CATJ

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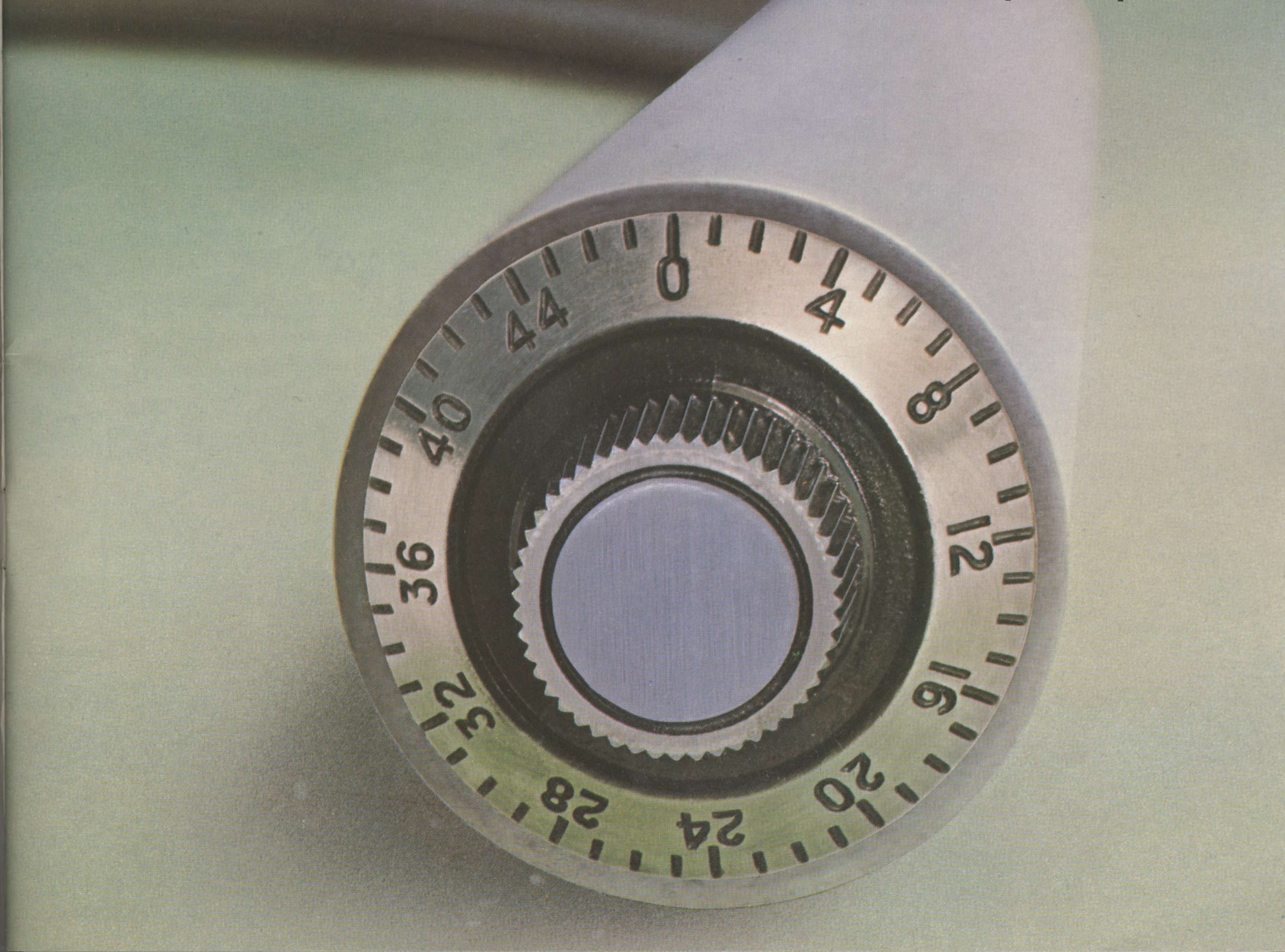

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DEPARTMENTS

–OUR COVER–

BI-CENTENNIAL COVER NO. 2 — On July 1, 1898, Colonel "Teddy" Roosevelt led the fabled rough-riders in a charge up Kettle Hill near Santiago, Cuba. Look closely at Roosevelt (with saber) and his four front-men. Any resemblance between these five patriots and persons in the CATV industry is intentional!

CATA ~ TORIAL

KYLE D. MOORE, President of CATA, Inc.

Happy Hunting Grounds

When the Federal Communications Commission marched into the CATV world in March of 1972, and proclaimed **their law was to be the law of the land**, there were (according to FCC records) 2,839 operating CATV systems in this country. These 2,839 systems were "grandfathered," which is a clever Washington term for being allowed to continue to operate for a period of some years **before full obedience** to the FCC conquerors is required.

Of all of the requirements which grandfathered systems face by March 31, 1977, one stands out above all others. And that is the requirement that all grandfathered systems have on file at the FCC an application for a Certificate of Compliance, by March 31, 1977.

Now the CAC by itself is, as they say in Washington, "a piece of cake." Unfortunately, the cake is laced with arsenic and here is why. To **apply** for a CAC, the grandfathered system must go before the local town officials and obtain a **new** or substantially modified operating permit (franchise, easement, etc.). The FCC rules require "total compliance" with FCC franchising guidelines (76.31 [a] 1-6 and [b]); and that means most (if not all) pre-72 CATV permits, franchises, etc. have to be modified to suit the FCC's guidelines.

And that is where the industry is in deep trouble.

In the September, 1974 issue of CATJ, a report entitled "The Horrors of Preparing for March 31, 1977" talked about what **might** well happen out there in grandfathered CATV land when existing systems were **forced** to go to their local franchising authorities to obtain **new** agreements. In that report we quoted CATV's Madam Ambassador Polly Dunn of Mississippi, who said, **"Suppose a system upgrades its technical specifications, as required by the 1977 technical requirements, at a considerable outlay in new capital funds. Then suppose the CATV company went to its city council and asked for a new franchise, a franchise that meets the requirements which the FCC has set. Now... also suppose that a second party or group has designs on your cable system and its franchise, and through local political pressure, backdoor politics or just plain outright bribery, talks the local franchising authority into denying your request for a new franchise, and in granting a replacement franchise to this second party or group. Then what?"**

This question, based upon the real world politics one often finds in small and medium sized communities of every size and shape and location, is uppermost on the minds of several thousand "grandfathered system operators" these days. And for good reason, the fears of Ms. Dunn have already begun to mature and existing systems are already losing franchises to new groups!

Here are two cases in point. On October 21, 1975, the local cable office of Cablecom General, Inc., in Idabel, Oklahoma, was notified that a request for granting a competitive franchise was on the agenda for the Idabel City Council meeting for **that** very night. Idabel is a community of approximately 6,000 people in extreme southeastern Oklahoma, and the system serves approximately 1,950 subscribers. The system has been operated by Cablecom General since 1961. The competing firm, made up of a couple of veteran cable people, promised to deliver to Idabel a number of new services, including: (1) Pay television consisting of between 5 and 10 major motion pictures per month, (2) Two news service channels, (3) Local origination events of a local interest, (4) A channel dedicated to use by local schools, and (5) carriage of network signals from Oklahoma City, a point 215 miles distant, and, (6) an increase in the franchise fee paid to the city. At the end of the presentation the City Council voted 3 to 1 to grant a new franchise to the new firm. Keep in mind that Idabel has fewer than 2,000 subscribers, and is essentially fully saturated.

Now move ahead to November 4, 1975, and change the scene from Idabel, Oklahoma to Hugo, Oklahoma, a nearby community of 6,600 residents and 2,400 cable subscribers. Cablecom-General also operates in Hugo, where they have operated since 1957. The Hugo customers are served by six channels of television, a weather channel, an emergency (weather) alert system, and FM signals. Hugo has three of its six signals brought in via microwave while Idabel brings in two of its signals via microwave.

On November 4, a group that identified itself as Hugo Cablevision asked for a new CATV franchise. Hugo Cablevision consists of the editor of the **local** Hugo newspaper and his son, a **local** CPA, a **local** grocer who coincidentally **is the husband** of a member of the Hugo **city council**, and, a local attorney, who coincidentally **is also** the City Attorney for Hugo.

At a further meeting on January 13, Cablecom-General and the new firm, Hugo Cablevision, made separate presentations to the Hugo city council. At that presentation, the principals of Hugo Cablevision identified as the "captains of **their** team" the **same** two veteran Cable people that had been awarded a new CATV franchise **in Idabel** back in October. Cablecom-General sought to have **their** Hugo franchise adjusted, updated and extended, **based upon the FCC requirements** as set forth in 76.31 (a) and (b). Hugo Cablevision wanted Cablecom-General booted out of town and they wanted their own group awarded a franchise.

Finally, on January 27, the Hugo city council moved to adopt the application from the new group, and by a vote of 6 to 1, **Cablecom-General was out of business in Hugo**, effective this coming June 27 (six months following the vote).

Now shift the scene north to a small town (that will for now go un-identified, but it is real and this is a true story, nonetheless) in south central Kansas. The town has a population of around 800 and the **fewer-than-200 subscriber** CATV system operating there has been doing a good job for more than 12 years. The owner-operator **is** a local man, who hardly earns even a partial living from the system, and he must depend upon his general electric and electronics business to even sustain a poverty income level for his family. Here a group of **out-of-town** sharpies from a neighboring state have come to town to work up the local populaion against the local cable operator. His five channel low band system has been undergoing a rebuild for several years, **a piece at a time** as he could manage the cost of aluminum cable and solid state amplifiers. The sharpies came into town and promised "twice as many channels." This individual is now locked in a life and death struggle for his **very** small (fewer than 200 subscriber) cable system, and the focal point is **his having to obtain a new franchise** before March 31, 1977. The same group is also working up the residents in **another** nearby community where a local operator serves fewer than 300 subscribers in a system that is 14 years old in a town of 1,100 people.

In **each** of these four towns, the local cable system has been invaded by people **already in** the cable business, people who operate on the fringe of legitimacy. Anyone who has been around a few years has picked up enough of the blue sky jargon to know how to persuade a city council with promises such as "distant signals," "5 to 10 movies a week," and the like. The two fellows who engineered the Idabel and Hugo, Oklahoma take-overs of Cablecom-General franchises have nearly forty combined years of cable background!

It has long been **thought** that the **local** operator would or should have the upper hand in situations such as this. He was, afterall, on hand, in place, and doing business in the city. And if his local relations were good, the theory went, he should have little difficulty staving off "strike applications." Sadly, the local operator may be at a tremendous **disadvantage**. He is oftentimes a **realist** while the new applicants are quick to promise **the blue sky**. The established operator hesitates not a moment to try to point out why a distant 200 mile plus station is **not** economically feasbile for the system, while the applicant for the franchise talks glibly about "satellites," microwave and all of the other **promise-them-anything** programs we can all rattle off without drawing a breath.

Now the mere fact that we have related four recent events in Oklahoma and Kansas should not lull **you** into any false sense of security. We have chosen these events to relate only because we have been close enough to watch with concern, first-hand, as the stories unfolded. Our mailbox and telephone has been filled of late with similar stories from California to New York, Minnesota to Florida.

At a recent state-association cable meeting, an FCC type person invited to address the group was asked what assistance or relief the grandfathered cable operators might expect from the FCC in this area. **"You certainly have a problem alright... but perhaps if you had taken better care of your local city relations, you wouldn't have that problem...."** was the terse reply.

The FCC man missed the point completely. He, and his fellow 59 cable attorneys in the Cable Television Bureau, and the seven FCC Commissioners, **are the cause of this problem.** Without the March 31, 1977 "franchise compliance requirement," it is doubtful that Cablecom-General would be facing a "get out of town by June 27th" edict, in Hugo, Oklahoma. Without the Commission's stepping into our **private** contracts with our **local** municipalities, and without the Commission's **demanding** that we modify those **private** contracts to a set of terms which **they find** more to **their** liking, the sharpies would not moving in on two small towns in Kansas, nor would they be out making wild-eyed blue sky promises in Idabel and Hugo, Oklahoma.

Back in 1974, when Ms. Dunn of Columbus, Mississippi voiced concern for her own system, an FCC man showed concern not for the potential plight of Ms. Dunn, but rather he showed concern for a "continuation of cable service to the town's subscribers." The commission clearly is not going to act as a court of last resort to overturn local decisions. **Nor should they.**

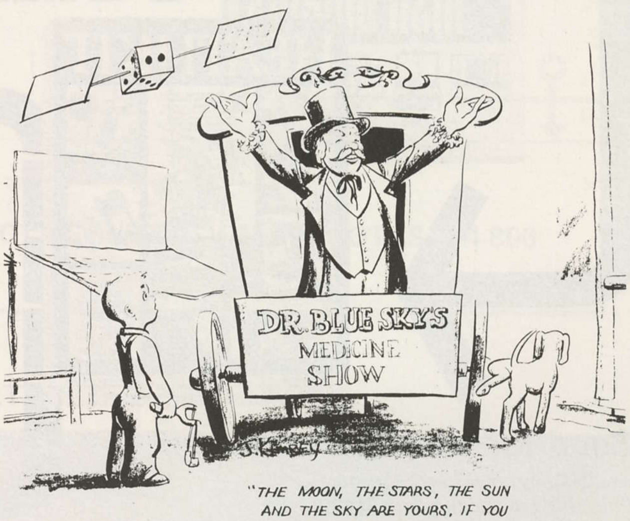
But they **should** quit beating around the bush **and hiding from the plain truth,** that being, that because of **their** rules, dozens, and perhaps hundreds of hard working cable operators may wake up on April 1, 1977 and find that 10, 15, 20 or 25 years of **their** lives have gone for naught. That because of the **FCC's** CAC rules, and because of the **FCC** requirement that franchises be re-awarded before March 31, 1977, the established system operator is, like Cablecom-General in Hugo, left with tens of miles of local cable plant, **and no local permit to operate.**

This is squarely a problem created by **federal meddling** in local affairs. The sharpies are using the **federal rules** to force established operators **out of business**. They are using the fact that the **local** cable operator is **forced** to update his franchise as an excuse to move in on the local operator, promise lots of blue sky, and romance the local city council away into a never-never land.

Now — what can be done? Well, for one thing, we **could** publish a list of the names and addresses of these vultures who would put fellow operators out of business. Then if and when a supplier signed a contract to supply equipment to one of these fellows or firms, we **could** publish that also. You, as a concerned operator, might find it useful to know whose equipment these vultures would be using. That might have some bearing on the next equipment **you** would buy. But that probably has anti-trust implications, and besides, the suppliers cannot be expected to be held accountable for who they sell to; at least **not** in these perilous times that our supplying arm is now experiencing!

No, the answer is not "after-the-fact;" it is "before-the-fact." The answer, like it or not, is at 1919 M Street in Washington: **at the FCC**. The FCC must and should recognize that **they** are the primary cause of this problem, and that like it or not, **their rule** is being utilized by **some** people to deprive existing citizens of their property, often **without** proper due process.

The FCC must get **their** head out of the sand, **admit they are at fault,** and take action to relieve the pressure before it gets totally out of hand. They should **immediately** move that rather than insisting on a March 31, 1977 franchise compliance date, that grandfathered systems have until their **present** city franchise (permit, easement, etc.) **runs out** to bring the franchising instrument into "compliance." If the March 31, 1977 deadline is voided, and the existing grandfathered systems are allowed to continue to operate with**out** federal franchise compliance **until** their present franchises (permits, etc.) expire, the pressure now placed on operators in towns like Hugo and Idabel will evaporate. **And that will slow down the franchise grabbers in one big hurry.**



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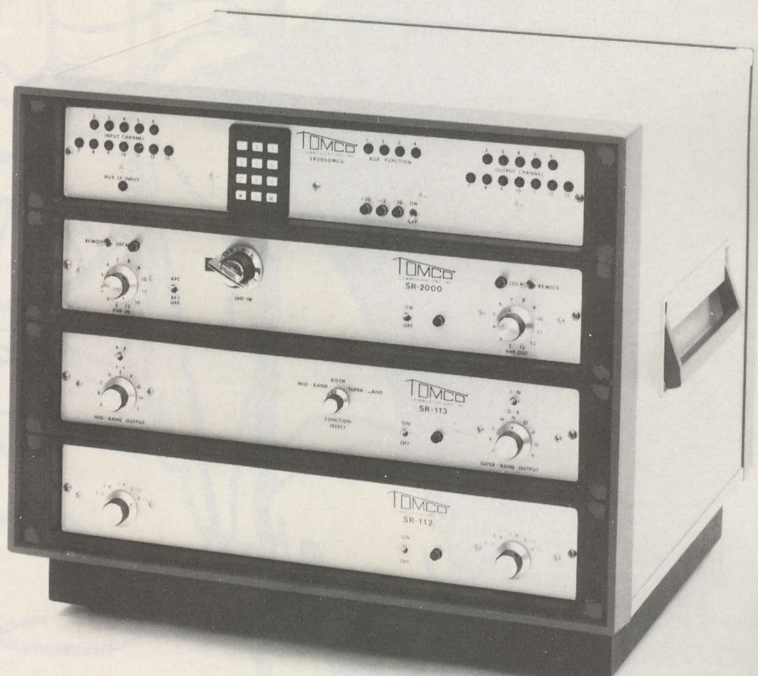

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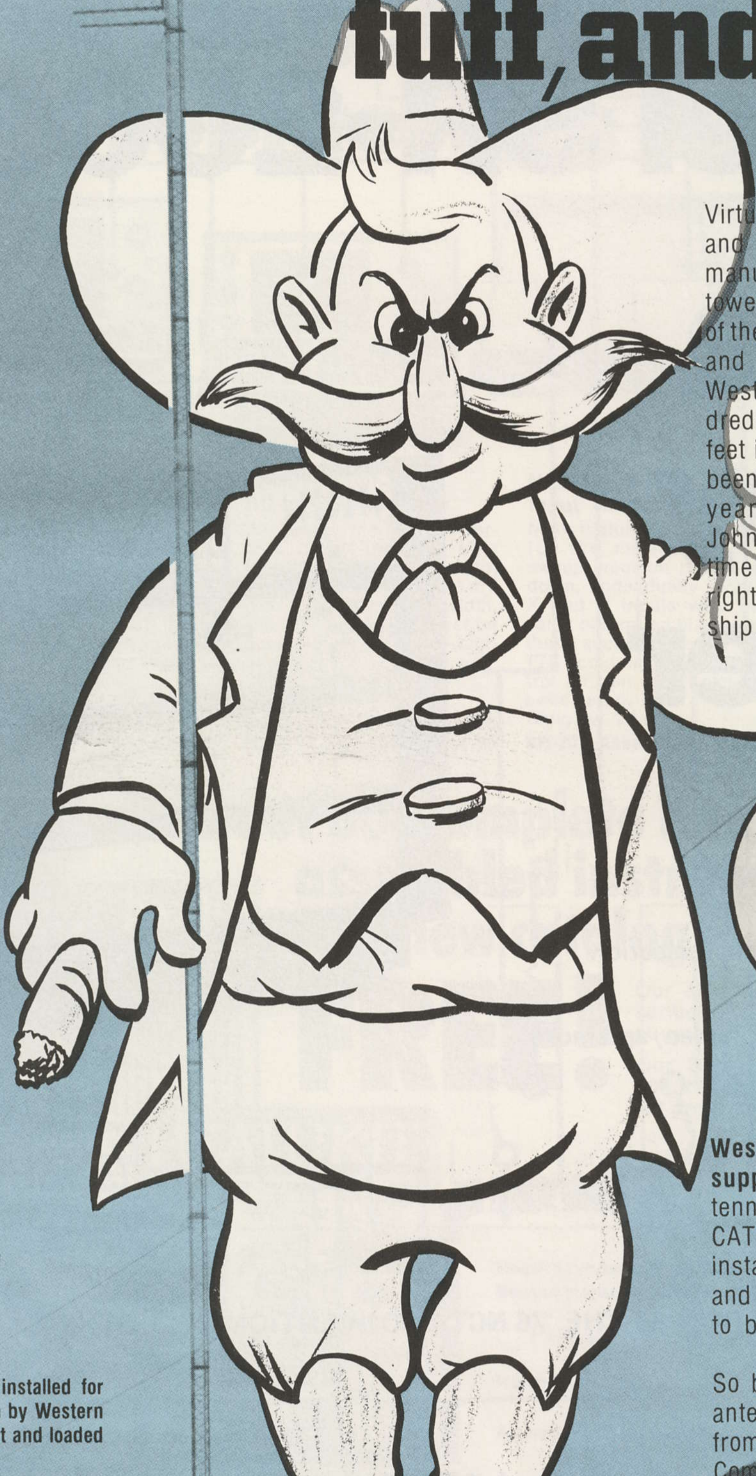

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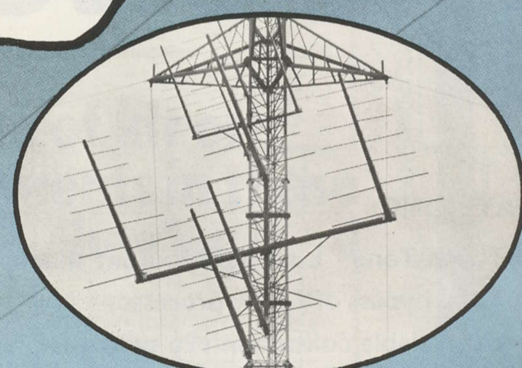

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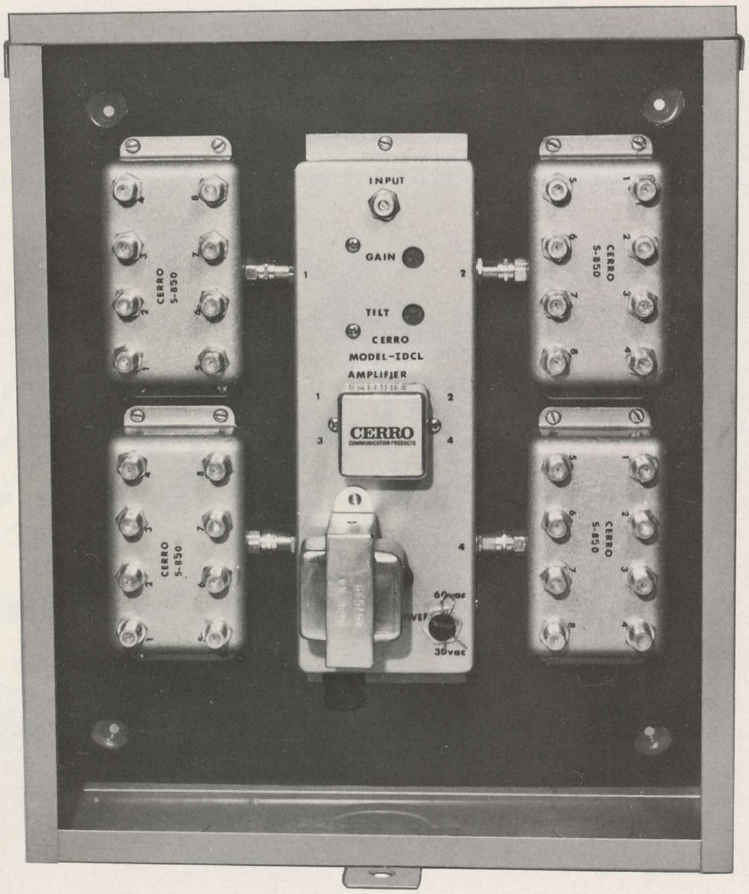

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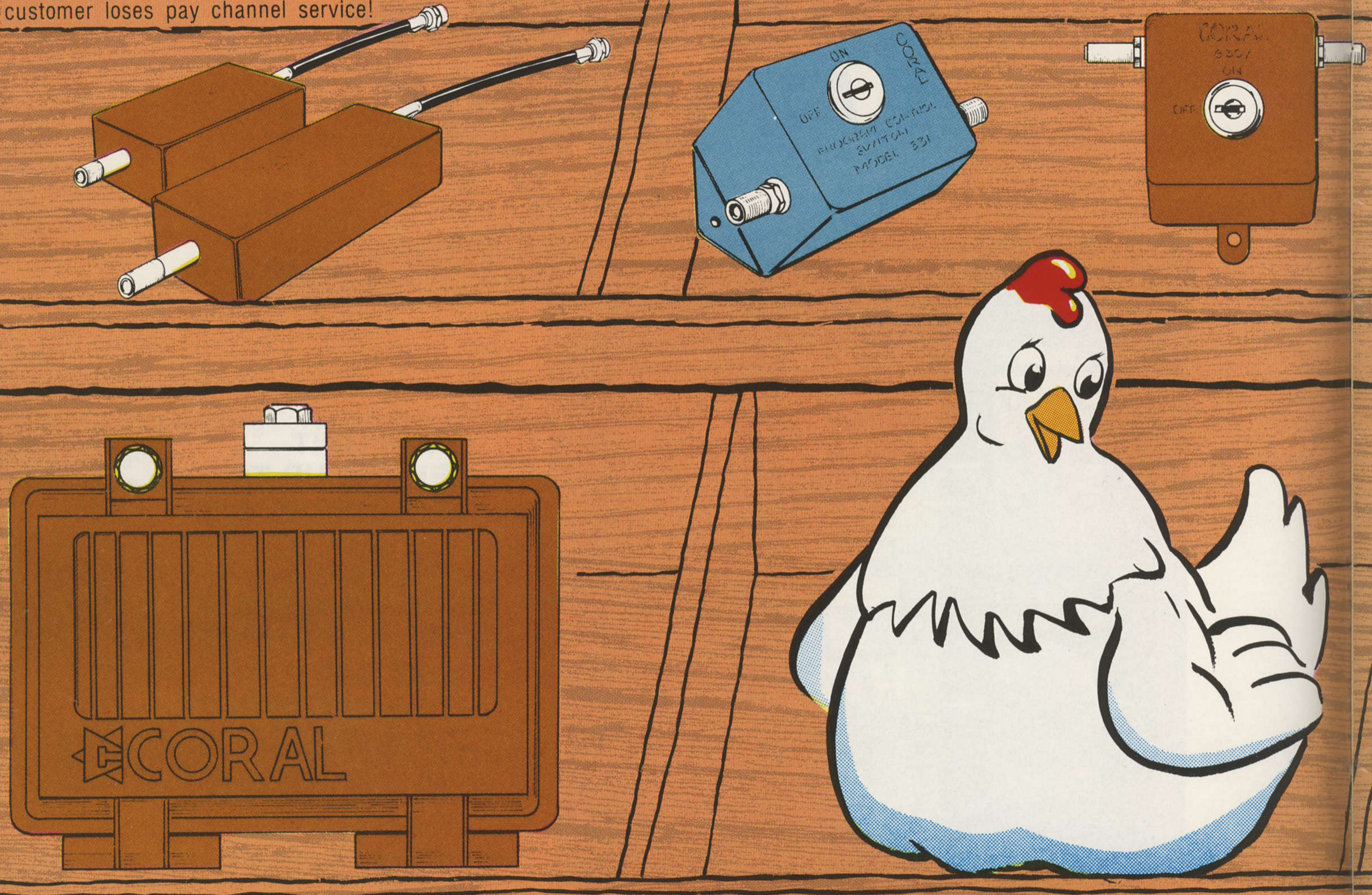

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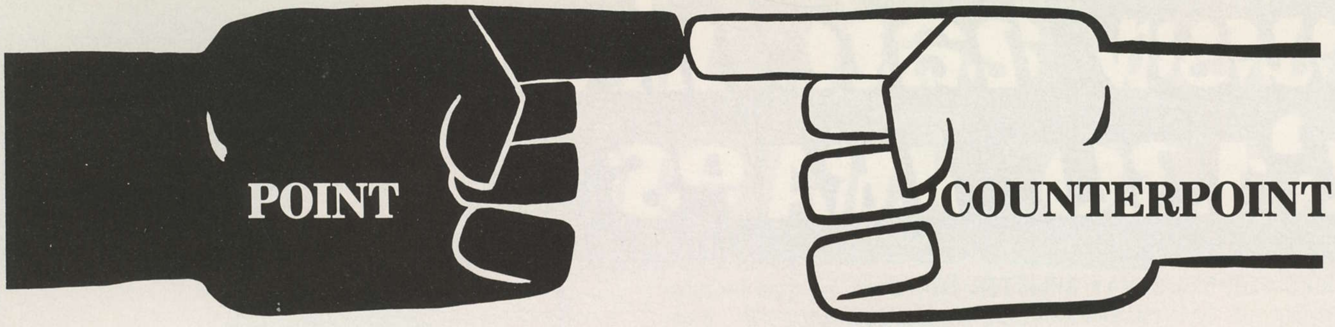

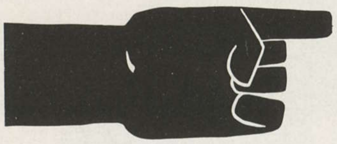

A MODEST PROPOSAL TO RESTRUCTURE AMERICAN TELEVISION

For more than 30 years, with respect to the "most pressing" (1) problem of television frequency allocation and assignment, the Federal Communications Commission (FCC) has been embroiled in a morass of political, technological, and economic overtones and pressures. There is a lengthy literature on this situation. (2) In all these years—at least since 1944 (3) —there has been no "perfect" or even generally accepted solution to the question of how one provides (in the words of Section 307(b) of the Communications Act of 1934) a "fair, efficient, and equitable distribution" of television broadcasting service to "the several States and communities."

