustain temperature and climate variations which only a Naval vessel at sea or an airplane at 50,000 feet could ever hope to run into.

The passive technology world at 4 GHz is dominated largely by something called MIL SPEC which is short for military specifications; a system which the United States military has devised to insure that they always get the very best quality when they buy, and that apples are always compared to apples. When you order in one or more passive items for your TVRO, you are buying in the MIL SPEC world and as you might expect the pricing for the passives you buy is going to be somewhat higher than you have been lead to expect with CATV grade equipment in the lower frequency ranges.

Power Splits

There seems to be a misunderstanding around as to what it is you do when you add a two way or four way signal or power divider ahead of your receiver to drive two or more receivers.

"How can I put a 3.5 dB power divider ahead of my receiver if I am only 4 dB above the threshold of the receiver" is a question heard from time to time. **"Won't that take me down almost to the threshold?"**

The answer is no. It will not.

When you power divide the carrier ahead of the receiver, you are **also** power dividing any **noise** that is present. Thus when you lower the thermal plus galatic plus LNA noise by 3.5 dB in a power split, that 'lowering' matches exactly the same lowering taking place with the carrier level.

The signal to noise ratio **at RF** is established for the system by the noise temperature of the LNA. It is the noise-limiting factor for virtually all TVRO installations. The voltage gain of the LNA is what is being split and it follows the same math that applies for VHF power splitting along a trunk or feeder line.

Most TVRO installations 'have 4 GHz energy/voltage to burn', which is another way of saying you don't have any reason to worry, with a typical 40-50 dB gain LNA, about running out of signal voltage before you run out of receivers to drive. If you have any concern about this at all, you should contact your LNA or receiver supplier.

Construction of power dividers at 4 GHz is largely along strip line techniques. That means there is a piece of copper clad teflon fiberglass material which is photographically exposed to a master circuit which has been carefully constructed on 'paper'. The design created by engineers is etched onto the copper clad board. This results in a high degree of uniformity between devices (i.e. each is a photographic 'mirror image' of the original master 'print') and if the engineering was done properly the performance is very close to the maximum theoretical limits imposed by the power division equation.

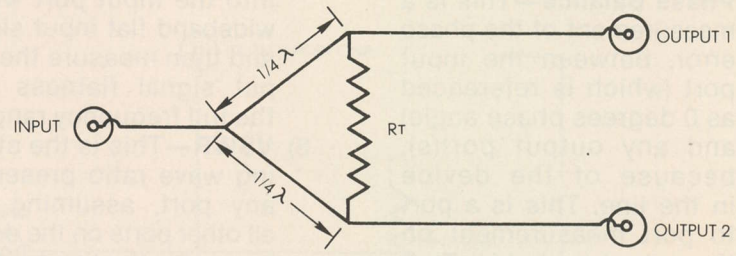
The devices we have looked at in preparing this report are products of **Merrimac Industries, Inc.** (41 Fairfield Place, W. Caldwell, N.J. 07006/201-575-1300). Merrimac power dividers pretty much dominate the CATV TVRO passive field; they are utilized by most of the suppliers of TVRO systems.

The basis for a power divider is a stripline configuration 'Split T' circuit, shown here graphically. The input is divided across a pair of 1/4 wavelength lines etched onto the copper coated board. At the end of the 1/4 wavelength etched line there is an internal termination across the lines. The termination is with a precision 1/8th or 1/4 watt resistor.

In the GHz region product nomenclature and device performance is specified utilizing a language that is not totally comparable to CATV lingo. It is often close, but not precisely the same. For example:

1) **Isolation**—a measurement of the degree of signal isolation (in dB's) between any two ports. You apply RF power to one port and measure how much of it is available at the other port(s).

Largely because of the stripline configuration isolation values can be extremely high in a 4 GHz power divider. The key is to keep the mis-match present at the input port to an absolute minimum. The ultimate match is a 40 dB match, representing a VSWR (standing wave ratio) of 0 or infinity. If the input port match is below 40 dB the isolation between the two output ports suffers accordingly. A VSWR of 1.10 (to 1), which is the same as a match of 26 dB (return loss), results in a lowering of the isolation from 40 ±dB to 31.4dB for example.



SPLIT "T" HYBRID POWER DIVIDER

How important is power divider isolation to the CATV world? It depends upon how and where you will be utilizing your power divider. If you have it installed at the base of your downline to split the TVRO RF signal into two or more parts, then your input port is typically the downline itself while the output port is a jumper cable (probably RG-9/B/U) of some modest length going to the input N fitting on the back of your TVRO receiver. The integrity of the input port match is the match integrity of your downline. The better the grade or quality of your downline **and** the connector on the end of it the better the match your input port sees. With 100 foot and up downline runs the output match of the low noise amplifier is probably not going to be 'seen' through the match presented by the downline itself and the connector on the end of it. Of course if the output match on the LNA was extremely poor, it could 'override' or push through the match of the downline/connector segment of your system and become the determining factor for the match presented to the input port on the power divider.

If you happen to have a not-acceptable match at the input port of the power divider, how might that affect the operation of the two receivers tied to the output ports? Well, as the isolation between the two output ports diminishes the threat of one receiver's LO and other non-desired products getting into the second receiver increases. Just how far you can go **before** you are into difficulties is plainly conjecture at the moment; it is an area that will deserve additional test and study as the number of receivers tied to a single TVRO increases (with the addition of new services on the birds).

2) **Coupling Loss**—Here we are concerned with the signal voltage loss, at the operating frequency, caused by the simple **power division** within the device. Coupling losses are specifed under matched port conditions; in other words, to achieve the rated coupling losses stated in the data sheet you must have well matched ports in your actual operating system.
3) **Insertion Loss**—This is defined as the net power loss due to the electronics of the circuit. Another way to look at this is to say in the TVRO world insertion loss means the power lost **due to circuit inefficiencies.** In most CATV passive specs the insertion loss is not as closely defined; it may mean both insertion loss **and** coupling loss, **or** it may mean only insertion loss.

4) **Phase Balance**—This is a measurement of the phase error, between the input port (which is referenced as 0 degrees phase angle) and any output port(s), because of the device in the line. This is a port to port measurement on the output port side. That is, assume that you go into the input port with a 0 degree phase angle. . .and then measure the phase angle present at **all** output ports. The phase balance measures the difference of the phase at each of the output ports and tells you how much (if any) phase imbalance there is between any two output ports.
5) **Amplitude Balance**—This is the measurement of the RF output power level variation across the full range of frequencies for which the device is designed. We call this 'flatness' in CATV lingo. Simply go into the input port with a wideband flat input signal, and then measure the output signal flatness over the full frequency range.
6) **VSWR**—This is the standing wave ratio present at any port, assuming that all other ports on the device have a 0 reflection (no SWR or a perfect match). We call this 'match' in CATV.

Bandwidth

As you might suspect, bandwidth of the device is somewhat dependent upon the design. When you have 1/4 wavelength etched lines on the power divider circuit board, logic tells you that these can only be quarter wavelength lines at certain frequencies. In the GHz realm the device is measured for VSWR change and isolation as a function of frequency change. For example, a device may have a VSWR of 1.0 to 1 and port to port isolation in excess of 40 dB at the design frequency (call it 4 GHz); but at a **pair** of frequencies up **and** down from the center design frequency where the 1/4 wavelength striplines are respectively 0.2 and 0.3 waves long the VSWR and the isolation changes. This is reflected in the data sheets you will read as VSWR and isolation **either side of** the design frequency range.

There are design tricks to broaden the bandwidth of course. Some of the clever Merrimac designs extend the range over several octaves of region, such as 2.5 to 12 GHz. This is usually done by making the number of stripline sections increase, to provide a pair of resonant strip line sections for each center frequency region in the full range covered. This results in 'S' shaped VSWR and isolation curves; they are best at each of the optimized frequencies represented by the quarter wave segment resonances, and the fall off towards the next design center frequency, where they come back down again.

