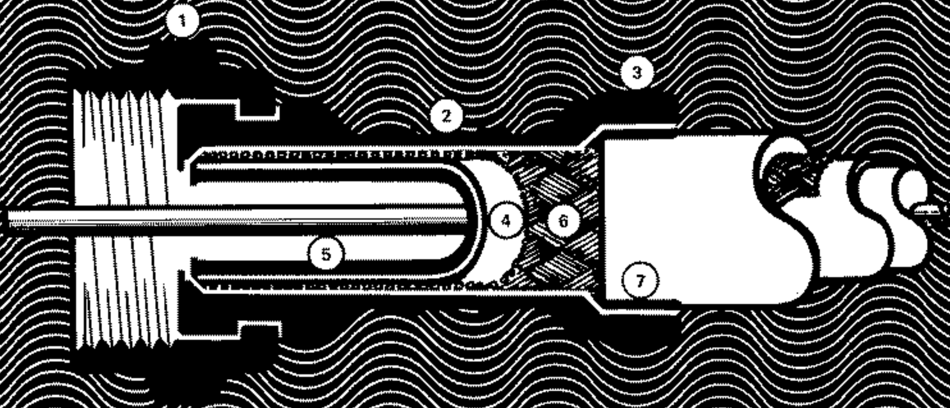

CATJ
AUG.
1975



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CATJ

AUG. 1975

VOLUME 2

NUMBER 8

PUBLISHED MONTHLY, AS ITS OFFICIAL JOURNAL, BY THE COMMUNITY ANTENNA TELEVISION ASSOCIATION, INC., OKLAHOMA CITY, OKLAHOMA AS A SERVICE TO THE CATV/MATV INDUSTRIES SERVING THE AMERICAN TELEVISION VIEWING PUBLIC.

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Subscription rates: $10.00 per year for non-CATA members; $8.00 per year for CATA members. $7.00 per year for system personnel requesting "at-home" delivery. In Canada, $11.00 per year for non-CATA members, and $8.00 per year for system personnel. Single copies, $1.00 each as available.

Third Class Postage rates paid in Oklahoma City, Oklahoma; Second Class nonprofit association application to be filed in 1975.

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

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OUR COVER

Telco maintains construction practices which (we are told) we should try to emulate. Our front cover shot this month suggests that not all TELCO personnel follow the book. We'll have more to say about TELCO construction practices and pole problems in September/October CATJ.

CATA-TORIAL

KYLE D. MOORE, President of CATA, INC.

Creeping Federalism

Unlike the fog which crept into Chicago on cat's paws, the encroachment of federal power into purely local affairs seems to know no ends. At least the fog blew away when the winds shifted.

First it was microwave (1963—**Carter Mountain v. FCC**); then it was a freeze in the Grade A contours of the top 100 markets. Then it was a freeze to end all freezes, rivaling the ice age. Following which there was the gentle application of federal heat to semi-thaw the federally imposed "freeze". If you wanted the federal heat turned **in your direction,** you had to **agree to play the game by federal rules** (i.e. play it any other way, and you couldn't play at all).

The attempt of the 1972 rules was nationalization of cable policies. We would **all** have 20 channel capacities, two-way capabilities (there is a funny story about how Dean Burch got us involved in two-way, which we will save for another day), local origination, public/educational/government access, franchises that must conform to federal mandates, ad infinitum. Everything that we as an industry would do, after March 31, 1972, would be with the able "helping hand" of the federal power structure.

Since 1972 we have seen strict new non-duplication rules, **and then change.** Strict new local origination rules, **and then change.** Strict new franchising rules, **and then changes on top of changes** on top of changes (does anyone **really** understand where we are **today** on franchising standards???). The Commission, en banc, has inundated our tiny, not-all-that-important industry with rule making actions that would, with rare exception, **adversely impact** (how's **that** for federal talk!!!) our revenue base and further restrict television viewing diversity.

Good grief. And all we really wanted to do was to bring clear and more abundant **"microvolts to the masses".**

The Commission has a defensive answer for virtually everything. When you point at the present "freeze" in new system construction (a **CATJ** study of equipment suppliers tells us business activity **is from 30-70% below** last year's comparable levels, and last year was a bummer); the Commission responds **"But look how many CAC's we are processing".** Paper work, their strong suit, is our undoing.

When you point at the idiocy of the so called "technical standards" and the **trial-run tests** we have been conducting since 1973, and will continue to conduct for two more years, the Commission responds **"But look at how we have put off 1977 re-build requirements".** Commuting a death sentence for an innocent man is hardly meritorious.

When you complain about non-duplication rules and try to make the point that after 28 years of CATV, there still has been **no documented evidence** that cable endangers the financial well being of "public-spirited broadcasters", the Commission points at their recent rule makings that **reduced** non-dup compliance to **only** those systems with more than 1,000 subscribers, and then only within 35 miles of a top 100 or 55 miles of a smaller market city. Restricted viewing choice through federal fiat is censorhship, **no matter where it is applied.**

And when you go to the time, trouble, effort, and expense of preparing a well documented history of FCC mis-handling of television allocations since the late 40's and show a **continuous demonstrated favortism** by the Commission for the "financial well being" of two or three networks and a handful of fat-cat major market telecasters, as **CATJ** did in the recent March and April issues, how does FCC Chairman Richard E. Wiley respond to the charges? By answering an honestly concerned inquiry from Senator Ted Kennedy with the retort "...The fact that Americans now enjoy radio and television service second to no other in the world indicates that the Commission has been reasonably successful in the discharge of its duties...." (see **CATA NEWSLETTER,** July 1975).

During July President Ford held a meeting with his executive staff and leaders of major federal regulatory agencies. All seven FCC Commissioners were on hand. President Ford said "...free and open competition...is the best form of regulation". And, "we must remove long-term impediments to faster and more efficient (federal) agency actions". **Most** of the regulatory bodies represented at that meeting gave the President reports of what they were doing or will do to streamline their activities. **Most** stressed that they were concerned about cutting out red tape where the end result of the red tape was pure and simple increase in costs of goods and services to the ultimate consumer; the public. The argument that regulation costs money, not only tax paying dollars to administer, but consumer dollars to offset the supplier costs of complying, and that these costs **often far outweigh real benefits** to the consumer, is an excellent one. The argument holds a great deal of water when applied to cable's problems today.

FCC Chairman Wiley did **not** make a verbal report to the President. Rather, Wiley said afterwards to the press "We feel we are in real good shape", and, "...the FCC has already simplified or eliminated some 300 rules...."

Wiley apparently believes the current Executive Branch interest in de-regulation is for somebody else; **not the FCC.** We suspect he has in mind "token compliance" with the Executive Branch dictums. **We hope we are wrong;** because his agency is resplendent with rules and regulations that do nothing more than perpetuate the meteoric growth of the bureaucracy.

And as a broadcaster said so tastefully in June, with respect to **re-regulation**: "If you have lice, which would you prefer? To be reloused or de-loused"? The FCC needs close monitoring of its **re-lousing** program. The Commission is preparing proposed legislation to submit to Congress to give it plenary jurisdiction (i.e. **read complete and absolute**) over CATV. While the FCC now **pretends** that it has such jurisdiction, and often acts as if it already had such authority from Congress, our goal as an industry when this new "cable act bill" reaches Congress should be to **relieve** the FCC of its authority; **not to codify its pretensions.**

CTAC STUDY

The much belabored CTAC report to the FCC, relating to our industry's views of where we should be going with technical standards in the years ahead, is now available in part, through the Society of Cable Television Engineers.

Volume I, the CTAC Steering Committee Report to the FCC, plus selected excerpts from Volume II, the Technical Panel Reports, is priced at $8.50 to SCTE members and $11.00 to others.

Order directly from the SCTE at Communication/Engineering Services, 1300 Army Navy Drive, Arlington, Va. 22202 with checks made out directly to SCTE.

PERHAPS YOUR COMMUNITY CANNOT LEGALLY GRANT YOU A CATV FRANCHISE

Even the most casual acquaintance with the literature of cable television would probably be sufficient to reveal that this valuable communications industry had its origins in the hinterlands of Pennsylvania and Oregon. CATV got its start by providing much-needed service to small and medium-size communities outside of the primary service areas of metropolitan television stations. And while the development of local origination, two-way facilities, and other services has made CATV increasingly more attractive in big cities, the cable industry's need to serve the smaller community has not been outgrown. One of the main reasons that this is true is that, even today, the demand for cable television is at least partially based on the demand for *television.*

Obviously, "demand" is not the single determining factor in CATV growth. The economic composition and the population density of an area are examples of very real considerations in predicting the success or failure of a given system. Given the economic realities of CATV, few people are shocked to discover that, in many cases, the areas with the greatest need for television service are precisely those areas in which CATV is an unlikely solution to the problem. Yet, there are circumstances in which the economic prerequisites exist, and growth continues to be inhibited.

Some cable companies and communities are faced with the unhappy choice of either admitting that no franchising authority is available to them or playing a guessing game over the identity of that authority. Despite the recognition by both company and community that cable service might be mutually advantageous, this dilemma has gone so far as to actually preclude the availability of CATV to the very type of community which spawned this industry. It's unfortunate but true that, after more than a quarter century of the evolution of cable technology and the definition of regulatory apparati on the various governmental levels, the expansion of cable television in the United States is limited by what might easily be termed *regulatory oversight.*

This problem will be illustrated by the discussion of the lengths to which West Peoria, Illinois, has gone in its attempt to obtain cable television. It is in this small, suburban community

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where a serious impediment to CATV growth has come to light—an impediment caused, not by considerations of demand or operational cost, but by a flaw in the jurisdictional fabric of CATV.

The West Peoria Plight

On October 8, 1974, the town of West Peoria, Illinois, brought suit against General Electric Cablevision Corporation in an effort to secure cable television service for that community. Central to that action was a jurisdictional question which might easily have gone unasked. The defendant attributed its reluctance in extending service to West Peoria to "a very complicated legal question which must be settled," but steadfastly maintained that it *did* want to serve West Peoria. Attempting to clarify General Electric's position on the matter, the local manager told the Peoria *Journal Star* that "Some people in West Peoria have said we don't want to serve the area and that is simply not true."

West Peoria is a town of approximately 6600 people that is surrounded on three sides by the City of Peoria. Its small area, relatively high population density, and proximity to a city in which a cable system was already operational would seem to characterize it as a likely target for CATV service. And, as if to dispel whatever remaining doubt a cable company might have in respect to offering service, the citizens of that community are eager to acquire cable television. "The real value," explained West Peoria's Supervisor, "is the availability of additional channels both local and Chicago based. There are a lot of Cub and White Sox fans in West Peoria eager to watch these teams play ball from the comfort of their living rooms."

The "complicated legal question" that so effectively reduced this picture of apparent harmony between company and community to one of litigation is this: West Peoria is a *township.* Prior to this case, the ability of a township in Illinois to grant a CATV franchise had never been specifically addressed, either by statute or by judicial interpretation.

General Electric Cablevision Corporation began offering service to metropolitan Peoria on April 16, 1973, when the first drop was hooked up in suburban Peoria Heights. Service was extended into Bartonville and Peoria shortly thereafter. The addition of West Peoria, a community nearly en-

Preparing—Part Two

In the September, 1974 issue of **CATJ**, we dealt with some of the underlying problems facing the industry as it attempts to prepare for the March 31, 1977 deadline for FCC "franchise standard compliance".

The Federal Communications Commission has mandated that by March 31, 1977, all systems in operation (including so-called grandfathered systems operating prior to March 31, 1972) must have full compliance with applicable (FCC) rules and regulations. Particularly sticky is the question of "franchise-format-compliance". In a fluid atmosphere created by the FCC, franchise standards are at best undefined and at worst subject to the interpretational whim of the FCC staff attorney processing an application for compliance.

To complicate matters, the various states and communities have shown some reluctance to adopt state statutes which allow municipal entities to write franchises "to meet the federal specs".

1977 looms ahead; but as researchers Geary and Carlberg point out, the chances that the industry can comply are thin at best, lacking cooperation at the state level with federal guidelines mandated.

cased by the City of Peoria, beyond yielding enthusiastic subscribers, would have provided the system with a more direct line to its existing franchise areas. Had General Electric not questioned West Peoria's jurisdiction, there is every reason to believe that the complaint against it would not have been filed. Had that been the case, however, the problem would have been eliminated—just put off.

To the extent that General Electric's precautionary stance is founded upon its unwillingness to jeopardize the substantial capital outlay involved in setting up cable operations, it can hardly be blamed. Yet, this unemotional observation is small comfort to the resident of West Peoria who knows that his neighbor across the street has access to programs and services that are unavailable to him. Indeed, the position assumed by General Electric could even appear arbitrary and unjust when viewed in light of the knowledge that no less than *nine* Illinois townships are currently being served by or have entered into franchise agreements with cable television operators (the 1975 *Cable Sourcebook* lists the following Illinois townships as having granted franchises: Bruce, Coloma, Eagle, Hopkins, Mont Mercy, Otter Creek, Reading, Rockton, and Sterling). This fact, rather than deciding the controversy, merely intensifies the need for its swift resolution.

Before any meaningful analysis of the West Peoria situation can be carried out, it might be helpful to review the traditional justifications for local control of cable television.

Regulation By Need

Historically, authority over CATV was almost exclusively the domain of the locality during the first decade of cable development. It was not until 1958 that the Federal Communications Commission formally addressed the question of its jurisdiction over CATV, only to deny a broadcaster's request that cable television be subject to FCC control (*Frontier Broadcasting Co. v.* Collier, 24 F.C.C. 251). As a result of hearings conducted the following year, the FCC confirmed its refusal to bring the fledgling industry into its regulatory purview (*Inquiry into the Impact of Community Antenna Systems*, 26 F.C.C. 403). But, after having indirectly asserted its authority over cable television in *Carter Mountain Transmission Co.* in 1962, the Commission finally claimed general jurisdiction in 1965 (*First Report and Order*, 38 F.C.C. 683).

The role of the state was established even later. A relative newcomer, the state was not firmly situated in the regulatory hierarchy until 1970 when, in *TV Pix, Inc. v. Taylor*, the U.S. Supreme Court affirmed the authority over CATV claimed by the Nevada Public Service Commission. (This, of course, is not to say that some state governments hadn't claimed the power to regulate CATV prior to *TV Pix*. Notably, the Wyoming Public Service Commission assumed jurisdiction in 1953, though that assumption was comparatively short-lived, being judicially invalidated in 1958. Connecticut successfully granted franchising authority to its Public Utilities Commission in 1963.)

In the absence of these higher levels of authority, it was the local government that assumed jurisdiction from the outset. Since cable television obviously involves the stringing or laying of cables in order to distribute its signal, permission must be obtained to use the public rights-of-way along which the cables are to be located. Most commonly, this permissión has taken the form of a franchise, permit, or similar exercise of local authority over public streets and ways. Indeed, when the FCC announced its current CATV policy, the decision to avoid the conventional licensing process was partially attributed to its recognition that "local governments are inescapably involved in the process because cable makes use of streets and ways" (*Cable Television Report and Order*, 36 F.C.C. 2d 141, 207). Apart from those comparatively infrequent cases in which the relationship of the local government to its streets is circumvented (e.g., where a state has vested exclusive control over telephone companies in its public utilities commission, the local government may lack any basis of authority over cable systems which make use of telephone company cables for the distribution of their product, *city of New York v. Comtel, Inc.*, 293 N.Y.S. 2d 599) local jurisdiction over streets and ways remains intrinsic to CATV regulation.

The physical use of public ways thus established the locality as the most direct and, because of that, the earliest franchising authority. But, while state governments seem to have been neatly bypassed in the history of cable regulation, it is, nevertheless, the state which has primary jurisdiction over the franchising process. "The power to grant franchises resides in the state; and a city, in granting a franchise, acts as an agent for the state." (12 E. McQuillin, *Municipal Corporations* Sec. 34.10.) The unit of local government is a creation of the state whose powers are but manifestations of the act of its creation. An examination of the traditional forms of local authority over CATV reveals three methods by which franchising power has been derived from the state: by express grant, by home rule, and by implied power. (For both an excellent and a thorough discussion of this point, see Richard W. Byrum, "Channeling the Energies of Cable Television: A Case for Positive State Involvement," 5 *Urban Lawyer* 376 [Spring, 1973].)