In the 1952 *Sixth Report and Order*, the "Commission said that it had . . . endeavored to meet the twofold objective set forth in Sections 1 and 307(b) of the Communications Act of 1934, to provide television service, as far as possible to all people of the United States and to provide a fair, efficient and equitable distribution of television broadcast stations to the several states and communities. In attempting to carry out these objectives, the Commission set forth certain principles, in terms of priorities, underlying the Table of Assignments. These principles were:

Priority No. 1: To provide at least one television service to all parts of the United States." (4)

There is no objection to this first priority. It is the other priorities listed in this *Report and Order* (to provide each community with at least one station, and then to provide for competition within the framework of the two priorities: two services, two stations, etc.) (5) and the methods chosen to implement them, that have led to the present situation—which is neither equitable nor efficient:

1) although 8% of Americans have access to a dozen or more television stations, 18% have access only to four or fewer stations (1972 Nielsen data);
2) there are only four networks (including PBS), thus restricting program diversity, reducing opportunities for new talent, and so on;
3) the unequal distribution of channels has created conditions of monopoly or near monopoly in a number of communities;
4) only a small proportion of UHF channels have been activated, and—despite the more-than-a-decade-old requirement that all receivers be capable of tuning all channels—stations on these channels are generally at a competitive disadvantage when compared to VHF stations in the same markets, although 1974 data place the median UHF station in the black (7);
5) time charges in many markets are so high that advertisers (including political campaigners) often cannot afford to use television as a selling medium;
6) there is a critical shortage of space in the electromagnetic spectrum for other services, including those involved in public safety activities;
7) there is *little* financial incentive to provide television service to rural and other sparsely populated areas;
8) there is a lack of local input into licensee selection and retention; and
9) the high capital cost for entry into television station ownership makes it very difficult for less well financed groups or companies to successfully apply for a license. This same high capital investment apparently has contributed to a reluctance on the part of the FCC to "punish" errant licensees with the ultimate penalty: loss of license. (8) This "stability," once a license has been granted, seems almost directly related to the amount of investment that would be disrupted or lost, even though in some instances the public interest, convenience and necessity (9) might better be served by change.

by
John M. Kittross
Temple University
Philadelphia, Pa. 19122

To modify this system naturally requires careful planning, and consideration of a variety of political, economic and technological factors. For example, the enormous political inertia caused by the more than $20 billion worth of television sets in millions of American homes has frustrated nearly every

Editor's Note:

John M. Kittross is Associate Dean and Professor of Communications at Temple University, Philadelphia. Mr. Kittross initially prepared this paper for presentation to the Media Management and Political Economy Paper Session at the Association for Education in Journalism Convention, held in Ottawa, Ontario in August 1975. Mr. Kittross is suggesting that the experience of other nations of the world with their own non-USA type television allocation plans offer examples of more efficient use of the VHF and UHF spectrum than the present USA approach. In view of recent renewed interest on the part of Congress in the television signal delivery problem (i.e. House Subcommittee on Communications Report **Cable Television: Promise Versus Regulatory Performance**), and Congressional hearings scheduled for this year, CATJ believes the paper of Professor Kittross should have wide distribution throughout the television broadcasting and receiving industry.

consideration of change in the allocation system since the late 1940's; unequitable distribution of channels has given rise to many attempts to solve technological problems by political fiat, most recently in New Jersey (10); the concentrated political strength in large centers of population makes any reduction of service to them inadvisable, and so on. (11)

Any suggestion for major change in the television broadcasting system must take into account the emphasis on the listener or viewer articulated in the Communications Act and in *Red Lion* (12), and must overcome the inertia that no doubt will lead to a chorus of "the mistakes were made in 1944 and 1952 and can't be changed." In addition, any new proposal must consider such varied legitimate needs, interests and concerns as those of set owners, present station operators, those who didn't or couldn't apply for a television channel when they were plentiful or those who don't get the programming they desire, program producers and the craft unions with which they exist in interdependence, advertisers, and citizens (as individuals or in groups) who should have additional voice in programming and licensing and who should have access to the maximum amount of information which they need in order to make rational decisions in a democracy.

Previous Proposals

During the 1944 General Allocations Hearings and the hearings that led to the *6th Report and Order*, a number of suggestions were made with respect to rationalizing television frequency allocations. In essence, there were those who wished to maintain the *status quo* with respect to the number and location of channels for television, and those who wished (usually for business reasons of their own) to move television to a new location in the spectrum. After 1954, when it became obvious to all that UHF stations were not able to compete with VHF stations licensed to the same market, there were three major propositions presented to the Commission: an all-VHF system using some additional channels secured form the military; an all-UHF system; and a policy of deintermixture, which would make a given market either all-VHF or all-UHF. The military wouldn't provide additional channels, the weight of investment by the public was an immovable barrier to the second (all-UHF) solution, and local objections and FCC timidity prevented full implementation of the third. (13)

Still later, the unsolved problem of providing sufficient choice and diversity of television programming to the American public was approached by new and adapted technology. The choices in the late 1960s and early 1970s were the existing television allocation system (modified by deletion of some under-used channels at the top of the UHF band), an all-UHF system (not seriously considered), an all-VHF system (the military and other users still prevented serious consideration of this, and the fact that all existing receivers would be obsolete would have turned Congress [and hence, the FCC] against it), and, the one new idea, what is now called "the wired nation." This last proposal, an extension of community antenna or cable television (CATV), was expected to be a broadband wired telecommunications network that would provide multiple channels of television and many ancillary services to the home for a fee. (14) There were many who thought that CATV would be the greatest invention since the zipper, but the recession and numerous other factors have restricted cable's penetration after more than a quarter century to be 15% of U.S. television households. (15) The ancillary services (except for pay-TV over cable) have failed to materialize on a non-experimental basis.

The FCC has always been a reluctant regulator. Possessed neither of clear perogative jurisdiction, sufficient information on which to base decisions, or the power to enforce them, it is no wonder that this politically sensitive body traditionally has ignored problems in the hope that they will go away. (16) The Commission rarely has asked for and the Congress rarely has provided means for the FCC to independently evaluate new technologies or alternative proposals. As a result, the Commission has tended to rely upon the adversary process that is less likely to result in enhancement of the public interest in a rule-making proceeding than in a law suit.

A Fresh Look

It is for the reasons touched on above that this speculative proposal for the allocation and assignment (17) of television channels is presented. The proposal borrows from a number of solutions to similar problems elsewhere in the world, and from suggestions made in prior allocation and other proceedings in the United States. The proposal is deliberately brief, intended only to provide logical underpinning for the basic scheme rather than expand this article to include the myriad of specific details. (18)

First, establish a system of channel asignments

Arbitrary rectilinear grid, approximately 150 miles to a side, approximately 130 Clusters or intersections within the 48 contiguous States. The second, interlaced, grid also would have approximately 130 intersections or Clusters; each intersection would be in the middle of the cells shown.

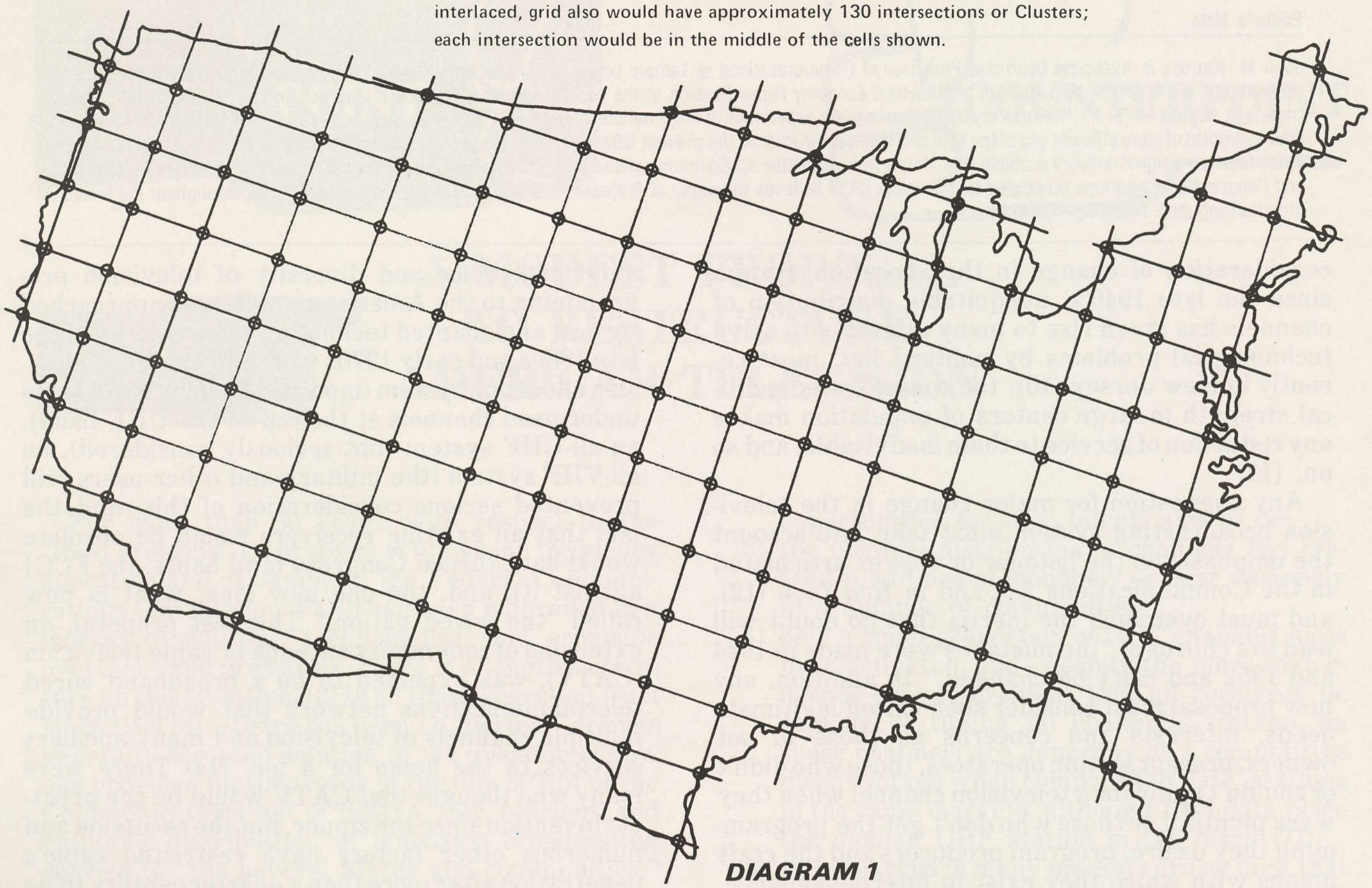

DIAGRAM 1

based upon an arbitary (technologically determined) rectilinear grid pattern rather than the past system of assigning television channels to "markets" more or less according to their size.

This system would be similar to the highly workable system adopted under International Telecommunication Union auspices in Europe (Stockholm, 1961) and Africa (Geneva, 1963). (19) In those continents, problems of potential interference are greater than in the United States due to language differences, and problems of adequate diversity and coverage are greater due to the smaller geographical limites of nations—and radio waves do not respect national boundaries.

In essence, a rectilinear grid would be established for the United States (see Figure 1), analogous to arbitrary imposition of the system of latitude and longitude. The sides of each cell could be approximately 175 miles long. This would result in approximately 95-100 intersections of the "north-south" and "east-west" lines. As *each intersection* is approximately the current co-channel separation distance for Zone 1 (20) from every other intersection, it would be possible to place transmitters for VHF channels 2, 4, 5, 7, 9, 11, and 13 at *each* of the 95-100 intersections without co-channel or adjacent-channel interference. (We will save discussion of the use of UHF channels until later). Each intersection point will be called a "Cluster" hereafter.

However, it probably isn't necessary to use a 175 mile separation. Since all transmissions in a Cluster would be from the same tower or "site," use of such spectrum-saving techniques as precision offset and vertical vs. horizontal polarization on an alternate-Cluster basis (which will not substantially affect receiver performance) should permit the Commission to order a reduction in co-channel (two stations on the same channel) distance separation standards to approximately 150 miles. The essence of this proposal, however, doesn't depend on this reduction in spacing. Slight adjustments to the pattern due to terrain may be necessary, and "*prime meridians*" may be run through such cities as New York, Los Angeles, New Orleans—Chicago and Los Angeles—St. Louis—Philadelphia (or New York) to insure continuation of full service to these large centers of population.

With the exception of a relatively small area in the center of each cell of the grid, which will be discussed in the following paragraph, almost every part of the United States could thus have *at least seven VHF channels* available. The "*area in the middle*" would be an exception. It would constitute nearly one-third of the area within a rectilinear cell under the 175 mile separation plan. But this unserved area of locations *more than 80 miles* from the transmitters of a given Cluster would be reduced to less than one-sixth the area within the cell *if co-channel separation* were reduced to 150 miles.

However, there still would be *some* area in the middle to serve. That area, and the desire for even more potential choice for the viewer would require a second grid, to the same standards as the first, *but interlaced with it* so that the intersections would fall in the center of the cells or rectangles formed by the first grid. At the intersections of this grid there would be placed transmitters for channels 3, 6, 8, 10 and 12. The combinations of the first Cluster (channels 2, 4, 5, 7, 9, 11 and 13) and second Clusters (channels 3, 6, 8, 10 and 12) *would provide at least 12-channel service* to two-thirds of the

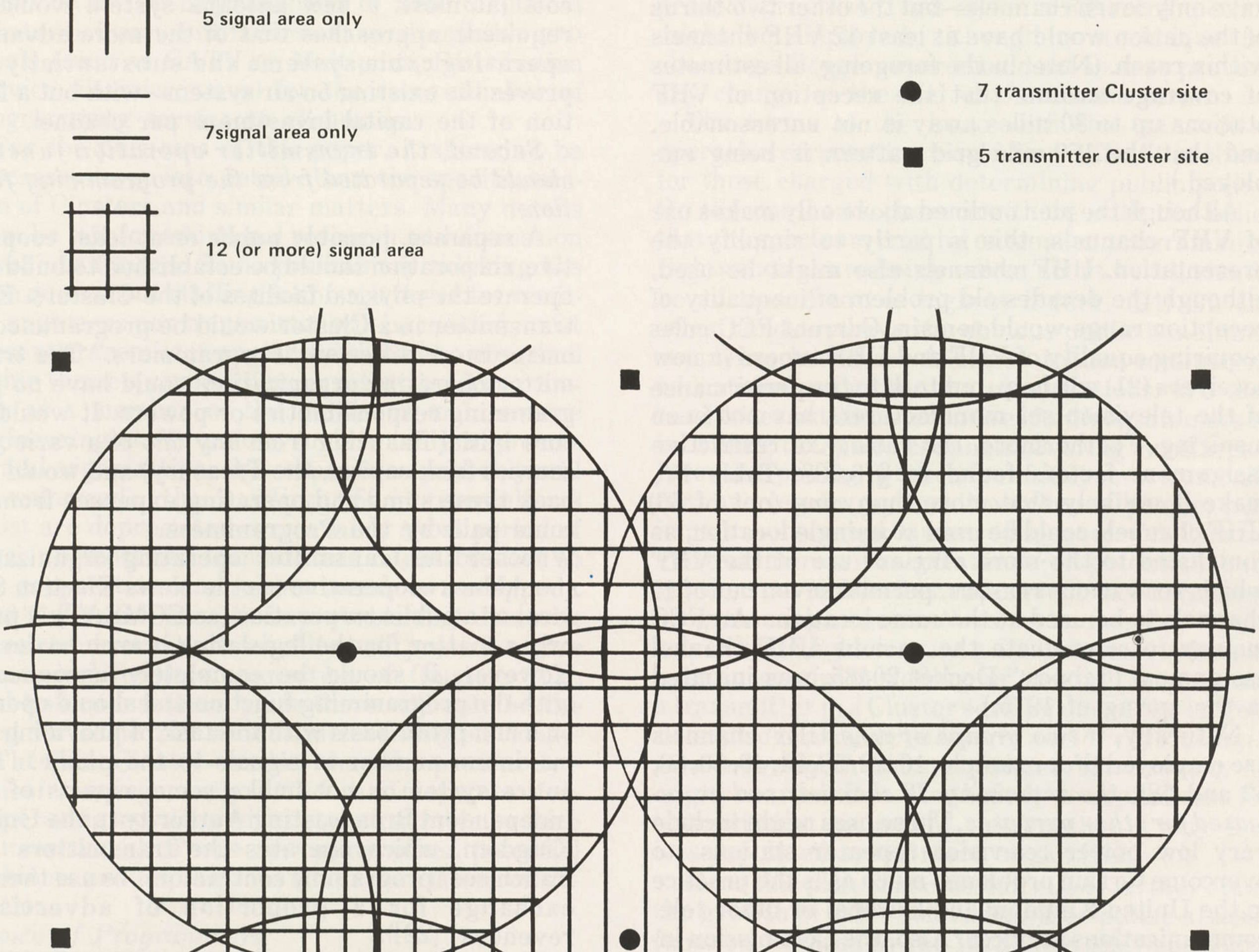

DIAGRAM 2

United States (see Figure 2), and as many as 24 channels in some places. *No location would have fewer than five VHF channels available.* Those limited locations would constitute roughly one-sixth the area of a cell; a similar proportion would have only seven channels—but the other two-thirds of the nation would have at least 12 VHF channels within reach. (Note: in the foregoing, all estimates of coverage assume that the reception of VHF stations up to 80 miles away is not unreasonable, and that the 150-mile grid pattern is being employed.)

Although the plan outlined above only makes use of VHF channels, this is partly to simplify the presentation. UHF channels also might be used, although the decades-old problem of inequality of reception range would remain. Current FCC rules requiring equality of VHF and UHF tuners in new receivers (21) will help, but to date the performance of the television set manufacturers has not been inspiring. Furthermore, the variety of restrictive assignment factors found in §73.698, Table IV, make it unlikely that more than *nine* (out of 56) UHF channels could be used at a single location, as contrasted to the more efficient use of the VHF which, for various reasons, permits seven out of 12 channels to be used at the same location. (An FCC inquiry to re-evaluate the various UHF channel assignment "taboos," Docket 20485, was initiated in the spring of 1975.)

Naturally, *if two groups of nine* UHF channels are employed (For example, 16, 22, 28, 34, 40, 50, 56, 62 and 68), *the remaining 38 channels can be released for other purposes*. These uses might include very low power television repeater stations (to overcome terrain problems, much as is the practice in the United Kingdom and Europe) or other telecommunications services. Also, the Commission inquiry, announced in May 1975 regarding improvement of the quality of UHF tuners and other circuitry in order to eliminate the §73.698 restrictions, could eventually lead to use of *every-other-channel* UHF assignments at the two types of Cluster location. If this were the case, the first type of Cluster might contain transmitters for channels 2,4,5,7,9, 11,13,15,17,19,21,23,25,27,29,31,33,35,39,41,43,45, 47,49,51,53,55,57,59,61,63,65,67 and 69. The second type of Cluster might contain transmitters for channels 3,6,8,10,12,14,16,18,20,22,24,26,28,30,32, 34,36,38,40,42,44,46,48,50,52,54,56,58,60,62,64,66, 68. Such an arrangement would allow the first type Cluster to supply 34 channels, and the second type 33.

Thus, if all channels (2-69) currently allocated to television were used as proposed above, with transmitter Clusters of the same type located 150 miles apart, approximately one-sixth of the nation would be within range (nominally, 80 miles) of only 33 channels, another one-sixth within range of only 34 channels—*and two-thirds of the nation within reception range of at least 67 television broadcast signals!*

Even if the current restrictions imposed by §73.698 remained in force, the first type Cluster would have some 16 channels and the second type some 14 channels. This diversity, which would reach every citizen at no additional regularly levied cost (at most, a new antenna system would be required), approaches that of the more advanced operating cable systems and substantially improves the existing on-air system—with but a fraction of the capital investment per channel.

Second, the transmitter operation function should be separated from the programming function.

A separate, possibly public or at least cooperative, corporation should be established to build and operate the physical facilites of the Clusters. Each transmitter in a Cluster would be programmed by one or more different "Programmers." The transmitter operating organization would have no programming responsibilities or powers. It would secure initial financing from any one of a variety of sources (risk capital, the Treasury) and would pay back these sums and operating expenses from income paid by the Programmers.

Whether the transmitter operating organization should be a cooperative (as the News Election Service) or a public corporation (as COMSAT) is properly a matter for the legislative branch to decide. However, it should be completely unconnected with the programming function and should operate on a non-profit basis with the task of providing the maximum number of signals to the public. (This entire system is not unlike some aspects of the Independent Broadcasting Authority in the United Kingdom, which operates the transmitters and franchises "programme contractors" to use them in exchange for a proportion of advertising revenues [22]).

The savings in both capital investment and operating costs would be tremendous. There need be only one transmitter building, one access road, one antenna tower per Cluster. Because all transmitters would be operated by the same corporate entity, in the same transmitter hall, there should be substantial savings in personnel costs. A preliminary estimate indicates that, *using a VHF system only*, the number of TV stations presently on the air could be increased by 50% but that transmitter personnel savings per year could approximate $15 million—with the saving in professional personnel rising as the number of transmitters in a given location rises. Because of the use of a single building, Cluster land acquisition, building construction, utilities, and similar costs would be below the total cost of the present system of each station building its own. To illustrate, if a single transmitter and antenna costs $200,000 (purchased in quantity), the building $300,000, the tower $100,000, and other on-site costs for the Cluster $100,000, the cost of a Cluster of seven transmitters would be some $1.9 million, for a Cluster of five transmitters some $1.5 million, for an average of $1.7 million per Cluster—

but at a cost of less than $300,000 per channel! This is far below the average cost of "going it alone," with further savings to be realized from operating procedures. If 240 Clusters were needed to cover the nation using 150-mile separations, the total cost would be in the neighborhood of $400 million—a substantial sum, but far less than alternative proposals (such as CATV or Multipoint Distribution Service via microwave) for the same number of programming service to *all* homes.

For the purposes of this paper, it shouldn't be necessary to go into detail about the specific location of Clusters and similar matters. Many details must be left for additional research and discussion in various forums. Some preliminary thinking has been done about staffing (although fewer transmitter engineers per transmitter will be needed, most present transmitter engineers should be absorbed within the new corporation, or return to a Programmer as a member of the studio or maintenance engineering staff), unions (unless truly a governmental organization, the corporation probably will be unionized), the existing 950+ transmitters (most are depreciated over a fairly short period of time; unamortized transmitters might be sold to the corporation and either used or scrapped), AT&T network lines (it is probable that domestic space communications satellites will prove far more economical for interconnection of Clusters than land line connections, since there will only be the need for some 240 wideband receiving stations—one at each Cluster—rather than the present system of serving nearly a thousand separate non-cooperating locations with network service by wire or microwave). There are many other potential problems and implications that await later consideration.

Choice of Programmers

The most delicate problem remaining is the question: who is to program all these transmitters? Although this is fit material for another inquiry, it also is part of the entire "package" proposed here.

Adequate and proper mechanisms can be established, it is believed, that would permit the Commission to license one or more Programmers to program a given transmitter in the public interest, convenience and necessity for a fixed length of time.

Some form of local input into the Programmer selection process, after the prospective licensee has met minimal statutory provisions, would be desirable. Much opposition to longer (say, five years) license terms would evaporate if there were more local voice in determining whether a given applicant were to be licensed or not. The technique for insuring that local input would have to be chosen by Congress. One possible, although extremely complicated, technique is that used by the Netherlands. Essentially, various groups (social, religious, and some organized for the purpose) share the limited amount of air time on the basis of the number of paid-up members (who thus receive program guides) they have. (23) A modification of this principle, combined with the great number of channels available for distribution, would enable minority groups to have a fair share of air time under the present proposal. Then again, a different method might be employed, although no technique for choosing a Programmer should act so as to prevent any change at the end of the license term.

The terms of the lease with the transmitter operation corporation would be a difficult problem for those charged with determining public policy. On the one hand, there are those with the belief that the spectrum (and by extension, programming rights such as are being talked about here), should be auctioned to the highest bidder. (24) On the other hand, we have the obvious public benefits of supplying broadcast facilities to non-commercial educational programming organizations. We also need to set out some incentives for Programmers to be willing to take on channels covering rural areas. Incentive pricing (a token fee of $100 for a transmitter covering a very small number of people, perhaps, as contrasted to many thousands of dollars for Programmers with a greater profit potential), subventions to subscriber-supported or educational programming organizations, or a form of "tie-in sale" that would *require* a Programmer who has been successful in bidding for the right to program a transmitter in a Cluster serving one of the largest cities *also to program a certain number of transmitters covering the less populated countryside*, all might be tried. Because there is no capital cost for transmission equipment, entrepreneu may find less-populated areas more attractive.

Since this plan, if successful, *might further stunt* the growth of cable television, the "public access" function required by the 1972 cable television rules would have to be fulfilled in other ways. Although the presence of television production equipment in most school districts has never been exploited fully for providing the general public access to an audience on cable or on the air, theoretical considerations and experiences elsewhere (northern Canada, for instance [25]) lead one to suggest that radio would be far more effective than television for most kinds of public access. In addition, the increased number of television channels on the air should permit some time on them to be made available for public access use. Finally, and very important to the entire concept, the lower capital investment required of a Programmer should permit easier full-time access to the marketplace of ideas by minorities, the poor, schools, associations, and others who might be able to aquire studio facilites but not the money with which to purchase a transmitter, building, and antenna tower.

If some form of open bidding is used to initially select the Programmer of a given channel, means must be found to weigh the bids of non-profit and other groups whose only disadvantage is a lean purse. Arbitrary pricing, a multiplier for funds received from individuals in small amounts (subscribers), and a host of other techniques may be used. Recognizing that the commercial Programmer's perceptions of the attractiveness to advertisers of that channel in that Cluster (and his opinion of his competition's plans) generally will determine his bid, it may be necessary to establish a floor for commercial bids depending upon the population to be served. (26)

Some current FCC regulations would need modification under this plan. Presumably non-commercial channel reservations would continue on a rough "one channel in four" basis (two in a Cluster of seven, one in a Cluster of five); again, reduced need for capital should lead to greater utilization of these channels. The duopoly rule (27) should be amended to permit a Programmer to apply for leases in all Clusters serving a given metropolitan area. The multiple ownership rule should be on the basis of a limit on the proportion (perhaps 25%) of the total U.S. population that can be served by a given Programmer, rather than on the number of transmitters programmed.