This is nice technology to be aware of, but for CATV use the 3.7 to 4.2 GHz band represents no design problems to the skilled power divider design engineer and our market is therefore not really concerned about what happens to power divider characteristics outside of our frequency range. However, it **is** useful to know that you probably can**not** expect useful performance from a 3.7 to 4.2 GHz splitter power divider at 12.2 to 12.7 GHz (or CARS band). Better to be forewarned than disappointed.

Power Handling

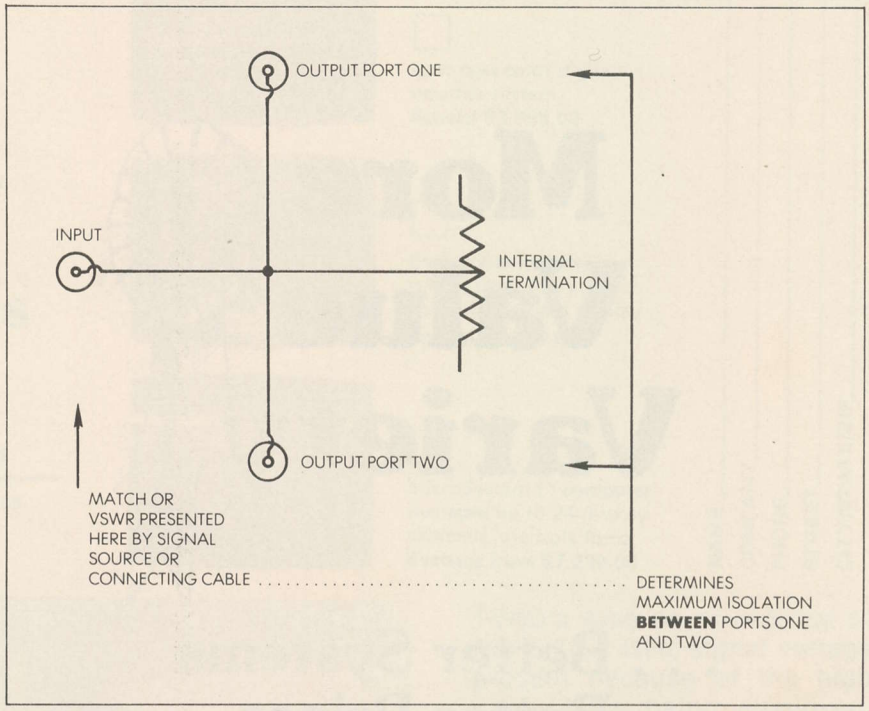
The ability to handle RF power is a function of the design, the values of the internal terminating resistor(s) and the match. **A poor match will quickly reduce the power handling capability;** a well matched power divider (i.e. one that sees a VSWR of under say 1.25 to 1) in the Merrimac series most commonly utilized for CATV TVRO receive applications will handle six watts of RF power. Because we are receiving only, the power handling capability is of minor importance. Remember again that you cannot use one at CARS band for transmit power division, even with lower power levels, because of the match problem however.

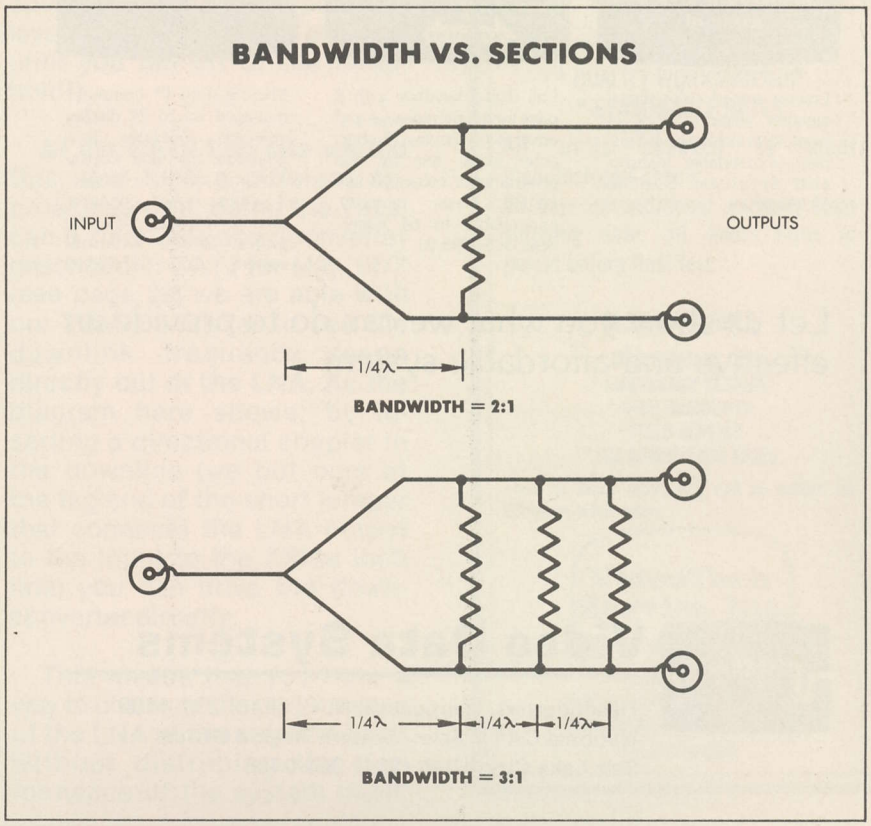
Current Applications

As previously noted the most frequent use of the power divider/signal splitter is at the base of the feedline for feeding two or more receivers. Remember that in CATV parlance insertion loss must include both coupling loss **and** insertion loss, and both depend upon the integrity of the match (primarily at the input port).

Let's take a two port coupler/divider. The losses are 0.25 dB (Merrimac model PD-20-3.95G) for the insertion loss **plus** the 3.0 dB coupling loss. The **total** loss is therefore **3.25 dB** if there is a very good match presented to the device. The device has a rated input and output match in the design band of 1.25 to 1. This translates to a match of around 19.5 dB and isolation of 22.5 dB port to port (assuming the input port also has a match of around 25 dB return loss). A four port coupler (one in, **four outputs**) such as the Merrimac PD-42-3.95GA has an insertion loss of 0.5 dB plus a coupling loss of 6 dB. The total voltage 'loss' or division between the input port and any output port therefore becomes 0.5 plus 6.0 or 6.5 dB; assuming match as previously noted.

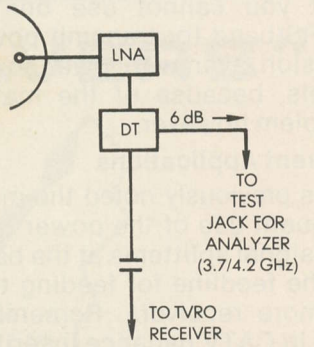
Most TVRO systems try to run their hardline (7/8ths or whatever) to the input of the power divider and then branch on to the input to the various receivers with a quality 'soft' line such





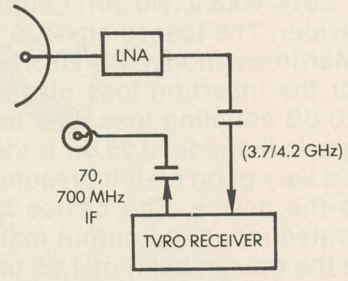
as RG-9/B/U. The loss characteristics of the RG-9/B/U are not all that much better than RG-8/U cable but the 9/B/U cable does have some shielding and integrity advantages over most 8 you might find for sale in your area. With the advent of CB, there has been a large number of poor quality 8/U cables placed on the market; some of which exhibit such low shielding characteristics that the cable is all but opaque to 4 GHz signals that might wish to exit through the shielding.

Virtually everything we deal with in the 4 GHz region has type N connectors on it. There are some type SMA and TNC connectors available on some hardware, including power dividers. When ordering any equipment for your TVRO, you are best to stick with 'microwave rated' type N connectors. There are two grades here; **most** type N are good through 8 GHz or so (this varies with the type, and the supplier) and then there are top grade that are rated to 12.4 GHz. Be advised.