Inasmuch as the source of all local power is the state, certainty as to the franchising ability of a local governmental unit requires that attention be paid to the actual *expression* of that particular unit's authority. Even where an express grant of authority over CATV exists (and at last count, only seven states have specifically empowered designated units of local government to franchise CATV) the assumption that the grant is applicable to *all* political units within that state is, at best, a gamble.

Control of public ways has been the customary basis for local franchising of cable television, and the assumption has been that this franchising authority can be *implied* from the jurisdiction over streets and ways that has already been delegated to the local government (e.g., see *Community Antenna Television of Wichita, Inc. v. City of Wichita*, 205 Kan. 537). So, in the absence of a statute which *clearly* identifies the franchisor, both the cable operator and the community would be wise to consider whether or not the power to grant a CATV franchise can be implied from the authority over public streets which has been given to the community in question. That may be more easily said than done, except through the time-consuming and often costly route of judicial interpretation. To make matters worse, there is no guarantee of uniformity from state to state. The acts which create and define the powers of the various political units can differ, not only between states, *but within a given state as well.*

Home rule is a product of constitutional or statutory design and it too can vary from state to state and from community to community. And while it may provide a community with an alternative to resting its franchising hopes on what might be a very slender authority over its streets, home rule units are not always neatly coincident with areas desirous of cable television.

Questions surrounding the identity

of the legitimate franchising body have become even more pressing since the issuance of the FCC's 1972 *Cable Television Report and Order.* Stemming from the *Report* is the rule which provides that "no cable television system shall commence operations or add a television broadcast signal to existing operations unless it receives a certificate of compliance from the Commission." While the FCC considers the franchise to be a prerequisite to its granting a certificate of compliance, the designation of the franchisor remains a matter for state interpretation. The recent regulations do not define the relationships between state and local entities. However, it is evident that they are not meant to, for, as the Commission itself points out, the FCC has "no desire to become involved in the interpretation of state laws. (*Clarification of Rules and Notice of Proposed Rulemaking*, 39 Fed. Reg. 14293 [April 22, 1974].)

In lieu of a challenge to the authority of the franchisor, these considerations are merely academic. *Still, it is evident that neither the granting of a franchise by a community nor the issuance of a certificate of compliance by the FCC necessarily constitutes assurance that no questions concerning the legitimacy of the franchise will be forthcoming.* Even if most state and local governments adhere to FCC policy as a necessary prerequisite to cable service, the cable operator *himself* may have cause to question the power of the local entity to grant the franchise—a question that the certificate of compliance does not address.

Despite all that has been said up to this point, the evolution of the regulatory structure for CATV has successfully minimized the occasions in which the identification of the appropriate franchising authority poses a major problem. Circumstances in which this authority is either incorrectly placed or open to question are limited. Yet, such circumstances do exist. West Peoria is proof enough of that.

TV Pix, Inc. v. Taylor confirmed the idea that a CATV system is, both by its nature and by the absence of preemptive federal interest, one of local import. Jurisdiction over public ways is delegated to the local government by the state, but the *classification* of the particular unit of local government can act as a determining factor in establishing the nature of that jurisdiction and the extent to which it is applicable to CATV. The apparent refusal of General Electric to look upon "local government" *as a collective term* compels the examination of the franchising powers of the specific type of local government—in this case, the Illinois township.

Illinois As An Example

As a question of Illinois law, the problem can alternatively be defined as one of West Peoria's *not* being a municipality. In the State of Illinois, the ability of the "municipality" to grant a CATV franchise has been both granted by statute and upheld through implied right.

In *Illinois Broadcasting Co. v. City of Decatur* (238 N.E. 2d 261), the Court held that a municipality has the power to grant a franchise to a CATV operator by virtue of its specified authority to regulate the use of its streets and ways. (The Court noted that an extensive basis of authority already existed in respect to municipalities, citing such statutory provisions as: "Use of Streets," "Obstructions upon Streets," "Use of Space over Streets," and "Crosswalks, Curbs, and Gutters.") Recognizing that an express grant of municipal jurisdiction over cable television had been enacted while the case was still in progress, the Court concluded that, *irrespective of the express grant of authority,* municipalities already enjoyed sufficient power to issue a CATV franchise. (The Court acknowledged that, so long as the use is reasonable, in the public interest, and carried out in a way which respects the public's right to safety, a municipality may authorize the use of its streets.)

Although its implied right would have been adequate, an Illinois municipality is now empowered by statute to deal with cable television. At the present time, however, municipalities possess the distinction of being the *only* clearly specified entity in Illinois with the power to regulate CATV. (Although the word "regulate" does not appear in the wording of the statute, the Illinois Supreme Court explained that it had "no doubt that the power to franchise and the power to license carries with it a power to regulate.")

West Peoria, as a township, lacks express authority over cable television by virtue of its exclusion from the definition of "municipality" that is contained in the *Municipal Code:* " 'municipality' does not include a township, [or] town when used as the equivalent of a township." Moreover, unlike municipalities, townships in Illinois do not qualify as home rule units, thus eliminating that as a possible solution to the problem.

While a municipality was found to have not exceeded its jurisdiction over public streets by granting a CATV franchise, the basis for implied power is not nearly so broad in the case of a township. According to the Illinois *Constitution,* "townships . . . shall have only [limited] powers granted law." And of those powers enumerated in the *Township Organization Act,* no reference is made to general authority over streets and ways, *franchising ability,* or cable television.

Recourse, then, to the traditional methods used to justify local jurisdiction over CATV affords the township little cause for rejoice. Although a township may resemble a municipality in matters of geographical location, population density, and desire for CATV service, its resemblance to a municipality as a political unit is slim.

Probably to no one's great surprise, the Court, in June of 1975, dismissed

Challenging The Challenge

If a state has failed to adopt legislation (or if the state's constitution fails to authorize) procedures for an "area" to grant a CATV franchise; **what then?** Perhaps **the FCC** is satisfied with its own provisions which allow someone to gain a Certificate of Compliance in the absence of a franchise, if a showing can be made that no such authority exists. But what about the financial risk attendant to the operator building the system?

What about nine Illinois areas that have granted "franchises", when it appears that these "franchises" are not **valid** in that state? Some of these already have FCC Certificates of Compliance. Does **that** make them legal? Has the FCC stepped into state delegated power areas to usurp state powers? What happens if someone decides to challenge these nine Illinois franchises? Are the systems out of business? Are the operators there open to take over by other "operators" who know the law and "know" that the franchises are invalid?

Could the FCC, since it granted a Certificate in these communities, become a party to the case? And if yes, on which side would they function? Could the existing "franchised operator" sue the FCC for granting him a CAC when in fact his original franchise was not valid by reason that the "municipality lacked state jurisdiction" to grant a franchise? Could the original operator claim "he had federal authority to build and operate", and that "he needed no other", even if his franchise itself is not valid?

Are you confused? **You are not alone!**

the West Peoria case on the basis of that community's lack of jurisdiction over the matter. So, from the standpoint of the most obvious remedy available to it, West Peoria is situated in a jurisdictional void. Or is it?

Does Anyone Have Authority?

What might have been a possible alternative to its lack of authority was severely undermined by an April 17, 1974, opinion of the Illinois Attorney General. Considering the question of whether or not a *county* has the power to license or franchise CATV in the unincorporated areas which lie within its boundaries, the Attorney General reasoned that, because it is given no express authority over CATV, and because its jurisdiction over roads and highways is not as extensive as municipalities' jurisdiction over streets and ways, there is no basis for the implied power necessary for franchising cable television. (The Attorney General hinted that home rule counties may be exempt from his ruling. In any case, West Peoria is *not* located in a home rule county.)

That the problem of township—and, for that matter, county—jurisdiction over cable television is one which should be resolved by legislative action is made clear in the light of state primacy in matters of public streets and ways. (This is not to say that state regulation of cable television is being recommended. That is a different matter altogether. However, where existing statutes serve to *dis*enfranchise certain communities from cable service, the most logical and effective remedy would seem to be state action.) Moreover, it has been suggested that it is not the place of the courts to rectify whatever loopholes might exist in CATV regulation. An Illinois Circuit Court, while commenting in an earlier case, insisted that questions such as this "are matters of State policy which, regardless of one's personal opinion as to the present need for regulation of cable TV . . . must be dealt with at their proper source, i.e., the Legislature of the State of Illinois."

The FCC has been mindful of the fact that areas presently exist wherein no authority has sufficient power to grant a franchise. In its 1974 *Clarification of Rules*, the Commission explained that it has granted certificates of compliance when "an appropriate alternative proposal is supplied." This alternative consists of "an application claiming that there is no local authority capable of issuing a franchise or other appropriate authorization." The FCC is quick to emphasize, however, that

> "We do not like this procedure but see no way around it so long as some states delay designating the appropriate local jurisdictional authority . . . We would urge, . . . that in the few remaining areas where this problem still exists it be clarified at the state level in the near future."

As an alternative to a community which is desirous of CATV service but which is in want of authority to grant the franchise necessary to secure it, the FCC procedure may be welcome relief. But, especially in view of the FCC's lack of enthusiasm toward this alternative, it probably would be of significantly less value to a cable operator who wants something more in the way of *assurance* before commiting himself financially.

Again, the most expedient, unequivocal, and, indeed, *happy* answer to a jurisdictional problem of this nature would emanate from state action. To this end, a bill was introduced into the Illinois General Assembly in 1974 which would have amended the *Township Code* to permit the franchising of cable television by townships. That bill died in committee. *Clearly, West Peoria is the victim of regulatory oversight.*

Are They 'Legal'?

Of course, this raises questions concerning, among other things, the legitimacy of the franchises of those several systems currently serving the nine Illinois townships. Can such townships seek remedial action if the cable operator fails to abide by the terms of the contract? Is the operator subject to the whims and caprices of the franchisor out of fear for its investment? These same questions can be asked in relation to a none-home rule county which has granted a CATV franchise (yes, Illinois has *them* too!), an exercise, according to the Illinois Attorney General, of a power which it does not have.

Interesting and worthy of study as they might be, these questions do not directly proceed from an earnest wish to either provide or receive cable service. Rather, they are the result of the regulatory oversight which caused them to be asked. More relevant to the issue would be actions which would result in an equitable and orderly expansion of cable television into all areas that want and can support it. In a period when increasing public acceptance, rapid technological change and intensified regulatory activity on all levels of government foretell the continued growth of cable television, these gaps in the jurisdictional structure of CATV seem that much more unfortunate and old-fashioned.

Perhaps the most devastating note of all is that there are indications that this is not solely an Illinois problem. The FCC, of course, implied that in the statement cited earlier. Beyond that, while there have been no legal challenges paralleling the West Peoria case, both Kansas and Indiana may well be suffering from the same ailment. Both states have enacted statutes granting franchising authority to "municipalities," but in *neither state* does that power *extend to townships or counties*. Furthermore, recent correspondence with Indiana's Public Counselor and Kansas' Acting General Counsel for the State Corporation Commission suggests that it is improbable that those political subdivisions have the ability to franchise by means of home rule or implied power. (Interestingly, as in Illinois, *Cable Sourcebook* lists some Indiana townships as having granted CATV franchises.) Curiously, officials in several other states were unwilling to address themselves to the question. Could it be that they were made aware of a problem that they didn't know existed?

Nebraska, on the other hand, has alleviated the problem. While townships in that state have not been given the authority to grant franchises for cable television service, all Nebraska counties have been empowered, since 1971, to regulate and franchise on behalf of those unincorporated areas within their boundaries.

Cable television is a relatively recent phenomenon, so it is understandable that all the questions that are capable of arising from it have not been answered. Still, provisions must be made to allow all areas in the state to have specific franchising authorities. Nebraska is a shining example of the ease with which this problem can be eliminated. As for those other states where this problem continued—most notably, Illinois—legislative amendment is probably the best solution. And the sooner the better.

The frustration of West Peoria in not receiving cable service is likely to be no greater than General Electric's in not being able to provide it. Neither a community nor a cable operator can be condemned for aspiring to begin service as rapidly as possible, but it is imperative that *all* facets of the negotiation be investigated as thoroughly as possible. The existence of a case in which the granting of a franchise is found to have been presumptuous suggests that, in comparison to operational considerations such as rates, services, and fees, the *jurisdictional* consideration may have been taken too lightly. But even more unsettling is this characterization offered by West Peoria's Supervisor, Daniel R. McAvoy: "It is ridiculous when one party wants to buy a service and the other presumably wants to sell it and they have to go to court to accomplish it."

Fix AFC Problems

A SOLID STATE DOWN CONVERTER FOR COMMANDER I

This is one of those "projects" you have always wanted to do, but it took a system operator coming to us with a problem and a plea for a "low-cost solution" to get us off the dime and onto the bench.

Having come into the CATV world in the mid 1960's, I cut my teeth on Channel Commander One headends. Anyone who has ever had the Com-1 experience knows that this basic signal processor by Jerrold took us out of the dark ages of straight-through (on channel) signal processing by offering the option of heterodyne processing.

In these troubled CATV times, it is somewhat comforting to recall through ten-year-old filters that *this was a dynamic era.* Equipment changed (for the better) almost before your eyes; what was good and current yesterday was outmoded and headed for the museum today. Transistorized equipment made the scene, plants got longer and longer, and Jerrold brought out the Commander One.

by:
Steve K. Richey
Richey Development Company
Oklahoma City, Oklahoma 73107

The Commander was introduced at a time when a whole new myriad of problems were being offered to CATV: *technical problems* with *technical solutions.* There were new stations and with them came adjacent channel interference. Then there was color smear, as more and more stations went to more and more color. Off-air distances increased, and as we went further into the fringes we discovered we need more AGC range. And then channel conversion hit us square in the headend as we moved into markets with one or more local stations. Finally, with heterodyne processing, we discovered the phrase "beats."

The Commander One had the headend world by the tail in this era, and after a few false starts with early units, the world suddenly looked better; better that is, than it had looked before with demods and re-mods, and on channel processing.

So it was the rare headend that did not have at least one Commander One. But today, a scant ten years after the introduction of this most popular and successful headend unit, where do you find them? Usually in small systems where updating costs too much, or larger systems in backrooms gathering dust in a pile next to other relics of an era gone by; relics such as the Super 60, the AV-7, and the ATM-50.

Our message, naturally, is that this is not really necessary. Not if you address the major problems of the Commander One, and set about to *solve* them one by one. What is so terribly wrong with the Commander One?

Priority Objections

(1) AFC drift

(2) Tuner overload (strong signals zap it)

(3) Tubes (aging and replacing is a pain)

(4) Output oscillator drifts as tubes age

(5) Dirty contacts (on turret tuner)

There may well be other problems, but they seldom give the operator as many fits as the five just listed. If you will notice, *the tuner is the problem*, as a sub-module, not the Com-1. Anyone who has used (or is using) a Com-1 knows of the daily (usually morning) trips to the headend to flip the AFC switch off, turn the fine tuning 1/32nd of a turn, and then flip the AFC back on. Shortly after the Com-1 hit the industry, word was out about a prototype crystal-controlled down converter for the Com-1. Thus shortly after the Com-1 was introduced, everyone (including Jerrold) *knew the tuner was the major shortfall* for the design.

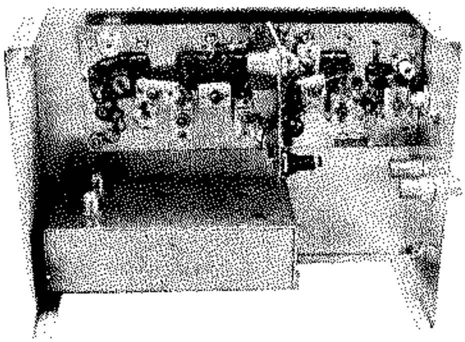
Other than the tuner (which we will address ourselves to), the major complaint is that the unit is tube design. Frankly, within reasonable redesign-cost parameters, there is little that can be done about that; *with one exception.* The output oscillator (part of the drift problem) *can be replaced* with a solid-state Fetron TS6AK5 (made by Teledyne Semiconductor). This will cure *that* portion of the drift problem. Additionally, if real care is used in aligning the Com-1 I.F. and the match between modules is truly optimized, *it is possible* to go through tube change-outs with little degradation in performance (and thus avoid realignment).