Discussion

It is beyond the scope of these comments to speculate at length on the effect such a radical—compared to a few drop-ins (28) —change might have on the different components of the American broadcasting structure. Networks, with their control over programming sources and experience, probably would survive as syndicators and news sources. *It is even probable that at least seven national networks would be viable*—with others filling specialized niches. Because of the increased competition expected from this plan, the proposed restrictions on proportion of the population that may be reached directly by a given programmer, and some shifts in transmitter location, it is probable that the present network owned-and-operated stations no longer will dominate their own markets or supply the lion's share of broadcasting's profit to the network corporations.

Another possibility is an increase in the amount of exchange between stations of locally-produced programs. It is hoped that there would be more voices capable of disseminating national and international news, and that there would be greater diversity in programming (a probable necessary condition for the favor of voters in a plebiscite), but such prognostication is very uncertain. The odds seem to be that many might gain and few would be harmed.

A schema such as presented above would permit *all* members of the public to receive many more channels than the average citizen now enjoys. It should cost most citizens nothing, except possibly an antenna rotor—thus protecting the multi-billion dollar investment in receivers. It would use the radio spectrum more efficiently. Broadcasters would have a reduced investment, which makes entry into the marketplace of ideas far less expensive for less-affluent groups. This reduction in investment may make the concept of revoking the license of a broadcaster who hasn't been operating in the public interest less traumatic to the commission—and the "bad apple" broadcaster himself. There would be opportunity for a minimum of seven networks, and concomittant competition and diversity. All stations would be on the same footing with respect to transmission facilites. With this competition and availability of time on many stations serving his market, local advertisers would find time they could afford. Certainly, more programs would be needed—together with the talent to produce them.

Although some (particularly Commissioner Robert E. Lee) have enthusiastically promoted the UHF channels as the future home and hope for an expansion of competitive television broadcasting, the FCC action to delete the uppermost 14 channels from the UHF television band (70-83) and reallocate these frequencies to land mobile services clearly indicates that a majority of the FCC has lost faith in an all-UHF system.

The proponents of CATV are still active, although cable television itself, due to its financial structure, has severely felt the impact of the recession of the early 1970s. Because of this loss of momentum, many questions about cable hitherto overlooked are being asked. Although cable entrepreneurs have maintained that the industry really would take off once the larger cities were penetrated with 20—or (30)—channel cable systems, the experience in New York has soured many cable operators and their sources of financing on the idea that cable will take over program distribution from over-the-air television. The author confesses a bias against any distribution system including news programming that is unavailable (because of the limits of wired technology and CATV financial arrangements) to *everyone*.

Accordingly, this is a good time to consider the proposal presented. Although these ideas may provide vast public benefits in program diversity, citizen control, different kinds of access, competition, television service to rural areas, and conservation of a scarce natural resource (the electromagnetic spectrum), it may be that they only will serve as a stimulus to think more radically about basic assumptions and axioms about television frequency allocation and assignment than has been acceptable in the past. Even if they do only this, they will have been worthwhile.

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1 Frederick W. Ford, "The VHF-UHF Television Problems — some Possible Solutions," address before the Radio and Television Executives Association of Houston, Houston, Texas, December 5, 1958, p.1. Then-FCC Commissioner Ford later became Chairman of the Commission.

2 See, in particular, William W. Golub, Commission on Organization of the Executive Branch of the Government (1949 Hoover Commission), Committee on Independent Regulatory Commissions, staff report on the Federal Communications Commission, unpublished (mimeo), September 15, 1948; Sydney W. Head, **Broadcasting in America** (2nd edition), Boston: Houghton Mifflin, 1972; Joint Technical Advisory Committee (IRE-RTMA), **Radio Spectrum Conservation**, New York: McGraw Hill, 1952; Joint Technical Advisory Committee (IEEE-EIA), **Radio Spectrum Utilization**, New York: Institute of Electrical and Electronics Engineers, 1965; John M. Kittross, "Television Frequency Allocation Policy in the United States," unpublished doctoral dissertation, University of Illinois, 1960; Erwin G. Krasnow and Lawrence D. Longley, **The Politics of Broadcast Regulation**, New York: St. Martin's Press, 1973; David M. Leive, **International Telecommunications and Internation Law: The Regulation of the Radio Spectrum**, Leyden: A.W. Suthoff and Dobbs Ferry, N.Y.: Oceans Publications, 1970; Harvey J. Levin, **The Invisible Resource: Use and Regulation of the Radio Spectrum**, Baltimore: Johns Hopkins Press, 1971; Kenneth A. Norton, "The Five-Dimensional electromagnetic Spectrum Resource: The Silent Crisis Screams," unpublished, 1967; President's Communications Policy Board, **Telecommunications: A Program for Progress**, Washington: Government Printing Office, 1951; Robert H. Stern, "The Federal Communications Commission and Television: The Regulatory Process in an Environment of Rapid Technical Innovation," unpublished doctoral dissertation, Harvard University, 1950; Telecommunication Science Panel, Commerce Technical Advisory Board, **Electromagnetic Spectrum Utilization: The Silent Crisis**, Washington: Government Printing Office, 1966. This bibliography is by no means complete, although it does touch most important points.

3 Although the first allocation of frequencies for television in the United States was made in 1928 (see U.S. Federal Radio Commission, General Order No. 55, December 22, 1928), the decisions that actually shaped the television service we know today were the result of the FCC hearings in Docket 6651, "In the matter of allocation of frequencies to the various classes of non-government services in the radio spectrum from 10 kc to 30,000,000 kc," known as the "General Allocation Hearings of 1944." These results were formalized in a series of FCC reports dated January 15, May 25 and June 27, 1945.

4 U.S. Federal Communication Commission, **Sixth Report and Order** in the matters of amendment of Section 3.606 of the Commission's Rules and Regulations, Docket Nos. 8736 and 8975; Amendment of the Commission's Rules and Regulations and Engineering Standards concerning the television broadcast service, Docket No. 9175; Utilization of frequencies in the band 470 to 890 mcs for television broadcasting, Docket No. 8976, released April 14, 1952. Quote is from Paragraph 63.

5 **Ibid.**

6 Public Law 87-529, signed by President Kennedy on July 10, 1962. It is known as the All-Channel Receiver Bill of 1962. See FCC Rules and Regulations §15.65.

7 National Association of Broadcasters, news release 74.75, "Typical UHF TV Station In Black in 1974," (mimeo, June 1975).

8 John D. Abel, Charles Clift III and Frederic A. Weiss, "Station License Revocations and Denials of Renewal, 1934-1969," **Journal of Broadcasting**, 14:4:411-421 (Fall 1970).

9 The touchstone criterion for licensing of stations under the Communications Act of 1934 [Section 307 (a) and 309 (a)]. See also, Frederick Ford, "The Meaning of the 'Public Interest, Convenience or Necessity,'" **Journal of Broadcasting**, 5:3:205-218 (Summer 1961).

10 New Jersey Governor Byrne and the New Jersey Coalition for Fair Broadcasting have challenged renewal of New York and Philadelphia television stations on the grounds that New Jersey is receiving inadequate VHF service and that at least one VHF commercial station should be licensed to New Jersey. See **Broadcasting**, June 9, 1975, p.26.

11 The FCC always has been very sensitive to the concentration of political strength in Congress. Because of the rural/small town orientation of Congress, service to such areas always has been a major priority of the Commission. As the composition of the Congress changed in response to **Baker** vs. **Carr** and other "one man-one vote" decisions of the Supreme Court, the FCC also assumed a more urban bias. Since population density is now reflected more strongly in representation, the FCC's reluctance to upset Congress serves to protect the service enjoyed by larger markets.

12 Section 307(b), prior to amendment in 1936, provided ''The that people of all the zones established by this title are entitled to equality of radio broadcasting service, both of transmission and of reception....'' The Supreme Court, in **Red Lion Broadcasting Company** vs. **FCC** [395 U.S. 367 (1969)], held that ''It is the right of the viewers and listeners, not the right of the broadcasters, which is paramount.''

13 Kittross, ''Television Frequency Allocation Policy in the United States,'' **op. cit.**

14 See Ralph Lee Smith, **The Wired Nation**, New York: Harper, 1972. Also see Don R. LeDuc, **Cable Television and the FCC: A Crisis in Media Control**. Philadelphia: Temple University Press, 1973.

15 A.C. Nielsen Company, **Nielsen Newscast**, Np.1, 1975, p.3.

16 ''One of the hallmarks of this and I suspect most regulatory agencies is a preference for known evils over unknown evils. I am not sure that preference leads to the best public policy result.'' (Then-FCC Commissioner Nicholas Johnson, letter to the author, June 7, 1972). See, John M. Kittross, ''The Federal Communications Commission: Neither Fish Nor Fowl,'' in David G. Clark and Earl R. Hutchinson (eds.), **Mass Media and the Law: Freedom and Restraint**. New York: Wiley-Interscience, 1970, pp. 360-362. See also Krasnow and Longley, **op. cit.**, and Ross D. Eckert, ''Spectrum Allocation and Regulatory Incentives,'' **Papers and Proceeding of the Conference on Communication Policy Research, November 17-18, 1972.** Washington: Office of Telecommunications Policy, 1972.

17 Allocation is the apportioning of a given part or parts of the electromagnetic spectrum to a particular service, such as television broadcasting. Assignment is parcelling out of channels within that allocated part of the spectrum to particular communities (or, in other service, classes or users). A given user will then be licensed to use a particular channel or channels in a particular location.

18 Clearly, to provide valid and reliable details of Cluster siting, detailed financial data, etc. for this proposal would require a great deal of computer-assisted reserach. Since the basic tenets of a preliminary proposal such as this do not require such details, and since funding was neither sought nor received for this paper, they will not be presented here.

19 International Telecommunication Union, **African VHF/UHF Broadcasting Conference**, Regional agreement for the African broadcasting area. Final protocol, resolutions, and recommendation. Geneva: ITU, 1963. Also see ''The African VHF/UHF Broadcasting Conference,'' **EBU Review**, 80A (August 1963) pp. 154-161.

20 §73.610 of the FCC Rules and Regulations (47 USC 73.610).

21 §15.67 and 15.68 of the FCC Rules and Regulations (47 USC 15.67 & 68).

22 Among a number of recent books on British broadcasting are Anthony Smith, **British Broadcasting**. Newton Abbot: David and Charles, 1974 and Peter Black, **The Mirror in the Corner**. London: Hutchinson, 1972. (Both these volumes deal with the IBA at length).

23 Walter B. Emery, ''The Netherlands: Pluralism with Freedom,'' in Walter B. Emery (ed.), **National and International Systems of Broadcasting.** East Lansing: Michigan State University Press, 1969, pp. 140-157.

24 Perhaps the most complete early discussion of this principle is to be found in R.H. Coarse, ''The Federal Communications Commission,'' **Journal of Law and Economics**, 2:1-40 (October 1959). Levin, **op. cit.**, and others in and out of government (particularly at OTP) also have considered this approach to spectrum allocation and assignment. See, in particular, Roger G. Noll, Merton J. Peck, and John J. McGown, **Economic Aspects of Television Regulation**. Washington: The Brookings Institution, 1973.

25 See, for example, reports appearing frequently in the Canadian communications quarterly, **In Search**. An extremely interesting report by Douglas Ward of the CBC was interspersed with commentary by editor Lorenzo Milam and published in **The Radio Times** #115, December 1952, pp. 2-4.

26 The author tends to hold that the selection of Programmers and decisions about their retention best can be done by viewers in some form of plebiscite after initial screening by the Commission for meeting minimal legal and financial criteria—but that is a subject for another paper.

27 73.35 of the FCC's Rules and Regulations (47 USC 73.35).

28 The VHF ''drop-in'' inquiry announced in the Spring of 1975 is Docket 20418.

COUNTERPOINT

THERE IS NOTHING MODEST ABOUT 67 CHANNELS OF TELEVISION

John Kittross and his "modest proposal for restructuring American television" is about 25 years too late. Had the proposal been made, and properly studied, during the 1948-1952 FCC freeze on new television allocations, it might have found sufficient support to make it fly. But alas, nearly 25 years after the infamous freeze has been lifted, it is too much too late.

Still the proposal has merit and it should receive honest debate and honest study. To dismiss it as another example of academia meddling in the real world is tempting but unfair to the Professor and his considerable effort.

Professor Kittross correctly asserts there are vast unserved or underserved segments of America—regions that receive too little or no television service. He attributes this shortage of signals to (1) the allocations table of 1952, and, (2) the high cost of constructing and operating television broadcast facilities, and he has obvious trouble with cable as an answer to both problems.

In the Professor's view, if we "simply moved some television stations around" and created an allocations table based upon something the Europeans call "rectilinear grids," all of our problems will go away.

Rectilinear grids are an interesting approach to spectrum allocations. The Swedish have employed this approach for a number of years, and are apparently reasonably happy with the way it works for them. Other Europeans have recently shown interest in this approach to frequency allocations; and a recent European agreement in principal will re-structure the AM broadcast band throughout all of Europe following essentially the rectilinear format. Seemingly, if several dozen sovereign states can get together in unison following such a format, one nation of 50 states should be able to do the same thing.

Rectilinear grids recognize something that the FCC recognized in 1952, that being the spectrum is *finite*, it has boundaries of its own, and its limits are soon reached. Rectilinear grids accept those limits, define those boundaries, and establish the maximum utility for the finite spectrum based upon the characteristics of the spectrum and the transmitters that will occupy that spectrum. It is a neat plan, a much better and more sensible approach to *proper* useage of a *finite resource* such as the spectrum than the hodge-podge the FCC created in 1952.

But we fear that it is not destined to be.

The Professor suggests the largest stumbling block to the FCC's moving all television to UHF channels (where adequate spectrum does exist even for an FCC market-by-market approach to allocations) has been the public's investment in television receivers. The Professor suggests that the rectilinear plan would not cause the public to lose much or any money, simply because the receivers that now work for our present allocations would continue to work after rectilinear grids were implemented. That is, the channels we now have are the channels we would have, only they would come from different transmitting towers.

All-UHF was first considered in 1950-51. Then FCC Chairman Wayne Coy thought the idea had merit. There were but slightly fewer than 10 million television receivers in the hands of the public in 1950, a number that had risen to nearly 16 million by the end of 1951. All-UHF was again considered in 1954-55, an era that saw between 35 and 43 million television receivers in the hands of the public. Clearly the public had a lot of money invested in receivers by 1955 and the FCC was itself too late to seriously consider such a move by that time.

Professor Kittross suggests that because the rectilinear grid approach would not require new receivers for the public, that the public would not be harmed by such a move. He suggests "at most, a rotor would be required." The Alliance Manufacturing company should like this proposal. So too should the likes of Channel Master, Winegard, and JFD. If you take the six Philadelphia transmitters out of north Phillie and move them 40-50 miles out of town, there are going to be a lot of new outdoor antennas required. Repeat that all across the United States, and you have some grasp of the magnitude of the new public investment for antennas and possibly rotors.

And that is precisely why the plan, as proper as it might be for a *new* nation starting out with *no public investment* in receiving systems and no firmly entrenched broadcasting fiefdoms, is *not* the answer to *our present day problems.*

Still, it does have merit. Even as one ticks off the reasons why it does not solve *our* problems, the advantages to such a system keep coming back to haunt you.

The FCC of the recent 1948-1952 era was no better and probably no worse than those that preceded and followed it. The FCC of that era was just as dependent upon "advice" from its regulatees as the present industry is, perhaps even more so. The FCC of that era cannot be faulted for not looking at each and every plan *advanced.* There were, as you may recall from the March and April 1975 issues of CATJ, some pretty far-out suggestions. One plan wanted to launch a series of flying transmitters that would circle aimlessly in figure 8's across the nation, covering huge chunks of terrain from each airplane transmitter, so that only 13 airplane units would be required to cover coast to coast. Another plan wanted every metropolitan area covered by multiple transmitters operating on the *same* channel, replacing the present *one super power* unit per channel with perhaps *a dozen low or medium power units per channel,* and slaving them together so that they would not interfere with one another. Alas, for the all of the input the 1948-1952 FCC received, *it did not receive a plan for rectilinear grid allocations.*

If the FCC of that era can be faulted for one basic bit of dumbness, it was that when the 1952 allocations table was released, it was *not* a *new* allocations table; rather it was the old (1944) allocations table, with appendages attached. The FCC of 1948-1952 kept stumbling over the 107 licensed and operating television stations that existed when the freeze was announced; and rather than incur the wrath of these operating stations, the FCC chose to

CATJ Editor-In-Chief Bob Cooper responds to the John Kittross proposal for a new national format for television allocations. At the "bottom line" Cooper finds the Kittross proposal has merit but questions whether there would be **less** need for cable with the Kittross plan, or, alternately, **a greater need** for cable. Cooper's conclusion is that cable's role in the nation's communications system would be enhanced, not diminished by the Kittross proposal.

allocate around them (with only a handful of exceptions).

Those 107 operating stations represented a considerable bit of power at the FCC and to Congress. They were successful in keeping *their* pre-freeze allocations for the most part, and they demonstrated just how much power television broadcasters could muster when the chips were down. And *this* is the fatal flaw in the proposal of Professor Kittross; it ignores the reluctance, or refusal, of the existing broadcasters to change one tiny bit their present established status-quo.

The numbers which the good Professor plays for us are impressive. As many as 67 channels of service for some of the population, no fewer than 5 for even the most remotely located American home. There would be 260 separate clusters of transmitters, with from 33 to 34 possible transmitters per cluster. If our mathematics is correct, with all transmitters operating at all cluster locations, the nation would have 8710 separate television transmitters on the air. Considering there are only slightly more than 8,000 AM *and* FM radio transmitters on the air (including educational radio outlets), that is one heck of a lot of television. It is approximately 9 times as many transmitters as presently serve the United States. It is more than four times as many transmitter-channel *allocations* as the present FCC plan calls for, and that is some indication of how sloppy the present FCC allocations scheme *really is*.

If all of this is too much for a poor nation like the United States, perhaps the plan would be more realistic if the UHF channels were simply eliminated from the proposal. Professor Kittross does this at one point, noting that if the rectilinear grid format were followed, the present 12 VHF channels could provide no less than five channels of service to every citizen. The top number would become 12 under the VHF *only* plan, still not a bad number. With 130 clusters of 5 transmitters each and 130 clusters of 7 transmitters each, the nation would be blanketed by a total of 1560 television stations, all on VHF. If one assumed, as the Professor does, that in a 5 transmitter cluster one transmitter would be dedicated to ETV/PBS and in a 7 transmitter cluster two transmitters would be dedicated to PBS/ETV, we have room for a fourth network at 260 clusters (out of 260) and a fifth network at 130 of the clusters. Or if we stuck with the present three networks, we would have room for at least one non-network (i.e. independent) station at 130 clusters and room for 2 independents at 260 clusters. That holds a certain attraction for television starved *rural* America, and the people who slave in Hollywood to produce programming ought to find this appealing as well.

Still, as advantageous as an *all-VHF system* might be, and as beneficial to the nation's communications system as turning UHF completely back to two-way communications might be, there are serious flaws even with the VHF-only rectilinear grid approach.

Present day transmitters are located by their licensees where the transmitters will cover the maximum number of people. This means that virtually every transmitter has been spotted, *for profit reasons*, where shadow areas and dead spots, *within* population centers, *will be minimized*. Within broad FCC guidelines, the present licensees have a fair amount of latitude as to where they will locate their transmitters. Such latitude would not exist with a closely policed rectilinear grid plan. For the plan to work properly, the transmitters would have to be within a few square miles of the exact spacing specified by the grid. Inevitably, out of 260 grids or clusters, many will fall in areas where tall towers can be constructed only at very great expense. The Professor seems to opt for a single tower per cluster site, an admirable approach for the FAA and the leave-the-countryside-unspoiled buffs. But this is not something one does with $100,000 towers (the number budgeted by the Professor). To hold high safely, 5-7 television broadcast antennas with the associated feedlines and microwave reflectors, and the inevitable FM antennas, is a *multi-million dollar* project *per cluster site*.

Now assuming the Congress got into the act and the considerable political persuasion of the existing licensees *could be beaten*, what about the public? Would it really benefit?

If all 260 sites were activated, there is little doubt that many *new* homes would receive their *first* multiple channel television. But certainly a whole lot less than the full nation would receive the benefits of the program. *The Professor assumes a smooth earth*; that is, one with no intervening terrain. The clusters would require precise transmitter placement, even when that happens to create a situation that results in intervening terrain taller than the cluster antenna farm *between* the cluster transmitters *and* a major population center. Suppose the Denver-area cluster location was 40 miles east of Denver? And the Albuquerque 40 miles east of Albuquerque? Both communities would suddenly become excellent cable-potential cities. The possibilities are endless and the opportunity for manipulation of grids in the planning stages almost beyond comprehension. Detroit, for example, *might* have 12 channels available, 7 from a grid cluster 50 miles *north* and 5 from a grid cluster 70 miles *southeast. Anyone for cabling Detroit?*

No, Professor Kittross, we don't think the cable role would *diminish* with your proposal. *We think it would be enhanced.* With half-decent odds, the rural areas would end up with far better over-the-air television than the metropolitan areas. This might get cable *out of the sticks* and into the big markets faster than anything the Congress, the *FCC, or the cable industry could ever do.* Instead of being pressed to find auxiliary services to make cable fly in the big cities, we would be able to just plod along as simple, efficient, *community antenna systems*. While out in the rural countryside, where the land is flat and the signals go forever, we would have to devise ways to add auxiliary services to make cable fly.

It is all a wonderful dream—the way cable *might have been* if some 25 years ago this industry had been forced to wire *the big cities first* because someone at the FCC came along with a rectilinear grid plan in 1951 or 52.

And the Swedes have such an allocation's system now, you say? When does the next airplane leave for Stockholm??

CATJ'S GUIDE TO PASSIVES (Part One)

One Born Every Minute

The CATV passive supply company operates in a strange environment not unlike the Atlantic City Boardwalk carnival operator. His matching transformer (pad, attenuator, splitter, direction tap, etc.) is the greatest thing since sliced bread and mom's natural milk. In an industry with twenty five years of *active* history, the study of the coming and goings of passive manufacturers is a study in a sub-culture. There is one born every minute; *or so it seems.*

To many segments of the CATV operating industry, passives are the jockey shorts of life, a necessary evil, but not something you spend very much time thinking about or studying very carefully. Like the jockey shorts, they go through life holding up their end of the system but they seldom show up in public so you don't waste any time choosing which version you will use.

So the passive salesman has to resort to some real tricks of salesmanship to attract even your *marginal* interest. "Smallest," "highest quality," "your name imprinted free," "economy," are but a few of the sales by-words of the passive salesman.

You yawn and ask how cheap can you buy it for.

"Look at this seal, it can't leak no matter what." Or, "have you ever seen such a strong box?".

You yawn again and repeat, "how *cheap* can I buy it?"

For most of the industry, buying passives is a study in "Cost Acceptability". That is, "how cheap *can* you buy it?"

A system operator will spend \$2,000.00 on a mainline amplifier station that has redundant this, bi-directional that, future growth room and snap-in, snap-out modules. He will critique the color of the case and his engineers will spend days pouring over the specifications, heating it, cooling it, thumping upon it and filling it up with sand and water. Then the system operator will call the amplifier manufacturer on the telephone and report, "You know that Super-Whammy 8 mainline station you left for us to evaluate? Well, it drops off 0.1 dB at 297 MHz when it gets down to 40 degrees below zero and it is filled up with strawberry ice cream. What can you do to fix that?".

But when the passive salesman calls and goes into his speel the same system operator gestures with his hand halfway through the opening dialogue to cut the salesman off with "Print my name on the case and knock 4 cents off the 10,000 lot unit price and you have the order". Chances are his engineers never have the opportunity to drop the temperature to 40 degrees below zero, *or* fill it up with strawberry ice cream. And chances are equally good that they wouldn't bother if they had the opportunity.

Passives, like jockey shorts, are simply not very exciting.

What Is A Passive?

We are not certain anyone has ever taken the time to adequately define a passive. We won't try here. At least not in one neat Websterism.

Passive. The word itself is 180 degrees out of phase with the industry. *This is an active industry.* It always has been, and in the near-term future, it will continue to be. There is something negative about a device that just sits there and does nothing *actively*. Perhaps the passive arm of the industry made its first mistake by calling themselves passive to begin with.

Passives. They are like cookies; cut from a mold with minimum wage labor. "Everyone is like every other one" one passive manufacturer touted not long ago. He meant that his passive products had great quality control. It came across differently.

Passives. You can start a passives company in your garage, or basement. Several have started in garages or basements. Simply buy one-each-sample from several leading suppliers, open up the case, can or container, and "jap" the innards. Buy several big boxes of descrete parts and you are in business.

Passives. They don't command much respect. Rodney Dangerfield would be a great passives salesman.

"Passives are just alike, buy price" is a common bit of sage advice 'old-timers' give in this industry.

Passives, like jockey shorts

and Rodney Dangerfield, need a new image. *We'll try here.*

Two Pinks, a Blue....

And a dozen white....

Pick up a copy of Television Factbook, services edition.

Daytona Beach — Benco headend, Kaiser amplifiers;

Superior Cable; Telemation origination.

So what type of passives does Daytona Beach use? Factbook doesn't care. You probably don't either.

Chances are they use several brands. Maybe a dozen or more. The Benco headend is *active*. The Kaiser amplifiers are *active*. The Telemation local origination equipment is *active*. The Superior cable is *not*. Cable manufacturers don't have the identity problem that passive manufacturers do.

Why?

Because cable manufacturers *have class*. They sell the same "every (foot) is like every other (foot)" product that passive manufacturers do. They run big four color ads spread across double trucks. Their ads have class, and wit (I'm in a telephone booth halfway to Bermuda and we still haven't run out of signal...."). System owners welcome cable salesmen with open arms. And they seldom fill the cable up with strawberry ice cream and drop the temperature to 40 degrees below zero to see what happens at channel W.

But then nobody ever started a cable manufacturing operation in a garage or basement.

System owners select amplifier and headend suppliers with considerable care, because they half-*expect* to have problems at some point with the gear. And *when* they have those problems, they want to be able to pick up the telephone and find some help. *In a hurry.* They don't want to have a recording come on the line and tell them that the number has been disconnected for three months and the company is out of business.

But passives aren't very complicated, and, they aren't very expensive. And, they seldom (if ever) quit. A passive, being a passive, will probably work *forever* if it works the day it comes out of the carton. In short, once the passives have been bought, and paid for, the hassle is over. The buyer knows that. The seller knows that unlike the active supplier, who can *count on being called back in* every now and again for some *help* to replace or repair a burned up active unit, the passive supplier is much like the token taker in the subway. The buyer won't call him because something quits working. In short, once bought, installed and working, the buyer doesn't need the passive seller again. At least not until he runs out of inventory.

Not being needed is the potential hangup every passive salesman must face. Once the deal is made ("imprint my name and knock four cents off the unit price"), he passes from view *and* from thought.