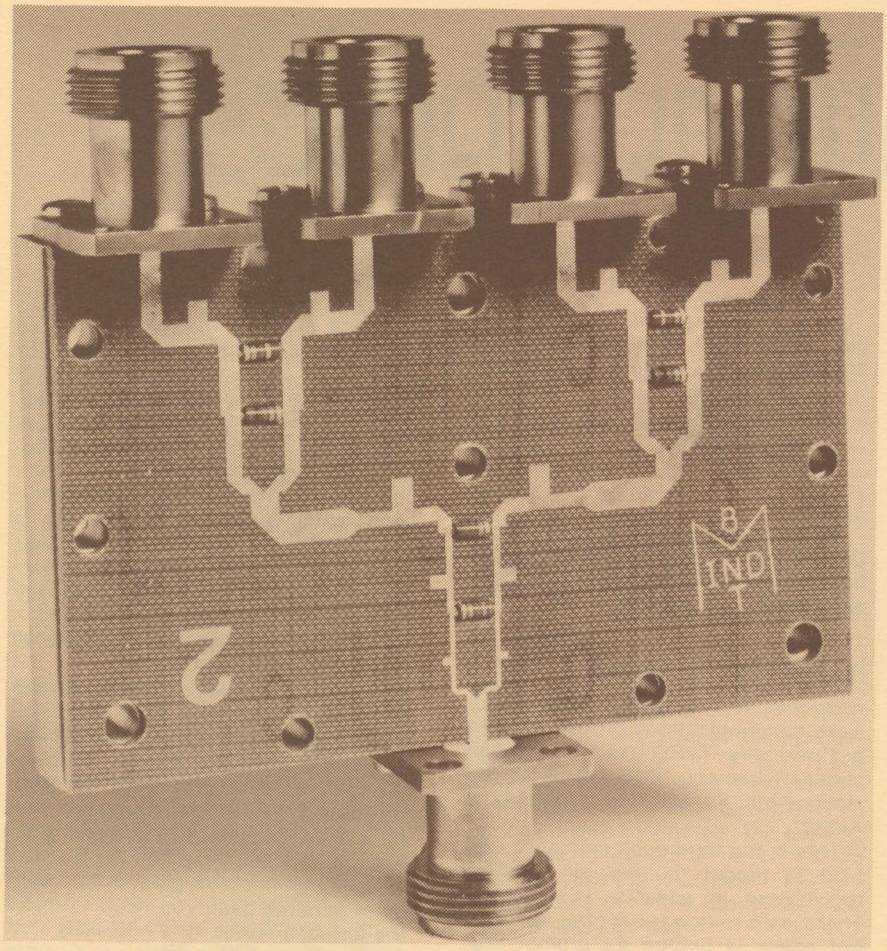


ONE APPROACH TO TVRO ANTENNA—SITE SPECTRUM ANALYZER SIGNAL SOURCING

OR



RUN RETURN LINE FROM TVRO RECEIVER BACK TO ANTENNA PAD TO MONITOR RECEIVER IF TEST PORT



INSIDE A POWER DIVIDER—Merrimac unit utilizes etched strip line circuit approach on teflon base board. Tolerances are very tight, resulting in extremely high performance characteristics.

The Directional Coupler

Another item you might be interested in is the directional coupler. It functions pretty much like you would expect, along lines similar to the DT at CATV. Where might you use it?

Well, there is a common practice in most terminal installations to jack into the IF output spigot on your TVRO receiver to find the 70 or 700 MHz signal which allows you to measure the **input level after down conversion.** Then most systems run a length of RG-59 or .412 cable **back out** to the terminal pad where they mount a box with an F fitting on it. This allows you to plug your SLM/FSM or spectrum analyzer in at the antenna pad and monitor, via your receiver IF, the signal level from the satellite. This is very useful for antenna pointing exercises (always turn **off** the receiver **AGC** before doing this or antenna pointing level changes will not be seen until you fall off of the threshold!).

At the CATJ Lab site we did this, **and** took a different approach as well. Using the Texscan 3.7/4.2 GHz downconverter described in CATJ for May 1977 (see page 29) we are able with our VSM-2 analyzer to see the downlink frequency range **directly out of the LNA.** As the diagram here shows, by inserting a directional coupler in the downline (we put ours at the tag end of the short jumper that connects the LNA output to the input to the 7/8ths inch line) you can drive the downconverter directly.

This means that you have a way to check on the performance of the LNA **at the antenna** itself without distrubing the performance of the system itself.

The Merrimac line of directional couplers are extremely well suited to outdoor operation and the 6 dB value DT has a total through loss going towards the TVRO receiver of 1.45 dB and towards the downconverter/ spectrum analyzer jack on the antenna pad of 6.20 dB. Using the Texscan prototype VSM-2 downconverter we have signals in excess of 30 dB above the VSM-2 noise floor on our display.

If you feel uncomfortable with the 1.45 dB through loss on the directional coupler, choose a higher value. A 10 dB DT in this series has a through loss total of 0.66 dB and a 20 dB version has a through loss of 0.24 dB. However, most CATV TVRO's have an abundance of raw 3.7-4.2 GHz signal voltage present because of the high gain LNA's being employed, and the 6 dB DT provides a good range of spectrum analyzer display for even weaker TVRO signals (such as the beacons).

TECHNICAL TOPICS

Responsible

"The Coop's Cable Column appearing in the September CATJ was excellent. I am very pleased to see someone in a responsible position point out that the providers of goods and services can only be squeezed so far before everyone starts losing."

Roy E. Bliss
Executive VP
United Video, Inc.
Tulsa, Ok. 74105

Roy-

Most suppliers applauded the column and so did the majority of cable operators. However a few operators **wondered if we were opting for higher TVRO prices. The answer is of course no; if somebody can profitably sell a TVRO for a buck ninety eight, more power to them. However, as long as people insist on buying 'below book value', they should be told going in that the only way a supplier can manage to sell for those low prices is to cut down on the quality of the product, or the service that backs the product up. Or both. We simply wanted the record straight. You get what you pay for, and if you pay too little, you may be getting less than you need. One plus one still equals two. Not 1.5!**

Man Has Magazines

"I understand that there are CATJ readers who do not have the full set dating back to the first issue in May of 1974. I would be willing to sell a set from May of 1974 through December of 1976 for their subscription cost. I would prefer selling them all as a set but would also consider individual copies as an alternative."

Alban Hatzell
P.O. Box 267
McAlester, Ok.
74501

Alban—

We hope you have a large mailbox! OK you people who have been pestering us for a 'collector's set' of CATJ's early years. . .go get 'em!

Hughes TVRO K.C. Seminar

Hughes Aircraft Company's microwave communications group will hold a three day TVRO (earth terminal) seminar January 16-18 (1978) at the Holiday Inn, Kansas City International Airport.

This is the third such seminar to be held in recent months by Hughes; registration in advance is required. There is no tuition fee for the seminar, but space is limited so prompt pre-registration is urged.

The seminars delve into virtually everything you need to know about TVRO system design, planning, installation and operation and each participant receives what is probably the best, most comprehensive TVRO system manual in existence today. You should pre-register by contacting **Hughes Microwave Communications Products** (Building 237, P.O. Box 2999, Torrance California 90509) at area code 213/534-2146 (extension 2376).

LNA Improvements Ahead?

When the FCC approved smaller-than-nine-meter TVRO terminals in December of last year, certain requirements were placed upon potential users of small(er) terminals. One of these requirements says that you must have around a 3 dB carrier/threshold ratio at the input to the TVRO receiver; as a 'buffer' against degradation of the system (either at your terminal, at the transponder or in between).

There are only two ways to develop improved or higher C/N. You use a larger antenna, to capture more signal, or, if the amount of signal you can capture is fixed or limited (by your not being able to use a larger antenna). . . then you use a lower noise figure LNA (low noise amplifier).

C to N is a ratio; between the carrier signal you receive, and, noise you receive **plus** the noise your system generates. **Raise the carrier, or lower the noise.** It's just that simple.