DESIGN YOUR HEARTS OUT

Normally construction features in CATJ take on reasonably detailed step-by-step instructions, or they rely heavily on some design criteria which even modestly experienced personnel can cope with.

This is the exception to that rule. A solid-state front end for the Channel Commander One series headend signal processors may well be beyond the capability of the average bench tech. However, we have a different purpose in mind in presenting this piece. There are unknown numbers of Channel Commander One units still operating in the CATV industry. When **CATJ** ran a survey of reader interest, in last year's August issue, readers voted our (frankly) manual-oriented "Alignment Procedures For Channel Commander One" near the top of the list. This told us that practical features dealing with commonly utilized CATV equipment have real interest and serve a useful purpose.

Now most anyone with real bench savvy can duplicate Steve Richey's instructions given here and come up with a state-of-the-art solid-state front end for a Commander One. But if you have never constructed something from scratch, other than a step-by-step Heathkit, we advise you to leave this one alone. Rather, profit from what it teaches you about design problems, and, run down some guy in the next town who has the necessary savvy to put this one together for you. It will be well worth the effort, because now for the first time you can forget about "morning visits" to the CATV headend to re-lock the Commander One AFC!



Curing The Tuner Problem

The design criteria for curing the tuner and its associated problems was this: the replacement module, a solid-state crystal-controlled down converter, must interface directly with the Com-1 mainframe. That is, unhook the Com-1 turret tuner RF/I.F. Connections, plug the cables back into the new solid-state replacement, and slip the replacement into its main frame.

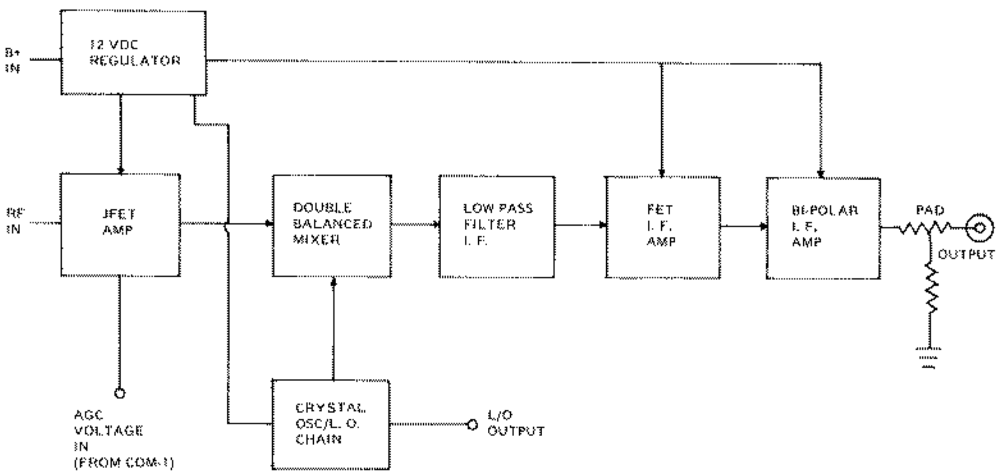
The block diagram of the replacement tuner is shown in Diagram 1. The final operational specs are as follows:

Gain . . . . 28-30 dB
AGC Range . . . . 35 dB
AGC Voltage . . . . —1 to —4 Vdc
In Channel Response . . . . +/— 0.25 dB
Output Match . . . . 27 dB
Input Match (*) . . . . 15 dB
Noise Figure (*) . . . . 3.0 dB
Upper Adjacent Sound Reject . . . 10 dB
I.F. Bandwidth . . . . . . 46.5 / 41.25 MHz
*—at Maximum Gain

Design Tricks

Diagram 2 shows the complete RF portion of the down converter, less the local oscillator. The local oscillator for low-band and high-band channels is shown in Diagram 3.

Input RF is coupled through impedance matching network L1, C1 and into the source of the J-310 FET RF stage. Normally FET's of this family operate with the gate grounded, where maximum gain and non-neutralized stability are required. However, to provide protection against large input signal levels (overload) to the tuner, the gate *in this application* is brought above ground and a negative (AGC) voltage provided. This AGC voltage



BLOCK DIAGRAM - COM 1 SOLID STAT DOWN CONVERTER

DIAGRAM 1

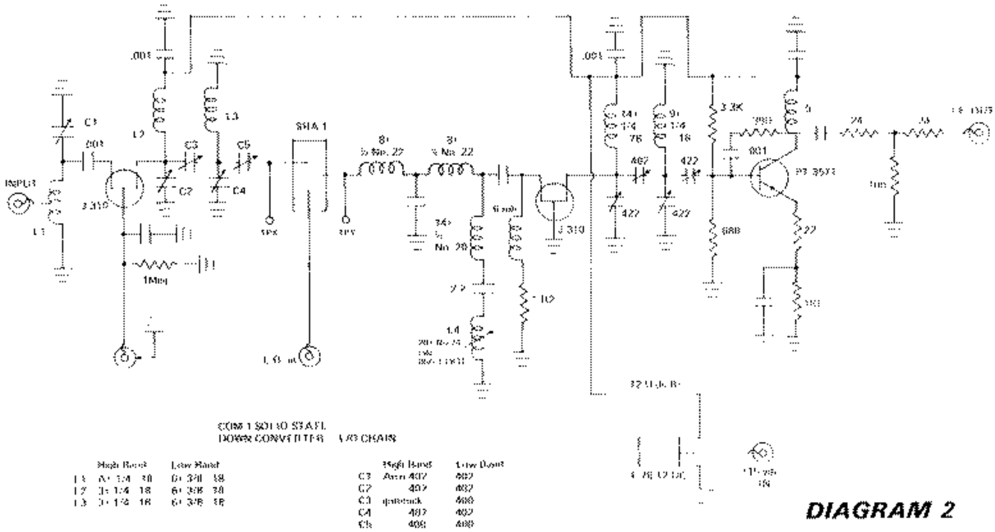


DIAGRAM 2

will bias the J-310 FET to the point where overall circuit gain is reduced by as much as 40 dB. By keeping the front end from *overloading*, we have achieved one of our design criteria.

The output of the input RF stage is coupled through a bandpass filtering circuit composed of L2, L3, C2, C3, C4, and C5. The bandpassed signal is then fed into an SRA-1 double balanced mixer.

The double balanced mixer has been selected for three reasons:

(1) Excellent *dynamic* range (i.e. good signal-handling capabilities);
(2) High *rejection* of the input RF signal (i.e. frequency) at the output port;
(3) High *rejection* of the local oscillator (injection frequency) at the output port.

Additionally, modern double balanced mixers have quite respectable "noise figures," even when standing alone *without* an RF stage before them. This is *another way of saying* that a double balanced mixer has low(er) conversion loss. And this contributes to the overall Com-1 noise-figure equation, meaning simply that higher signal plus noise-to-noise ratios are possible with *given* RF input levels than can be expected with the factory (tube-type) RF stage plus mixer. In a few words, the picture quality improves for lower input levels, and long(er) cascades become possible before signal to noise becomes a problem.

The local oscillator is a separate submodule inside of the container of the replacement down converter. The L/O signal is coupled into the SRA-1 double balanced mixer through an F-61 connector. The output of the SRA-1, now an I.F. signal, is run through a low-pass type of filter and a series (resonant) trap which is tuned to 47.25 MHz (lower adjacent channel sound frequency after conversion).

Following the low-pass filter, the I.F. signal is fed into an I.F. amplifier stage, another J-310 FET. Now in the "old days," designers usually felt that if they wanted a low noise figure, the only real "design trick" was to build up sufficient gain in the RF amplifier stage to overcome the conversion loss in the mixer, and to make the usually low noise figure of the RF (first active) stage the commanding noise figure for the processor. However, this usually meant that I.F. amplifier stages tended to be high gain, and often little

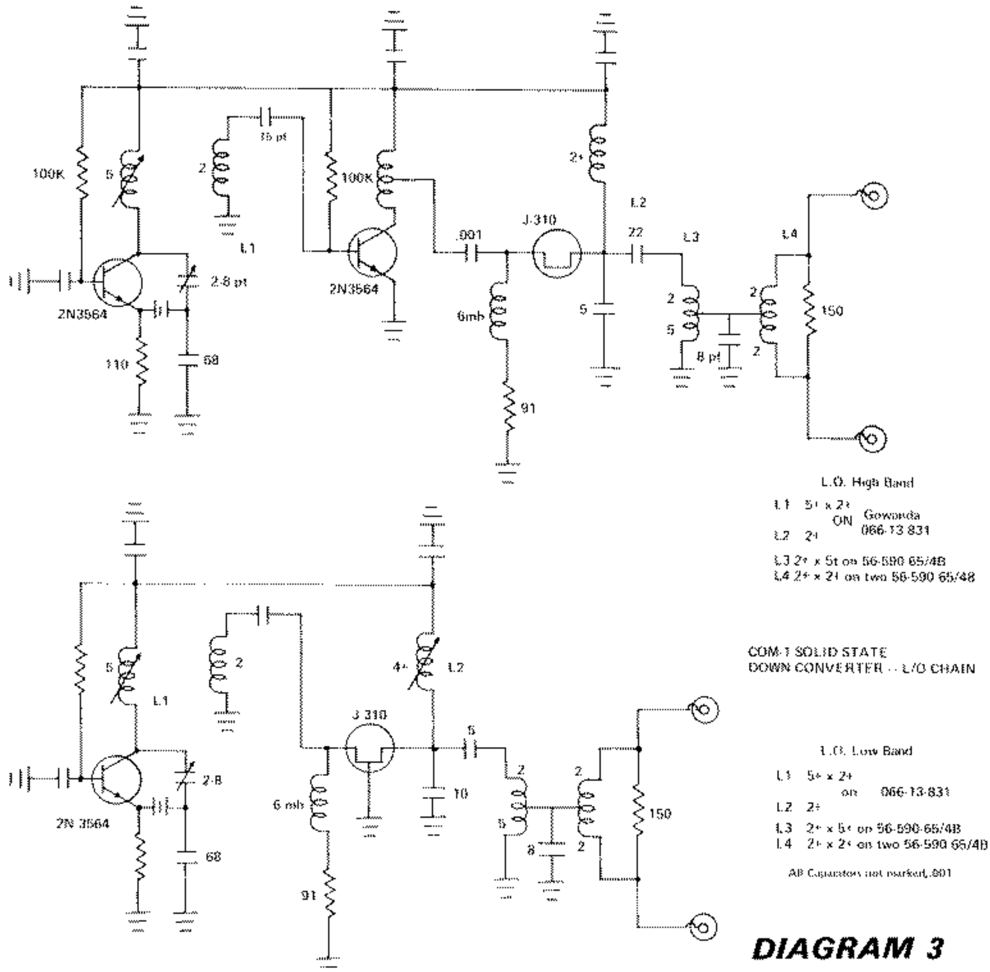
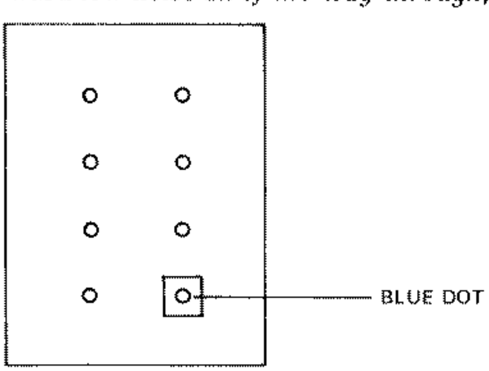


DIAGRAM 3

concern was exhibited for their own noise figure. Modern trends lean toward low noise *all of the way through*, especially since FET (and bi-polar) technology now makes low noise and high gain possible, for about the same price per device as high gain alone. One of the features of the design shown here is that the worst case (single "stage") noise figure (under *maximum* wide-open-gain conditions) is the 6.5 dB noise figure of the double balanced mixer; and when you precede and supersede the 6.5 dB mixer "noise figure" with 3.0 dB noise-figure devices, with suitable gain parameters, you end up with a unit noise figure not over 3.0 dB all of the way through (at maximum gain with the front-end J-310 so biased as to run wide open).



SRA-1 DOUBLE BALANCED MIXER

The output of the J310 I.F. amplifier is further bandpassed, and then amplified one more time by a broadly tuned bi-polar amplifier stage. This stage is *primarily for output match*, which we further ensure by inserting a 6 dB pad directly on the output. By achieving a high degree of match integrity, we end one of the major realignment bug-a-boos normally associated with *any* down converter.

Our approach to the power supply was to design one fairly stiff "brute-force" type of supply which could be utilized to power *several* down converters for several Com-1 channels in use, simultaneously. The supply (see Diagram 4) provides 15 volts DC to each converter. At the converter this is further regulated to 12 volts DC, by a Fairchild 3 terminal regulator.

The local oscillator chain provides the necessary L/O drive to the mixer (SRA-1). See Diagram 3 for the local oscillator section. The L/O drive is brought out to the SRA-1 and to a separate port for looping into the Com-1 output "up converter." A table here gives the local oscillator (crystal) freqencies for each channel in the VHF spectrum.

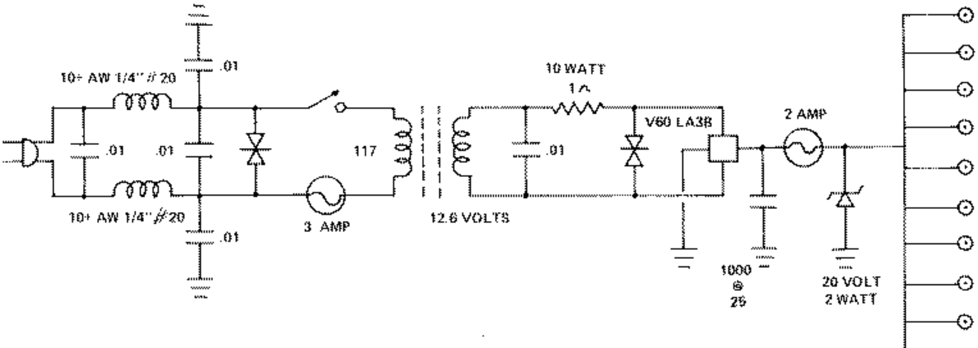
Solid-State Oscillator Frequencies

L/O Freq	Channel	Crystal
101 MHz	2	101 MHz
107 MHz	3	107 MHz
113 MHz	4	113 MHz
123 MHz	5	123 MHz
129 MHz	6	129 MHz
221 MHz	7	110.5 MHz
227 MHz	8	113.5 MHz
233 MHz	9	116.5 MHz
239 MHz	10	119.5 MHz
245 MHz	11	122.5 MHz
251 MHz	12	125.5 MHz
257 MHz	13	128.5 MHz

Alignment

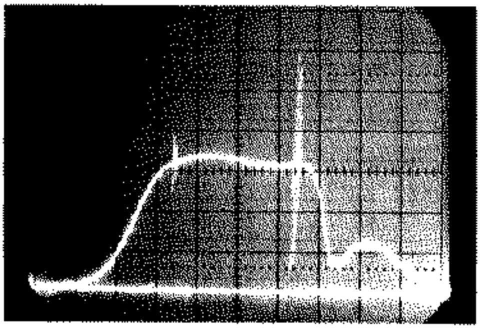
To align the unit, first solder a 330 ohm resistor to test point "X" (input to SRA-1 double balanced mixer); connecting the opposite end of the 330 ohm resistor to the center terminal of an F-61 connector (with shell connected/soldered to chassis).

Insert your sweep into the input of the J310 RF amplifier and connect the detector to test point "X" (through the 330 ohm resistor). Align the unit with C1, C2, C4, and C5 for best (i.e. flatest) response (at maximum gain) across the VHF input channel. When this is completed, move the detector to the output of the down converter and connect the sweep to test point "Y" (see Diagram 2), through a 330 ohm (isolation) resistor. This is the output (I.F.) section of the down converter, and it is to be aligned for response in the 41.25 to 46.5 MHz region (see scope-screen display of response of one unit). At this time, set L4 for maximum rejection of 47.25 MHz; remove the test-point connections.