An Unearned Image

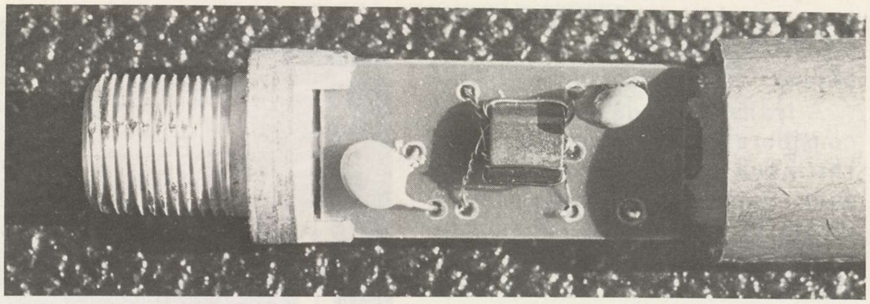
At the risk of having belabored the problems faced by the passives supplier, we want to make the point that the passives end of CATV is (1) *vastly underrated*, and, (2) *of considerably more importance* than 99% of the cable operators allow. It may take us an issue or two to show you how and why this is so, but in the end *we will do so.*

To study passives in some depth, to provide some basic knowledge you do *not* now have about passives, and to critique some of the common problems you have *now* because you bought passives *by price* rather than by performance (*you know you did!*), CATJ has dug into the present state of the passives industry with our usual (if not legendary) devil-may-care attitude. We aren't out to slay any paper tigers, but, we won't sweep any *large* chunks of dirt under the rug in the process either.

First of all, if you have never *really* studied passives, you probably know a lot less about them than you think you do. True, they are *not* complicated. At least not when compared to a piece of microwave gear or a complex phase-lock headend unit. But, unlike the microwave gear or the phase-lock unit, they cost a few pennies or dollars each, and where the microwave or phaselock unit manufacturer can *afford* to charge off ten or thirty hours of test and alignment time to that *single* unit *you* order, the passives manufacturer is lucky if he gets to do much more than eyeball the finished product as it moves down the conveyor belt between the nimble fingers of the assembly girl and the carton packer at the end of the production line.

The secret of passives, if there is one, is (1) creating an *optimized* set of engineering conditions, and then (2) *repeating those conditions* over and over and over again every time the product-master is duplicated. So the real key to passives is *quality control*, or the ability to take a one-each hand-wrought engineering prototype and mass-produce it again and again. That is where the amateurs are separated from the novices with passives.

Active-electronic engineers seldom care much about passives, and they probably suspect that passives are "a piece of cake". Relative to the kind of engineering done in secret engineering R and D labs at active-electronic companies, *they are* "a piece of cake". But unlike the active-units, which have numerous individual points for the alignment personnel to *tweek upon* the knobs and wires and controls to *bring* an active unit into spec, the passive unit either flies, or, it dies. There is seldom any tweeking possible, and even if it is possible, you are not going to tweek *very long* with \$5-\$7 per hour labor on a device that nets to the user for 50 cents or a dollar. In a word, the passive business is under more strict quality controls (if the company is going to succeed) than many of the active companies. There is simply *no room for error* in the economics of passives, because there is not the money in passives (on a per piece basis) to correct for sloppy workmanship down on the assembly line.



The Transformer

The mightly matching transformer is the bread and butter of the passives business. If there are in fact some 11 million or so cable connected homes in this country today, with something more than 1 set per home, there are a like number of 75 to 300 ohm matching transformers "hanging around" in dusty, hot corners doing their job.

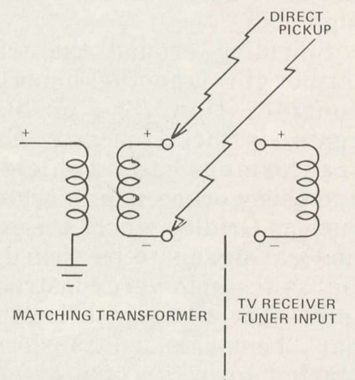
The matching transformer started out many years ago being a several buck per unit device. It also started out being several times as large as the present versions. The matching transformer is a pretty simple device, and one would expect after 25 organized years of CATV that we probably are about as close as we are ever going to get in the development of the "matching transformer" *state-of-the-art.*

The variations one finds in matching transformers today are largely of individual (designer) *taste*. Every designer hopes his "taste" will capture the fancy of the marketplace. Reference is made to diagram 1; the schematic for the RMS model CA 2500 matching transformer.

The transformer accepts 75 ohm unbalanced RF energy at one port (i.e. from cable drop) and transforms that energy into 300 ohm RF energy at the opposite port. The CA 2500 has a trio of .001 disc ceramic capacitors, one on the 75 ohm input and a pair on the 300 ohm output. They are there largely as voltage protection devices to insure that should somehow some operating voltage (i.e. not RF) appear at either terminal, the voltage is stopped at that point from (1) getting into the transformer itself, and, (2) feeding through the transformer and into equipment on the opposite end of the device. Not all transformers have voltage blocking capacitors; nor do all have the *trio* of caps which the CA 2500 has. There are various arguments for having three *or* two capacitors. RMS maintains three is the *correct* way to do it without *cheapening* the product. There are at least a couple of others that maintain that two is adequate. It hardly seems like a big deal when the capacitors are small and cost under a penny each in the far east where they are procured.

The transformer itself is true-passive, that is, when RF signal goes through the device, there is *some* signal loss. This is true with virtually any transformer known to man, in virtually any transformer type application. The *amount of loss* is a measurement of transformer *efficiency*; the lower the loss, the better for you.

A transformer has something known as "balance"; which means it creates equal RF signals and exact 180 degree phase inversion on both sides, on both legs of the 300 ohm side of the device (see Diagram 1-B). The better the balance, the better the transformer can deal with strong local signals (i.e. reduce direct pickup of local signals). Balance depends largely on the



When signals are combined in the receiver (tuner) transformer, the original + and − (I.E. phase) signals are combined to add to each other (and they are accepted by the tuner). However, direct pickup injected at each side of the transformer line at the same phase will cancel itself at the transformer.

DIAGRAM 1B

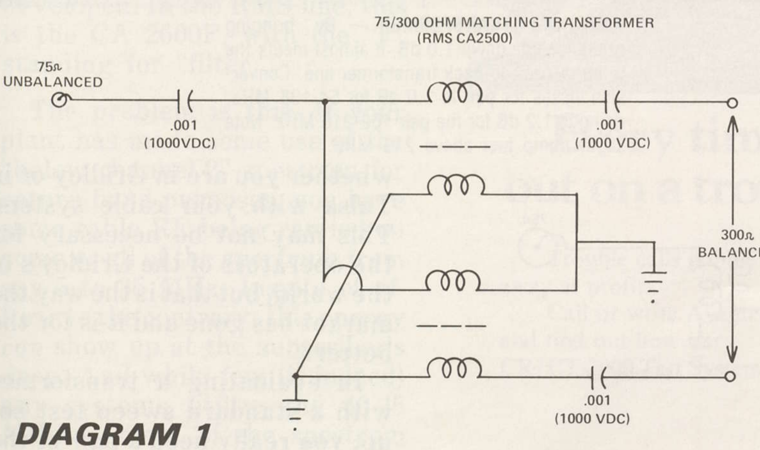


DIAGRAM 1

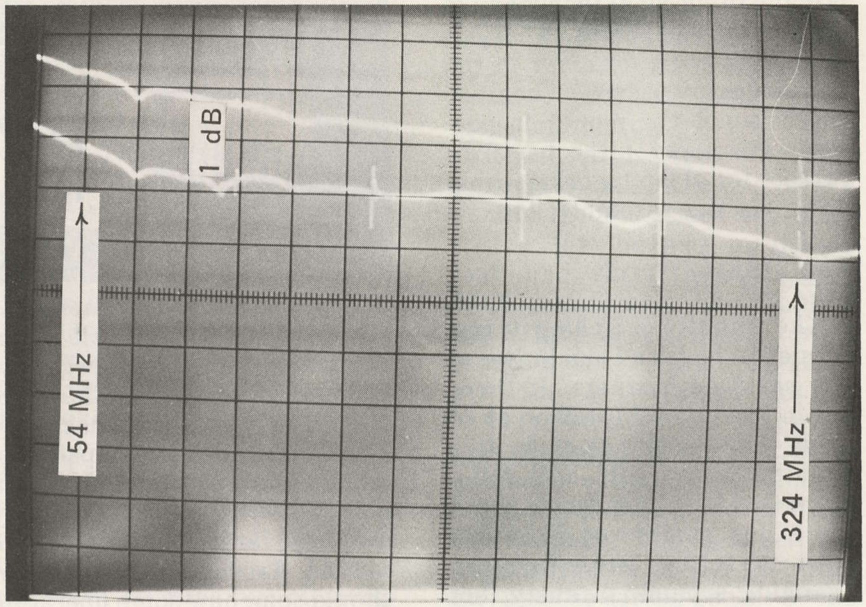
CA-2500 MATCHING TRANSFORMER	
Design	Balanced
Frequency Range	40 to 300 MHz
Return Loss	22 dB minimum
Balance Ratio	40 dB minimum
Insertion Loss	.9 dB minimum
Response	+/− .25 dB
Isolation	1000 volts

Manufacturer
RMS Electronics, Inc.
50 Antin Place
Bronx, New York 10462
(212) 892-1000

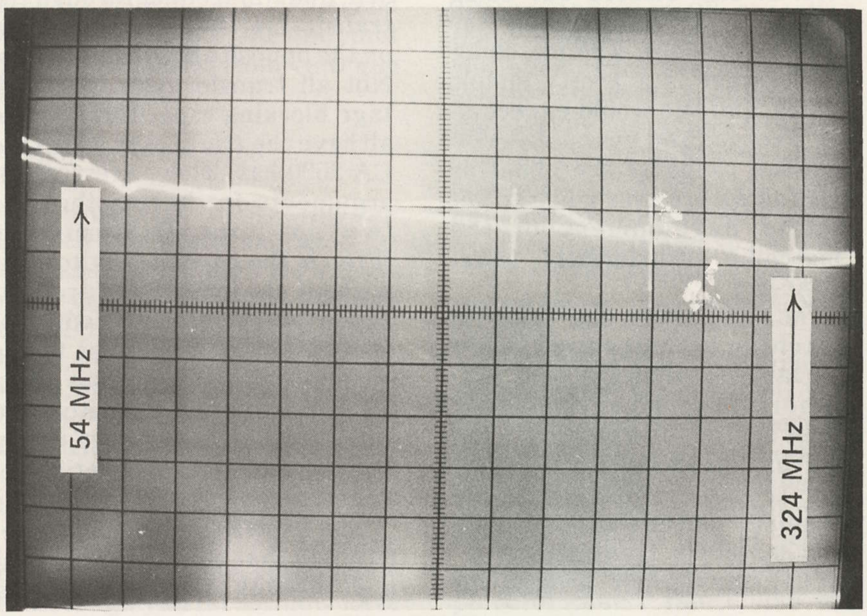
care or skill with which the transformer is wound (see photo).

A transformer is subjected to considerable rough treatment on the back of many subscriber sets. One of the popular arguments is whether the 300 ohm spade lugs on the transformer should be soldered to the flat ribbon lead coming out of the transformer. If the leads are soldered, they obviously have greater pull-strength should someone try to lift an elephant with the device. On the other hand, copper wire (or copper coated wire) when soldered takes on a brittleness. It may "pull" harder *but* it "snaps" *easier*. And applying solder does weaken the 300 ohm pigtail lead somewhat, simply because the heat applied to afix the spade lugs on the end of the 300 ohm pigtail softens the poly insulation on the pigtail for a split second or so. When it *re*-hardens, it is not as stout as it was in the virgin (unsoldered) state. The CA 2500 does not use soldered lugs.

Shielding around the transformer guts is another important consideration. The problem, again, is direct pickup. Early tranformers had no shielding and this worked fine in systems such as Gridley where there are no local signals to be picked up. But as systems were constructed in or near areas with local signals, the unshielded transformer started to be *its own antenna*. This causes ghosts on signals carried on channel, or co-channel on signals carried on the local station's channel. A metal shield, bonded all around to the 75 ohm fitting on one end, was *part* of the answer (better transformer balance was the rest). Most transformers today *are* shielded,



MATCHING TRANSFORMER — Through a pair of CA-2500 matching transformers, top reference line is comparison line, bottom line is back-to-back matching transformers. Markers are in 54 MHz increments.



MATCHING TRANSFORMER — By bringing reference line down 1.0 dB, it almost meets the through-back-to-back transformer line. Conversion losses for **pair** is 1.0 dB for 54-108 MHz, rising to 1.2 dB for the **pair** 162-216 MHz. Note slight hump just above 216 MHz.

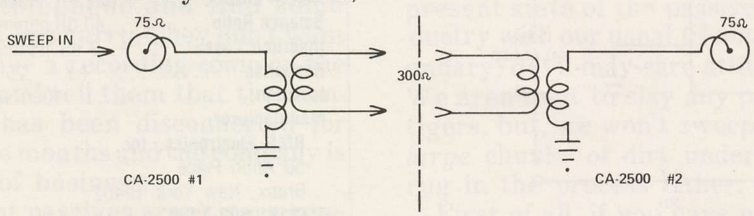


DIAGRAM 1A

whether you are in Gridley or in Tulsa with your cable system. This may not be necessary for the operators of the Gridley's of the world, but that is the way the market has gone and it is for the better.

In evaluating a transformer with a standard sweep test set up, you really need a *pair* of the devices connected up "back to back" as shown in diagram 1-A. Note that what we have done is come in with the sweep source at 75 ohms to one transformer, transformed to 300 ohms which we back-to-backed with another transformer to *its* 300 ohm side, and then come out at 75 ohms from the *second* transformer. This does two things: it keeps the measurements at an impedance (75 ohms) which CATV gear is set up for, and, it *doubles* any problems present in a single transformer. For example, if the conversion (i.e. through) loss of a single transformer in stepping from 75 ohms to 300 ohms is 0.5 dB, then the loss through a pair is 1.0 dB (as displayed on the scope display).

Utilizing the Wavetek 1051 customized test set described in the February CATJ (pages 29 to 35) and the Wavetek 1901C display scope, the CA 2500 (and other devices to be discussed here) was checked out for performance. Photo 1 shows the 40-340 MHz bandwidth of the CA 2500 (with two units back to back) while photo 2 shows the 1.0 dB combined loss of a pair of CA 2500 units when 1 dB of compensating pad loss was cranked into the display on the reference base line.

The Funny Transformer

As CATV systems have gone more complicated and the cable spectrum has found new uses in many markets, a specialized matching transformer has been developed. In the RMS line, this is the CA 2600F, with the "F" standing for "filter".

The problem is this. If your plant has made some use of the "below channel 2" spectrum for return-band purposes, you have some cable RF being carried on some or all of the spectrum from say 5 to 35 MHz. Inspite of efforts to the contrary, this energy *can* show up at the subscriber's drop. And while few (if indeed) any systems utilize the 40-45 MHz segment of the spectrum

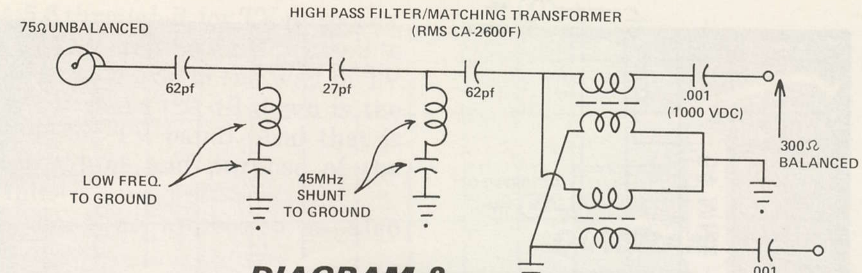


DIAGRAM 2

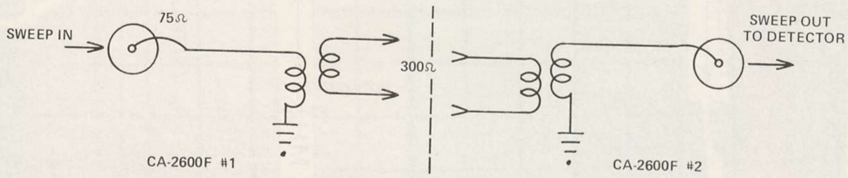
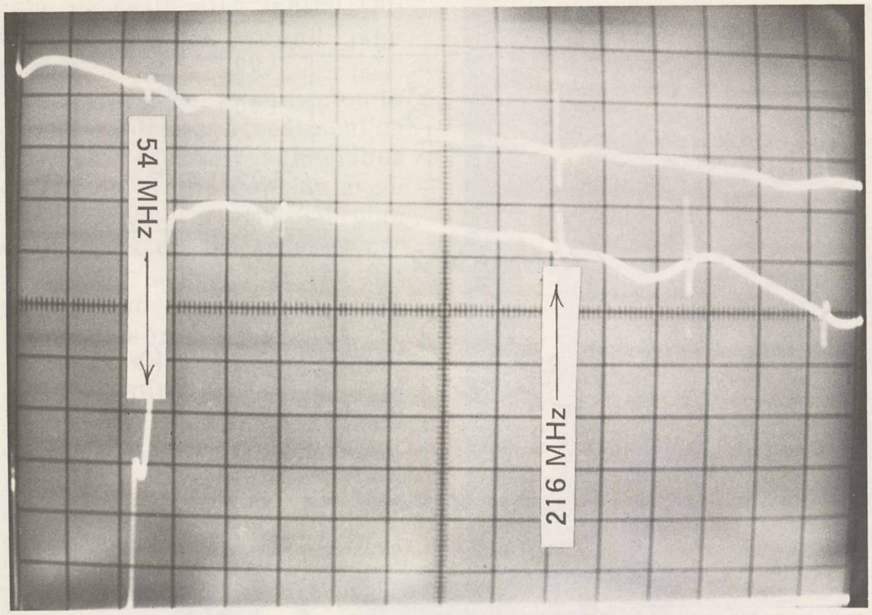
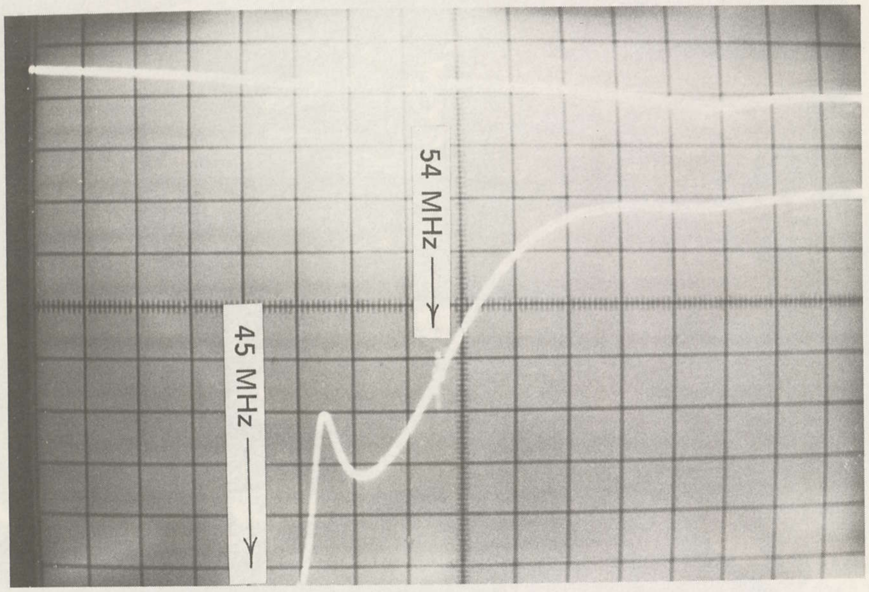


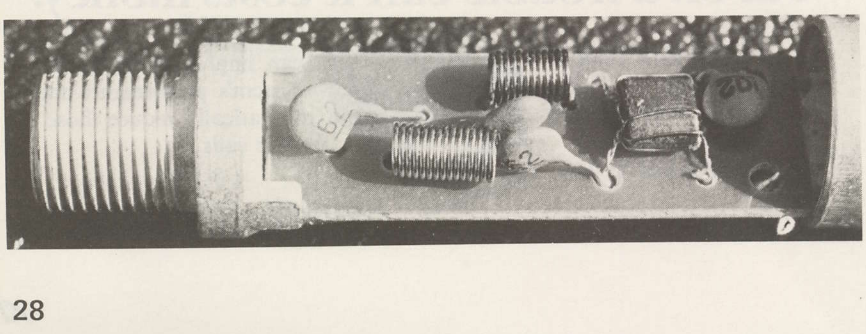
DIAGRAM 2A



MATCHING TRANSFORMER/FILTER — Through a pair of CA-2600F devices, the accentuated roll off at 54 MHz (marker) is down 4.5 dB (see text for correction factor). Note sudden drop left side of through device line indicating trap/filter **below 50 MHz**.



MATCHING TRANSFORMER/FILTER — Expanded scale shows pigtail ear at around 47 MHz before rapid drop off in through-loss attenuation that is peaked to notch 45 MHz i.f. range.



for signal carriage, there are problems with sub-channels such as T9 getting into the 45 MHz i.f. at *twice their cable frequency*. The solution is "trap out any RF energy below 54 (or 55.25 MHz) at the set", before it gets into the receiver and creates a problem with the TV receiver i.f. operating in the 40-45 MHz region.

The filter or trapping for "all energy below 54.0 MHz" can be built *into* the matching transformer. See diagram 2. This is the RMS CA 2600F matching transformer, a transformer that *includes* a set of filters for trapping or eliminating all energy below channel 2.

The input to the filter at 75 ohms includes first a low frequency to ground (i.e. shunt to ground) form of a high pass filter. All energy below approximately 50-52 MHz is shunted to ground by the combination of the coil and the capacitor. Next there is a 45 MHz shunt *trap* to ground, tuned to sit on top of the TV receiver i.f. range to create a special "trap notch" at that frequency. After the filter/trap sections, the transformer looks pretty much like any other matching transformer.

CA-2600F HIGH PASS FILTER MATCHING TRANSFORMER

Design . . . . Constant K high pass filter
Frequency Range . . . . 5-300 MHz
Return Loss . . . . 16 dB minimum
Cut-Off Frequency . . . . 50 MHz
Balance Ratio . . . . 25 dB minimum
Attenuation . . . 5-35 MHz, 28 dB minimum
Manufacturer
RMS Electronics, Inc.

The method of checking the unit out is identical to the straight-forward matching tranformer; two units are connected back-to-back (diagram 2-A). Photo 3 shows the broadband response of the pair of transformers back-to-back, while photo 4 shows the up-close notch depth and location (in frequency) of the 40-45 MHz region. Note that we do have some roll-off at the channel 2 visual carrier frequency, we measured it as 3.75 dB at 55.25 MHz for a *pair* of transformers, indicating it is around 50% of that (1.875 dB), *less the conversion loss* (0.5 dB) or, 1.375 dB per unit at 55.25 MHz in the CA 2600F. This slight "lisp" of the bandpass response on the channel 2 visual carrier should *not* cause anyone grief in the field.

The FM Tap

The FM tap is one of those passive devices all systems utilize, and never give much thought to. Perhaps after reading what follows, you will be a little more careful.

As shown in diagram 3 there are at least two (actually there are many more) engineering-approaches to "taking an FM signal out of the cable." The top diagram 3 is the RMS approach for their model CA-1041/S subscriber FM tap off unit. There is a "TV-thru" line, with an input and an output (which can be reversed with no harm) and there is an FM-out spigot. The FM out spigot is a simple little FM band*pass* filter which passes the general region 80-120 MHz with minimal degradation but which rejects rather badly the lower and upper portions of the cable spectrum.

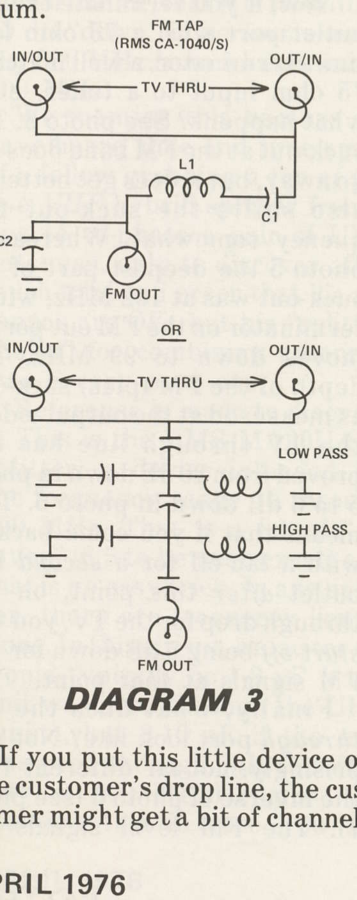


DIAGRAM 3

If you put this little device on the customer's drop line, the customer might get a bit of channels 4-5-6 through it for TV purposes, but he would be hard pressed to find much else in the way of TV signal there (20 dB down is the spec for TV band). And that is the intent and purpose of the unit.

Another approach is also

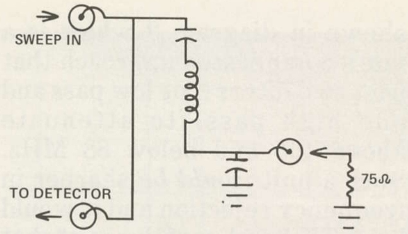


DIAGRAM 3B

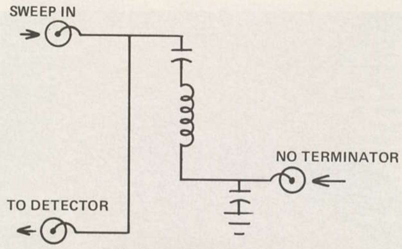


DIAGRAM 3A

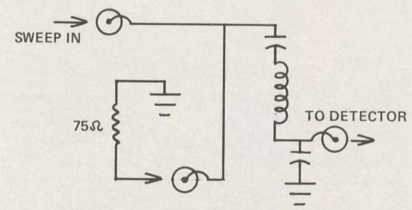


DIAGRAM 3C

shown in diagram 3 which is a more complicated approach that uses two filters (one low pass and one high pass) to attenuate above 108 and below 88 MHz. Such a unit *would be* sharper in frequency rejection and it would limit TV-band usefulness of that "FM dedicated outlet" more than the RMS circuit shown. It would *also* cost *more* money.

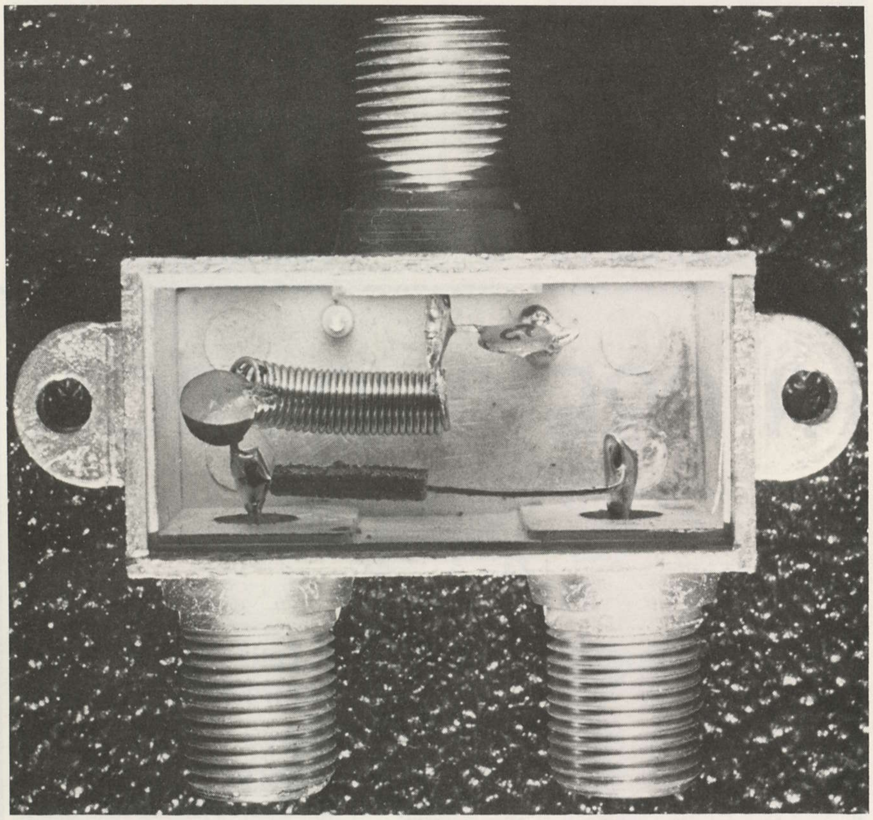
Now — what happens when you use this (RMS) unit?