Antenna technology suggests that for a fixed (i.e. selected) antenna aperture, we have about reached the practical (theoretical) limits of gain. If you want **more** antenna gain, you need to make the antenna **larger.** It is not likely that you will increase the 'efficiency' of the antenna itself with a fixed size.

When CATV systems began utilizing low noise amplifiers (LNA's) just over two years ago, we had amplifiers that cost around $4,000 each and with noise figures of approximately 2.7 to 2.9 dB. If you are a noise-temperature man, that's in the 250-275 degrees K range. But the LNA technology has developed rapidly, largely because the technology associated with the premium Gallium Arsenide Field Effect Transistors (abbreviated GaAs-FET) has developed rapidly. Today if you shop around abit you can buy a 1.5 dB noise figure LNA for under $2,000. That means you get approximately twice the amplifier for half the price that the 'CATV TVRO pioneers' paid.

During the last six-eight months the people who labor in quiet laboratories developing GaAs-FETS have been strangely quiet. It turns out to have been the lull before the storm. Big. . . very big. . .changes are about to push GaAs-FET technology to the approximate same point as antenna efficiency is now at. In other words, for us at 3.7 to 4.2 GHz, the ultimate state of development for the GaAs-FET device.

Now GaAs FETS are made in a chemical composition environment. The procedure for manufacturing GaAs FETs is tedious and complex; it involves 'growing crystalline structures' in an extremely pure situation. A GaAs FET has three layers of materials; a substrate layer, an 'active layer' and a 'buffering layer' between the two. By

of the rules might prove harder to deal with.

And, costs for terminals might once again tumble. We'll discuss all of this in greater depth in future issues of CATJ.

LNA No-No's

Not all CATV TVRO low noise amplifiers provide adequate user instructions. Most tell you how to hook them up (very simple usually) and where and how much voltage to apply, but little else. The reason for this lack of data is straight forward enough; the GaAs FET devices are new and the LNA's are even newer.

Experience gained with low noise small signal GaAs-FET amplifiers do tell us that:

1) **Failures are accentuated by cold.** If something is going to fail, either within the GaAs-FET structure itself or in the surrounding circuitry, it will fail quicker when it is cold than when it is hot. If that tells you to have a particularily good 'technician on call' system working for wintery cold snaps, you read that right.
2) **Although it is exceedingly unlikely** you will ever handle a 'raw' GaAs-FET out of the circuit, even taking the top off the case and inspecting the miniature circuit can be dangerous. If the front end (first stage) GaAs FET in your LNA has gold metallization (i.e. gold colored) leads that means it is less susceptible to static burnout than the aluminum-based lead devices. Poking around with your finger or (shudder) a metal tool of any kind is not a good idea.
3) **There is no such thing as a breakdown voltage test** for a GaAs FET. They are like fuses; there is a non-reversible bulk breakdown of the materials in the devices, unlike many bi-polars which have an avalanche breakdown. This says that when you are looking around for a DC supply for the LNA (most operate with DC voltages of from 12 to 35 volts or so) that you choose a supply voltage close to the **lower-end** operating region (such as 12 volts) and that the supply be very well regulated, filtered and transient or spike protected.

Sun Outage

Twice each year, within a two/three week span either side of the fall and spring solar equinoxes for **most** USA locations, CATV TVRO systems experience a phenomenon known as a solar outage. The recent fall saw the period October 5-8 the affected period for systems located through the mid-belt of the nation, looking at SATCOM II.

Here is what happens. As the earth and sun constantly change position with one another, relative to a fixed point on earth, at some point in time each spring and fall the sun, SATCOM II (or whatever satellite is involved) and the TVRO antenna system main beam all line up. In effect, the TVRO terminal looks at SATCOM II in a fixed location in space **and** the sun lines up directly behind SATCOM II so that the TVRO antenna is looking **at both** the satellite **and** the sun's surface.

When this occurs the TVRO antenna, being relatively massive in size and gain, picks up the noise source(s) within the sun itself. The sun, because of the dynamics of the solar system, is one of the most potent generators of wide (frequency) spectrum wide-band noise known to man. It is not unlike having a Sadelco Analyst Noise Generator in space, with a one billion times amplifier tacked onto the end of the Analyst.

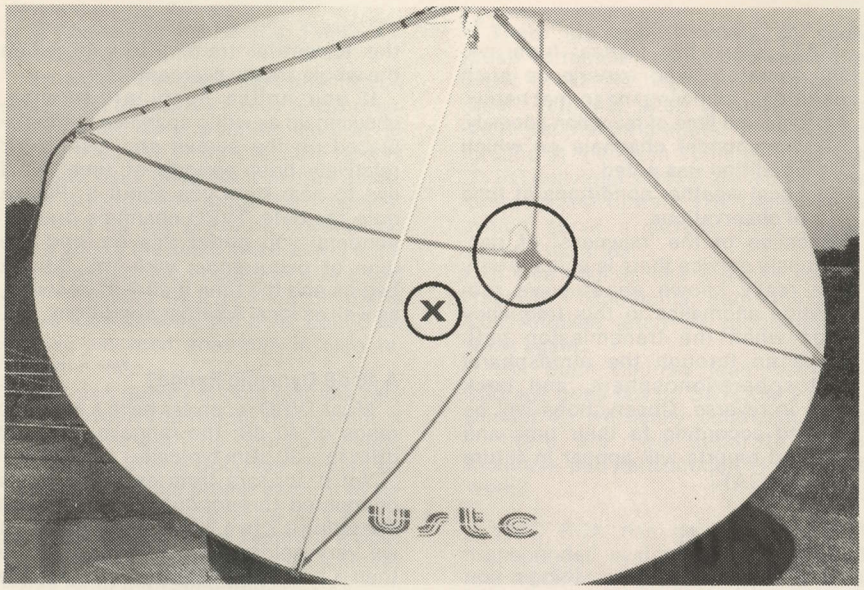
Because of the relatively narrow (typically in the 1 degree region for plus/minus 3 dB) beamwidth of the TVRO receiving antenna, the noise from the sun's interior and surface is picked up by the TVRO antenna only for a few minutes. The sun is constantly on the move across the sky (for which any thinking person will be grateful) and it moves towards, into, and then through the sharp beamwidth receive pattern of the TVRO antenna in a matter of minutes.

What happens during a sun outage? Do you lose service altogether for the period during which the sun lines up directly behind the satellite you are receiving?

Basically the high noise output of the sun saturates or floats in with and through the regular TVRO signal. Those who have seen a sun outage report that the picture first begins to have weak horizontal lines moving in a pattern. The lines become more severe as the solar noise peaks in the TVRO antenna beamwidth and depending upon the elevation of the sun (i.e. whether it is **directly** in line with the satellite on the day of your sun outage **or** a few tenths of a degree above **or** below the direct line from your antenna to the satellite) the horizontal crud may either totally wipe out SATCOM (or whatever) reception, or it may simply severely impair the picture.

If you were to know the date and time of the sun outage for your area (RCA and others have been known to supply this data in the past) you could do the following:

1) **Switch** just ahead of the time to a non-used TVRO channel (such as 2 or 14; be careful that you select one that is **really** not in use, many have data on them; a vertical channel such as 1 or 3 might be preferable);
2) **Connect** a chart recorder to your SLM and connect the SLM to the IF output connector on your TVRO receiver.
3) **Activate** the chart recorder and as the sun passes through the line from your antenna to the satellite the solar noise will 'draw' your antenna pattern for you on the chart recorder paper.



How's that again?

The solar noise source is for all practical purposes a constant noise source at TVRO frequencies and for relatively short periods of time. If the antenna is stationary, and this wide band, constant amplitude noise source moves through the fixed antenna, the relative wide band noise power received by your antenna system will translate to voltage—out of your SLM and to your chart recorder. You will therefore be recording on paper the actual pattern of the TVRO antenna using the 93,000,000 mile test range along the path from the sun to your location.