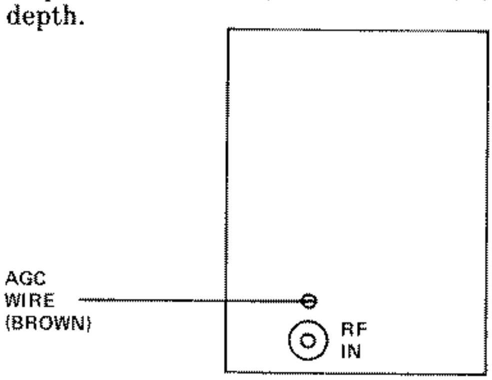
COM-1 SOLID STATE DOWN CONVERTER- POWER SUPPLY

DIAGRAM 4



The alignment or tuneup of the local oscillator is quick and easy. With power to the L/O, connect the output of the L/O chain to the marker-input on your scope/sweep system. Adjust L1 until you have a birdy (pip) on your display. Disconnect the L/O from the marker-in and place the detector on the output of the L/O. Now simply tune L1 for maximum scope display (i.e. greatest amplitude or signal from the L/O) on a DC coupled scope (alternately, an AC VTVM). Then back off 1/4 turn on L1, and tune L2 for maximum output. This completes the L/O tuning.

Now insert the L/O signal into the down-converter L/O input jack, with the sweep connected to the input of the RF side of the down converter. (Keep your sweep level down in the 0/+10 dBmV range.) Connect the detector to the output of the down converter and touch up alignment for best single-channel response, making sure the 47.25 MHz adjacent-channel sound trap is still notched for maximum depth.

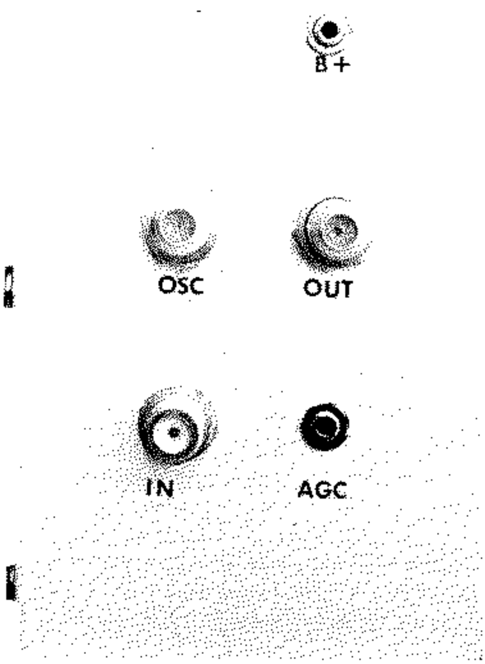


COM-1 Hookup

Interconnecting the solid-state down converter to the Com-1 unit is very simple. Just connect the antenna input to the down converter and run a jumper from the output of the solid-state down converter to the I.F. input on the Com-1.

Run a wire from the AGC connection on the tube tuner to the AGC input on the down converter. (Note: When *no voltage* is applied to the AGC input, it should be shorted to ground. This can be done by using a normally closed miniature phone jack.) See illustration.

The L/O output (from the new local L/O input on the Com-1 up converter, if you are using "on-channel" conversion/operation. If you are converting to a different output channel, terminate the L/O output on the new L/O chain with a terminating resistor, on



the F connector on the solid-state converter.

One item of additional note: you can *delay the AGC* additionally by inserting a 1N914 diode in series with the AGC lead. This should be done on channels with very low input levels; do it on a try-and-see basis.

This completes the solid-state down converter for the Com-1. It should provide you with *hands-off* operation and forever end your daily trips to the headend in the morning to touch up the wandering nature of the tube-type Com-1 front end!

III Is Better Than II

DESIGN CONSIDERATIONS FOR MODERN CATV HEADEND SIGNAL PROCESSING EQUIPMENT

This report describes signal processing requirements of a modern CATV headend, with design criteria for heterodyne processing equipment and modulator equipment.

Multiple Sources/Multiple Requirements

The signals to be reprocessed in a CATV headend may arrive from many sources and by various forms of transmission. Diagram 1 depicts some of the signal sources to be expected with a modern headend. Assuming all signals are cable carried in the 40-300 MHz VHF band the following forms of signal processing may be required:

(1) VHF to VHF processing (possibly requiring channel conversion on the output/cable end);
(2) UHF to VHF conversion (always requiring channel conversion);
(3) Video to VHF modulation (from multiple sources);
(4) Special CATV channels (possible channel conversion or channel dropping);
(5) Sub-band to VHF conversion.

Although the types and sources may vary widely, the headend equipment must deliver each signal at a VHF channel with consistent technical characteristics to guarantee proper operation of the distribution system.

Generally speaking, baseband video signals have consistent electrical characteristics (i.e. peak to peak levels, spectrum, etc.). However, RF (radio frequency) signals are much less pre-

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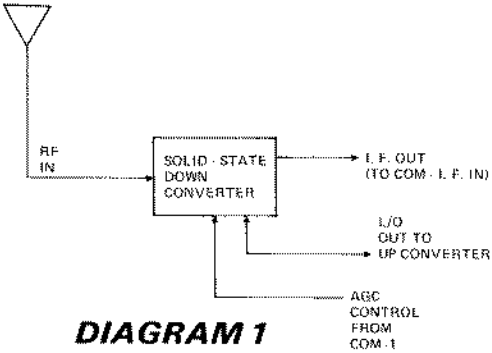


DIAGRAM 1

dictable, if predictable at all! Hence the headend equipment must accommodate signal conditions which may vary widely. Some of the important *variable* characteristics of typical RF signals include:

(1) *Signal Fading*—Fading as much as +/— 20 dB (or more) relative to nominal signal level is possible, especially when signals are transmitted over paths beyond "line of sight". Additionally, differential fading (i.e. separate fading of visual, color and aural information) may also occur.

(2) *Interference*—A desired signal may be received together with some undesired electrical signals in neighboring frequency bands or on immediately adjacent channels. Such unwanted signals must be prevented from appearing at the input to the cable-distribution system.

(3) *Spectra of Received Adjacent-Channel Signals*—The RF spectrum of the TV signal is constantly changing with video information content. Figure 1 shows typical spectra of four different color-signal test patterns (i.e. static displays). Note that all of the spectra have energy distributions concentrated around the picture carrier, color sub-carrier (3.58 MHz) and sound sub-carrier (4.5 MHz).

The headend equipment must provide optimum quality signals to the cable system, despite variations in the received signals. In addition, the headend must operate without degrading the quality of the received signals.

Table One-A lists the characteristics of the CATV signals which must be *regulated* or *controlled* by the headend.

Something Old, Something New

Elsewhere in this issue of CATJ, Steve Richey discusses a solid state front end (down converter) for the **original** Channel Commander One unit. Steve makes the point that the tube type (turret) tuner in the Com-1 unit was the major culprit in that unit, and with a little moxie the unit can be rebuilt with a solid state down converter to cure the ills.

Of course a **really** critical person would find **other** faults with the Com-1 unit. Even Jerrold found them, when it brought out the Com-2 unit (solid state). Now there is the Commander III; the brand new version of this processing package, complete with solid state adornments which even the Com-2 unit did not contain.

Technology, especially in the solid state arena, is changing almost daily. The television processing industry is on the threshold of even another major step forward with a new approach to I.F. filtering in the **basic** television **receiver.**

Interestingly, until very recently, CATV processing equipment technology has been in the main off-shoot-technology from the receiver manufacturing industry. That situation may well be changing; more and more often now we find CATV processing equipment striking out into areas not touched by receiver manufacturing firms.

This report, by Jerrold's Director of Engineering Graham S. Stubbs, is an excellent example of innovative approaches to "master processing".

1A. **Video Signal Level** — Proper trunk and distribution amplifier operation requires regulation of level at the headend output to within +/— 0.5 dB, regardless of input signal level variations (a particularily severe situation is when the headend must receive signals through a heavily traveled air flight route).

Audio Signal-Level Ratio — The level of the audio sub-carrier should be reduced to approximately minus 15 dB, relative to the picture carrier, and regulated during differential fading. Experience has indicated that during severe (selective/differential) fading conditions, the relative levels received of the audio subcarrier and the video carrier may vary. Correct operation of an adjacent channel system requires careful control of the audio subcarrier level. If the audio-video-carrier level ratio becomes too great, an audible **sync-buzz** may occur in receivers due to the limiting nature of the TV receiver. If the audio sub-carrier level becomes too high, it can cause adjacent channel, beat interference in the upper adjacent channel.

Rejection of Interference—Interference in neighboring channels should be reduced to at least minus 60 dB, relative to the desired channel video-carrier level.

Channel Conversion—Required channel conversions may include: (1) Conversion to VHF from UHF; (2) VHF to VHF conversions; (3) Mid-band, super-band or sub-band conversions to VHF.

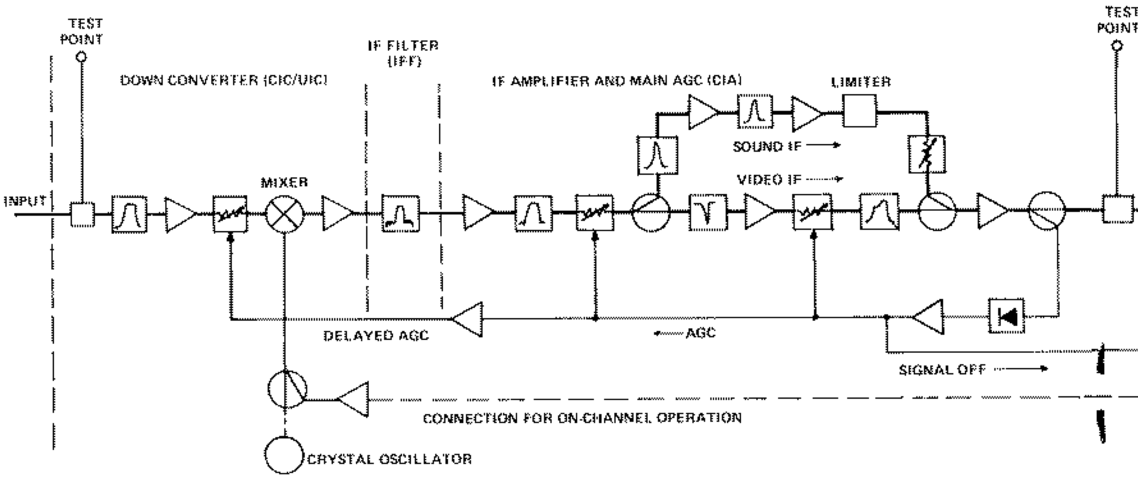
Phase-Locking—The facility to phase-lock the transmitted channel carrier to an off-the-air reference signal may be required to permit operation on channels subject to direct pick-up at subscriber locations.

Proper care in design must be exercised in order to minimize impairment of signal quality by the headend equipment itself. Table 1B lists *desired* performance characteristics of the headend.

1B. **Carrier-to-Noise Ratio**—The signal fed to the distribution system should be as nearly perfect as possible, and a carrier-to-noise ratio of 55 dB is desireable at normal operating levels.

Spurious Signals—Spurious signals generated within the equipment should be completely invisible, at least minus 70 dB below carrier levels.

Frequency Accuracy—A frequen-



HETERODYNE SIGNAL PROCESSOR

DIAGRAM 2

cy accuracy of the transmitted (on cable) signal of better than +/— 25 kHz is recommended to correct **adjacent-channel** operation of selective (I.F.) circuits within the television receiver. To permit such operation and to allow for typical received-signal-frequency offsets of +/— 10 kHz (or more with station drift), a conversion accuracy of +/— 15 kHz (or less) is required.

Amplitude Distortion—For good reproduction of waveforms consisting of a wide spectrum of video information, a passband flatness of +/— 1 dB is desirable, over a video passband do minus 0.75 MHz to plus 4.0 MHz (reference frequency of video carrier).

Non-Linear Distortion — There should be no discernable distortions due to either the desired signal or to adjacent and neighboring channels. Cross-modulation distortion should be small, compared with required distribution system performance.

Delay Distortion—Phase distortions are inherent in highly selective circuits and must be compensated separately to achieve low time-domain errors.

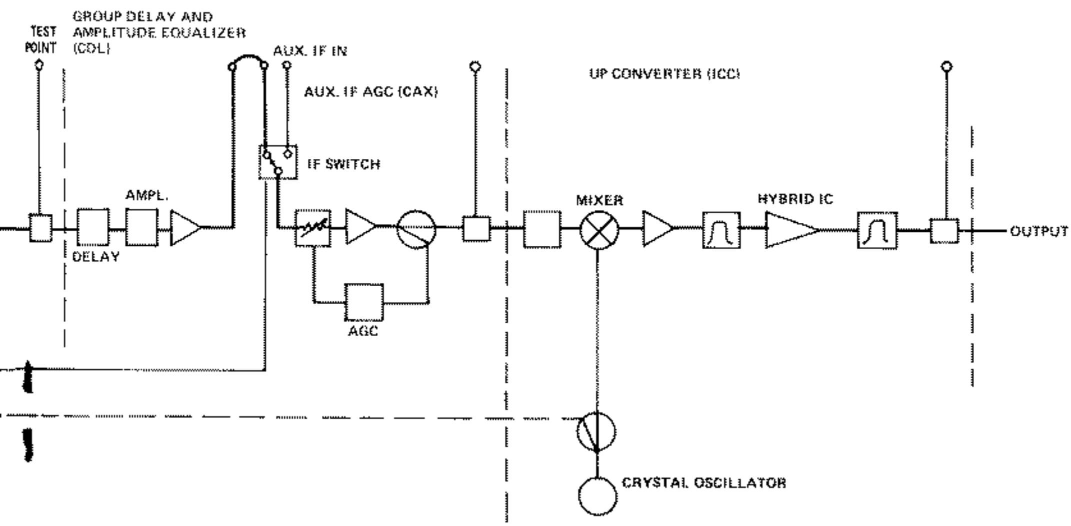
(i) Pulse amplitude distortion, measured as "k" rating: a "k" rating of the headend equipment of better than 2% is desirable;

(ii) Chroma delay distortion—differential time delay of chroma information and luminance information can cause mis-registration of color in a TV picture. A chroma-delay distortion of less than 50 nanoseconds is desirable from the headend equipment.

The Heterodyne Processor

For modern CATV headends, the use of heterodyne (double-conversion) RF signal processing is now extremely common. Compared with earlier tuned-amplifier (on-channel/strip) processor equipment, the heterodyne processor has a number of advantages:

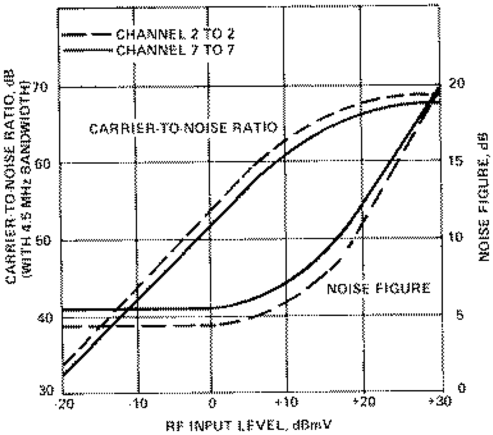
1. Optimum and uniform selectivity, regardless of channels;
2. Flexibility of channel conversion, with no "forbidden conversions";
3. Independent control of audio/video carrier ratio;
4. Independent AGC action for aural and video carriers;
5. I.F. signal switching and substitution;



6. Commonality of spare modules for the critical automatic gain control (AGC) and (I.F.) selectivity functions.

A block diagram (Diagram 2) shows a modern signal processor, the Channel Commander III. The configuration shown in Diagram 2 is for processing VHF broadcast signals. Another configuration, using input module UC, is used to process UHF broadcast signals.