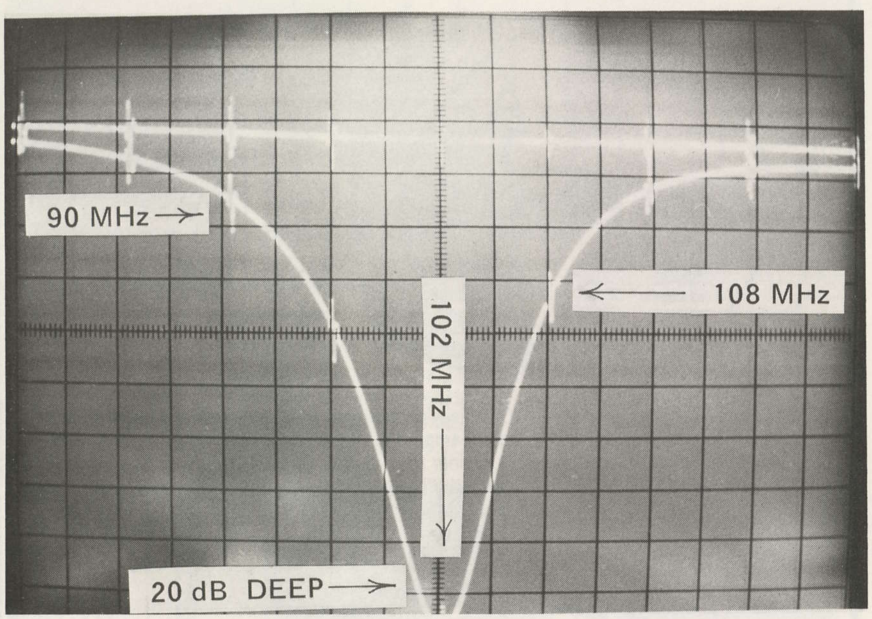
If you run the TV line through, as shown in diagram 3-A, and "forget" to put a terminator on the FM outlet side (i.e. do not connect the FM outlet side to a properly matched FM tuner or simply leave the FM outlet with nothing connected to it) you end up with a sharp "suck-out" on the TV line between 84 and 114 MHz. This would or could cause two subscriber problems on that TV through line:

(1) A roll off or loss of channel 6 audio at 87.75 MHz;

(2) *No FM band signals* further on down or along that subscriber drop, should you want to stick in *another* FM outlet on the *same* drop.

See photo 5.





FM TAP — without termination on FM output side, the TV thru line shows deep 20 dB suck-out peaked at 102 MHz. Markers are in 6 MHz increments.

CA-1040/S FM TAP	
Housing	Aluminum die-cast, stainless steel bottom plate
Insertion Loss	5 dB thru FM port, 0.5 dB thru ports (*)
TV Signal Attenuation	20 dB thru FM port
VSWR	1.2 to 1 (**)
Impedance	75 ohms
Bandwidths	FM, 82-108 MHz TV, 5-300 MHz
Manufacturer	**RMS Electronics, Inc.**

* — see text
** — VSWR depends largely on frequency

Now, if you terminate the FM outlet port with a 75 ohm load (i.e. a terminator, a well matched 75 ohm input to a tuner, etc.), what happens? See photo 6. The suck-out at the FM band does *not* go away, but it does get better. It also shifts the suck-out frequency somewhat. Whereas in photo 5 the deepest part of the suck-out was at 102 MHz, with a terminator on the FM out port, it moves down to 99 MHz. The depth of the FM (plus) suck-out, as measured at the output side of the TV through line has improved from 20 dB down in photo 5 to 6 dB down in photo 6. This means that if you come back in with a tap-off for a *second* FM outlet *after* this point, on the through drop for the TV, you will *start-off* being 6 dB down for the FM signals at *that* point.

Finally, what does the *FM through* port look like? Not surprisingly, not far different than the inverse of photo 6 (see photo 7). The FM level signals are down 3.5 dB worst case, which is about the expected through loss for the FM bandpass filter built into the unit.

The Hybrid Splitter

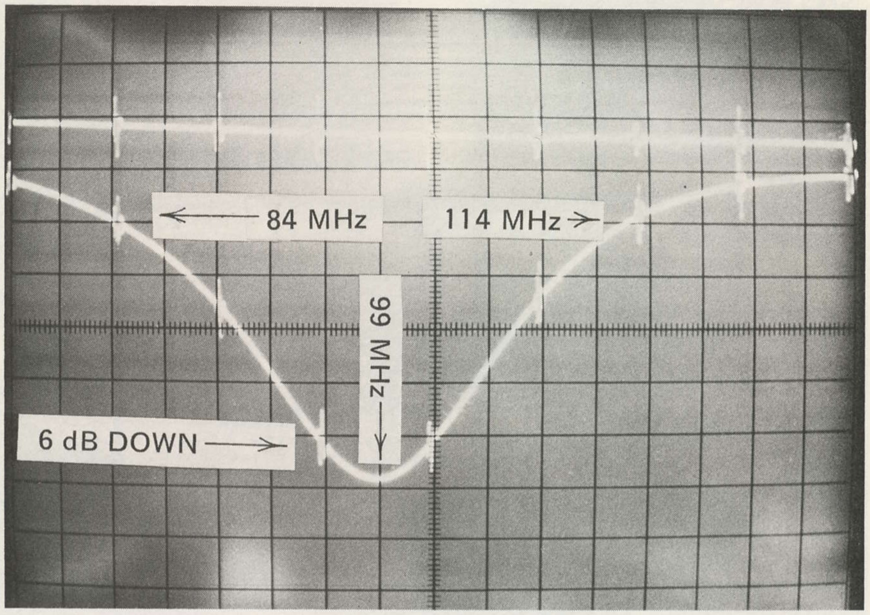
The FM-out tap is not far away from a splitter, only it is a splitter that is "frequency sensitive."

The splitter needs to be (1) secure from the elements, (2) rugged enough to install and forget, and (3) electrically designed so that most anything done at one output port is not reflected on the signal quality and level at any *other* output port. That is no small order for a device that also has to be broadband, and as they say, "cost acceptable".

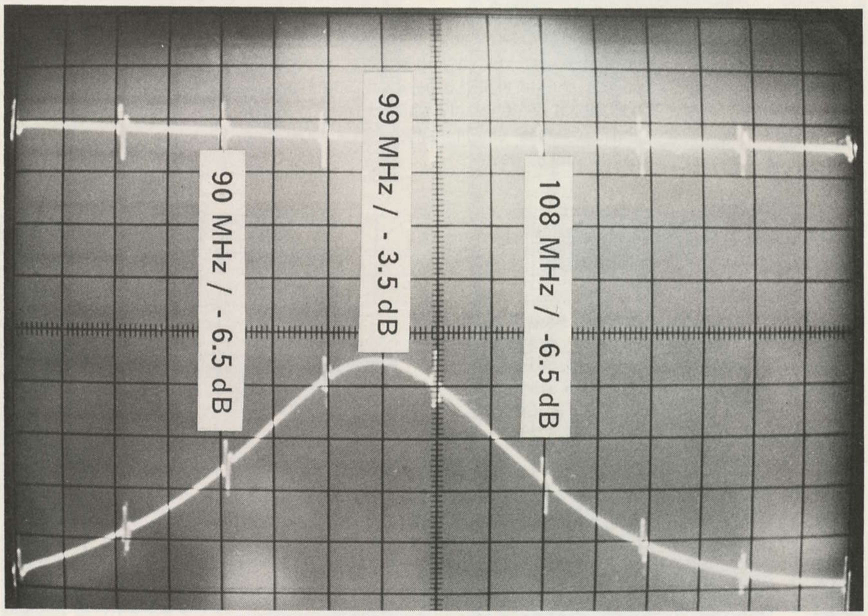
Any signal splitter *is* frequency sensitive. That is the nature of the animal. Now it may be that the unit you are buying is not frequency sensitive from say 10 to 300 MHz; but by the time you get up to say 500 MHz, it *is going to be* very frequency sensitive. Take a standard VHF "hybrid" splitter and try to use it as UHF. You will promptly find, if you have the ability to measure performance, that it is from 10 to 20 dB "down" in performance at say 500 MHz from what it was at 300 MHz.

We mention this because we have heard time and time again of a fellow grabbing a *top of the line VHF* hybrid splitter from a box to co-phase a pair of UHF antennas, only to discover after much trial and error that his antennas are OK; but his "splitter choice" for combining antennas was a very poor one.

Reference is made to diagram 4. This is the RMS MA20U/SM splitter; a device intended for the frequency range 10 through 900 MHz. That is a lot of "octaves" (6.5 to be near-exact) and that is no easy trick. In any splitter, there are frequency limitations. In this circuit, capacitor C2 would typically be 1-2 pF *if* the unit was good through the UHF region, but 8-10 pF if the unit was good through *only* the VHF (say to 300 MHz) region. We mention this in case you are



FM TAP — with termination on FM output, depth of suck-out is now 6 dB and center of notch is **down to 99 MHz.**



FM TAP — FM bandpass with sweep in at one TV thru port, other port terminated and detector at FM out port. FM passband centers at 99 MHz, is down 3.5 dB best case falling off to 6.5 dB at 90 and 108 MHz.

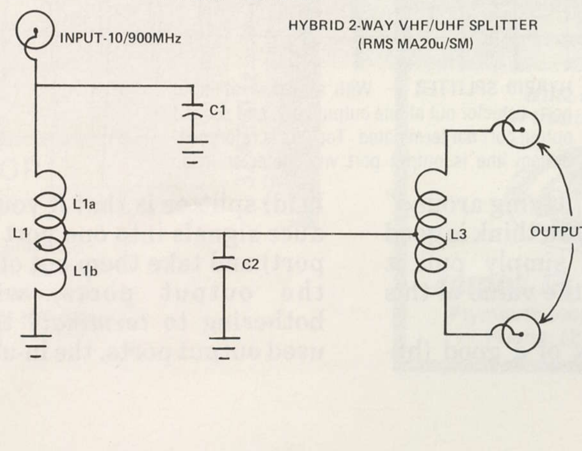
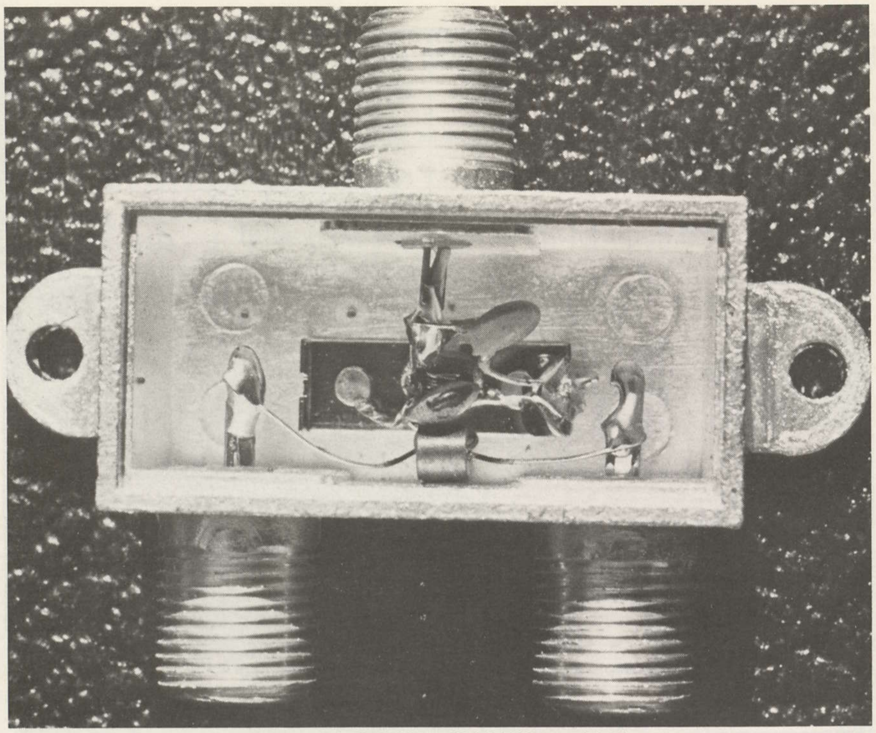
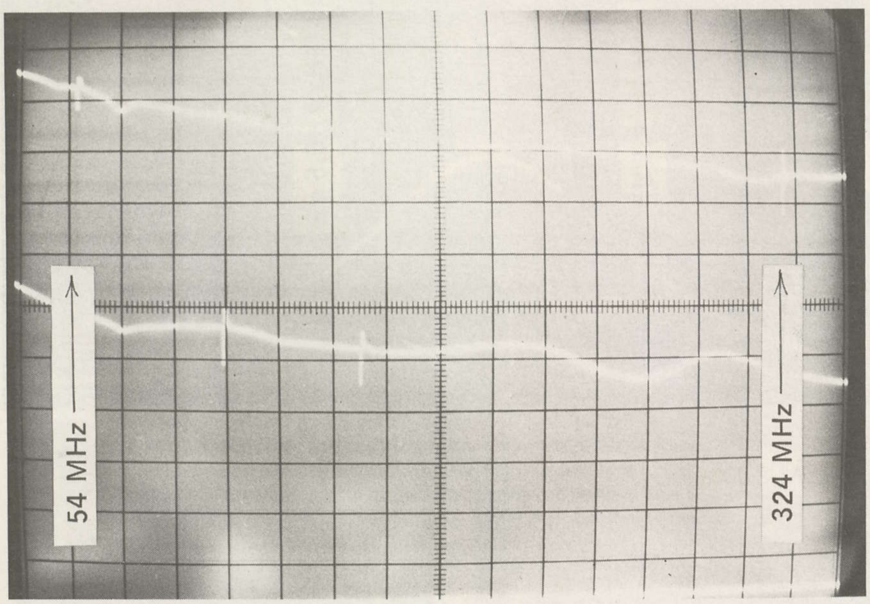


DIAGRAM 4



HYBRID TWO-WAY SPLITTER — RMS MA20U/SM. Match and balance at two outputs is ''tweekable'' by varying spacing between L3 and case inner wall (L3 between output ports), but should be done only while observing match **and** split loss simultaneously over operating bandwidth of device.



HYBRID SPLITTER — With sweep in at input port, detector out at one output port, and second output port **not** terminated. Top line is reference, bottom line is output port with detector load.

tempted to use a "laying around" hybrid splitter "you think is good for UHF also", simply pull it apart and check the value of this capacitor.

Now the mark of a good (hybrid) splitter is that if you introduce signals into one port (input port) and take them out of *one* of the output ports, without bothering to *terminate* the unused output ports, the in-use output port keeps on delivering ghost free signals. See diagram 4-A.

In photo 8 we have a sweep display that was produced with the test setup shown in diagram 4-A. The top line is the reference line while the bottom line is the signal after going through the output port. The second output was *not* terminated.

Now see diagram 4-B and photo 9. Here the reference line was dialed down to the actual through line and the splitter "loss" measured at from 3.2 to 3.4 dB. In photo 10 we have the same situation, unchanged, *except* that rather than allowing the second output to lie there with*out* a termination, a 75 ohm terminator was stuck on. Note that overall there is some, *but slight*, change in the signal present at the detector-fed output port, *after the other port was properly terminated.*

Now see diagram 4-C. The sweep source was moved from the input side of the splitter to one of the two output ports, and the detector-fed signal was taken out of the *second* output port. The input was left *unterminated.* See photo 11; the "isolation" provided through the device (with the input unterminated) is only 6 dB.

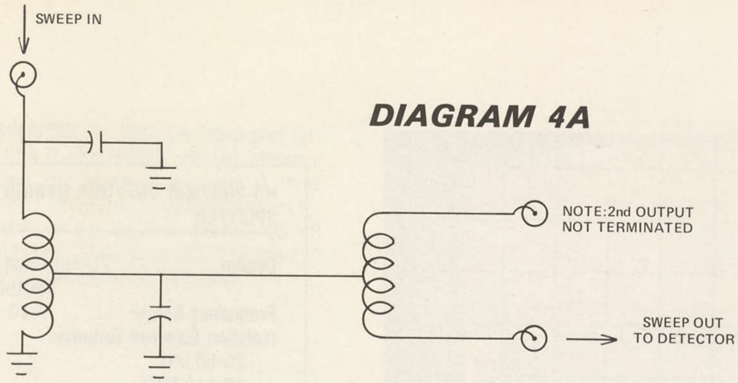
And see diagram 4-D; the situation is the same but the input has now been properly *terminated.* Now see photo 12, the isolation between the two outputs is now in excess of 20 dB (reaching 27 dB from 150-250 MHz) through the spectrum.

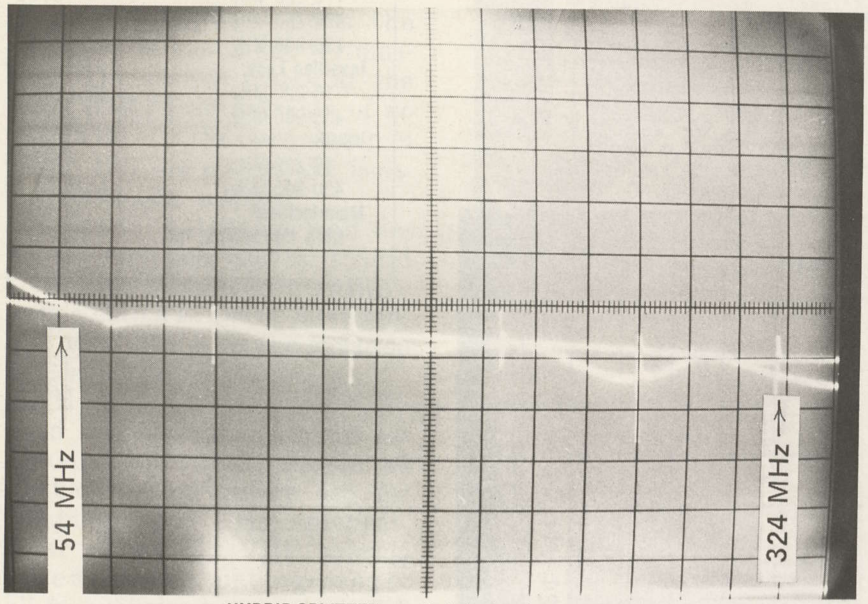
Of course it would be hard to operate a splitter without *any* source-match at the input, but it *would be* possible to operate one with a "poorer than 75 ohm" source-match. And if or when you do, you *can expect* the isolation between the two (or more) output ports of the splitter to go to pot in a hurry.

So the important things to remember about using hybrid splitters are:

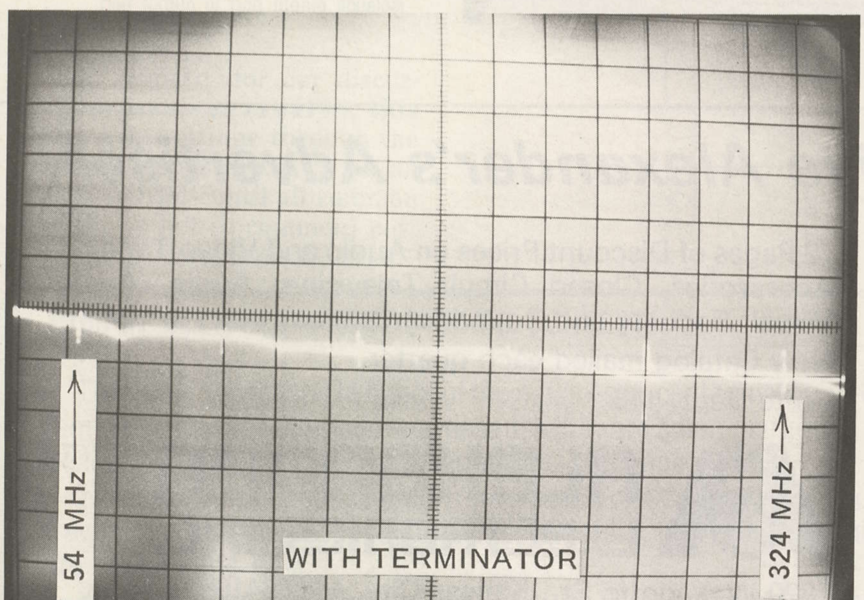
(1) The isolation between the two (or more) output ports is

DIAGRAM 4A





HYBRID SPLITTER — By bringing the top reference line down in .1 dB steps with Wavetek 1051 custom test set, the thru line and the reference line are mated. Average loss is 3.2 dB in this unterminated situation, worse case appears at 270 MHz (about 3.7 dB).



HYBRID SPLITTER — The joys of a proper termination. The difference is not great, but the bump near 270 MHz all but disappears when the second (unused) output is terminated; split loss now averages 3.2 dB **across** board.

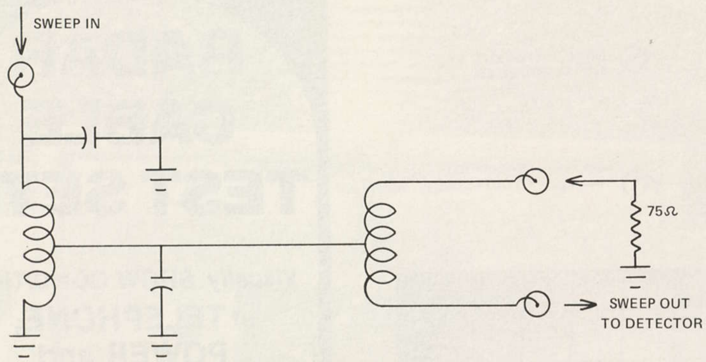
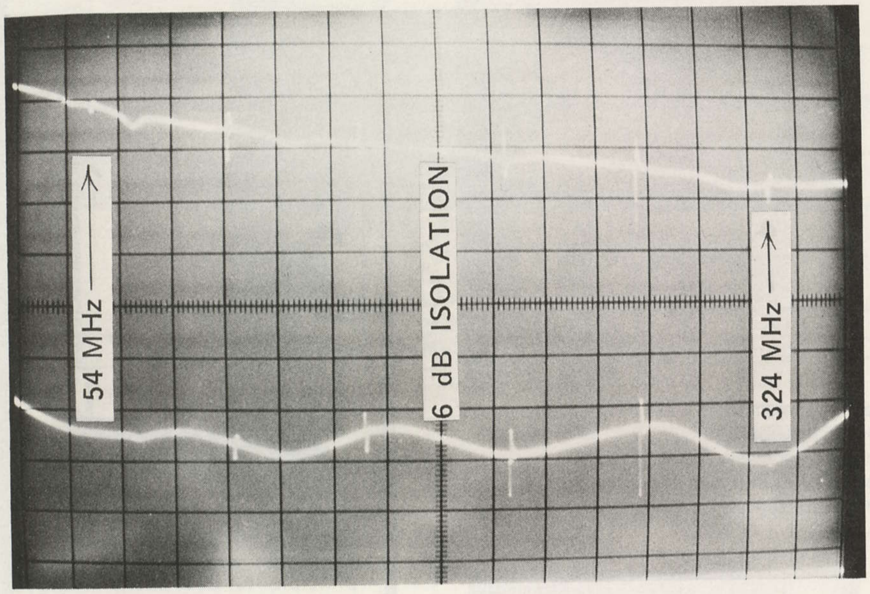


DIAGRAM 4B

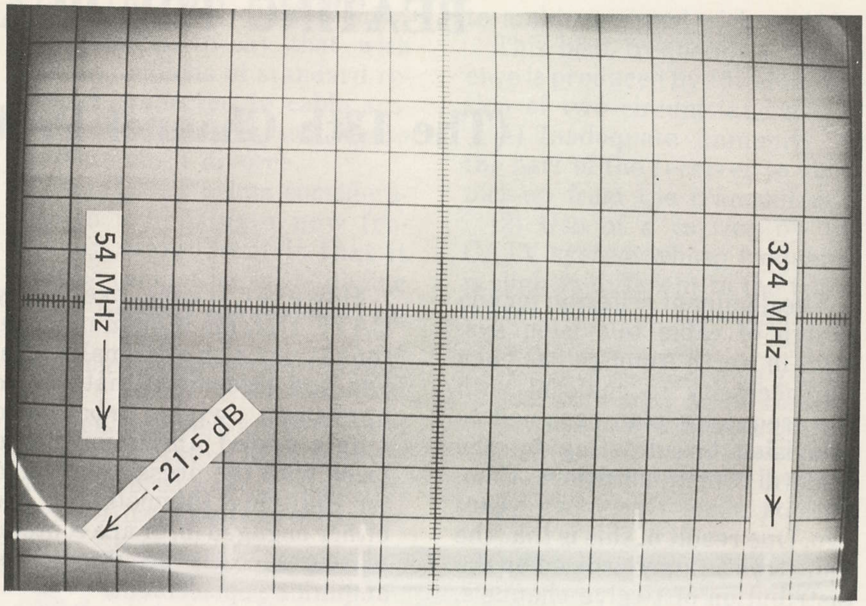
HS-20U/MM VHF/UHF HYBRID SPLITTER

Design .... Zinc die-cast housing, weatherproofed
Frequency Range .... 10-900 MHz
Isolation Between Outputs:
20-50 MHz .... 22 dB
50-110 MHz .... 25 dB
170-220 MHz .... 30 dB
400-750 MHz .... 30 dB
750-900 MHz .... 25 dB
Insertion Loss:
10-220 MHz ..... 3.4 dB (thru splits)
450-900 MHz ..... 3.8 dB (thru splits)
VSWR:
10-220 MHz 1.2:1
450-900 MHz 1.4:1
Manufacturer
RMS Electronics, Inc.



HYBRID SPLITTER — With sweep introduced into one of the output ports, and the detector at the second output port; with the input port open (i.e. not terminated). Top reference line is 6 dB above the through detected line, indicating in this condition the splitter has an average of 6 dB isolation output port to output port.

HYBRID SPLITTER — With the input port terminated with a 75 ohm resistor, the top reference line (straight line which is top-most of three shown) is 21.5 dB down (by pad adjustment for measurement) to the 54 MHz marker, 25 dB down at 108 MHz, 27 dB down 162, 216 and 270 MHz, and 26 dB down at 324 MHz.



largely dependent upon the "quality" of the input termination. The poorer match at the input (out to an extreme of *no match* such as the open shown in photo 10), the poorer the isolation between outputs.

(2) A well balanced, well designed and constructed hybrid splitter is relatively insensitive to mis-match at one or more output ports, vis a vis the isolation *between* the output ports.

(3) Hybrids, as commonly utilized for combining devices for phasing antennas, should be double-checked before use for combining any UHF antennas. Most (if not all) VHF hybrids have a natural shunt to ground of all frequencies between say 300 and 500 MHz (*and up*); and this creates medium to high loss in the UHF region, especially at the *high end* of the UHF region.

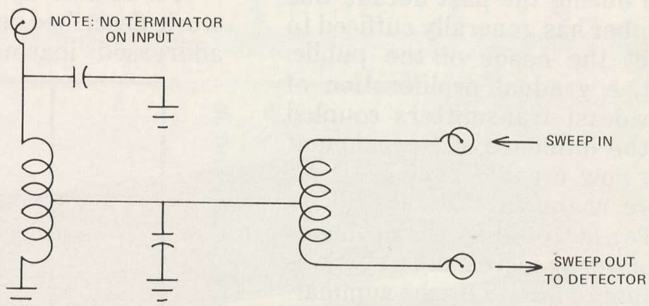


DIAGRAM 4C

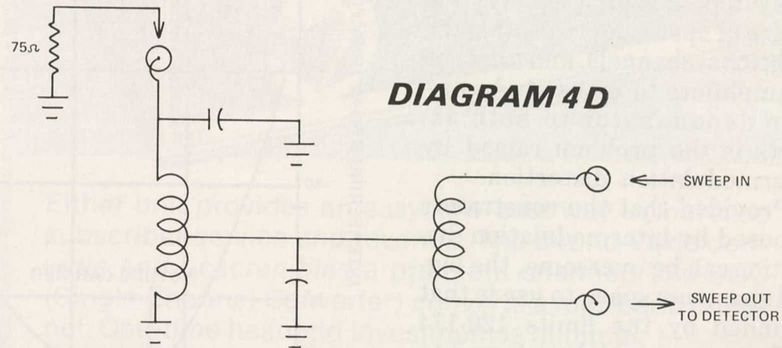


DIAGRAM 4D

After Passives

The "climate" for our discussion of passives created, this series will continue through the Summer issues of CATJ on an irregular basis until all common (and many not so common) passive units have been covered.