The accuracy of this system will depend upon only one factor; whether your TVRO antenna lines up exactly with the sun's surface, or whether it simply 'comes close'. Exact alignment will produce the most 'honest' recording of your true antenna pattern; close alignment will provide a close approximation.

This fall's solar outage just happened to occur during the CATA/CATJ sponsored 'mini-CCOS' held in Dallas, Texas. During the course of the afternoon session on October 6th TVRO pro Dan Yost of Compucon was explaining how TVRO systems work. He had only moments before shown a slide to the gathering depicting what should happen during a solar outage. Then, almost 'on cue', the sun did its neat trick and the 'mini-CCOS' attendees were treated to a real world sun outage. Yost admits he was caught a little by surprise when it happened but fleet footed Jerry Thorne of RF Systems put two and two together in a hurry when he saw the crud come up on the screen. Jerry ran outside to look at the dish to confirm the alignment.

Because the sun casts **a shadow** of the feed antenna **onto the dish surface,** you can use the position of the shadow as an indicator of where or when you might expect **your** solar noise outage. When the shadow is **below** the **center** of the dish the solar outage is **ahead** of you in the **fall** and **behind** you in the **spring.** When the shadow is **above** the center of the dish (see photo here) the sun outage is **ahead** of you in the **spring** and **behind** you in the **fall.** When you are close or at the solar outage date the shadow of the feed/LNA will cross the center of the dish.

The duration of the solar outage will vary, typically between two and ten minutes. The intensity of the outage will also vary; it is a function of the **exact** alignment of the sun, the satellite and the TVRO receive antenna. The typical outage occurs during the mid-day period to mid-afternoon; a function of where you happen to be in your own time zone (remembering that during daylight savings time you are actually sun-time one time zone east of your true location) and the direction of the satellite in azimuth from your location.

The 'PI's' Will Get You

Ed Taylor of Southern Satellite Systems (they handle the common carrier packaging for WTCG-17 Atlanta) tells how effective the WTCG advertising is. "WTCG has some really first class per inquiry (that's known as a **'PI'** in the advertising biz) advertising business" notes Taylor "and when they added the toll free 800 number the sales from those advertisements really picked up; especially in the satellite cable distribution regions."

Advertising bought on a 'PI' basis benefits the TV station in direct proportion to the amount of 'pull' of the commercial. The station 'shares' in the orders and if you get enough orders for a commercial schedule often the income from such PI advertising exceeds what the station could expect from normal rate schedule billing for the same commercials.

"Southern Satellite is plugged into the fellow who handles the WTCG 'PI' program" goes on Taylor "and we get a computer run off of where the orders come from. I've found the order sequence to be very interesting."

What Taylor is saying is that he has a **way of verifying** the impact of WTCG in **each** cable community served via satellite. Some systems really generate the sales for 'PI' offerings of Elvis records and the like; in others they fall flat. But for all practical purposes he can 'see' each and every system using the WTCG signal via satellite each and every month, from the 'PI tallies' supplied by the station.

"We've found a couple of CATV systems using our signal before they were supposed to be" notes Taylor with a chuckle. **"There have been some mighty surprised operators when I called them on the telephone to ask how they 'liked having WTCG on the cable'!"**

Super 17 Progress

This type of report has a tendency to be outdated before it even gets into print, not to speak of the extended delay before the mailman brings your own copy to your doorstep. However. . .

Channel 17's Don Anderson reports WTCG should be over the 1,000,000 cable-homes-via satellite mark 'early in 1978'. Perhaps even sooner if some large systems such as Austin, Texas (55,000 cable homes) begin service this year. Austin, like many larger systems already carrying a full compliment of signals, is adding WTCG for nighttime hours (the all night movies).

The next big hurdle for the Super Station will be the FCC's expected action on the petition by Southern Satellite Systems to serve Hawaii, Alaska and Puerto Rico. SSS has FCC common carrier status permission only to serve the basic 48 states. SSS had filed a petition requesting authority to serve cable systems in the 49th and 50th states plus Puerto Rico earlier this year. However the friendly folks at the Motion Picture Association of America (MPAA) objected to the petition by SSS proclaiming their fears that channel 17 was turning into a 'super station' that threatened to upset normal film and syndicated programming marketing practices.

Running Proofs On 17 (6)

Of the various off-bird signals in use today, HBO's transponder 20 or 24 signals are for several reasons the best transponder channels to utilize for system proof of performance, even if you are not going to be carrying HBO on your system (for now).

This is especially true with the various video tests such as differential phase and gain. For example, while proofing the CATJ Developmental terminal recently, we had the occasion to compare the differential phase and gain on transponder 6 (WTCG), and HBO 20 and 24 (making most video tests with CBN is not possible because they lack the necessary VITS data). We found that on channel 17's transponder

six that we had around 11% differential phase and gain non-linearity, while HBO 24 (east coast) was less than 3% and HBO 20 (west coast) was less than 1%. For reference sake, **a 10% error** is the equivalent of a **1 dB error.**

The WTCG signal is taken off air at Atlanta by an off-air receiving antenna, fed into a demodulator and the baseband video (and audio) is utilized to drive at baseband the uplink transmitter to SATCOM II. According to engineers who have inspected the WTCG off-air and uplink site, there are no special efforts made to correct for the non-linearities of the demodulator at the off-air site, and consequently any WTCG transmitter non-linearities **plus** any added by the off-air demodulator are passed on through the full system to your TVRO terminal.

Normal CATV proof tests, such as Carrier to Noise or Signal to Noise are **not** affected by this Atlanta off-air site situation however; tests you make on transponder six at RF or IF are just as true as would be made with either of the HBO channels.

Intermittent Sparklies?

Several system operators (**including** the CATJ Lab-Site six meter TVRO) report that they have seen low-level (noticeable but not degrading) 'sparklies' in TVRO reception at **random** times.

Some checking indicates that the phenomenon may be weather related; most of those reporting this type of reception 'problem' note that:

1) Typically it lasts for only a few minutes (10-12 seems about average);
2) All but one have noted it during occluded (i.e. wet, heavy overcast) conditions;
3) The appearance is a low-quanity of white speckles on the screen, randomly placed;
4) Most report that the received signal level (i.e. carrier) during the condition is typically **up** by 0.5 to 0.7 from the 'normal' level.

It is possible that the systems reporting this condition are within a dB or less of receiver saturation (i.e. antenna gain plus LNA gain plus receiver AGC) and the 'sparklies' are due not to a lack of signal but rather to an overabundance of signal.

CATJ would like to hear from system operators who experience such conditions, following the format here:

1) **Date and time of reception anomaly,**
2) **Transponder channels on which condition was noted,**
3) **Local weather conditions at time of observations.**

Because of the 'newness' of geostationary service there is actually very little really known about wave propagation anomalies in this frequency range when the transmission path moves up through the atmosphere/stratosphere/ionosphere, and back down in reverse. Observations will be grouped according to their time and date and reports will appear in future issues of CATJ.

TVRO Sparklies-II

One of the deceptive things concerning sparklies (noise) interference in an FM/FM mode (which is what our TVRO signals are) is that even co-channel interference (to use CATV lingo) often looks like the presence of noise.

So if you start to see **white sparklies** that flit and dash across the screen, and you know for the world that signal levels are at normal levels it may well be that the 'noise sparklies' you are seeing are coming from not a **lack of signal** (or too much signal as noted previously) but rather from an interfering carrier in the same frequency range.

CATV systems licensed in the TVRO area are required to make an FCC showing regarding their C to I or carrier to interference threshold. This means that the frequency coordination search you conduct looks at **both** existing **nearby** terrestrial transmitter (signal/noise) sources **and** at those which may well be several hundred miles away. The latter, further transmitter sites are of concern because of something known as precipitation scatter. Under the right (or wrong depending upon your viewpoint) lower level atmospheric condition; the distant 3.7-4.2 GHz terrestrial signal 'scatters from' the moisture laden low level clouds and some of the scattering signals end up at your antenna. This may happen when the sky is clear at your site (but raining or overcast along the path towards the terrestrial transmitter), or when the whole area is overcast.