In both cases the signal fed to the cable system is a VHF signal in the (output) frequency range of 5-300 MHz. The signal path is shown in bold print. The input signal enters the first module for conversion to I.F. (intermediate frequency). The I.F. frequencies chosen are F_{IF} video = 45.75 MHz and F_{IF} sound = 41.25 MHz. The front end system employs a three-pole helical resonator filter, followed by a low noise, high-linearity preamplifier stage and a self biased double-balanced mixer. The input filter is designed to prevent overload of the front end by unwanted signals. The preamplifier stage is a linear broadbanded feedback-type amplifier, designed to handle adjacent channel signals at input levels up to +30 dBmV with negligible cross modulation and/or inter-modulation distortions. In fact, for hub style reprocessing applications, the front-end performance is minus 80 dB cross modulation (vis a vis NCTA standard) for any number of contiguous channels, with each channel at a + 10 dBmV signal level. To prevent distortions from occuring within the balanced mixer circuit, two precautions are taken. First, the mixer is designed to work with a high local oscillator (L/O) injection level, for maximum linearity. Second, after the preamplifier stage, delayed AGC is applied. The local oscillator frequency is crystal controlled and a suitable injection level is obtained for the mixer through a buffer amplifier. The



MEASURED CARRIER-TO-NOISE RATIO AND NOISE FIGURE vs. INPUT-SIGNAL LEVEL

DIAGRAM 3

delayed AGC technique is employed to preserve the best possible carrier-to-noise ratio at low signal levels. As the AGC reduces the gain of the input converter, however, the noise figure increases. See Diagram 3. At typical operating levels of 0 dBmV to + 10 dBmV, the carrier-to-noise ratio is affected only slightly by AGC action. At levels above + 10 dBmV, carrier to noise ratios in excess of 55 dB are to be expected.

The signal passes from the input converter to the I.F. filter, where adjacent channel selectivity is determined. A typical overall response curve is shown in Diagram 4. Note that rejection filtering is employed to attenuate the upper adjacent picture carrier, lower adjacent sound carrier and the lower adjacent chroma information. For a hub processing system, all carrier and sideband information associated with equal level video-modulated adjacent channel signals is suppressed to a level of at least 60 dB below the level of the desired signal.

The I.F. amplifier module provides amplification and automatic level control of both the video and aural components; separately. The composite I.F. signal is applied to a broadband fixed-gain amplifier stage. The

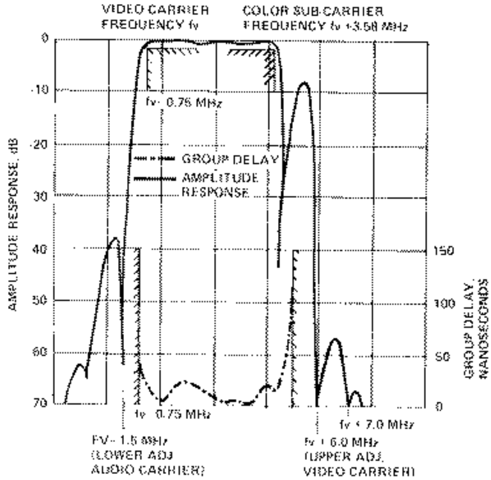


DIAGRAM 4 AMPLITUDE RESPONSE
DIAGRAM 5 GROUP-DELAY RESPONSE

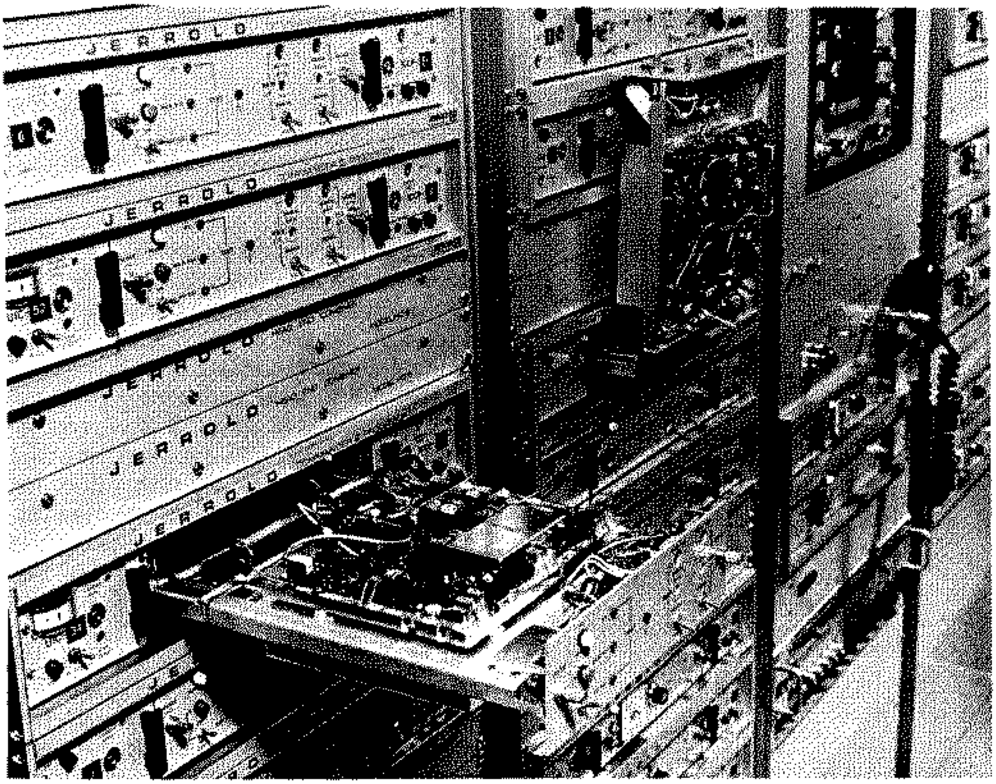
amplified signals pass through a five-pole bandpass filter which rejects interfering signals other than immediately adjacent video and audio carriers. The signals are level-controlled by a PIN diode attenuator, with the degree of attenuation determined by the AGC (voltage) system.

At the attenuator output, the signal is divided into two paths by a directional coupler. The signals from the through leg of the directional coupler are applied to a 41.25 MHz trap assembly which provides high attenuation to the accompanying aural carrier and its modulation sidebands. The video I.F. signal now stripped of its audio subcarrier, is amplified again before it passes through another PIN diode attenuator and then to a bridged-T amplitude response compensator network. This network is adjusted for optimum passband-amplitude characteristics.

The audio I.F. carrier from the tapleg of the preceding directional coupler is filtered by a two-pole bandpass filter to reject the accompanying video carrier and its video color sub-carrier. The audio carrier is further amplified and filtered. It then passes through a limiter which rejects any residual amplitude modulation (i.e. such as might still be present from the video carrier modulation sidebands) and fixes the audio I.F. carrier level. This limited is followed by a PIN diode variable-attenuator network which is DC controlled from the front panel. This permits adjustment of the audio I.F. carrier to the desired level. The audio signal passes through an additional filter to remove unwanted products from the limiter; and then it is recombined with the video I.F. signal; which at this point is fixed in level by AGC action.

After further broadband amplification, the composite I.F. signal passes through a directional coupler where a sample of the signal is tapped-off for AGC level reference. The level-reference sample passes through a potentiometer attenuator which controls the AGC operating point. The attenuated signal sample passes through an integrated circuit I.F. amplifier which increases the signal level for efficient detection. A tuned circuit selects the video I.F. frequency and couples the signal to a detector diode. The resulting video signal is applied to an operational amplifier comparator (sync stripper) which is biased to respond only to the peak-of-sync level of the detected video. Local feedback from the output of the sync stripper to the predetection amplifier, using its gain control input, reduced the vertical sync distortion usually associated with a very short time-constant AGC system. The output of the sync stripper is filtered, amplified and fed back to the PIN diode gain-control attenuators in the main amplifier system. Thus, in the AGC mode, closed-loop control of composite I.F. signal level is obtained.

Manual operation (for testing and set-up purposes) is obtained by using a variable DC voltage in place of the output of the AGC detector. Manual operation can be selected and controlled from the front panel. The AGC control voltage is used to bias two PIN diode attenuators directly. a third PIN diode



Modularized construction approach to Commander III headend; note that equipment draws out from back (foreground); and for easy in-rack service, modules fold up (background).

attenuator (in the input converter) is activated only when the AGC control signal increases to a value corresponding to a + 5 dBmV input signal. This insures a low system-noise figure will be maintained for input levels up to approximately + 10 dBmV, at which point the majority of the gain-reduction function is transferred to the input module.

The AGC control signal is also fed to an additional comparator which senses when the input signal level falls below approximately — 20 dBmV. In this signal-off condition, a switching circuit activates a front-panel lamp and I.F. signal switching relay.

After automatic gain control, the composite I.F. signal is fed to the I.F. group-delay and amplitude-response equalizers. These equalizers consist of cascaded bridged-T sections, designed to optimize group-delay and amplitude response over the entire video-information passband. (See Diagram 5.)

I.F. SWITCHING AND SIGNAL SUBSTITUTION

Following main I.F. filtering, AGC and equalization functions, the I.F. signal is brought out to a rear-panel jumper for easy implementation of any external I.F. splitters or matrix switching.

A universal I.F. signal-switching and control system is a standard feature of the model CHPD heterodyne processor (and also of the model CCM modulator). See Diagram 6. An internal I.F. switch is used to connect a substitute I.F. signal source. This signal, externally generated, may be used for: signal replacement, in the case of signal failure; emergency alert; or system testing.

The internal I.F. swtich is activated by either: an RF signal-off condition (1) (from the AGC system), following a programmable delay of 0, 5, or 25 seconds; or an external command signal in the form of a contact closure.

To guarantee a constant output signal level, regardless of variations in switching loss and substitute signal levels, an auxiliary I.F. AGC circuit is used prior to the output I.F.-to-channel converter. Detection and feedback techniques used in the auxiliary AGC are similar to the main I.F. system, but they are restricted to a +/— 7 dB gain-control range.

The output module converts the I.F. signal to the desired VHF output channel and amplified it to a high level (+ 60 dBmV), suitable to feed a broadband directional coupler combining network. The I.F. signal (level approximately + 30 dBmV) passes through a variable attenuator which is controlled from the front panel. This control sets the composite RF output level of the heterodyne processor. The signal then passes through a low-pass filter—to reject local oscillator signals—and then to a balanced mixer, similar in form to that used in the input converter.

At the output of the mixer, undesired products of conversion are rejected by another low-pass filter. The RF output channel signal passes through a single-stage broadband amplifier and then to a bandpass filter whose function is further to reduce the level of the local oscillator signal and other conversion products. Final amplification is achieved in a broadband hybrid integrated circuit amplifier. Any remaining spurious signals are rejected by the output filter, which has a three-pole bandpass response similar to that of the filter used in the input converter module. This system of sequential broadband amplification and filtering permits operation at a very high output level (+ 60 dBmV) with an outstanding performance specification, — 60 dB spurious from 5 to 350 MHz.

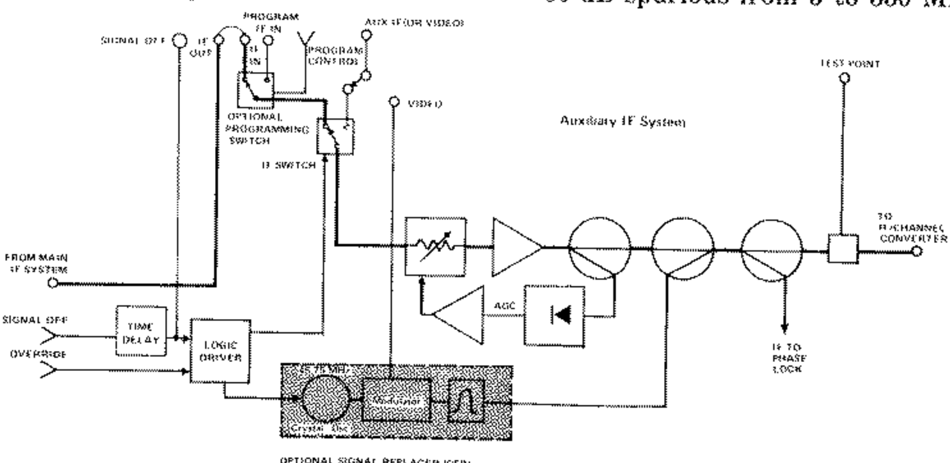


DIAGRAM 6

Hence, CHPD and CCM headend equipment requires absolutely no additional output filters.

UHF CONVERSION

Conversion from UHF signals is pro-

1) As an alternate, an internal (optional) signal replacer may be used, capable of video modulation. A second (optional) programming switch may be used in conjunction with timing equipment for pre-determined (non-duplication) program switching.

vided using a circuit technique different from that used in the VHF input converter. Diagram 7 shows a block diagram of the UHF-I.F. converter.

To provide the best possible conversion frequency stability, a form of automatic frequency control (AFC) is used, employing a voltage-controlled oscillator rather than a crystal oscillator/multiplier chain. A benefit of this direct conversion method is freedom from the "spurious beat" and "forbidden conversion" problems which have plagued UHF/VHF converters using multiplier techniques.

phase detector, with a signal derived from a crystal oscillator at 2.859375 MHz. (This frequency is equal to 45.75 MHz ÷ 16.) The error-signal output of the phase detector is amplified and fed back to the voltage-controlled oscillator to lock the loop. The phase-locked-loop design uses a sweeping technique to provide a capture range of +/— MHz, which is necessary to allow adequate margin for oscillator stability. The accuracy of the I.F. (45.75 MHz) output signal is +/— 2 kHz.

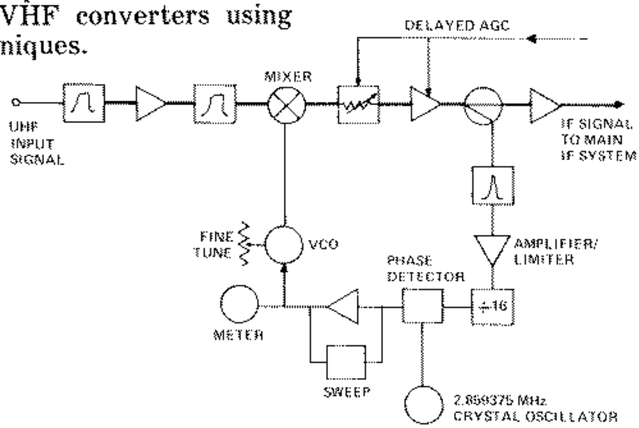


DIAGRAM 7

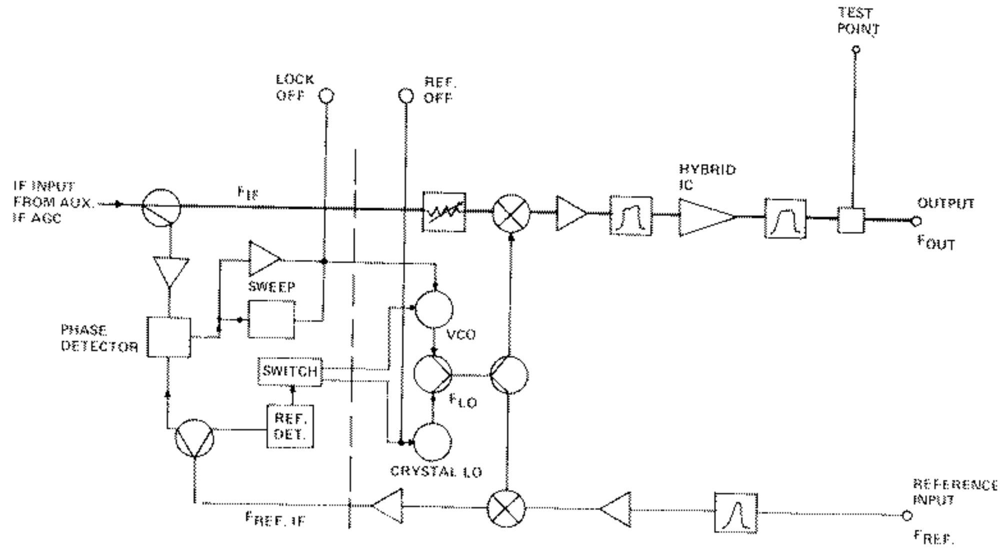
The UHF input signal first enters a tuned FET preamplifier stage. This tuned stage rejects undesired and image signals and established a low noise figure. The amplified signal is converted to I.F. in a double-balanced mixer which is driven by a voltage-controlled oscillator. The I.F. signal passes through a gain-controlled amplifier stage, for delayed AGC, with a tap-off for an AFC reference signal.