JUMPIN DECIBELS—THAT'S SOME CONTEST!

This month, perhaps in honor of the nation's bi-centennial or perhaps in honor of the industry's 25th (annual) trade show, or perhaps because they are smart marketing people, RMS is sponsoring a CATJ Reader Contest that ought to appeal to **every**one.

The prize is an expense paid trip to New York City on RMS and CATJ, for two people. Round trip travel, big-city hotel accommodations, spending money and Broadway Show tickets (big time stuff) are part of the deal.

You can enter more than once. . . . at the RMS Booth at the Dallas trade show, and by using the Reader Contest Entry Form found opposite page 57 of this issue. **But do enter.** The prize is for the winner and ''a friend''; and RMS promises not to ask for a marriage certificate when you get off the airplane!

BEATING THE BEATS

(The 13th Channel Problem)

The dominant criterion for the design of cable television systems in North America has been the necessity to conform with the frequency plan assigned to television broadcasting by the Federal Communications Commission some thirty-two years ago. One result of this is that the industry has standardized on the distribution of twelve channels, and during the past decade this number has generally sufficed to meet the needs of the public. But, a gradual proliferation of broadcast transmitters coupled to the influence of Government has now created a demand for more channels.

To a large extent the problems imposed by increasing a systems channel capacity can be summarized by considering two aspects of system design, namely, the choice of spectrum to use for the additional channels, and the type of amplifiers to be used. A common denominator to both aspects is the problem raised by intermodulation distortion.

Provided that the constraints imposed by intermodulation distortion can be overcome, the logical spectrum space to use is that bounded by the limits, 120-174 MHz, an area widely referred to as the midband. To the newer systems, i.e., those built within the last five years, the problems arising from intermodulation have been reduced by the availability of the push-pull type of amplifier whose A^2 and A^3 coefficients are superior to their single-ended predecessors.

However, there are many CATV systems (Community antenna television systems) in Canada and elsewhere that are in operation with broadband single-ended amplifiers, and faced with the pressing demand for additional channels they are either engaged in, or are contemplating a costly programme of amplifier replacement.

It is to such systems that the work described in this paper is addressed, inasmuch as it presents a method whereby channels can be added to the midband using the existing single-ended amplifiers.

Intermodulation Distortion

The problems associated with amplifier nonlinearity in broadband transmission systems have been well documented by numerous authors. An excellent review of the subject was given by C.A. Collins and A.D. Williams(1), wherein the build-up of second

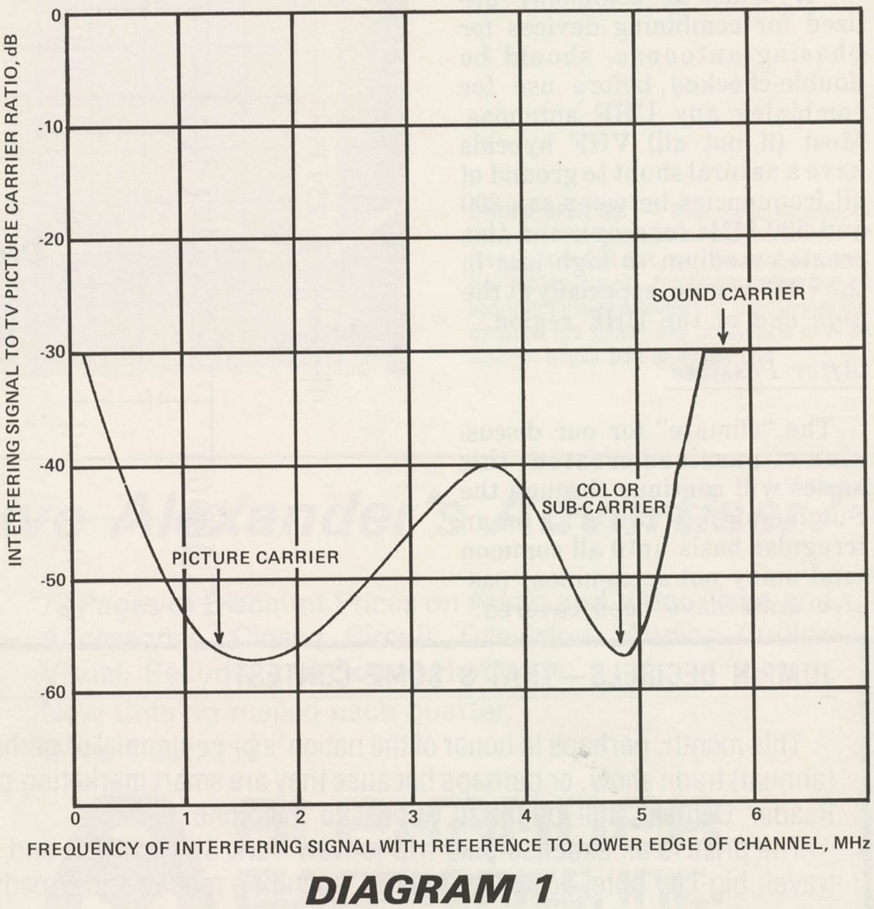


DIAGRAM 1

Editor's Note:

The use of phase locking techniques is growing rapidly throughout many sections of Canada, and in new CATV plants being designed to operate in metropolitan areas of the United States. Yet a goodly portion of the cable industry has not been exposed to this bit of engineering art and the advantages which it offers to the cable subscribers. The authors report on a series of system measurements conducted in Canada utilizing this technique, an experiment which illustrates how the 13th (etc.) channels can be added to existing **single-ended amplifier** distribution plants without causing the single ended plant to come apart at the seams.

and third order distortion products in cascaded amplifiers was analysed. In a noteworthy address on coherent carrier operations, I. Switzer(2) related how the emphasis on amplifier design for CATV use has been placed on minimizing third order distortion components with little regard to second order characteristics.

This design philosophy can also be traced to the FCC frequency plan because it designated the midband region as an unusable "guard band" in anticipation of second order intermodulation distortion resulting from conventional twelve channel operation.

Intermodulation distortion appears as an overlay of a number of black lines superimposed on a television picture. The degree of visibility of this interference is a function of the frequency and amplitude of the distortion product as it relates to the television picture carriers as shown in Diagram 1.

It is evident that this form of distortion must be overcome in any proposal to place carriers in the midband as an addition to the carriers used in the low and high VHF bands.

Receiver Compatibility

In contrast to a number of related operations in Europe, the North American cable television industry is predicated upon subscriber ownership of receivers. Receivers designed specifically for cable use have not appeared, and in consequence the distribution systems are designed for compatibility with receivers which have been manufactured for off-air reception in accordance with the standard frequency plan.

It is beyond the scope of this paper to discuss the limitations imposed by this unlikely marriage, suffice to say that with literally millions of standard receivers connected to cable systems, the family is too big to contemplate a divorce.

Therefore, a prime consideration in proposing a new frequency assignment is that it must be compatible with the fine tuning range of the standard receiver.

Phaselocking to Off-Air Carriers

When receivers are connected to a CATV system in close proximity to a broadcast transmitter, a type of distortion can occur due to ambient signal pick-up.(A)

This beat frequency interference is produced by the combination of two circumstances.

(1) Inadequate immunity on the part of the receiver to stray pick-up from the transmitter.

(2) Use of a carrier by the CATV system whose frequency is slightly different to the transmitter. (This is due mainly to

(A) This type of interference is not to be confused with a similar type of interference encountered in long distance reception from antennas. To differentiate between the two the CATV type of interference is generally referred to as "ambient pick-up with on-channel operation."

by
E.W. Finlay,
J. Cappon
Delta-Benco-Cascade
Toronto, Ontario
Canada

crystal tolerances.)

To eliminate this interference, CATV systems use a process whereby the broadcast carrier is compared with the CATV carrier. A frequency difference produces an "error" voltage which is applied as a correction to the carrier generation equipment at the CATV systems head-end.

This technique is known as "phaselocking" (B) and because in its absence the number of useable channels available to a CATV system would be reduced, it is an essential consideration.

Intermodulation Products Resulting From Standard Carrier Operation

The investigation commenced with a measurement of the spurious frequencies generated by intermodulation through a chain of CATV amplifiers. It was decided to use this empirical approach because the results of previous attempts to correlate between the predicted and measured amounts of intermodulation products has in general been poor.

The location chosen for the measurement was a point on the system preceded by fifty-seven amplifiers, all single-ended and comprising fifty-one trunk stations, a bridger, and five line extenders. A full complement of standard low and high band carriers was applied, and the tests conducted using a spectrum analyzer whose output was recorded on an x, y plotter.

The x, y plot given in Diagram 2 shows the location and amplitude of the spurious frequencies appearing in the midband, and clearly illustrates how the intermodulation process restricts the use of this spectrum space as a transmission medium.

Some of the spurious frequencies have been identified to draw the reader's attention to the fact that the most restrictive ones encountered both in regard to magnitude and location, are the products of second order sum and difference combinations.

Diagram 2 can also be used to justify the statement made concerning the poor correlation between predictions and measurements. The analysis by Collins and Williams(1), and others, has concluded that a second harmonic would predictably be 6dB less than a sum or difference product for equal amplifier input levels.

Reference to Diagram 2 will show that the second harmonic of channel 5 is more than 10dB below the sum of channels 5 and 6. Better correlation is evident between the second harmonic of channel 6, and the sum of channels 5 and 6, where the separation is approximately 7 dB. There appears to be a complete absence of the second harmonic of channel 4, but channel 4 is seen combining with other carriers in sum and difference combinations.

It is assumed that this situation can be explained by the vectorial additions of the combina-

(B) It is true that a fixed phase relationship is established at the head-end. However, it is not the phase angle that is of importance, rather it is the congruence of the frequencies or the "Frequency lock" that serves to eliminate the beat interference. Therefore, the description phaselock is really a misnomer.

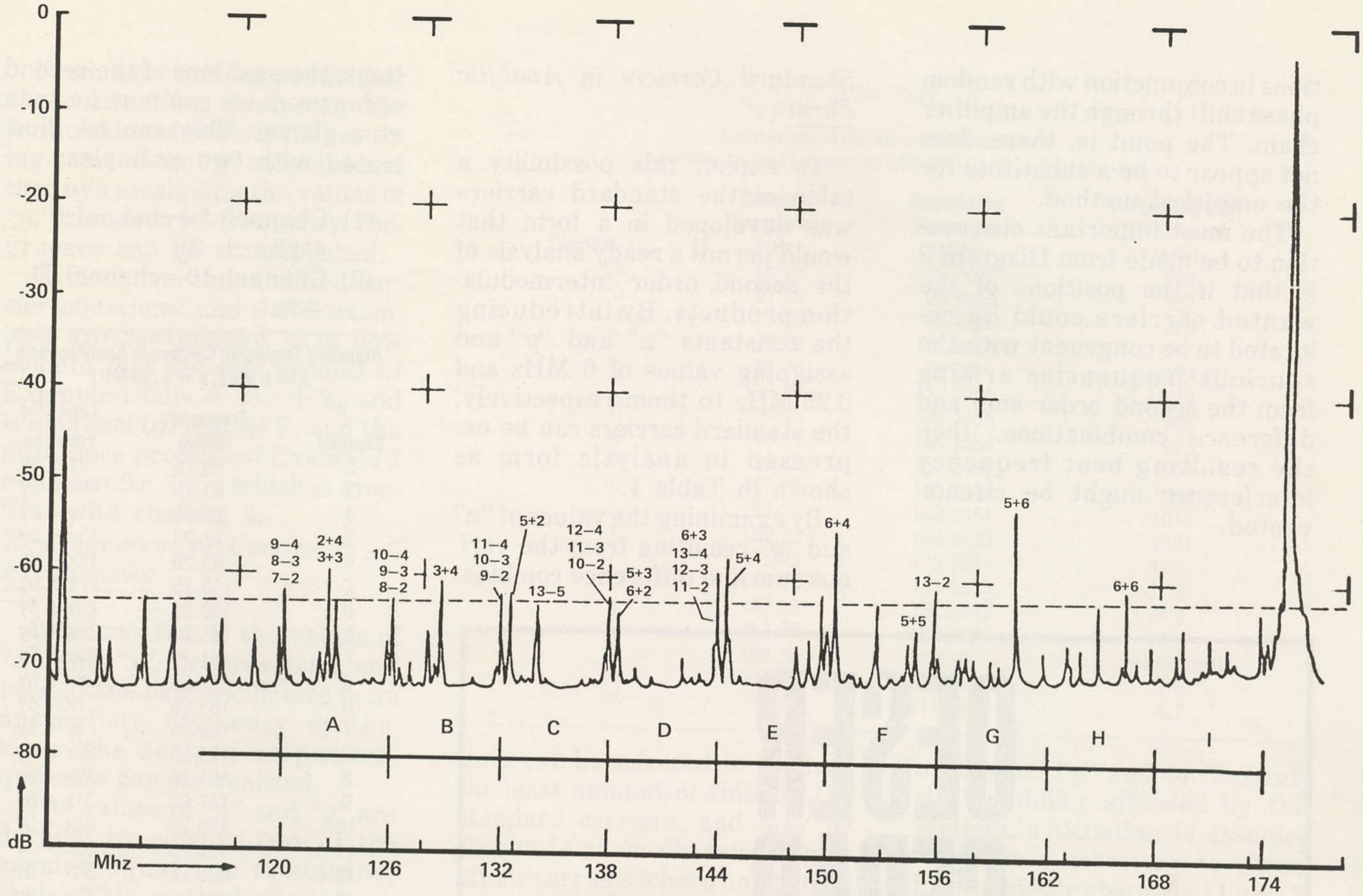


DIAGRAM 2

Hor. Scale: Approx. 2.5 Mhz/cm   Vert. Scale: 5dB/cm tions in conjunction with random phase shift through the amplifier chain. The point is, there does not appear to be a substitute for the empirical method.

The most important observation to be made from Diagram 2 is that if the positions of the wanted carriers could be relocated to be congruent with the spurious frequencies arising from the second order sum and difference combinations, then the resulting beat frequency interference might be circumvented.

Standard Carriers in Analytic Form

To exploit this possibility a table of the standard carriers was developed in a form that would permit a ready analysis of the second order intermodulation products. By introducing the constants "x" and "y" and assigning values of 6 MHz and 0.25 MHz to them respectively, the standard carriers can be expressed in analytic form as shown in Table 1.

By examining the values of "x" and "y" resulting from the various sum and difference combinations, the positions of the second order products can now be seen at a glance. This can be illustrated with two examples:

(1) Channel 4+channel 6 $=25x + 2y$

(2) Channel 10—channel D $=9x$

Standard Television Carriers in Analytic Form
x = 6 MHz, y = 0.25 MHz

Table One

Channel	Frequency (MHz)	Equation
2	55.25	9x + 5y
3	61.25	10x + 5y
4	67.25	11x + 5y
5	77.25	13x — 3y
6	83.25	14x — 3y
C	133.25	22x + 5y
D	139.25	23x + 5y
E	145.25	24x + 5y
F	151.25	25x + 5y
G	157.25	26x + 5y
H	163.25	27x + 5y
I	169.25	28x + 5y
7	175.25	29x + 5y
8	181.25	30x + 5y
9	187.25	31x + 5y
10	193.25	32x + 5y
11	199.25	33x + 5y
12	205.25	34x + 5y
13	211.25	35x + 5y

A glance at Table 1 shows the sum product of the first example to be troublesome to channel F because its equation is $25x + 5y$, hence a $3y$ or 0.75 MHz beat will occur.

The difference product of the second example appears at a distance $5y$ removed from channel 2 hence a 1.25 MHz beat is predictable.

Standard and Modified Television Carrier Equations

Table Two

Channel	Freq. MHz	Standard	New Assignment
2	55.25	9x + 5y	9x + 5y
3	61.25	10x + 5y	10x + 5y
4	67.25	11x + 5y	11x + 5y
5	77.25	13x — 3y	13x — 3y
6	83.25	14x — 3y	14x — 3y
C	133.25	22x + 5y	22x + 2y
D	139.25	23x + 5y	23x + 2y
E	145.25	24x + 5y	24x + 2y
F	151.25	25x + 5y	25x + 2y
G	157.25	26x + 5y	26x + 2y
H	163.25	27x + 5y	27x + 2y
I	169.25	28x + 5y	28x + 2y
7	175.25	29x + 5y	29x + 7y
8	181.25	30x + 5y	30x + 7y
9	187.25	31x + 5y	31x + 7y
10	193.25	32x + 5y	32x + 7y
11	199.25	33x + 5y	33x + 7y
12	205.25	34x + 5y	34x + 7y
13	211.25	35x + 5y	35x + 7y

From this it is apparent that the controlling factor in the formulation of beats is the resulting value of the "y" constant and that by reassigning the values of "y," the desired frequency congruence can be accomplished.

Table 2 lists the modified carrier equations, and if the examples are reexamined it is now evident that the sum product of Example 1 falls at $25x + 2y$ and is identical to channel F, and the difference product of Example 2 occurs at $9x + 5y$ which is identical with channel 2.

Reassignment of Carrier Frequencies

It follows that if the values of "x" and "y" are resolved and used as the base oscillators in an appropriate frequency synthesizer, the desired output frequencies can be realized.

The values of "x" and "y" are derived by solving two of the carrier equations simultaneously. This method allows considerable flexibility as the equations can be selected to produce the least amount of shift off the standard carriers, and may be chosen to allow phaselocking to off-air carriers where on-channel operation is necessary.

Table Three

Comparison of Standard and Reassigned Television Carrier Frequencies With Two Carriers Phaselocked

Channel	Standard Frequency (MHz)	Reassigned Frequency (MHz)	Frequency Shift Off Standard (kHz)
2	55.25	55.0036	246
3	61.25	60.9965	253
4	67.25	66.9893	260
5	77.25	77.2671	17
6	83.26	83.26	zero (locked)
C	113.25	132.2708	979
D	139.25	148.2635	986
E	145.25	144.2564	993
F	151.25	150.2495	1000
G	157.25	156.2422	1007
H	163.25	162.2351	1015
I	169.25	168.2280	1021
7	175.25	175.2884	38.5
8	181.25	181.2813	31.3
9	187.25	187.2742	24.2
10	193.25	193.2671	17.1
11	199.26	199.26	zero (locked)
12	205.25	205.2529	2.9
13	211.25	211.2457	4.2

As an example of the solution of "x" and "y" and to illustrate the flexibility afforded by this method, a situation is assumed where it is necessary to phaselock to off-air channels 11 and 6, both offset by 10 kHz.

From Table 1:

Table Four

Reassigned Television Carrier Frequencies With No Phaselocking Requirements

Channel	Equation	Reassigned Frequency (MHz)	Frequency Deviation (kHz)
2	9x + v	55.125	−125
3	10x + v	61.125	−125
4	11x + v	67.125	−125
5	13x + u − v	77.125	−125
6	14x + u − v	83.125	−125
C	22x + u	132.250	−1000
D	23x + u	138.250	−1000
E	24x + u	144.250	−1000
F	25x + u	150.250	−1000
G	26x + u	156.250	−1000
H	27x + u	162.250	−1000
I	28x + u	168.250	−1000
7	29x + u + v	175.375	+125
8	30x + u + v	181.375	+125
9	31x + u + v	187.375	+125
10	32x + u + v	193.375	+125
11	33x + u + v	199.375	+125
12	34x + u + v	205.375	+125
13	35x + u + v	211.375	+125

Channel $11 = 33x + 7y = 199.26$ Mhz

Channel $6 = 14x - 3y = 83.26$ MHz

By simultaneous solution the values realized for "x" and "y" are 5.9929 MHz, and 0.2135 MHz respectively.

Substituting these values for "x" and "y" in the carrier equations results in the reassigned carriers shown in Table 3. The amount of shift from standard carriers is included.

Where there are no phaselocking requirements, the amount of shift from the standard carriers can be minimized by expanding the carrier equations. The "y" components, $5y$, $3y$, $2y$ and $7y$ are replaced by v, $u-v$, u, and $u + v$ and by assigning the values of 6 MHz to x, 0.25 MHz to u, and 1.125 MHz to v, the second order cancellation objective is achieved with a carrier shift of ony 125 KHz as shown in Table 4.

The expansion to three variables x, u, and v permits phaselocking to a maximum of three off-air carriers. The amount of frequency shift is determined by the off-air channels to which the system is locked as shown in Table 5.

Use of Table 5:

(a) Decide the channel(s) to be locked to off-air signals.

(b) Determine the channel group(s) to which they belong, 2-4, 5-6 and/or 7-13.

(c) Select the column(s) which indicate a 0 freq. shift for those channel group(s).

(d) The shift in other channel groups is indicated in that same column.

Note: It is not possible to lock three carriers when each one is in a different channel group.

To illustrate the use of Table 5:

Assume a lock is required to off-air channels 5, 7 and 9. Channel groups to which they belong are 5-6, and 7-13. The fifth column shows 0 shift for channel groups 5-6 and 7-13, it also shows a shift of 250 kHz for channel group 2-4 and 1000 kHz shift for channel Group A-I.

Table Five

Phaselock to		Max Freq. shift in kHz*						
Channel Groups	one or two out of Ch. 2-4	0	0	0	—167	—250	—167	—125
	one or two out of Ch. 5-6	—250	0	—500	0	0	—167	—125
	one or two out of Ch. 7-13	+250	+500	0	+167	0	0	+125
	none out of Ch. A-I	—1000	—750	—1250	—917	—1000	—1083	—1000

* Slightly greater values may occur depending on the 10 KHz offsets of the channels to be locked.

Effect of Carrier Reassignment on Second Order Products

Assuming the use of the modified carrier frequencies contained in Table 3, a calculation was made of all second order sum and difference products in relation to the channels of interest and arising from the inclusion of five lowband, nine midband and seven high band channels. The complete results of the channel by channel analysis is appended to this paper; however, they can be summarized as follows.

(1) Total possible unwanted products=108

(2) Number locked to wanted carriers=72

Of the 36 which remain, a total of 18 are located at a position of wanted carrier plus 1.72 MHz.

A further 18 are located at wanted carrier plus 4.28 MHz.

Comparison of the locations of the unlocked products to the susceptibility curve of Diagram 1 reveals that a product at wanted carrier plus 1.72 MHz requires a margin of 46dB. A product located at carrier plus 4.28 MHz requires a smaller margin of 34dB.

Considering that the product of greatest amplitude was measured at 49dB below nearest carrier as shown in Diagram 2, it can be reasonably expected that no beat interference due to second order intermodulation will be visible.

EQUIPMENT REQUIREMENTS

To obtain the required modulated RF carriers at the precisely interrelated frequencies (based on x, u and v), a master generator was built employing 3 crystal oscillators as shown in Diagram 3.

By mixing a sample of the outgoing RF signal of each processor with its adjacent channel signal from the master generator, a "difference frequency" at the approximate value of "x" is gener-

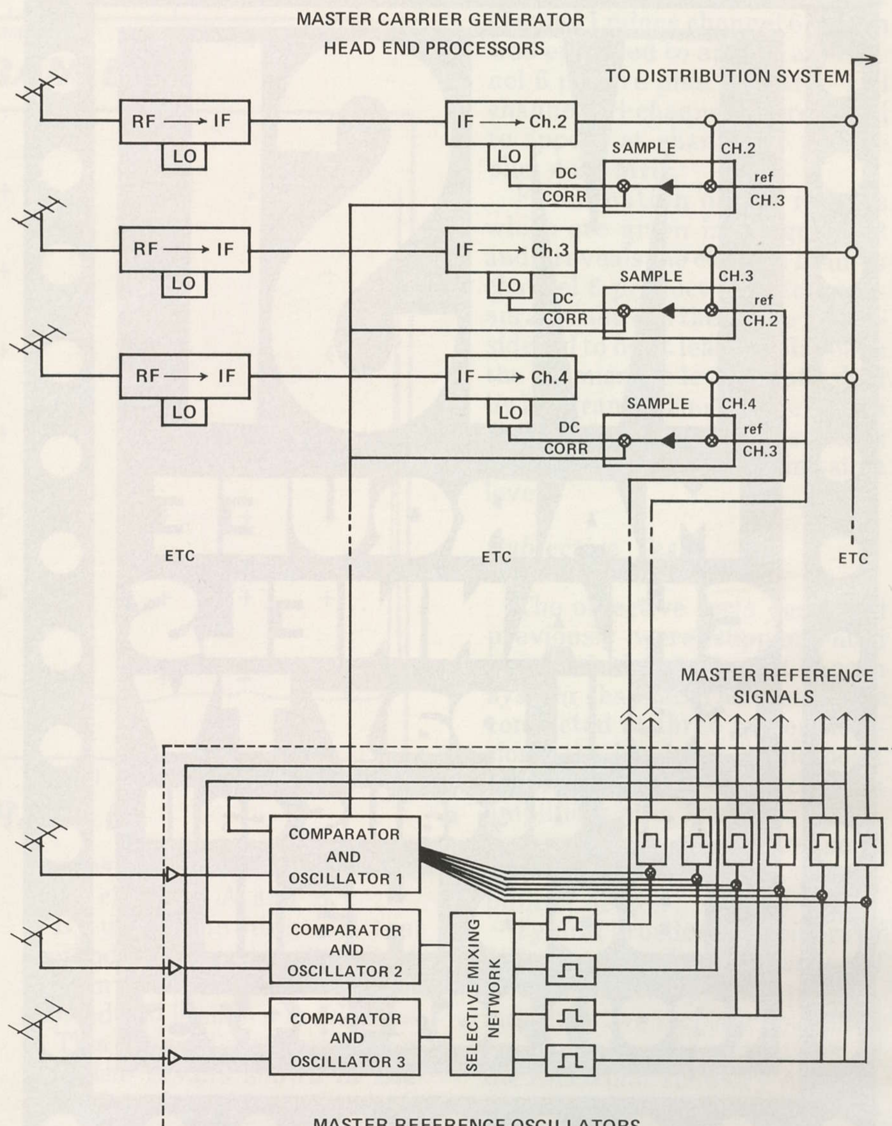


DIAGRAM 3

ated. A further comparison between this "difference frequency" and x, produces the DC correction voltage which controls the local oscillator frequency of the processors output converter thereby obtaining a precise lock.

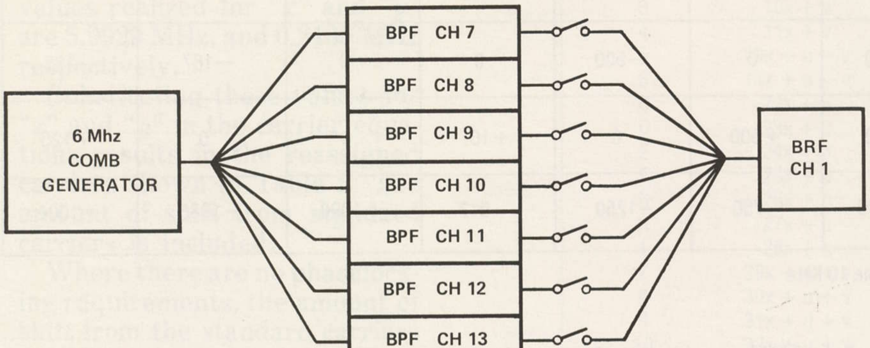


DIAGRAM 4

Since either adjacent channel can be used to develop the "difference frequency" only a limited number of reference carriers need to be generated. Diagram 3 illustrates a situation where 15 carriers can be locked to the master oscillator by use of 11 reference signals. Locking to "off-air" signals requires the master generator to be slaved to the "off-air" signals, which is also shown in Diagram 3 in a simplified block diagram.