If you notice such interference, showing up as white sparklies randomly placed on the screen and lasting for relatively brief periods of time, we'd like to hear from you about it. Please note the date, TVRO channels (transponders) you noted this on, and the time of occurrence; with the time it begins and the time it ends if possible, as well as local weather conditions.

A 40 dB Dynamic Range?

Most TVRO receivers have a dynamic range of 40 dB; the range being −70 dBm to −30 dBm typically.

Yet it appears from extensive tests conducted throughout the world with operating 3.7 to 4.2 GHz downlinks that we very seldom if ever require more than a couple of dB of 'AGC' because the downlink signals are exceedingly stable in the 4 GHz range.

John Kinik of Philco-Ford Aerospace reports that his group has checked on signal variations in Indonesia and throughout North America and they have yet to find a situation where the input signal level changes by more than +/−0.75 dB due to atmospheric and other system conditions.

The FCC, on the other hand, requires a 'margin' of 3.0 dB for TVRO (small) terminals. The FCC assumes that at some point in time **all** of the worst-case problems might coincide and at that point you could require a 'fade margin' of as much as 3.0 dB. The errors the FCC considers include everything from uplink transmitter power falling off to bird transponder power falling off to antenna pointing errors, heavily overcast (i.e. wet, signal absorbing) conditions and heavy winds resulting in buffeting of the TVRO receive antenna off of the bird.

Constant chart recording at the CATJ terminal over a one month period revealed no signal changes of greater than +0.4 or −0.5 dB. Clearly, if the real world variations are this small, or as small as Philco-Ford's Kinik suggests, the FCC requirement for a 3 dB margin may be another case of classic overkill. Additional data is required however before any firm conclusions can be drawn.

TVRO Maintenance Tips

Here are the four most common problems experienced with TVRO terminals to date:

1) Moisture in the transmission line or build up within the feed antenna assembly;
2) LNA quality (i.e. noise temp) is not what the buyer expected;
3) Center pins on coaxial line connectors pulling out due to improper installation techniques (this can happen to the 7/8ths line as well as to type N connectors on shorter transition lines);

4) Mis-alignment of the TVRO antenna.

To avoid moisture in the transmission line, most systems employ a low pressure (such as 2 pounds) source of dehydrated air. An air pressure tank is perhaps risky because it invites somebody to forget how to run the 'machine' cranking up the pressure beyond the point where the seals and line will hold. A line with holes popped in it is a bad deal. Pressure of 2 pounds on prime focus feed antennas and 1/2 pound on cassegrain feed antennas is also recommended.

The LNA quality should become very evident when you fire up the system. If the antenna pointing checks out and the coaxial line is good (as verified by the present of the proper amount of RF voltage at the receiver IF), a poor S to N almost certainly is the result of a poor C to N created by an LNA with a higher noise temp than specified.

Alaska And SATCOM I

SATCOM I (parked at 135 degrees west) is supposed to be the 'back up bird' for SATCOM II CATV users. However as a point in actual fact the SATCOM I bird is dedicated almost exclusively to service for Alaska.

SATCOM I operates a number of voice and digital relay functions for Alaska. It also has a rather interesting video (television) service going which may make life extremely interesting for the Alaskan CATV system operators.

Approximately one year ago the State of Alaska decided it was time to provide television service to the thinly scattered outback residents of the state. And so a program was drawn up to provide television (along with telephone and other service) through something know as 'Bush Stations'. Most Bush Stations are 4.5 meter antenna systems, utilizing LNA's similar to those we utilize for CATV purposes. The receivers, however, differ considerably.

The first problem for the Alaskan television distribution is the time differential. When it is 7 PM in New York City it is 2 PM in Fairbanks and Anchorage. Off to the west, in Nome, it is 1 PM. It wouldn't do to feed prime time television to Nome at 1 or 2 PM in the afternoon.

So from Valley Forge, Los Angeles and other sites where RCA has an uplink earth station, television station signals are taken **off the air,** demodulated, and plugged into an uplink transmitter headed for SATCOM I. In Anchorage they are taken off the SATCOM I transponder and taped. During the course of the broadcast day as many as a dozen or more television stations may be beamed to Alaska via SATCOM I for selected taping in Anchorage. Then at the appropriate time in Alaska the taped and edited programming is sent back to SATCOM I via the Anchorage uplink station for delivery to the Bush Country receive terminals.

There are approximately 30 such Bush Terminals now in operation; the State of Alaska has plans to provide Bush Terminal sites wherever 50 or more people congregate. Once on the ground at the Bush Terminal sites the TVRO delivered signals are fed into low power (5 and 10 watt) VHF transmitters which serve a several mile radius around the sites.

If this sounds like a handy way to 'receive' Philadelphia, San Francisco, Los Angeles (etc.) TV programming, **think again.**

The Bush Country feed from Anchorage goes out on SATCOM I transponder 23 (vertically polarized). . .and . . .there are two separate video channels per transponder. How's that work?

Well, RCA has developed a 'half transponder' system wherein most of the modulation (deviation) parameters are simply cut in half. At the Anchorage uplink transmitter two separate drivers, each individually modulated with a video signal, operate 9.5 MHz above and below the actual center of transponder 23. Using a peak deviation of around 6 MHz, RCA ends up with two video programs for the price of one. Well, **almost.**

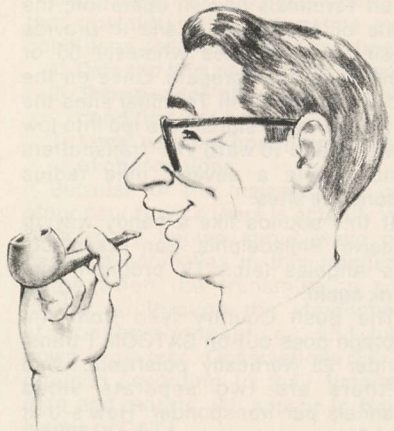
Naturally this requires special receivers. The IF must be narrowed and the discriminator circuit readjusted to respond to just half the normal bandwidth and the lower peak to peak deviation; and the LO must tune in 0.25 MHz steps.

When this program was first begun (and until very recently) RCA chose **not** to send the accompanying audio **along with** the video. This was done because the Bush Country sites were already equipped with SCPC (single channel per carrier) receivers as part of the rural telephone service maintained by RCA for Alaska. With the receivers already in place, RCA opted not to mess around with trying to squeeze aural sub carriers in the half transponder channel widths. However, now that Bush Country terminals are expanding beyond the original sites where SCPC was already installed, the State of Alaska (which is footing the bill) does not like having to have the special $20,000 receivers for the additional sites. So during the fall experiments were begun using a 5 MHz aural subcarrier (along with the video). If it proves successful, the new format will be adopted for all future SATCOM I television relays to the Bush Terminals.

And CATV? Well, the Juneau CATV system has a ten meter terminal installed and operating; and numerous CATV systems in Alaska have filed with the FCC seeking CAC's for carriage of the station signals being bundled north via SATCOM I for Alaskan use.

And beyond that? Well, if the '1/2 transponder' format proves totally satisfactory for transmission of **high quality** video, one just **might** expect that at **some** time the present SATCOM II channels **might** face a 'split'. Perhaps it is not in the cards for SATCOM II, but down the road a ways when a replacement bird is lifted up to settle in place for SATCOM II (RCA forecast an eight year life) the '1/2 transponder format' **may** well have some bearing on the way CATV systems receive signals.

Coop's cable column



bob cooper editor in chief
CATJ

Stirring The Satellite Pot

The recent Western Cable Television Show (San Diego - November 9-11) was, if nothing else, a satellite program delivery/TVRO emphasis 'show'. Two companies had TVRO antennas on display; the **Hughes** (Andrew) 4.5 meter (with shroud) and the **RF Systems** 6 meter. **Showing** antennas may be on the wane; it is a very expensive proposition to transport and set up the 'small' terminal antennas and by now virtually everyone has seen one play.