The automatic frequency control system is a phaselocked-loop design, in which the I.F. output video carrier is phase locked to a reference derived from a crystal oscillator. A sample of the I.F. signal is amplified, limited and then frequency-divided digitally by a factor of 16. It is then compared, in a

PHASE LOCK

A major feature in modern CATV headend equipment is the ability to phase lock the channel video carrier to a reference signal.

With the optional output signal phase-lock feature, the headend processor (or modulator) can be used for single-channel off-the-air phase lock to permit operation on channels which are subject to direct signal pickup at the subscriber's TV set. For this purpose, a sample of the broadcast signal causing the interference is used as a frequency reference. The output signal of the processor (or modulator) is phase locked to the reference signal to guarantee the coherency necessary to



PHASE-LOCK SYSTEM

DIAGRAM 8

eliminate "co-channel" beats. Using this technique, interference effects can be reduced by an amount equivalent to lowering the level of the offending signal 10 to 20 dB.

The application of phase-lock techniques to the output converter is shown in Diagram 8. The reference signal is mixed with the up-conversion local oscillator, resulting in a reference IF signal (F_{REFIF}). This I.F. signal is compared with a sample of the processed I.F. signal (F_{IF}) in a phase detector. The phase-detector error signal controlls the local oscillator frequency (F_{LO}) to complete the feedback loop. This feedback system operates to keep the processed I.F. signal (F_{IF}) and the reference signal ($F_{REF\ IF}$) identical in frequency. The output-signal frequency (F_{OUT}) is thus identical and locked to the reference-signal frequency, as can be seen:

$F_{OUT} = F_{LO} - F_{IF}$

$F_{REF} = F_{LO} - F_{REF\ IF}$

$F_{OUT} = F_{REF}$, since $F_{IF} = F_{REF\ IF}$ when the loop is locked

To guard against reference-signal offset and drift, a lock-in range of +/— 40 kHz is provided. An accurate crystal oscillator provides the local oscillator signal automatically, should the reference signal be unavailable temporarily.

The same techniques permit the processor (or modulator) to be phase-locked to a c.w. reference signal, and options are available for harmonic and incremental phase-lock coherent systems.

With harmonic phase-lock, the frequency, the frequency assignments of all video carriers are exact multiples of a 6 MHz reference signal. A comb spectrum is generated and distributed to each headend processor or modulator at which point the appropriate signal from the comb is extracted for use as a reference.

Harmonic phase-lock can be used to minimize the subjective effects of beat distortions produced by trunk and distribution amplifiers. Harmonic phase-lock "zero beats" second-order and third-order and all other higher order intermodulation beat products from video carriers. As a result, there is a subjective improvement in picture quality in systems in which second8 and third-order beats are the limiting factor. Harmonic phase-lock also permits the use of mid-band channels on some existing single-ended CATV systems in which only second-order beats are the limitation.

In an incremental phase-locked coherent headend, all carriers are phase-locked to an offset comb spectrum; i.e. the channel assignments are in increments of 6 MHz. Incremental phase-lock "zero beats" most of the third-order intermodulation beat distortions in amplifiers.

Both harmonic and incremental phase-lock systems employ the circuitry described previously for single-channel off-the-air phase-lock.

The phase-lock technique may also be used to lock the output-channel frequency to a precision reference source. In this case, the output-frequency accuracy will be equal to that of the reference.

THE CATV MODULATOR

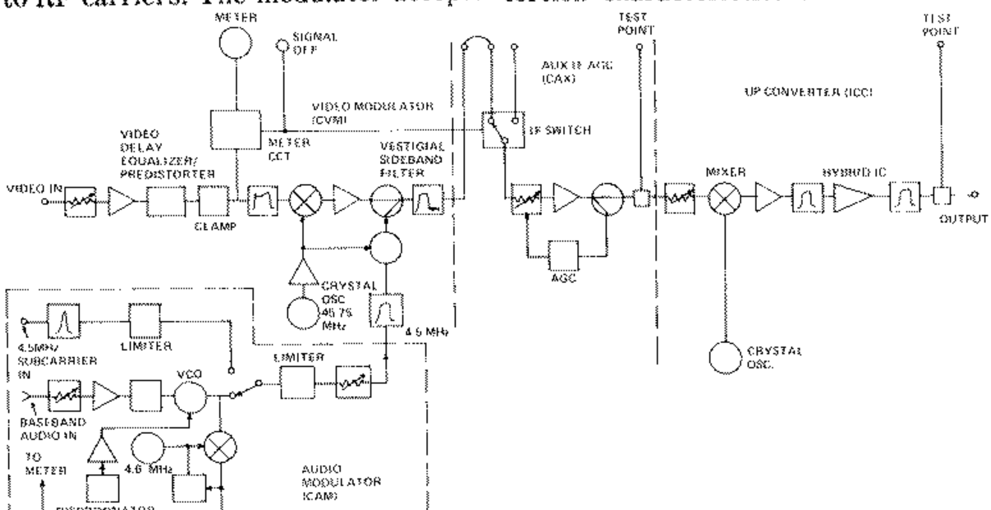
The CATV modulator is used for translating video baseband signals onto RF carriers. The modulator accepts baseband signals in either one of two forms: video and audio sub-carrier (4.5 MHz); or video and baseband audio (i.e. 600 balanced audio).

The key requirements of the CATV modulator are: adjacent channel operation requires vestigial sideband filtering; minimum color distortions, i.e. minimum differential phase and gain; delay predistortion for TV-receiver characteristics; and system compatibility with the heterodyne processor.

For system compatibility, the modulator is designed with many of the same features as the heterodyne processor: I.F. switching and signal substitution; I.F. override control; similar physical construction and interchangeable modules; auxiliary AGC; and phase-lock options.

A block diagram of the modulator is shown in Diagram 9. The input level of the video signal is reduced by a front-panel potentiometer control. The signal is passed through a buffer amplifier which provides isolation from the group-delay predistorter and equalizer section. It also provides a high input return loss (30 dB).

The video/RF group-delay predistortion characteristics shown in Dia-



MODULATOR WITH METERING

DIAGRAM 9

gram 10 are the FCC limits for predistortion of broadcast signals. After the delay equalizer section, the video signal is d.c. restored. The signal passes through a low-pass filter and then to the balanced modulator which uses four matched hot-carrier diodes. The video carrier is generated in a precision crystal-controlled 45.75 MHz crystal oscillator. The modulator output is fed through a buffer amplifier to the vestigial sideband filter which shapes the vestigial sideband response for adjacent-channel operation and removes harmonics inherent in the modulation process. The vestigial sideband filter consists of three parallel-tuned traps and two series-tuned traps which together determine a high-pass/low-pass characteristic. The result is an I.F. bandpass response in which the video carrier is situated 0.75 MHz below the upper edge.

A portion of the video signal from the d.c. restorer is applied to a peak-reading voltage sensing circuit to provide a meter indication directly proportional to depth-of-modulation percentage. In parallel with the meter is a threshold level sensor, activated when the video modulation level falls to 10% or less. It can be used in an identical manner to the signal-off sensing in the heterodyne processor.

The audio modulator accepts either 600-ohm baseband audio or FM 4.5 MHz sub-carrier (selected by an internal switch). The audio signal modulates a voltage-controlled oscillator (VCO) to provide a 4.5 MHz sub-carrier. The frequency is stabilized to +/— 1 KHz by mixing the sub-carrier with a 4.6 MHz crystal-referenced signal and by applying the resultant 100 kHz signal to a digital pulse integrating discriminator. The discriminator output is fed back to the VCO to complete an automatic frequency control loop. The 4.6 MHz oscillator is also used to gate the pulse width of the 100 kHz signal for precise timing and accuracy.

The 4.5 MHz frequency modulated signal is mixed with the unmodulated video-carrier signal resulting in a 41.25 MHz signal which is combined with the video I.F. signal, prior to the vestigial sideband filter. Following the vestigial sideband filter, the modulator operation is identical to that of the heterodyne processor.

Conclusion

This paper has reviewed the requirements of a modern CATV system for professional headend equipment. The greater variety of signal sources now used in CATV and the more stringent pèrformance requirements of modern systems demands considerable versatility in the equipment employed.

The primary factors of headend signal-processing equipment are:

(1) To control the video and sound carrier levels, both of which are subject to fading as received over the air;
(2) To filter out interfering signals accompanying the received desired signals.

In addition, channel conversion is frequently required to permit use of a UHF transmitting station on a VHF cable distribution facility; or to avoid direct pick-up problems with strong, locally available VHF broadcast signals.

Non-duplication rules require the switching of signals within the headend receiving facility; and good practice suggests the use of signal substitution wherever possible.

Locally originated signals and signals transported by microwave require the use of high stability modulators with excellent linearity.

Multifarious signal sources require flexibility for not only today's requirements, but the expanding services of tomorrows system needs.

FORD DIGITAL CAR RADIOS UNUSUAL SOURCE FOR RFI

Not all sources of interference to our cable pictures are well known; some, in fact, come from some very unlikely places. Witness a situation reported in Dover, New Hampshire where a non-cable customer found channel 5 being torn up with interference. Naturally the cable company was the first place to be called; based upon either "we were causing it", or, "we had the expertise to cure it"!

The problem in our case was limited to channel 5, but as a Ford Motor Company factory bulletin dated May 02, 1975 reports, the problem can show up on either channels 5 or 6. And what is causing it? A defective bit of digital clock design engineering in Ford Motor Company 1975 vehicle clocks!

According to Ford, "the digital clock (in 1975 model-year) may be the source of TV video and audio distortion on channels 5 and 6 when operating in a fringe area". Ford's bulletin also notes "the (clock radio) may also cause interference in low band (FM/AM) radios operating in the 30-50 MHz region". Seemingly, if the clock radio is capable of producing interference on receivers in the 30-50 MHz range, and in the

Interference Sources

CATJ frequently deals directly or indirectly with cable-marring interference sources. Common sources, such as ignition interference from vehicles, co-channel TV signals and the like are covered almost constantly by **CATJ** data.

But what about the not so common sources; devices such as electric fence controllers, water pumps, street lamps, and so on? **We all know** that given the right circumstances (or wrong circumstances, depending upon your point of view) they can put bars and dots and blitzes all across the screen.

Have you found a source such as this in your area? Have you traced a source, and either on your own or with the help of the manufacturer or dealer for the equipment solved the problem? If so, **CATJ** would like to hear **from you** with specific details on (1) the problem, and, (2) the solution, either worked out by you or by your friendly equipment dealer. **Chances are somebody else needs this information.** Send it along to **CATJ Editorial,** 4209 NW 23rd (Suite 106), Oklahoma City, Oklahoma 73107; **and we'll see that it gets into print!**

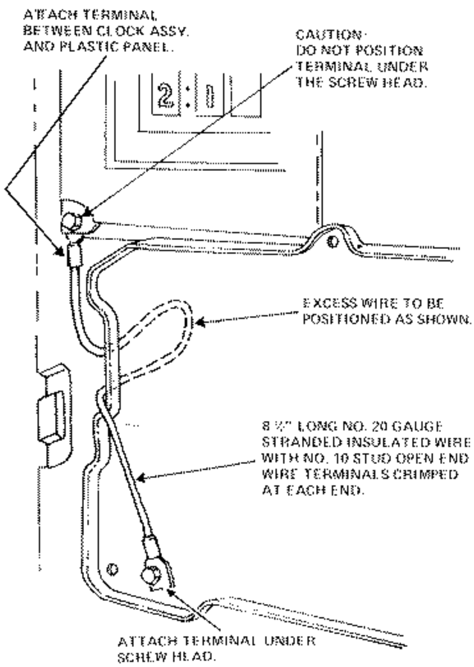
Prepared from Material
Submitted by:

William V. Hinton
Regional Systems Engineer
Continental Cablevision/
New Hampshire
Dover, New Hampshire 03820

76-88 MHz range, there is some likelihood that *other* low band TV channels (i.e. 2, 3, 4) *may also* be adversely affected.

The problem, according to Ford, is caused by an "unusual transistor oscillation within the digital clock circuitry". Ford also notes that clock radios coded with date codes prior to 0505 are apt to have the problem; those dated after that have the correction outlined here included at the factory.

There are two corrections; one for a car equipped with a digital clock, but not with a radio; and the second for a car equipped with both the digital clock and the radio.



1975 FORD DIGITAL CLOCK WITH RADIO

FIGURE ONE

For Ford cars equipped with the clock and the radio, see Figure 1 here.

(1) Fabricate an 8½ inch piece of stranded #20 gauge wire, with jacket on the wire. Place a #10 open end wire terminal at each end;

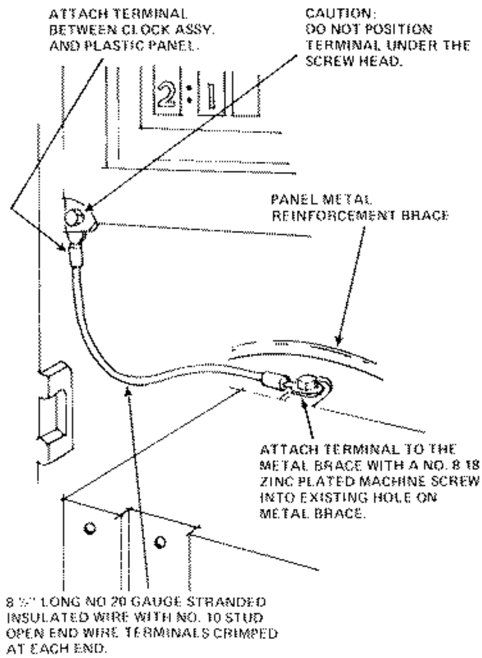
(2) Remove the radio control knobs; remove the two screws holding the radio trim applique and take off the trim applique;

(3) Loosen the clock mounting screws sufficiently to slip the prepared wire between the clock mounting tab (lower left) and the plastic panel; retighten the screws.

(4) Attach the other terminal of the prepared wire to the radio chassis mounting plate (see Diagram 1).

(5) Check for DC continuity (with ohmmeter) between clock case and radio chassis mounting plate.

(6) Replace trim applique and radio knobs.



1975 FORD DIGITAL CLOCK WITHOUT RADIO

FIGURE TWO

For Ford cars equipped with clock only, see Figure 2 here.

(7) Fabricate 8½ inch piece of stranded wire (#20) and attach #10 crimp rings on both ends as

in step (1) above;

(8) Remove two screws retaining trim applique and remove applique;

(9) Loosen clock mounting screws sufficiently to slip wire terminal between the clock mounting tab (lower left) and the plastic panel. Tighten screws.

(10) Attach the other end of the prepared #20 wire to the reinforcement brace (see Figure 2) using a ½" #8-18 zinc plated screw.

(11) Check for DC continuity, between clock case and reinforcement brace.

(12) Replace trim applique.

Note in the diagrams (1 and 2) that Ford instructions have only a single wire length for both applications; and that in the installation *with* radio, the excess wire is positioned under the clock. This is apparently a Ford effort to keep "wire length options" to a single length, based on the longer length required for the installation with *no* radio.

The processing mainly involves *grounding the case* of the digital clock radio to something in the vehicle that has a larger ground potential than the digital clock by itself; thereby *detuning* the "antenna-effect" of the clock radio *case* and "dumping" the RFI (radio frequency interference) in the process.

Ford provides no field intensity measurements with their factory repair notes so it is not possible to gauge the possible interference range which a mal-functioning clock might effect. Note that this is a warranty repair, and Ford will pick up the labor tab *if* the work is done by an authorized Ford dealer.