Measurement of Triple Beat

Recognizing that the coherent aspect of the proposed carrier arrangement would tend to stack third order products, it was decided to measure the amplitude of the triple beat described as $f1 +/- f2 +/- f3$. This could then be directly compared with the noncoherent or random carrier use generally encountered in CATV operations.

To conduct this test a carrier generator was built to provide seven carriers tuned to the high band channels (7-13), and spaced at precise 6MHz intervals as shown in Diagram 4. The triple beats appearing in the region of the channel I carrier (168 MHz) were recorded using a spectrum analyzer at the same test location at a point 57 amplifiers "deep," as previously described.

The "x", "y" plots given in Diagrams 5 and 6 indicate that the triple beats resulting from the seven coherent carriers added to produce a single spurious frequency whose magnitude was 10dB greater than the individual triple beat resulting from a random carrier source. However, it should be noted that this test condition represents a worse case situation because the proposed system limits the carrier coherency to the carriers of individual bands. Moreover, carriers that do not contribute to the formulation of second order products are excluded from the master oscillator unit.

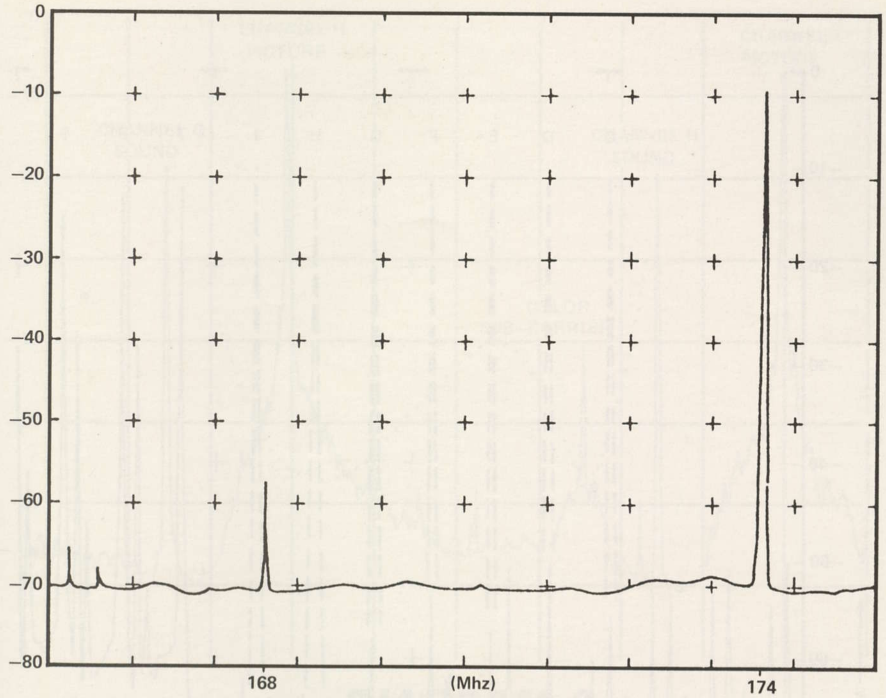


DIAGRAM 5

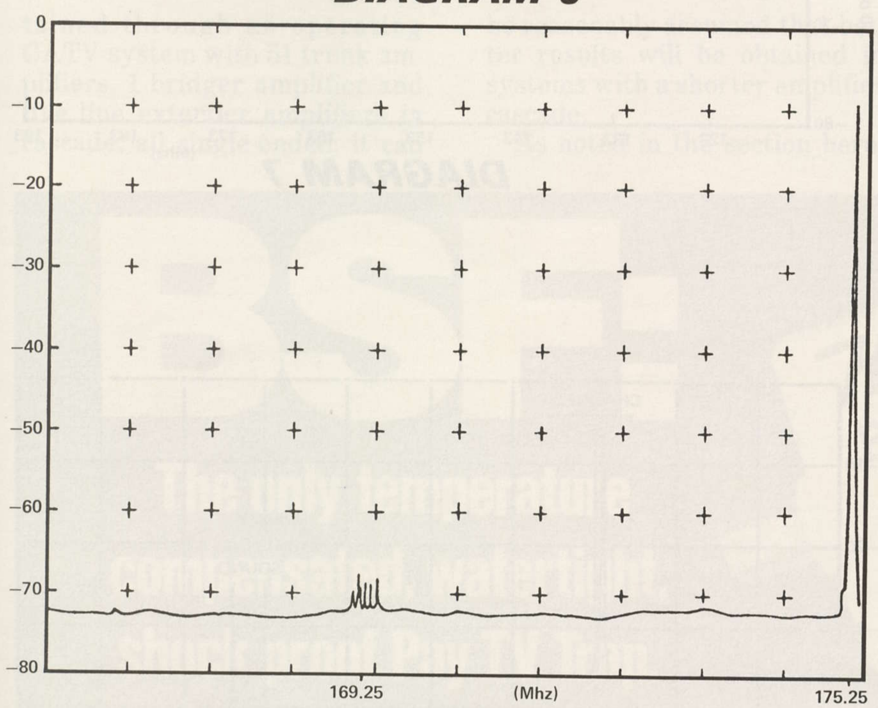


DIAGRAM 6

Measurement of Second Order Products

With the output frequencies corresponding to those listed in Table 3, a 17 channel head-end was installed and connected to the system. The number of channels used was restricted in deference to the regulation of the Canadian Department of Communications against the use of midband channels A and B.

By using the identical test method and location described, the midband spectrum was plotted and is shown in Diagram 7. This allows direct comparison with the results shown in Diagram 2 and to this comparison, the positions of the reassigned carriers have been superimposed on to Diagram 7. The frequency coincidence of the wanted carriers and unwanted products are self-evident.

The placement of carriers in the midband as an addition to the carriers of the low and high band channels produces a second order combination whose products appear in the low, mid and high band. This aspect was included in the analysis of second order products contained in this paper, and to confirm this analysis two of the spurious frequencies which are not congruent with wanted carriers were measured.

Again the same test location was used together with a spectrum analyzer and x, y plotter. The products measured were channel I minus channel 6, which was expected to appear at channel 6 picture plus 1.7 MHz, and channel 6+channel 6 predicted to appear at channel H picture plus 4.28 MHz.

Examination of the results which are given in Diagrams 8 and 9 reveals the channel I minus channel 6 product was not measurable and can therefore be considered to be at least 14dB below the permissible level established by Diagram 1. The channel 6 plus channel 6 product was measured at 27 dB below the permissible level.

Subjective Tests

The objective tests described previously were supplemented by a critical viewing test of each system channel. The tests were conducted at three system locations, the head-end, a mid point preceded by twenty-two trunk amplifiers plus a bridger amplifier, and finally the deepest point of the system described (57 amplifiers deep).

Typical broadcast receivers of different manufacture were used to evaluate the picture quality, including two receivers supplied by member representatives of the Electronic Industry Association of Canada. It can be noted that the two receivers referred to are purported to have the tightest A.F.C. ranges of any receivers available to the public.

In relation to the system considerations the tests can be described as follows:

(1) When viewed at the system's deepest point, no beat frequency interference was observed.

(2) Accompanied by member representatives of the E.I.A.C. tests of the compatibility with receiver fine tuning was conducted by switching back and forth between the standard and reassigned carriers. All receivers required only a slight retuning. Predictably, the receivers local oscillators could accommodate a 250 kHz shift. But the small amount of adjustment required exceeded expectations. Receivers equipped with A.F.C. required no adjustment.

(3) No visible evidence of crossmodulation was observed. This was confirmed by conducting a "blank screen" test on the systems community channel, channel 10 by removing the modulation and operating with normal sync and pedestal levels.

CONCLUSIONS

The test results indicate that the use of judiciously selected carrier frequencies as a means of circumventing second order intermodulation distortion in order to permit use of the midband is practical.

The amount of carrier shift resulting from the use of this system demonstrated it was fully compatible with standard television receivers.

The frequency shift occurring in the midband region, 1000 kHz, is not anticipated to be problematic since the number of receivers in use that are equipped with midband tuners is negligible. Hence to accommodate the use of midband channels the standard receivers will be dependent upon an external converter. The tuning range of these converters is more than adequate to meet the prescribed frequency shift.

Because the results were ob-

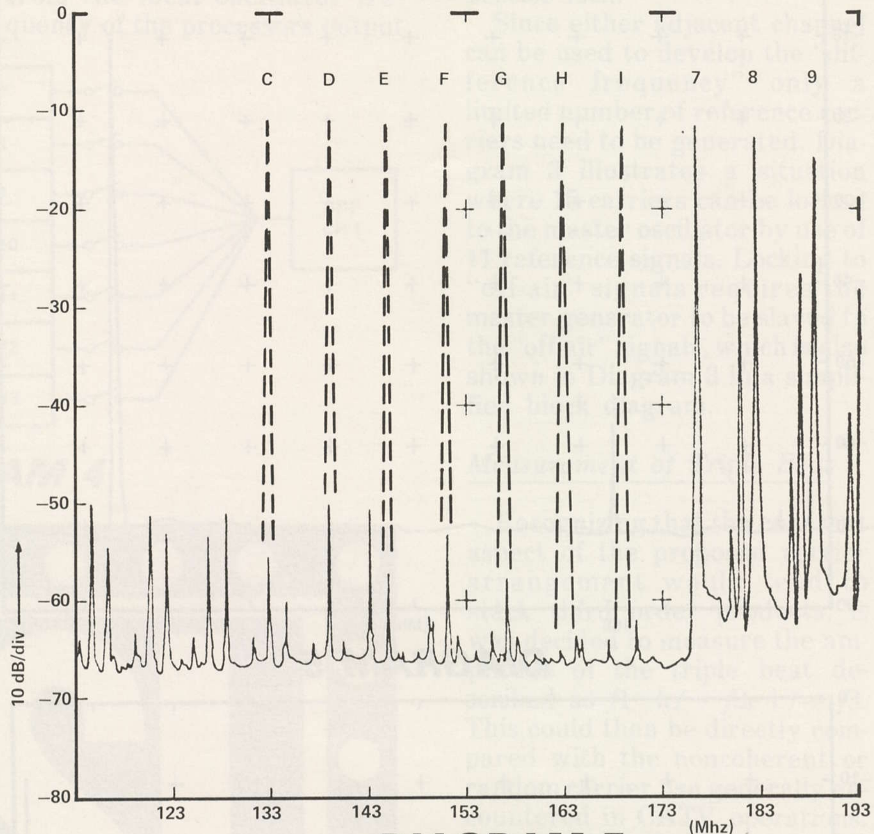


DIAGRAM 7

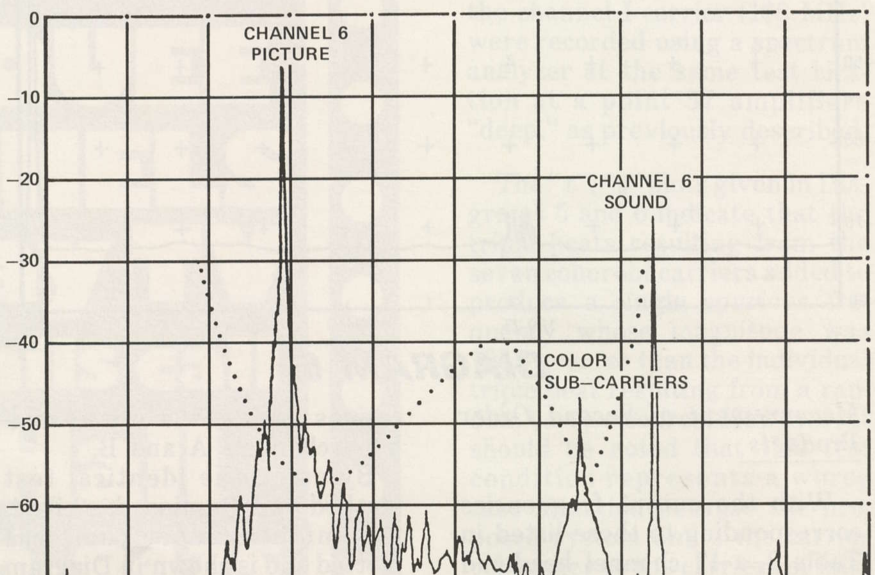


DIAGRAM 8

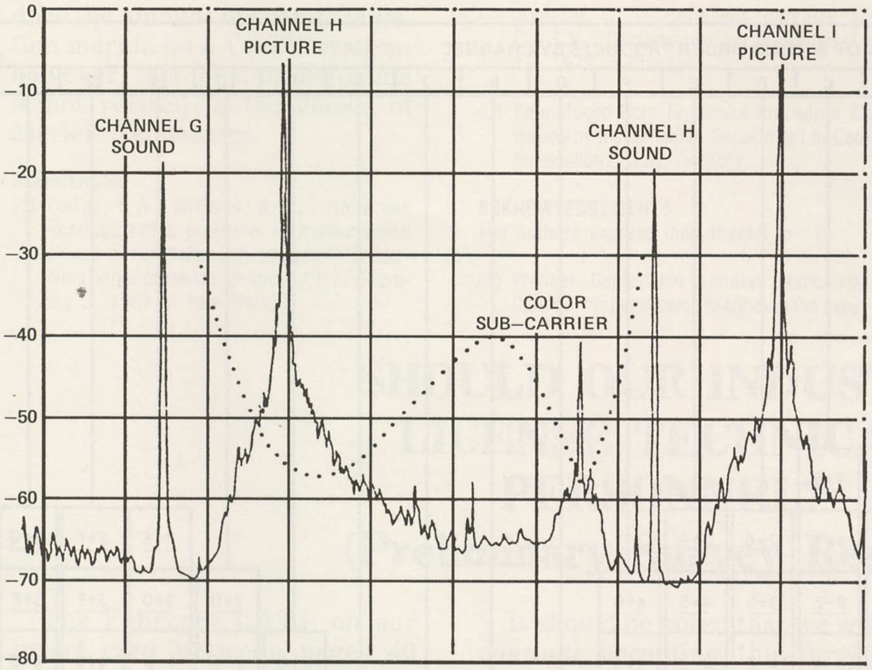


DIAGRAM 9

tained through an operating CATV system with 51 trunk amplifiers, 1 bridger amplifier and five line extender amplifiers in cascade, all single-ended, it can be reasonably assumed that better results will be obtained in systems with a shorter amplifier cascade.

As noted in the section here, the tests did not include midband channels A and B; however, since these channels are included in the analysis of second order products and in the light of the test results obtained, they can predictably be used.

Circumvention of second order distortion leads logically to a discussion of third order problems. The results of tests described herein suggest that triple beats will not impose a severe constraint on midband use on a typical system. However, as more channels are added the third order distortion products must be considered as the limiting factor to system reach. In particular the effects of coherent carrier operation will require close attention since the amplitude of triple beat was shown to increase dramatically in this mode of operation.

Another third order problem that will be encountered by additional channel operation is cross-modulation. Increasing the number of system carriers will re-

APPENDIX I

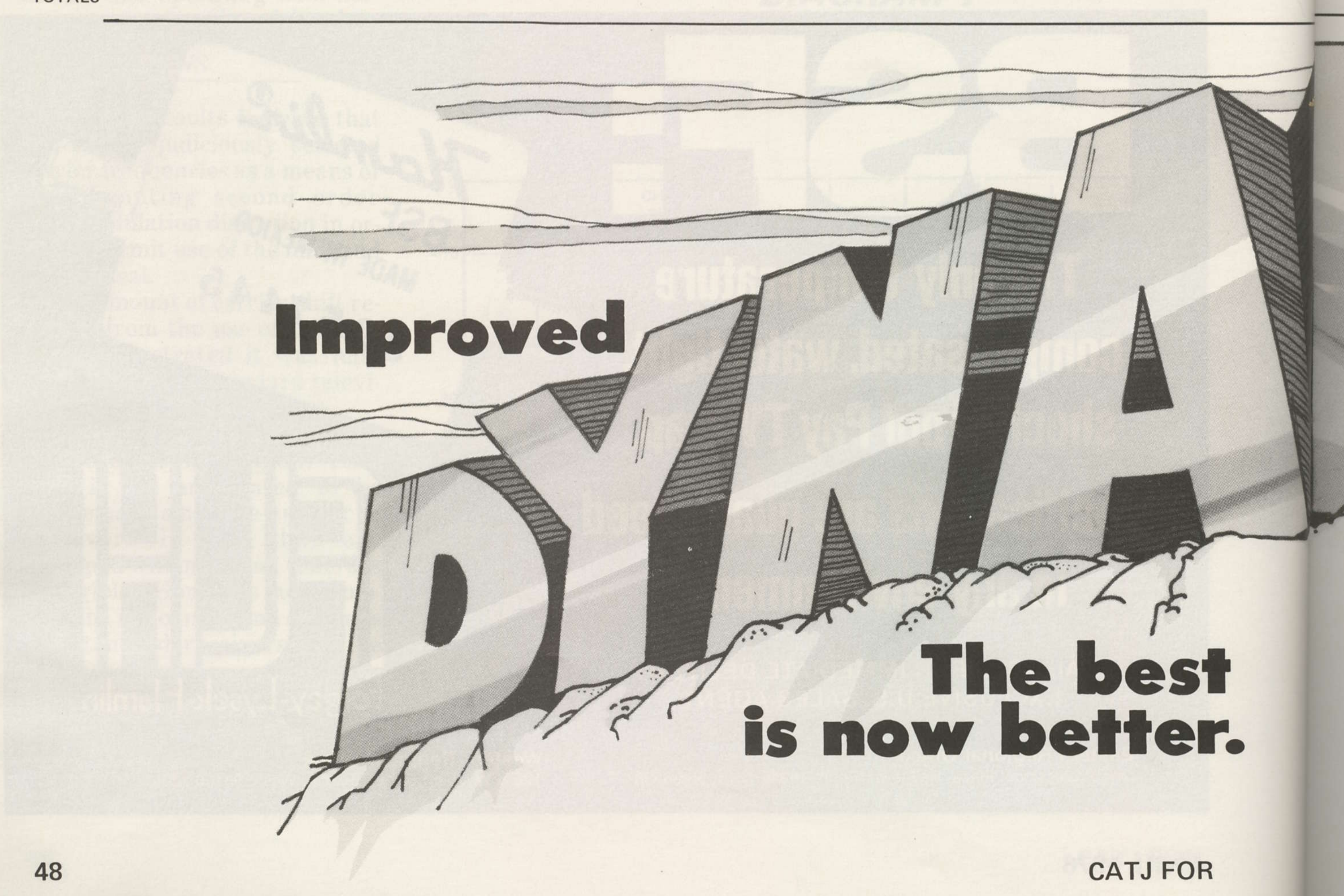
SECOND ORDER PRODUCTS RESULTING FROM THE REASSIGNED LOW, MID AND HIGH BAND TV CARRIERS

(LOCKED PRODUCTS ARE UNDERLINED)

LOCATION OF SECOND ORDER PRODUCTS BY CHANNEL

2	3	4	5	6	A	B	C	D	E	F	G	H	7	8	9	10	11	12	13
A-3	A-2	B-2	C-2	D-2	2+4	3+4	2+5	2+6	3+6	4+6	5+6	6+6	2+A	2+B	2+C	2+D	2+E	2+F	2+G
B-4	B-3	C-3	D-3	E-3	3+3	8-2	4+4	3+5	4+5	5+5	13-2			3+A	3+B	3+C	3+D	3+E	3+F
C-5	C-4	D-4	E-4	F-4	7-2	9-3	9-2	10-2	11-2	12-2					4+A	4+B	4+C	4+D	4+E
D-6	D-5	E-5	G-5	H-5	8-3	10-4	10-3	11-3	12-3	13-3						5+A	5+B	5+C	5+D
7-A	E-6	F-6	H-6	I-6	9-4	12-5	11-4	12-4	13-4								6+A	6+B	6+C
8-B	8-A	9-A	11-A	12-A	11-5	13-6	13-5												
9-C	9-B	10-B	12-B	13-B	12-6														
10-D	10-C	11-C	13-C																
11-E	11-D	12-D																	
12-F	12-E	13-E																	
13-G	13-F																		
11	11	10	8	7	7	6	6	5	5	4	2	1	1	2	3	4	5	5	5

TOTALS



duce the amount of crossmodulation margin on a CATV system; however, this form of distortion is not related to the choice of carrier frequencies.

REFERENCES

(1) Collins, C.A., Williams, A.D., "Noise and intermodulation problems in multi-channel closed circuit television system." Conference paper presented to the A.I.E.E. February 3, 1961 in New York.

(2) Switzer, I., "Coherent carriers for C.A.T.V." Conference paper presented May 17, 1972 in Chicago.

(3) Reproduced from Broadcast Procedure 23, issued by the Canadian Department of Communications, July 1, 1971.

ACKNOWLEDGEMENTS

The authors express their thanks to

(1) Premier Cablevision Limited, Vancouver, Canada, for permission to conduct the experiment on the York Cablevision system in Toronto.

(2) The Canadian Department of Communications for granting permission to conduct the experiments, and for witnessing the test results.

(3) The Electronics Industry Association of Canada for providing member attendance during some of the tests conducted and for providing receivers with high sensitivity to frequency shifts off the standard operation.

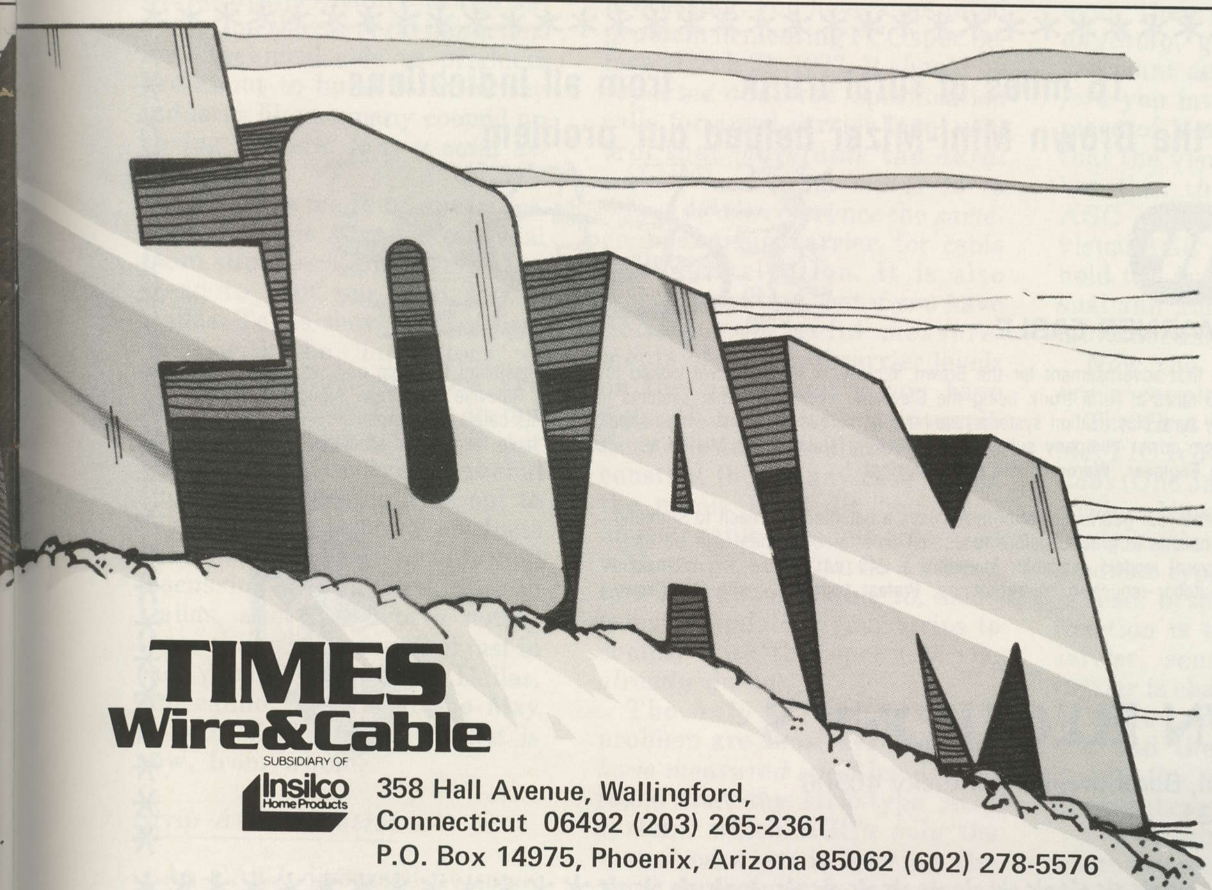
SHOULD OUR INDUSTRY LICENSE TECHNICAL PERSONNEL?

(Preliminary Survey Results)

The February CATJ, on our insert card between pages 40 and 41, asked for industry response to the question "*Should Our Industry License Technical Personnel?*". As we go to press for the April CATJ, there are sufficient survey cards back in our hands to make a *preliminary* report on the results to date.

It should be noted that we will *continue* accepting the survey cards from the February CATJ *until April 30th*, at which point we will cut-off the survey, tally the results and make them public. If you have *not* yet responded to this survey, *we urge you to do so* at this time. Dig out your February 1976 CATJ, turn to page 41 and look smartly to the left. There you will see the survey card, at the bottom of the insert-page card. Fill it out and drop it into the mail, postage is paid by CATJ.

The February survey card utilizes the same exact questions previously framed by the Society of Cable Television Engi-



neers in a study of their membership approximately 20 months ago.

Question "a" asks:

"Do you believe that job classification by license grade is a desirable direction for the industry to move?"

CATJ respondents *to date* answer in this way:

(1) *Yes* — 72.42%
(2) *No* — 27.58%

Question "b" asks:

"Do you believe if licensing is implemented it should be at the Federal, State or municipal level?"

CATJ respondents *to date* answer in this way:

(1) *Federal* — 85.19%
(2) *State* — 3.71%
(3) *Municipal* — 11.10%

Question "c" asks:

"Do you believe a variation on the FCC broadcast license, with an emphasis on cable technology, would suffice?"

CATJ respondents *to date* answer in this way:

(1) *Yes* — 84.62%
(2) *No* — 15.38%

Question "d" asks:

"At what point should job classification and/or licensing begin?"

(1) *Installer* — 17.86%
(2) *Technician* — 53.57%
(3) *Advanced Technician* — 7.14%
(4) *Chief Technician* — 10.71%
(5) *Chief Engineer* — 10.72%
(6) *Other* — 0%

When all of the cards are tallied *after* the April 30th cut-off date, a full report on the genesis of the original study and the CATJ results will be prepared for the *June issue*.

SHOW TIME 76

(Some of The New Products You Can See in Dallas)

Because this is the month of April, and because the month of April brings with it the annual industry trade show (the 25th incidentally), there is the assumption that several important new technical aids or products are about to burst forth on the industry like so many cooped up spring flowers. *It is a valid assumption.*

CATJ has made no special effort to solicit advance material from suppliers, preferring instead to wait our turn at the Dallas, Texas show to visit first hand with the "innovators" of the new product concepts, and then report back to you in our Technical Topics column in our May issue. However, several suppliers have sought us out to reveal some of the new products they intend to be showing and discussing for the first time in Dallas, and it is worth noting those that we are aware of just in case you don't make it to Dallas, and cannot wait until the May issue of CATJ to learn what is new, from whom.