But everything else associated with satellite program delivery is on the increase. Including rumors, aisle-talk and well meaning but mis-guided 'announcements'. Let's deal with a few of these and wade through the truths as best we can.

(1) **"The Bird Is Full. . .".** Well it is, or almost so. It is **so close** to full that various parties who have an option of the 'last horizontally polarized transponder' available on SATCOM II have been given until around January 1 to either take it (exercise their option) or lose a shot at the F2 horizontal channels (RCA calls their birds 'F1', which is SATCOM I, and 'F2', which is SATCOM II).

Let's see how the present channel line-up shapes up. There **are** some changes here, and this list supercedes our September issue published list. Remember the horizontally polarized channels are even-numbered:

Transponder	Who's (to be) There
2	RCA reserved
4	Showtime / east
6	WTCG / SSS
8	CBN
10	Showtime / west
12	Transponder 'sick', not useable
14	**last channel left**
16	Fanfare (1-15-78 start)
18	PTL (was on 16; January start)
20	HBO / west
22	HBO / in use by Madison Square Garden Events
24	HBO / east

Showtime is of course the Viacom pay-cable product that has around 100,000 pay subscribers via terrestrial and tape interconnection now. They will start feeding programming via F2 around the end of March. We'll have more to say about them next issue.

Fanfare is a new Texas/Oklahoma/-Louisiana/Arkansas/New Mexico service that will package Houston based Astrodome sporting events (some, **not** all) with movies ala HBO or Showtime for a 'regional look'. RCA will provide them with around 5 hours per day of programming time via **transponder 16** starting (they say) January 15. Fanfare swapped with PTL (who moves to 18 when they now start in January).

What about WGN (United Video) or Southern Satellite's KTVU? Well, RCA requires when somebody wants a transponder that they put up the first month's rent in advance and then they have six months (maximum) to either get operating or pay rent for the transponder **whether they use it or not.** Ed Taylor's SSS has an option on the last remaining 'horizontal channel' (or 14 as we figure it; assuming RCA does keep transponder 2 out of the running). He has until early January to exercise his option; we are betting that he does (we'll all know for sure **when** it happens).

So much for the full-bird rumor.

(2) **"RCA will move everyone to F1. . ."** Remember F1 is SATCOM I, parked at 135 degrees west. This is more than a rumor; RCA personnel in San Diego were around talking to antenna suppliers and software suppliers telling them **"We are seriously considering moving all CATV traffic to F1. . .".** What does that mean, if it happens? It means that on some magic fun-filled day **every** uplink station in the country (those feeding programs **into** the bird) and **every** TVRO receive station will move their antennas from 119 degrees west to 135 degrees west. **I feel** RCA is serious, **but testing** the water at this point. They've run a flag up the pole and now they want to see who salutes. From what we heard in San Diego, nobody was saluting.

"Why" we asked RCA.

"CATV needs more growth room; F1 has it" was the response. If the logic of that escapes you (**both** F1 and F2 are 24 channel design), we'll talk more about it next month.

(3) **"WESTAR will have four CATV channels soon. . .".** Another non-rumor, but in our judgement a very **un**likely 'truth'. A Florida-based outfit came to San Diego and announced at a press conference that they were (1) 'about to sign an agreement with Western Union for WESTAR', (2) and would provide four channels of television for CATV system operators via WESTAR. Western Union confirmed they had **'talked with'** the people involved, but refused comment on whether or not anything was likely to happen. Confirmed WESTAR watchers first of all wonder **where** Western Union would find 'four channels for CATV' **on WESTAR I.** That bird now has SIN, lots (and lots) of CBS/ABC (and even occasionally we are told NBC) 'feeds', and, four PBS channels will start in the first quarter of 1978. **It is a 12 channel bird.** The room does not appear to be there. **Period.**

Then there is the signal carriage problem. The 'promoters' of the 'four new channels for CATV' concept apparently have **not** done their homework very well; they are **talking about** an L.A. independent (KTLA-5), a Chicago independent (WGN-9) and a New York indie (probably WOR-9). And the fourth channel would be 'pay movies and sports'. They said **'cable operators will be required to take all four channels of service'.** What they seemed to have overlooked is the FCC's signal carriage rules. If WTCG is having difficulty clearing sufficient larger systems for full time (as opposed to nighttime only) coverage to project much **beyond** a million **full time** cable delivered homes, there is no way sufficient systems are out there to handle **three** indies. Unless they run only during the 'wee hours' (and that's alot of late night movies). SSS's **proposed** KTVU carriage is bogged down around the 150,000 cable subscriber mark and that ought to tell us something.

So what about the WESTAR package of four channels? Yes, the 'promoters' did **announce** it alright. But as for it becoming a reality. . .well, we aren't holding our breath.

(4) **"After CATV moves to F1, new growth will be on the vertical channels. . ."**

Again, RCA **was** 'saying it' in San Diego. They probably will have no choice **but** to put the first CATV signal provider **after** the last horizontal channel is taken, on vertical. If in fact there **is** such a signal provider.

Here's the rub. All of the **existing** dish antennas have a **horizontal** feed. With an LNA attached to the **horizontal** feed, and a piece of 7/8th's inch (or whatever size) transmission line going

into the headend. That works fine because all of the signals we receive are of the same polarization. Now if somebody pops up on a **vertically polarized transponder** with CATV program service, **before** you can use that signal you will need to:

a) Swing your feed around to vertical (thereby losing the present horizontal channels), **or,**
b) **Change** your present horizontal **feed** for a **dual-polarized** feed (one that responds to vertical signals in one plane and horizontal in the other).

If you elect b), and there is probably no other common sense way to do it, then you must procure a **second** (separate) **LNA** for the vertical feed and run a **second transmission line** from that LNA on into the headend (to the appropriate receiver or receivers).

The first CATV program supplier to 'go up on vertical' will therefore be slowed down in his own marketing. Whereas you can now add a new (horizontally polarized) channel by simply taking a signal split at the base of the feedline and adding another receiver, adding your first vertical transponder channel will cost you perhaps $3,000 or more **plus** an additional receiver. Maybe as much as $5,000 more, plus receiver. That will slow alot of CATV system operators down, and that will also slow down the first programmer guy to take the vertical plunge.

We all know what a second LNA and another feedline run will cost. But what about the dual-polarized feed antenna? We heard numbers that run from as low as $200 (if you buy it **when** you order your antenna) to $1,500 (if you order a retrofit). And some in between.

The bottom line? It might just prove to be alot easier if there was a 'freeze' of sorts (voluntary **or** otherwise) on **new** CATV transponder growth **after** the horizontal channels **fill up.** Sort of to give everyone a chance to catch their breath. We'll talk more about it next month. **For now, our advice is to not worry about it unless you are in the process of buying a terminal antenna.** In which case it might be smart to invest in a dual-polarized feed and to cap off the unused polarization for now. **It's not a big deal. . .**hopefully cool heads will prevail in the industry and it will stay a 'small deal'.

(5) **"WESTAR is converting to 6.8 MHz aural subcarriers. . .".** We are not sure why anyone really cares about this one; the only reported **CATV** service is the infrequent premium programming from Robert Wold and to the best of our knowledge only a single (Kentucky) system is taking it (**if** the programming really exists; **we** have yet to run into it). At any rate, it appears Western Union **is** going to 'standardize with SATCOM' at the 6.8 MHz aural subcarrier offset.