Because the source for such interference is mobile, it would normally be expected to come and go; unless your headend facility was located right next door to a Ford dealer showroom, in which case you would have the problem as long as their pre-factory modification change cars stayed on the lot awaiting sale!

CATJ Giving Away Equipment

CATJ READER CONTEST ANNOUNCEMENT — FREE CATV GEAR !!!

Earlier this year CATJ went to the U.S. Post Office in Washington to clear with the P.O. legal department a "scheme" for giving away CATV equipment to CATJ readers. The bureaucrats turned thumbs down on the plan. So we modified the plan and tried again. Same result.

Undaunted, we modified the plan one more time, hired an attorney in Washington to watchdog the application and son-of-a-gun, we got by with several inches to spare.

It seems that you can't give things away free, unless you happen to be the Government. (and then it may be that *free is not free*. . .but that is another story!)

What we are setting out to accomplish with the *CATJ READER CONTEST* is really very simple. There are many-many good products in the CATV industry. Many of the products are buried in manufacturer's catalog and some of these enjoy such a low volume of business that they simply do not "share" in the respective advertising budgets. So if you happen onto the product, and it fits a problem you have, you put it to work for you. But the fellow down the road, with the same problem, goes on having the problem simply because he is not aware of the product or what it does.

As CATV suppliers grow larger, they tend to concentrate more on *image advertising;* meaning that advertising sells you more on the company than on a specific product, or, more what a product *concept* does, and less on the detailed inner workings of the product itself.

Then when you are a small manufacturer, sometimes your advertising budget is very small; too small to make the kind of splash which a product may well deserve. So potential users of your product go on for months or years unaware of your product and what it might do for them.

Not everyone shares these problems . . .but many do. So *CATJ* has designed a program to:

(1) Help *explore* the inner workings of products (sort of an educational experience for the reader/user);

(2) *Educate* the reader/user about some particular area of CATV technology which he may not have been previously exposed to (again, an educational experience);

(3) Create an *interest* in the product for the manufacturer (even if these were not tough times for CATV suppliers, sales inter-

est is always appreciated);

(4) *Assist* the manufacturers in the CATV industry in evaluating product acceptance and create a system whereby the industry (i.e. the marketplace for the suppliers) "votes" for product features (a form of marketing survey).

The educational experience is easy to handle. We have been doing just that for 16 issues of *CATJ*, now. And specifically, since last November when we began a series of equipment reviews, *CATJ* has been looking hard at equipment specifications, features, and advantages (*and* dis-advantages). So our equipment review format solves the educational experience aspect of our program, and if reports to us from manufacturers who have had equipment reviewed are accurate, interest generated by reviews in specific products has also been good.

Now to reach our fourth objective, or assisting manufacturers in getting objective product evaluations for their equipment, we arrive at our "scheme" (it is *not* really a "scheme" at all; *that word* got us in a lot of hot water with the Post Office attorneys!). Here is where you as a reader come in, and where you and the supplier "come out".

(1) On a fairly regular basis, *perhaps* in every issue (but certainly in *most* issues), *CATJ* will review one or more products as a part of our *CATJ READER CONTEST* program.

(2) The *CATJ READER CONTEST* Equipment Reviews will be *independent* of our other equipment evaluations; for example the recently completed test equipment series of evaluations or the current antenna product series evaluations.

(3) Each time we run a *CATJ READER CONTEST* Equipment Review, we will give away (free of any charge or obligation) one or more manufacturer donated prizes. The prizes will always be the same as the equipment reviewed. The cash value of the prizes will never be less than $150.00, and there is no practical top end limit. If the product reviewed is an *individual item* costing less than $150.00 each, then the prize for that review will be some *combination of that product* totaling no less than $150.00 in value.

(4) Here is how readers participate in the *CATJ READER CONTEST*.

(A) In each issue with a contest Equipment Review you will find a colored card stock insert (between Pages 40-41 in this issue). *That insert card includes an entry form for this month's contest.*

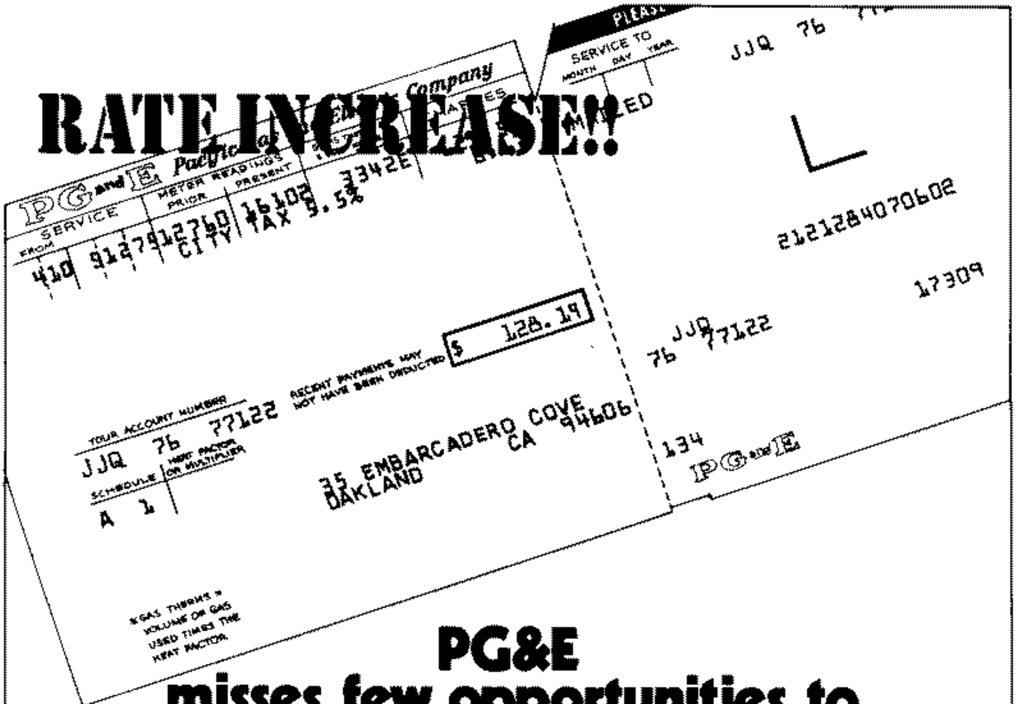
(B) To enter the contest, complete *ALL* of the blanks on the entry card; place 10 cents in postage on the card and mail it to *CATJ*.

(C) *CATJ* normally goes into the mails around the 15th of the dated month; that is, this August issue should hit the mails about August 15th. Cards submitted to *CATJ*, for the August contest, must be in our hands before the September issue goes into the mails (or by September 15th).

(D) Now because this *IS* a contest, there is some *skill* involved in your successful completion of the entry card. Not a lot of skill, but some skill. Again, answer *ALL* of the blanks on the card (that *is* a qualification to entry of the contest) to the best of your ability.

(E) *Some* of the questions asked require that you have *some*

RATE INCREASE!!



PG&E misses few opportunities to raise its electric rates.

How come PG&E twice refused up to two million dollars in extra revenue?

It happened in May, 1974 and in May, 1975. PG&E actually refused up to two million dollars in extra revenue. From the rental of otherwise useless, surplus space it owns on poles held jointly with the telephone company.

Why does it turn down extra revenue from this source? The local Cable TV company would like to know.

If this surplus space were rented to Cable TV, PG&E could be earning profits in excess of 100%. The California Public Utilities Commission has refused to regulate these rates by PG&E.

In 1974 and again in 1975, we tried to get PG&E to rent us this surplus space. PG&E refused. Two times. For Cable TV, this is a matter of survival. For PG&E, it is a matter of indifference.

They won't even compromise.

But then again, PG&E has its own way of raising extra revenue.

Just look at your electric bill.

Western Pole Committee

knowledge of the product reviewed. So naturally, we are suggesting that you carefully read the *CATJ READER CONTEST* Equipment Review *before* you fill out the entry card. There will be no trick questions; either you know the answer or you do not.

(F) Naturally (or hopefully!!) there will be *more than one card* with the correct answers. In that event, all cards with the correct answers will be placed in a container. At the appointed time (i.e. on the day that the September *CATJ* is ready for the mails) we will proceed to draw from that container *one single card.* The person submitting *that card* will be *the winner* of the prize for *that contest.*

(G) The winner will be notified by letter that very day, and we will in turn advise the manufacturer who supplies that contest prize(s) to forward that contest prize(s) on to the winner *directly.*

Winners will also be announced on a continuing basis; with the August issue winner announced in the October *CATJ*, and so on.

Now just in case you are inquisitive and wondering how the manufacturer or supplier comes out in this arrangement, be advised that they do alright. All entry cards become our property here at *CATJ*, and we will in turn forward all entries on to the sponsoring manufacturer/supplier at the close of each contest. This is where he benefits *from your comments* about his product; a marketing survey as it were. He also receives several pages of *CATJ* editorial (review) space, all for the price of giving away some product.

There may not be a *CATJ READER CONTEST* every issue, but on the other hand there may well be more than one in some issues (in which case there will be multiple entry cards in *CATJ*). Additional entry forms will always be available at *CATJ* offices and at the supplier of that contest prize(s). However, only one entry per person. But you need *not* be a *CATJ* subscriber to enter.

Abbreviated rules will appear with each contest equipment review in *future* issues. Turn now and read the review of the initial month's product and prize, the *Model RD-1 Radiation Detector* from Mid State Communications of Beech Grove, Indiana. And don't forget to fill out and submit your entry card (between Pages 40-41); someone *HAS* to win this unit, *and it could well be you!*

Find Out Where You Leak

READER CONTEST EQUIPMENT REVIEW RD-1 RADIATION DETECTOR

The very phrase "Radiation Detector" suggests the plot of a Japanese monster movie seen on the late-late late show early Saturday morning. The very *suggestion* that CATV systems *might* radiate something that *needs* to be detected smacks of NABism. None the less, we appear hung with the term whether we are guilty or not!

Delmer Ports, the NCTA's Director of Engineering makes a good case for changing our "radiation image" in his "Signal Leakage" manual (available at $5.00 from *NCTA Engineering Department*, 918-16th Street NW, Washington, D.C. 20006). And while we are not certain we are any more fond of *"leaking signals"* than we are of "detecting radiation", we urge anyone who has not placed Delmer's manual in their library to do so; it is worth every penny of the $5.00.

To detect leaking signals that *may* be radiating from our cable system requires a little more skill and expertise than might meet the eye on the surface. First of all, there are FCC prescribed "signal leakage" levels which are alternately, permissible, and, not permissible. The basis for "signal leakage" levels is found initially in Part 15.1 of the Rules and Regulations of the Commission, where among other things it is set forth that "*. . . incidental radiation devices emit radio frequency energy on frequencies within the radio spectrum and constitute a source of harmful interference to authorized radio communication service . . . .*" In effect, the Commission has the power through the 1934 Communications Act, as amended, to regulate the transmission of interstate signals; and when an *unlicensed* radiation device (i.e. a low power transmitter) causes interference to *licensed* transmitter *reception*, the unlicensed low power device is at fault and must close down or clean up its act.

For many years (dating back to the dawn of CATV), cable systems have been liable under the sub-parts of Part 15 (and more recently Part 76) for any radiation of signals which result in interference to home (television) viewer reception. In effect, the cable company can not (and *never* has been able to) run a messy operation that makes direct home antenna reception difficult or impossible *because of cable signal leakage.*

Fortunately for systems such as a certain system located in the far-far south of Florida, the Commission has seldom (if ever) sent field crews to monitor system "incidental radiation levels". But indications are that this is about to *change;* that FCC Field Engineering Office "inspections" can be expected to become a way of life for CATV system operators. It pays to be prepared.

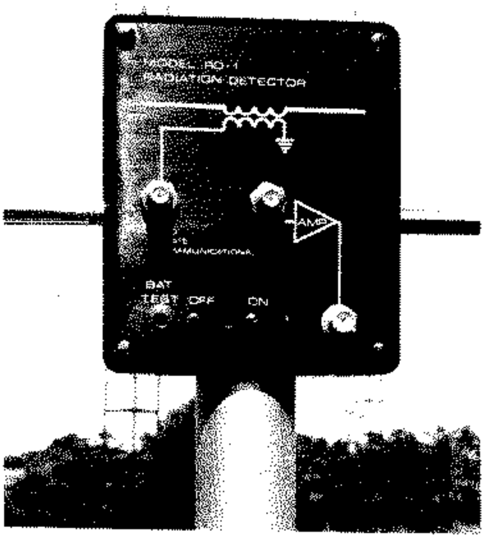
This is especially true with compliance with section 76.605 (a) (12) (radiation). For FCC Field Engineering Office personnel have the full authority *to shut you down on the spot* if they determine that your system is radiating or leaking signal levels above the Part 76 prescribed maximums allowed. For a fuller discussion of how these tests are performed, and the radiation levels permissible, see *CATJ* for December 1974 (Pages 24-26), or the *CATJ Cookbook For 1974/75 FCC Measurements.*

Basically Low Level

The permissible level of incidental radiation devices (i.e. devices where the radiation of an RF signal is *incidental* to their operation) assigned to CATV systems is very low. At channel 2, where the *maximum* levels are permitted, maximums are in the range of —36 dBmV; by the time we get to channel 13 the permissible level has dropped to —48 dBmV. These are levels received at a distance of 10 feet from any cable television system equipment (including drop line), on a 75 ohm dipole antenna.

Because these levels are so low, very few (if indeed any) SLM/FSM devices will produce accurate or even meaningful readings in this range. There is only one suitable solution to accurately determine levels this low; and that is to place an amplifier between the dipole receiving antenna and the SLM/FSM.

And that brings us to the RD-1 "Radiation Detector"



RD-1 Sense Head consists of amplifier housing with antenna out, amplifier in/out F connectors, battery test jack, on/off switch for amplifier, adjustable dipole antenna and LED readout for power-on indication

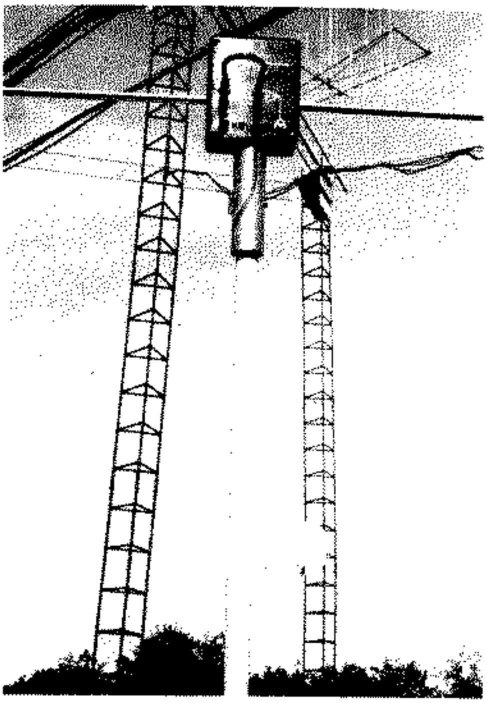
Dipole/Amplifier/Attachments

To go probing for radiation from any portion of a cable plant, you need something to receive the signal on (dipole antenna), something to boost weak signals up so they can be read accurately on an SLM/FSM (amplifier) and the readout device (the meter). Because tests must be made a specified distance from cable equipment or lines (see December 1974 *CATJ*, Pages 24-26), you also need some handy method of elevating the sensing device (the dipole antenna) into the proper position.

The *RD-1* (Radiation Detector) by Mid State Communications, Inc. has all of these component parts in one neat package (you supply SLM/FSM).

The RD-1 is actually a dual instrument; the dipole antenna mounts on a plastic case. The elements to the dipole are screwed into the case (replaceable) and sectionalized so that each half of

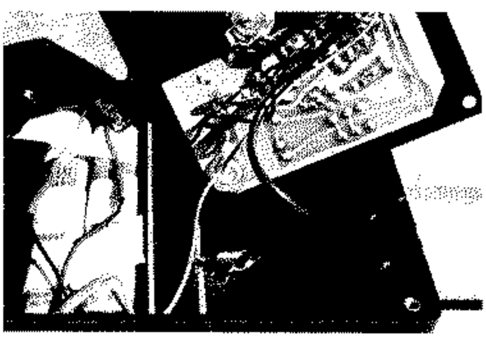
the dipole (see photo) can be adjusted in length for resonance on the test frequency. The dipole is a balanced 75 ohm antenna fed with unbalanced 75 ohm coaxial cable through a balanced/unbalanced transformer. Dipole output terminates in an "F" fitting on the case. This "F" fitting delivers the output of the test dipole to either your SLM/FSM, or, to an internal broadband amplifier housed inside of the RD-1 case. If you do *not* use the internal amplifier, the dipole signal levels are available for either radiation detection or signal survey work at a potential head end location, or as a test antenna to trace interference signals, etc.



RD-1 mounts on PVC handle (insulated), supplied and stands 63 inches high ground to dipole overall; note 59 jumper from dipole "out" to amplifier "in"

For most signal leakage detection work, the radiated signals from the CATV equipment will be of such low level that you will find it necessary to jumper (with a jumper cable — see photo) the output of the dipole into the input of the RD-1 internal amplifier. This is a broadband solid state amplifier powered from a set of four 9 volt batteries. The gain of the broadband amplifier is nominally 15 dB; which means that any levels you find going into your SLM/FSM are dipole levels *plus* the amplifier gain. If you are concerned with meeting the FCC radiation spec, with the amplifier in the circuit (and no allowance for downline loss from amplifier to SLM/FSM), you would be reading levels of —21 dBmV at channel 2 down to —33 dBmV at channel 13. This is still down in the noise region, even with the amplifier; but it is 15 dB better than you would have with the dipole antenna alone.

There are several nice touches to the RD-1. One is the fact that you can operate both with and without the internal amplifier. You may not always need the gain. There is also an LED (light indicator) to tell you when the power is switched on the amplifier (better than running down the batteries), and a battery voltage test jack that tells you when the unit is being supplied sufficient voltage to produce the rated amplifier gain figure.



Internal electronics includes battery storage compartment, test dipole balanced to unbalanced transformer, and 15 dBg amplifier electronics

We measured the gain on the RD-1 unit supplied to us by Mid State as between 14.5 and 16.0 dB, or +/— 0.75 dB over the frequency range 55.25 to 211.25 MHz. The amplifier swept as being considerably broader than 55-211 MHz, indicating that it will probab-

ly provide useful service out to beyond 300 MHz on the high end. It drops off quite rapidly below 50 MHz however.

The operating voltage for the RD-1 is 18 VDC. The RD-1 includes a PVC (insulated) handle that is 60 inches long. When the handle is attached to the collar mounted below the RD-1 housing, the RD-1 dipole antenna is 5 feet 3 inches *above* the bottom of the handle. Held at *belt level* while walking, this places the dipole approximately 8 to 8-½ feet above ground, suitable for checking lines that are ten feet higher than this or 18 to 18-½ feet above the street. In circumstances where lines are considerably higher than this, an extension handle could be easily fabricated for the existing handle, or a longer piece of PVC substituted.

One of the "complaints" we have heard about this *type* of broadbanded antenna mounted amplifier is that it may have a relatively *low* maximum output capability before overloading. We set up at *CATJ* and ran two low band and two high band TV signals (simultaneously) in the +12 to +15 dBmV dipole (antenna output) region into the *amplifier* portion. Then we looked for overload characteristics on a weaker low band and weaker high band channel. At antenna levels to +15 dBmV we found none. That is not to say the amplifier will *not* overload; it is to say that at these levels it will not; and in most situations the off-the-air signals are much weaker than in our test example.

However, the normal procedure in checking for line radiation is to set up the checks on a *cable secure frequency*, such as your pilot carrier, or a cable-only FM carrier. If this is the approach you use, a simple inexpensive bandpass filter (see *CATJ* for December, Page 11) inserted between the output of the dipole (at "F" connector) and the input to the internal RD-1 amplifier ("F" connector) would *attenuate* the local off-air signals sufficiently to prevent overload *in virtually any situation.*

RD-1 Specifications

Function	50-300 MHz test dipole with built-in 15 dBg amplifier
Antenna Gain	0 dB over reference dipole
Impedance	75 ohms, unbalanced, from dipole or amplifier
Match	16 dB or better, amplifier output
Height	66 inches with PVC handle
Weight	5 lbs. with handle
Operating Voltage	18 VDC (amplifier)
Powering	four (interval) 9 VDC batteries
Amplifier Gain	15 dB nominal
Connectors	F
Price	$166.00

Manufacturer—
Mid State Communications, Inc.
P.O. Box 203
Beech Grove, In. 46107
(317/786-9537)

The RD-1 amplifier is a surprisingly good little amplifier. Although the voltage gain is not quite up to a level which you would usually spec for "preamplifier" service, we took a 90 mile off-air signal on high band and ran it through the RD-1. The voltage gain we expected; but we were surprised to find that the noise figure of the amplifier is apparently quite low; picture degradation because of preamp noise did not result in this quickie test. Seemingly, in a pinch the RD-1 internal amplifier *could* be pushed into preamp service until a downed unit was repaired.

WIN AN RD-1!

How carefully did you read this CATJ Equipment Review? Turn now to the RD-1 Contest Entry Form between Pages 40 and 41 of this issue of *CATJ*, and complete the contest entry form. You may win an RD-1 from Mid State Communications!

cata ASSOCIATE MEMBER ROSTER

In recognition of the untiring support given to the nation's CATV operators, and their never-ending quest for advancement of the CATV art, the COMMUNITY ANTENNA TELEVISION ASSOCIATION recognizes with gratitude the efforts of the following equipment and service suppliers to the cable television industry, who have been accorded ASSOCIATE MEMBER STATUS in CATA, INC. for 1975.

Anixter-Pruzan, Inc., 1963 First Ave. S., Seattle, WA 98134 (**D1**)
Avantek, Inc., 3175 Bowers Avenue, Santa Clara, CA 95051 (**M8**)
Belden Corp., Electronic Division, Box 1327, Richmond, IN 47374 (**M3**)
BROADBAND ENGINEERING, INC., 850 Old Dixie Highway, Lake Park, FL 33403 (**D9, replacement parts**)
Burnup & Sims, Box 2431, W. Palm Beach, FL 33401 (**S2, S7, S8**)
Cable Dynamics Inc. 501 Forbes Blvd., So. San Francisco, CA. 94080 (**S8; equipment repair**)
CABLE NEWS, 2828 N. 36th Street, Phoenix, AZ 85008 (**S6**)
Cerro Communication Products, Halls Mill Road, Freehold, NJ 07729 (**M3, M5, M7**)
COMM/SCOPE COMPANY, P.O. Box 2406, Hickory, NC 28601 (**M3**)
DELTA BENCO CASCADE INC., 40 Comet Ave., Buffalo, N.Y. 14216 (**M4, M7, M8, D3, S8**)
Jerry Conn & Associates, 550 Cleveland Ave., Chambersburg, PA 17201 (**D3, D5, D6, D7**)
C-COR ELECTRONICS, Inc., 60 Decibel Rd., State College, PA 16801 (**M1**)
DAVCO, Inc., P.O. Box 861, Batesville, AR 72501 (**D1, S1, S2, S8**)
DEVINES Trailers & Accessories, Grantville, PA 17028 (**M9, cable trailers**)
ENTRON, Inc., 70-31 84th Street, Glendale, NY 11227 (**M4, M5, D4, D5, S8**)
GAMCO INDUSTRIES, INC., 317 Cox St., Roselle, NJ 07203 (**M5**)
JERROLD Electronics Corp., 200 Witmer Road, Horsham, PA 19044 (**M1, M2, M4, M5, M6, M7, D3, D8, S1, S2, S3, S8**)
Kay Elemetrics Corp., 12 Maple Avenue, Pine Brook, NJ 07058 (**M8**)
Microwave Filter Co., 6743 Kinne St., Box 103, E. Syracuse, NY 13057 (**M5, bandpass filters**)
MID STATE Communications, Inc., P.O. Box 203, Beech Grove, IN 46107 (**M8**)
Pro-Com Electronics, P.O. Box 427, Poughkeepsie, NY. 12601 (**M5**)
QE Manufacturing Co., Box 227, New Berlin, PA., 17855 (**M9, tools & equipment**)
RMS CATV Division, 50 Antin Place, Bronx, NY 10462 (**M5, M7**)
TEXSCAN Corp., 2446 N. Shadeland Ave., Indianapolis, IN 46219 (**M8, bandpass filters**)
Theta-Com, P.O. Box 9728, Phoenix, AZ 85068 (**M1, M4, M5, M7, M8, S1, S2, S3, S8, AML Microwave**)
TIMES WIRE & CABLE CO., 358 Hall Avenue, Wallingford, CT 06492 (**M3**)
TONER Equipment Co., 418 Caredean Drive, Horsham, PA 19044 (**D2, D3, D4, D5, D6, D7**)
WAVETEK Indiana, 66 N. First Ave., Beech Grove, IN 46107 (**M8**)

NOTE: Associates listed in bold face are Charter Members.

NOTE: Supplier areas are keyed at the end of each listing, as follows:

Distributors:

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

Manufacturers:

M1—Full CATV equipment line
M2—CATV antennas
M3—CATV cable
M4—CATV amplifiers
M5—CATV passives
M6—CATV hardware
M7—CATV connectors
M8—CATV test equipment

Service Firms:

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

CERRO'S NEW HYBRID MULTI-TAPS

A new line of hybrid multi-taps has been introduced by **Cerro Communication Products**, Halls Mill Road, Freehold, N.J. (07728). Two, four and eight way outlets in the multi-taps are available with respectively DT-2, DT-4 and DT-8 product numbers.

Cerro reports low insertion loss and high isolation are two primary advantages to their new product. Output to tap isolation is 25 dB minimum and typical tap-to-tap isolation is also 25 dB. Bandwidth is 5 to 300 MHz. The new taps are color coded for easy identification; brown represents a 7 dB value, black a 10 dB value, blue a 14 dB value, green a 18 dB value, yellow a 22 dB value, red a 26 dB value and white a 30 dB value. All of the new taps have a conductive gasket seal that has weatherproofing plus radiation proofing characteristics. Cable connections are center seized.

The taps can be pedestal or strand mounted, and are cast aluminum construction.

NEW ANIXTER-PRUZAN SOURCEBOOK

The new 1975 edition of the **Anixter-Pruzan Tools and Equipment Catalogue** is available; and it is a dandy. This year's version is compiled with more than forty separate sections (equipment is grouped by function) and over 2,000 items are listed. The new 75 version fits into your pocket to go with you on the job, and includes postage-paid order cards so that you can fill out your want list while atop a pole and post the order in the mail box on the corner.

If you don't have your 1975 A-P Tool and Equipment catalogue, better get a move on by contacting any of the Anixter-Pruzan sales offices or writing to the main office at (Anixter-Pruzan), P.O. Box 3777, Seattle, WA. 98124.

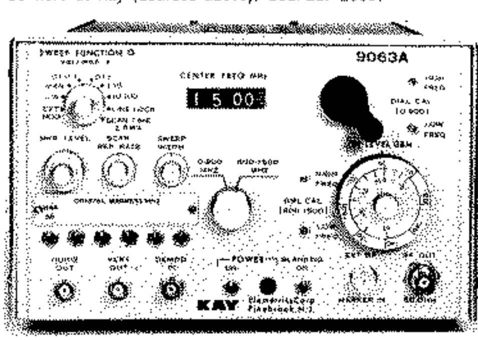
KAY HALF-RACK SWEEP

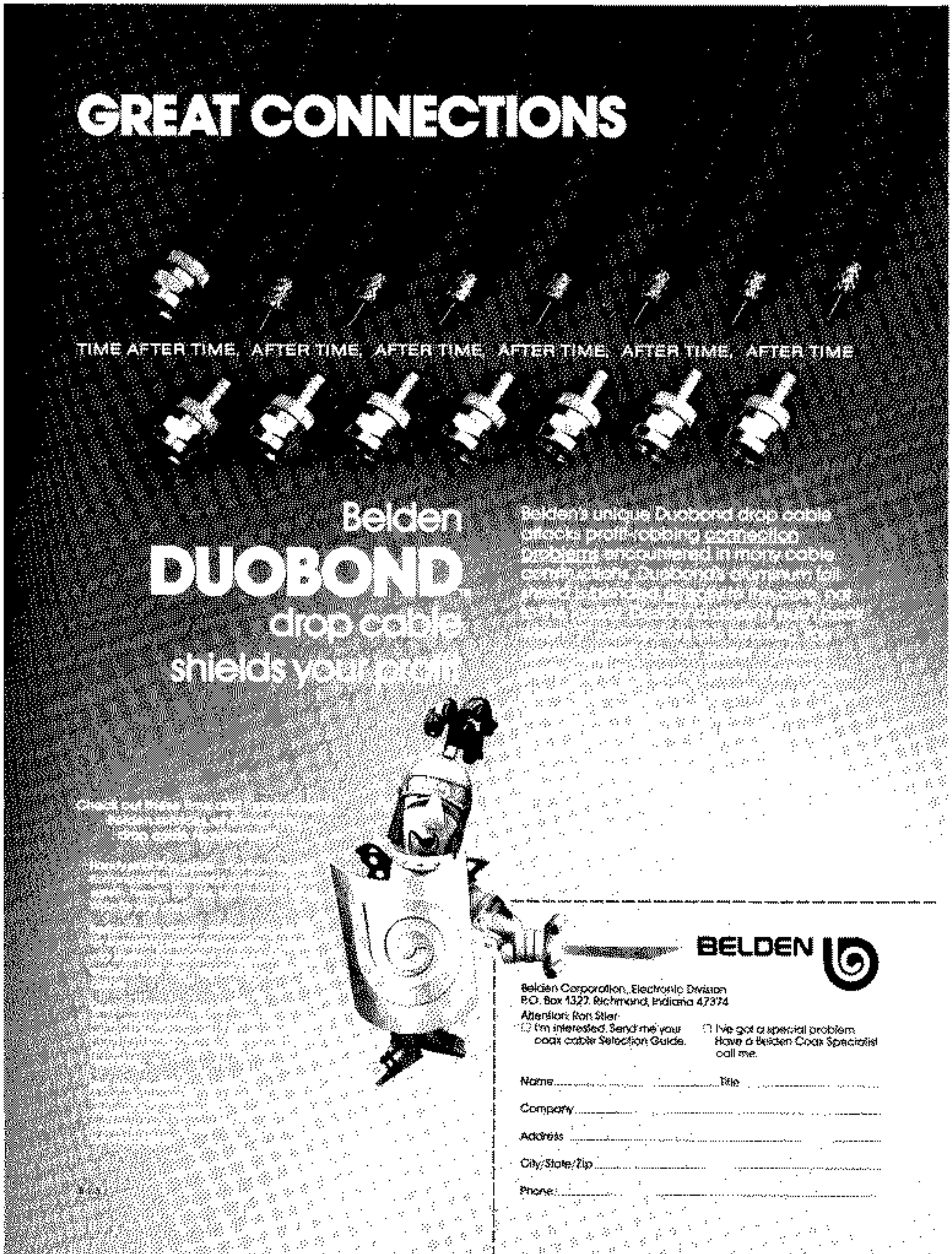
Kay Elemetrics Corporation, 12 Maple Avenue, Pine Brook, N.J. (07058) has announced a new sweep generator, the Kay 9063, which occupies only a half of a rack space, but covers 1-1500 MHz in two bands (1-900 MHz with 1 KMz sweep and 800-1500 MHz with a 700 MHz sweep).

The overlapping bands provide a 0.5 VRMS output, flat to within +/— 0.5 dB overall. Harmonic and spur outputs are more than 30 dB below the intended output signal(s), with "no spurs" in band 2 (800-1500 MHz). The frequency is dialed up by reading out a digital display, and built-in rotary attenuators go to 80 dB of attenuation.

Sweep rate selection includes variable from 1-100 Hz, manual sweep and line lock modes. External triggering and a summation sweep with a variable 0.2 to 5.0 mS sweep scan are available as options.

Further details, and availability are found by contacting Jim Conners at Kay (address above); 202/227-2000.

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