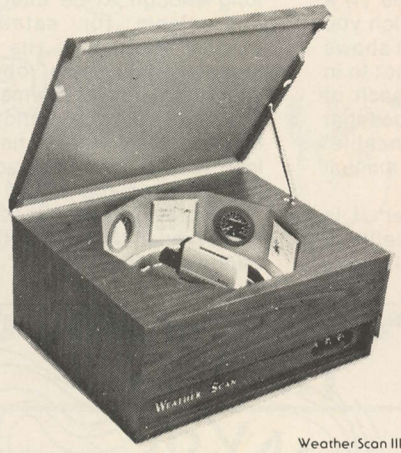
(6) **"Receiver prices are coming down. . .".** The truth is found in your interpretation of the 'rumor'. Hughes had a new 'single channel' receiver at San Diego. It is their SVR-462 (the 24 channel tuneable is the SVR-461). It **will** sell for 'under $5,000' according to Hughes people. Now here's the interesting part. Hughes **removed** their (24 channel) BCD tuning apparatus from the 461 and they give you (1) **a hole** in the cabinet through which you adjust a pot, and, (2) **a chart** that shows you what voltage to adjust the pot to in achieving receiver 'tuning' to **each** of the 24 transponder channels. Does that not mean it is still a 'tuneable' receiver? How about calling it a manual tuning receiver?

As a 'single channel receiver' it is more expensive than the competition. As a 'tuneable receiver' it is less money. It's a trade off, and an interesting one.

And the final rumor of the show.

(7) **"The satellites may fall down. . ."** There he was, impeccably dressed, right off of the airplane from New York. Apparently he'd been at WCTS just long enough to be infected with the enthusiasm for satellites racing through the crowd. His own internal measuring system obviously had caught the tone of the meeting. Racing down the hall to yet another meeting, his head filled with all he had recently learned and his fever racing with the emotions of the crowd he stopped dead in his tracks and said, to no-one in particular, **"Hey. . .do these satellite things ever fall down???".**

First In Reliability



Weather Scan III

Impressive quality . . . surprisingly low price. Just $2695 for the most reliable unit available (at any price!).

We have been in the cable television business for 23 years . . . and providing weather information systems for the past 16 years. We know what you need and we know how to manufacture it. For reliability and performance.

The Weather Scan III comes complete with Sony AVC-1400 camera with separate mesh vidicon and 2:1 interlace sync. Includes Time, Temperature, Barometric Pressure, Wind Velocity, Wind Direction, plus four card holders. Compact cabinet is just 38" wide, 23" deep and 14" high. For complete information call or write.

Weather Scan, Inc.

An R.H. Tyler Enterprise

Loop 132 and Throckmorton Hwy. Olney, Texas 76374 Ph. 817-564-5688

the new Sadelco

MODEL FS-733 B/SUPER DUAL-RANGE (VHF/Superband)

has an economy price tag that you'll really like...

Call us or write for your free color brochure.

Portable test instruments by Sadelco are available at major CATV Distributors.

Sadelco, Inc.

299 Park Avenue, Weehawken, New Jersey 07087 / 201-866-0912

General representative for Europe: Catec AG Luzern/Switzerland, Habsburgerstr 22. Tel. 041-41-75-50 Telex TELFI 78168. IN CANADA: Comm-Plex Electronics Ltd.

Oak banishes pay-TV piracy!

A double-edged attack on pirates

Pay TV pirates can cost you a great percentage of your profits, especially if you fall into the "trap" and trust soft security.

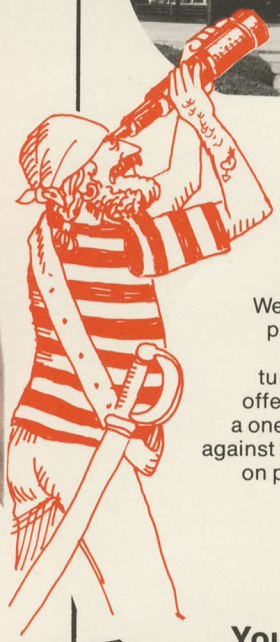
With the Oak single-channel Econo-Code or 35-channel Multi-Code, you can choose between two safe ways to guard your profits. Either of these hard security systems offers the greatest protection against theft of service in the industry.

Built and backed by Oak

All Oak CATV products are built in company-owned facilities ...your assurance of our commitment to the industry.

Key-lock option for the captain

When the captain demands control, you can offer the Oak key-lock option. This option gives customers the comfort of parental control of premium channels.



Smooth sailing

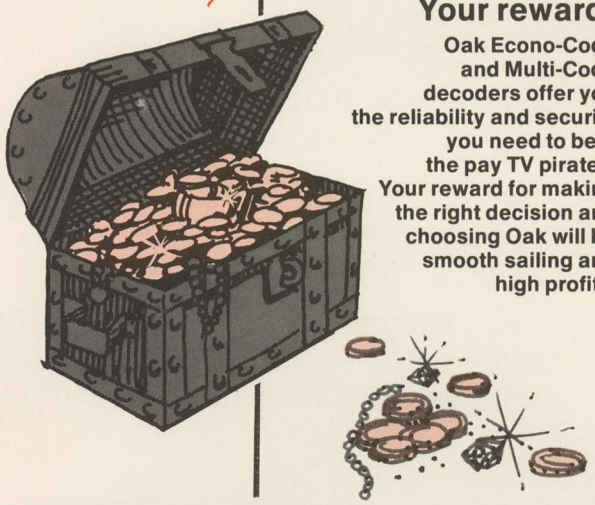
We follow up with prompt delivery, rapid service turn-around, and offer all customers a one-year warranty against factory defects on parts and labor.

Requires only one channel

If you're running a tight ship with space problems, relax. The Oak premium encoding/decoding information is transmitted within a standard TV channel. By using an Econo-Code, you can add pay TV to your existing 12-channel system. Econo-Code converts and decodes a mid-band channel to a low-band channel, allowing you to utilize your existing distribution system. If you require two pay channels, Oak will supply a two-channel Econo-Code as an option.

Your reward!

Oak Econo-Code and Multi-Code decoders offer you the reliability and security you need to beat the pay TV pirates. Your reward for making the right decision and choosing Oak will be smooth sailing and high profits.



A jewel case holds all

The 35-channel set top or Jewel Case Multi-Code allows you to pre-determine any combination of encoded channels, up to a total of thirty-five. Channel selection is easily accomplished with a single detented rotary control. Varactor tuning and wide range AFC provide highest reliability and stability. An attractive Jewel Case remote control is offered as an option.

OAK Industries Inc.

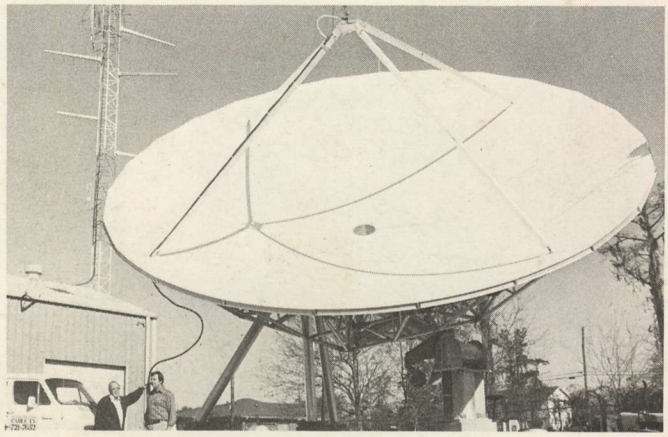
CATV DIVISION / CRYSTAL LAKE, ILLINOIS 60014

TELEPHONE: 815-459-5000 TWX: 910-634-3353

When It Comes To Earth Stations

We Try Harder!

Ask Our Customers



East Bank Cable
Kenner, La. (John Sims)

Turner Communications CH. 17 (WTCG)
Atlanta, Ga. (Gene Wright)

Hampton Roads Cablevision
Newport News, Va. (Britt Belyea)

R.F. Systems, Inc., subsidiary of Comtech Laboratories, Inc., has supplied more quality antenna systems to the CATV industry, OEM's, than any other antenna manufacturer in the past fifteen years!

Valley Cable T.V.
Harlingen, Tx. (Ollie Hensler)
Photo by Raul Cano

If you want straight-forward answers on the best 6-meter and 10-meter earth satellite terminals available, ask our customers (including other TVRO manufacturers) or give us a call at (305) 892-6111.

RF SYSTEMS, INC.

3100 Communications Rd., St. Cloud, FL 32769, (305) 892-6111
P.O. Box 428