Strip Audio Control

As CATJ discussed at some length in the December (1975) issue (pages 12 to 13), if your system utilizes strip-type AGC amplifiers for headend signal processing, you have a potential problem in meeting FCC spec before March 31, 1977. It should be *repeated* that the specification calls for aural carrier level control that *maintains the aural carrier level from minus 13 to minus 17 dB*, reference the *same*-channel visual carrier, for cable plant distribution. It is also worth repeating that *if* you have done some careful measurements of the aural carrier levels on the plant, and *if* you have found that even with strip amplifiers, the aural level stays pretty constant (but in any case within the minus 13-17 dB "window") on your cable channels processed with strips, that you do *not* need to worry about adding to, modifying or updating your strips to comply with this spec (i.e. you *already* do so).

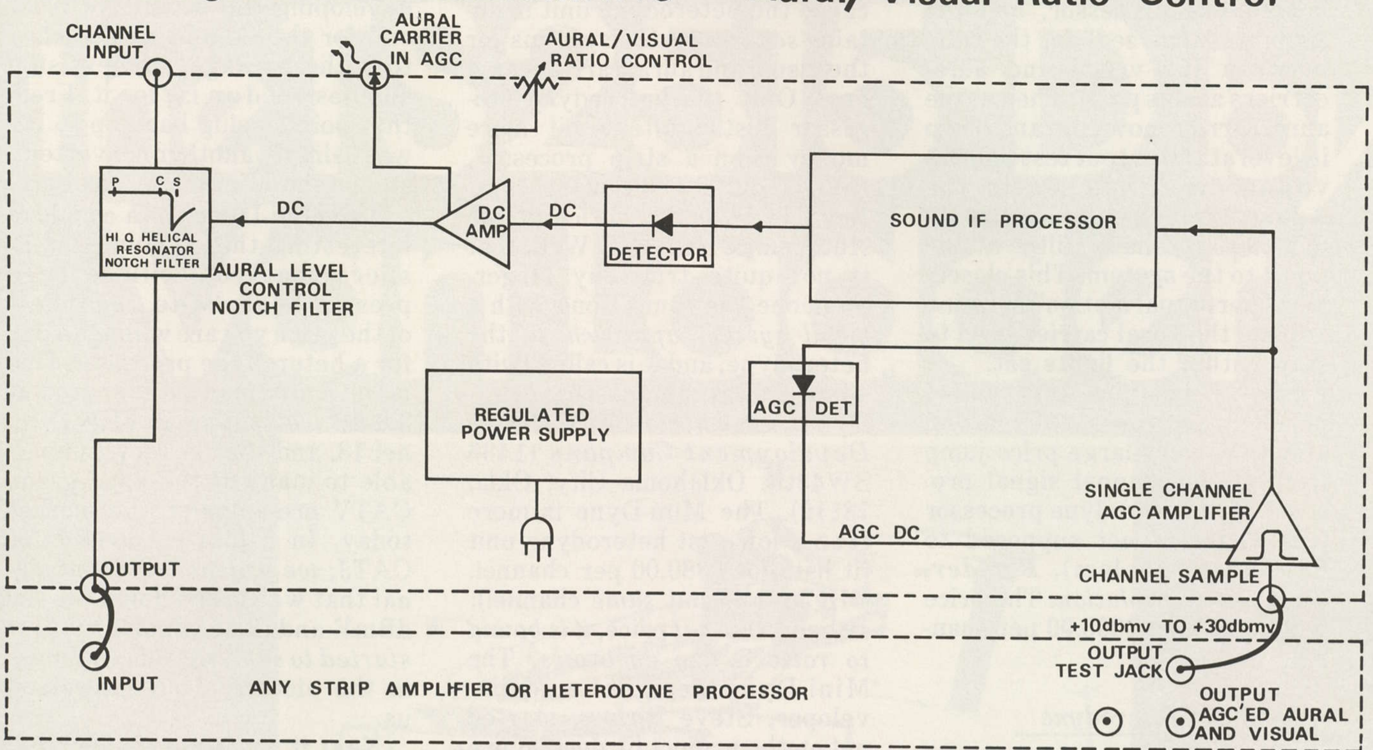
The *only* system(s) with a problem are those systems that *have measured* aural levels, and found that the strip-type AGC system, which AGC's *only* the visual carrier, is leaving the aural carrier wandering around in level on the plant. As noted in December CATJ, this will *usually* only happen with far Grade B to beyond Grade-B signals, and even then *before you assume anything*, go out and *measure* the plant aural signal levels *before* you invest a dime in a new piece of headend gear. Be *sure* that the visual AGC *is* working, but that the aural with*out* an AGC is not being held by the visual AGC (the visual AGC *will* hold the aural *as long as* the visual and aural fade *together* simultaneously).

Now the solution; and there *are* a couple of them.

The first is the new AUDIOMATIC from *Blonder-Tongue Labs* (One Jake Brown Road, Old Bridge, New Jersey 08857). The Audiomatic is an "after-strip" modular type box that retro-fits "ahead" of the strip amplifier. Its function is to sample the aural carrier, sense when the aural carrier is changing level *relative to the visual carrier level* present, and then *adjust* the aural carrier (i.e. AGC it) to stabilize the aural carrier. See diagram 1.

The unit consists of electronics which senses the *ratio* between the visual and aural carriers and

Block Diagram- B-T AUDIOMATIC(TM) Aural/Visual Ratio Control



utilizes this information to hold the aural carrier at a present level by adjusting the depth of a DC controlled aural carrier notch filter.

The Audiomatic is shown in diagram 1 as an add-on box for the Blonder-Tongue version of the on-channel or strip amplifier. However, it can be added to virtually *any* known on-channel (strip) amplifier of any manufacturer, or if such a need arose, even after a *heterodyne* type processor.

The Audiomatic actually is installed *ahead* of the strip processor or heterodyne processor, but, it works *after* the processor. This amazing feat is accomplished as follows:

(1) The input signal from the antenna system (with or without preamplification) is fed through the Audiomatic, and then to the strip/heterodyne processor. At the Audiomatic, a voltage tuned (i.e. varactor) Hi-Q helical resonator notch filter regulates the aural carrier level. The Hi-Q filter, says B-T, meets FCC specs for in-channel flatness and they claim it has no bad effects on the color sub-carrier. The voltage that tunes the Hi-Q varactor tuned filter comes from a sensing network that samples the *output* of the strip/heterodyne processor, through the output test point. This output test point provides the visual *and* aural carrier

coming out of the strip/heterodyne processor, and the signal is "analyzed" for the ratio between the visual and aural carriers at this point. Then as the aural carrier moves up and down in level at the output test point, a voltage is developed in the Audiomatic which *tunes* the Hi-Q helical resonator filter at the *input* to the system. This closed-loop "perpetual motion" machine adjusts the aural carrier level to stay within the limits set.

SO — *if* you have this type of problem, and you were agonizing about the very large price jump from an on-channel signal processor to a heterodyne processor (the latter is *not* supposed to have this problem), *Blonder-Tongue has a solution.* The price will be around $205.00 per channel.

Low Cost Heterodyne

As noted, a heterodyne processor is not supposed to have this type of "fluctuating aural carrier" problem, largely because the heterodyne unit maintains *separate* AGC systems for the visual and aural carriers anyhow. Only the heterodyne processor costs quite a bit more money than a strip processor, usually quite a bit more *than* the $205.00 add-on price of the Audiomatic from B-T. Well, that is not quite true any longer. Someone has come along with a *small system approach* to the heterodyne, and it is called (with some imagination) the Mini-Dyne. That someone is *Richey Development Company* (1436 SW44th, Oklahoma City, Okla. 73119). The Mini-Dyne is more than a low-cost heterodyne unit (it lists for $380.00 per channel, VHF in and out *same* channel); although at *that* price, *it is bound to raise a few eyebrows.* The Mini-Dyne designer and developer, Steve Richey, started out on the project by designing a new front end for the older tube-type Jerrold Channel Commander I units (August 1975 CATJ, pages 15 to 21). In the process of developing the substitute front end for the Com-I units, Richey took the package the next step and designed an i.f. for it. From that point, going back up to RF was "simply another converter", and so the Mini-Dyne was born.

The Mini-Dyne has a couple of interesting things going for it, specs that you will be hard pressed to duplicate, regardless of the price you are willing to pay for a heterodyne processor. One is the *noise figure*, it is speced at 3.0 dB *worst case* at VHF channel 13, and that is very comparable to many of the good grade CATV pre-amps on the market today. In a test conducted for CATJ, *we watched* an input signal that was taken down to —20 dBmV and at that point we *just started to see* a sign of graininess in the picture. That impressed us.

Next it has a very wide AGC range, something Richey found absolutely necessary with the high gain of the package (80 dB)

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Box 709 Spencer, Iowa 51301

and the low front end noise figure, 70 dB AGC range is the spec. That means that the output is held constant to within +/— 0.5 dB for any input that stays in the "window" range of —20 dBmV to +50 dBmV. That is some dynamic range!

The low noise figure is appealing, or should be, for small systems looking for ways to save bucks. In many cases, the outboard pre-amp can be *eliminated*. The wide AGC range should prove a boon to remote headend sites where you can't get to them as often as you would like to tweek upon the controls.

The Mini-Dyne is available with UHF in/VHF out, different VHF in and VHF out combinations as well, at slightly greater prices. The Mini-Dyne will *not* be formally seen in Dallas, developer Richey is much too busy trying to get caught up on orders at this point. (You can see a unit in a working display at the TOMCO booth, however). We have been promised a unit sometime soon to conduct a CATJ lab test, however, so if you wait around long enough, we'll tell you if all of the claims made for the unit are real or not.

Computer Headend

If you will recall the October (1975) CATJ, we reviewed the TOMCO SR-1000 "any channel in — any channel out" processor package. This unit allows the CATV operator to manually dial up any VHF or UHF channel at the input, and any VHF (or optionally any mid-band or super-band) output channel at the flick of a couple of switches. It is perhaps the ultimate standby headend unit in CATV today.

Well, Tom Olson of TOMCO has done it one better. They have announced a new unit, (the SR-2000), which does all of those things, and a few more, *by remote control*! Borrowing freely from some computer logic systems and leaning heavily on the telephone industry touchtone system, Olson has developed a *remotely programmable* headend piece that can be switched to any input channel, and any output channel, via a standard touchtone telephone unit, from virtually anyplace in the world!

The main service feature of the unit is that a system manager can from his home or office quickly direct the new unit to switch to input channel whatever and to output channel whatever, to replace a cable headend piece that has gone on the fritz. And he can do this from his home (or the neighborhood bar or the country club) by simply calling the headend on the telephone and commanding it to do the switching.

There is another application that has perhaps escaped Olson. CATJ had a letter no so long ago from an affluent West Virginia resident who was in the process of constructing a $20,000.00 headend for his home. The headend was going to be up on a hill, a couple of miles away from his home, and via a link of aluminum coax, the fellow was going to send 12 signals down the hill to his home. Now, if *he* had one of the new TOMCO units on the hill, with a suitable collection of antennas, preamps, et al, he could send a *single channel* down the hill on his cable and save a bunch of money on separate headend processors!

New Sweep Package

Just when we got used to the new model 1051 75 ohm dedicated-to-CATV sweeper from the folks at Wavetek, they introduce the 1052!

If you will go back to the February issue of CATJ (1976) and read the review of the Wavetek 1051, you will notice (or remember) that for review purposes Wavetek sent out to our CATJ Lab a *customized* test package that included the 1051, but also included a host of other features.

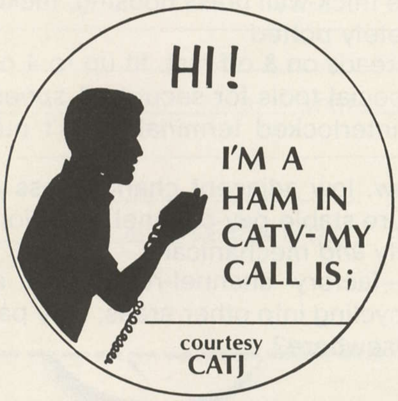
You probably *think* we are about to tell you the 1052 is *that* customized test package.
You are wrong.

The 1052 *is* the basic 1051, with a *number* of features (but *not all* of the features) taken from the customized test package discussed in the February CATJ. If you liked the customized test package options, take a look at the 1052 (either in Dallas or wait for our review here in a couple of months). Once again, it shows (we think), that Wavetek is continuing to "listen to what CATV operators want" in their test equipment.

ALRIGHT . . .
WHO'S THE HAM?

In the January (1976) issue of CATJ, we published an inquiry card asking that if you were a licensed Ham (amateur) radio operator, involved in some way in CATV, that you register with CATJ. The purpose of the registration is to provide a listing for CATJ (see here) by which Hams could identify one another, and, possibly set up operating schedules on one or more Ham radio bands.

For those who are not Ham operators, there is a spirit of kinship between fellow Hams that extends far beyond the kinship we normally find even in a tightly-knit industry such as CATV. It is the nature of CATV that we stick together, but it is also the nature of CATV that when we coagulate in one spot, that we seldom talk about anything but CATV!



I AM A HAM IN CATV — three inch multi-colored pin, produced by CATJ, is available free to any Ham operator in CATV who registers with CATJ.

For those industry people who are in attendance at the Dallas, Texas April 4-7 25th annual industry convention, CATJ has created a special three-inch multi-color shirt or coat pin that says *"I Am a Ham."* The pin (see illustration here) identifies you as a Ham operator, and has a place for you to fill in your amateur radio call letters. The pins are available at the TOMCO booth at the convention. There is no charge of course — we are happy to spend a few bucks doing this to promote greater kinship amongst CATV operators who just happen to also be Ham operators.

Now, if you were not at Dallas, but you are a Ham operator and would like one of the CATJ "*I Am A Ham*" operator badges, please do the following:

(1) *Drop us a note* with your name, address, company affiliation and a brief description of your job function in CATV;

(2) *Give us your Ham call*, the amateur bands you operate, and note whether you would be open to "schedule" other Hams in CATV on an amateur band.

The following listing is for Hams who registered through late February with CATJ. It is arranged by amateur radio call districts.

First District

W1RXE — Howard C. Arnold, consultant for Microwave Filter Company; 512 Elliott Street, Beverly, Ma. 01915. Active 80-10 meters and 2 meters.

Second District

K2HTE — Joseph D. Burgess, owner Allentown Cable TV; Hanover Hill Rd., Wellsville, N.Y. 14895. Operates 6 meters, not interested in skeds.

W2TQK — Walter E. Pfiester, Jr., Field engineer Eastern Microwave, 1 Skadden Terrace, Tully, N.Y. 13159. Operates 20 and 75 SSB, is interested in skeds.

Third District

W3DGX — Ted Gibson, Co-owner and engineer, Pine Grove TV Cable, 19 W. Pottsville St., Pine Grove, Pa. 17963. Operates all bands, including licensee for WR3ACI (04/64) on 2 meters.

WA3MXD — Ralph Spence, Headend and bench maintenance, Cable TV of Chester County, 16 S. Broad Street, Honey Brook, Pa. 19344. Operates 80-10 meters, is interested in skeds.

WA3NCM — James C. Moore, Bench and headend tech, West Moreland Cable Co., 53 Main Street, Freeport, Pa. 16229. Operates 2 meter FM and 20 meter phone, is interested in skeds.

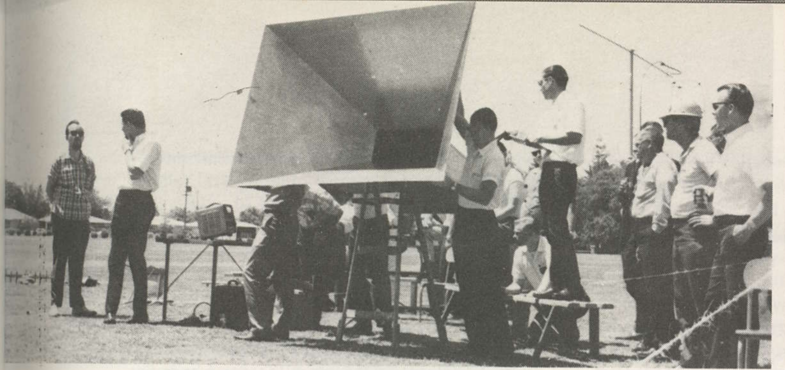
Fourth District

K4BOJ — R.C. Townley, installation and repair including WSFA-TV, 4715 Barby Rd., Montgomery, Ala. 36108. Operates 20 SSB, CW, is interested in skeds.

K4NTA — Ted A. Huf, engineer, Perry Cable Co., 1495 NW Britt Rd., Stuart, Fl. 33494. Operates 6, 2 and 432 (MHz). Would be interested in skeds.

WB4SXX — Bill Meacham, Chief Tech for Community Antenna, 222 Atkinson St., Laurinburg, N.C. 28352. Operates 160-10 CW and SSB, plus 2 FM. Would be interested in skeds.

W4VBT — B.L. Coleman, Chief Engineer, Master Telecable, Inc. P.O. Box 577, Peterstown, W. Va. 24963. Semi active on 6 meters. Might be interested in skeds.



Fifth District

W5BGW — Frank Narramore, Manager/Tech for TV Cable Co., Box 605, Yellville, Ark. 72687. Operates 80, 20 and 10 when active. Would be interested in skeds.
K5HSP — John Lord, Manager, Clayton TV Cable, 16 North 4th Ave., Clayton, N.M. 88415. Operates 75 and 2 meters. Would be interested in skeds.
W5KHT — Bob Cooper, Jr., Editor in Chief, CATJ, 4209 NW 23rd, Suite 106, Oklahoma City, Ok. 73107. Semi active 6, 2, 220 and 432.
WA5LBC — Jack M. Threadgill, Engineer, Hearne Cablevision, 803 Tanglewood, Bryan, Texas 77801. When active, 75 and 40 meters.
K5QMY — W.G. 'Bill' Comeaux, Futronics, Inc., 8067 La Salle Avenue, Baton Rouge, La. 70806. Not active, operates 80, 40 and 2 meters.
WB5RGY — Joseph J. Wormser, Manager Production Engineering, TOCOM, 7106 Meadow Rd., Dallas, Texas 75230. Operates 40 and 20 CW (ex-W5GKX), interested in skeds.
W5TMJ — Alan Hatzell, Engineer, McAlester Cable TV, Box 267, McAlester, Ok. 74501. Operates 10, 15 and 20, not active.
K5UMV — Walter C. Dillard, Owner, TV Cable Co., 605 N. Washington, Murfreesboro, Ark. 71958. Operates 80-10 when active, is interested in skeds.

Sixth District

WA6EZL — James Rieger, Engineer, Naval Weapons Center CATV, Code 3743, China Lake, Ca. 93555. Operates 2 meters and up, is interested in skeds.
WN6FDG — Michael Thomas Douglass, Lineman, Emmetsburg Cable TV, 2305 Main, Emmetsburg, Iowa 50536. 40 and 15 CW, when active.
WA6GEJ — Raymond E. Crawford, Chief Engineer, Apple Valley TV Cable Co., 21805 Hwy 18, Apple Valley, Ca. 92307. Operates 6 and 2 meters, would like skeds.
WA6PKN — Jerry Plemmons, KQED-TV, 1011 Bryant Street, San Francisco, Ca. 94103. Operates 80-10, 2 and 432. Would like skeds.
(W6VLL) — Glenn Chambers, Regional Engineering, ATC, Box 565, Appleton, Wisc. 54911. License currently expired, did operate 80, 40 and 15 meters.
WA6ZEM — Northe K. Oserink, Publication Writer, Avantek, Inc., 3401 Floral Rd., Santa Cruz, Ca. 95062. Operates 80, 40 and 20 meters, CW and SSB; suggests a '**CATV Roundtable**' on the air.

Seventh District

WB7AHL — Donald R. 'Bob' Johnston, District Engineer, Lander Cable TV (TCI), Box 483, Lander, Wyoming 82520. Operates 80, 40 and 20, would be interested in skeds.
K7EWG — Carl E. Schmauder, Manager, Lincoln Television Systems, Inc., Box 815, Lincoln City, Or. 97367. When active, on 75, 10 and 2 meters.
WA7TCQ — R.S. 'Joe' Pinner, Cable Technician, Telecommunications, Inc. 695 North 9th, Lander, Wyoming 82520. Operates 160-10 meters, is interested in skeds.

Eighth District

K8HLH — Bob J. Heim, Chief Engineer, North Central TV, 105 W. Shoreline Road, Sandusky, Ohio 44870. Operates 80, 40, 15, 10 and 6 meters.
K8JCB — Reynold J. Johnson, Chief Technician, Iowa Video (ATC), Box 1425, Ft. Madison, Iowa 52627. Operates 80 thru 2 meters. Is interested in skeds.
WB8KPM — Dale E. Bock, Chief Tech, Wood TV Corporation, 118 N. Main Street, Bowling Green, Ky. 43402. Operates 6 and 2 meters, is interested in skeds.
WB8VPI — Raymond Chapman, Manager, Richwood TV Cable Co., 1 E. Main Street, Richwood, W. Va. 26261. Operates 2 meters, interested in skeds.

Ninth District

K9CVW — Raleigh B. Stelle, Sales, Texscan Corporation, 7101 E. 43rd Street, Indianapolis, Indiana 46226. Operates 40 CW, interested in skeds.
K9HJN — William J. Draeb, Chief Tech, Draeb Enterprises, Ellis Rd., Rt. 2, Kewaunee, Wisconsin 54216. When active, on 80, 40 and 2 meters.
WA9HZT — William H. Ellis, Technical Management, Telesis Corp., 1018 Lincoln Ave., Evansville, Indiana 47714. Two meter FM, no time for skeds.

Tenth Call District

KØLCB — David C. Bland, Program Production, Director of Broadcasting, P.O. Box 1059, Independence, Mo. 64051. Active all HF, 50, 144 MHz SSB/CW and FM.
WBØODW — John F. Johnston, Technician, Cablevision of Colorado Springs, 4507 N. Carefree Circle, Colorado Springs, Co. 80917. Operates 40 meters, is interested in skeds.
WØPFM — George F. Provine, Chief Technician Fort Cablevision, Inc., 14 E. 2nd Street, Fort Scott, Kn. 66701. 40 and 20 CW. Is interested in skeds.
WAØZFE — Philip R. Brown, System Maintenance, Cowley Cablevision, Inc. 1004 Main Street, Winfield, Kn. 67156. Operates two meters, is interested in skeds.

Canadian

VE7BVP — Shannon D. Holt, C.R.T.V. Association, Chief Tech, 594 11th Avenue, Campbell River, B. C. V9W4G4. Operates 80 and 20 meters, is interested in skeds.
VE7XK — Walter Green, Managerial, Alberni Cable Television, Ltd., 2726 — 7th Avenue, Port Alberni, B.C. V9Y 2J7. Operates 75, 20, 15, 10 and 2 meters.

So there you have it, 40 CATJ readers are involved in CATV and share the common bonds of Amateur Radio. There must be at least another 40 of you out there . . . let's hear from you!

TECHNICAL TOPICS

FEEDBACK — HELIX ANTENNAS

The March (1976) CATJ carried a report on the status of multi-mode polarized antenna experiments being carried out at the CATJ Lab. The report included data for "winding your own" helix or helical antenna for low or high band VHF.

There has been some confusion concerning certain aspects of the instructions, and we admit that we did not help the clarity of the explanation by inadvertently dropping a full paragraph from the text!

Table 1 appearing on page 13 presents the first problem. The dimensions given for the channel 7 antenna are for an antenna that has a **center frequency** of 175-180 MHz. In other words, the design frequency range of this antenna is 133-226 MHz. This covers high band VHF alright, but, the user should **not** be misled by the antenna pattern material appearing as diagram 4 on page 14 into believing the antenna built as detailed in table 1 will produce **the same** patterns shown. The patterns for the antenna shown in diagram 4 are for an antenna with a design **center frequency** of 236 MHz. The antenna shown in pattern plots in diagram 4 covers 175 to 297(.5) MHz.

The helical antenna is designed typically for the **center** of frequency range of interest, but, the cleanest patterns (i.e. best front to back, front to side) will be at the **lowest** extremities of the frequency range covered.

Therefore if the antenna described in table 1 is constructed, the pattern you should experience will be similar to that shown for the 215 and 235 MHz antennas in diagram 4; **not the 175 MHz antenna** shown in diagram 4. More about this shortly.

Next, it should have been obvious to us that when giving the table 1 design data that if you have six turns on your helix, and there are therefore 5 **turn-to-turn spaces** which are .22 wavelength wide **each**, that you cannot have a helix with an axial length of 1.65 wavenlength. That is, 5 times .22 wavelength is 1.10 wavelength, **not** 1.65 wavelengths.

To achieve a 1.65 axial length helix with six turns requires a turn-to-turn spacing of .33 wavelengths. If you design for the **center frequency**, your actual turn-to-turn spacing works out something like this:

(1) Turn-to-turn spacing **lowest** frequency = .22 wavelength
(2) Turn-to-turn spacing **median** frequency = .275 wavelength
(3) Turn-to-turn spacing **highest** frequency = .33 wavelength

The spacing stays the same, but because of the wide frequency range coverage of the antenna, the turn-to-turn spacing (**as a function of wavelength**) varies. The range that is **acceptable** for a 6 turn helix is .22 to .33 wavelength turn-to-turn spacing.

Therefore, the 1.65 wavelength axial length is at the **highest** frequency (297.5 MHz in our case) whereas at the **low** frequency end (175 MHz) it is around 1.1 wavelength. Our apology to the reader for "dropping the paragraph" that explained this, and to those who have called to ask how .22 x 5 can possibly equal 1.65!

Now back to the center frequency versus pattern problem. The dimensions shown in table 1 (with the exception of the axial length **handle**) **are correct** for a **center frequency of 175-180 MHz**. However, chances are you want the clean pattern lobes shown in diagram 4, **for 175 MHz**, not the somewhat less desirable pattern shown **for 215 or 235 MHz.** Therefore a modified set of dimensions appear here which shows the dimensions to follow for a **center frequency** of 236 MHz (i.e. a low frequency of 175 MHz). If you follow these dimensions, your pattern should be improved on channel 7. If you want to design for a higher-than-channel 7 high band channel, take the visual carrier frequency of the channel desired, multiply that by 1.7 (frequency range of antenna), and halve the difference between the two numbers to add that number to the high band channel visual carrier frequency. That will be your **center design frequency**, around which the wavelength functions shown here can be calculated.

Measurement	**Channel 7(*)**
Ground Plane	40"
Spacing (GP to 1st turn)	6"
Axial Length (1.65)	82.5"
Turn Spacings (.33)	16.5"
Turn Diameter (.32)	16.0"
Number Turns	6

* — **Lowest** useful frequency

Finally, some sharp-eyes readers noted that it appears that our CATJ Lab antenna has five, not six, turns along the axial length. It does; and this is a case of "do as we say, not as we did!"

SORRY — WE GOOFED!

The March 1976 issue of CATJ carried an advertisement for Broadband Engineering, Inc. on page 37. Recently Broadband has had such a growth in their business that they moved to new, larger quarters. In moving, they naturally acquired a new address and a new telephone number. The March advertisement incorrectly listed both.

For the record, Broadband is now located as follows:

535 E. Indiantown Road, Jupiter, Fl. 33458 (305—747—5000).

MORE-FREQUENCY MEASUREMENTS

"I wonder why a person has to go to the trouble of actually measuring the cable-carriage frequency, if in fact there is a way to determine the cable carriage frequency without all of the fuss and bother of setting up a heterodyne beating system, or using a special piece of test equipment (i.e. Mid State SP-2) to drive a counter.

For example, suppose you took an average grade reasonably priced counter and sampled the local oscillator frequency in either a heterodyne conversion unit or in an UHF to VHF converter. If you measured the actual LO (which if you sample it at the fundamental or oscillator frequency is typically at, near or below 100 MHz), you would be measuring the frequency-determining network for the on-cable-channel signal.

Example: Channel 14 is 471.25 (plus or minus offset, if any) for the visual carrier frequency. You convert 14 to 7 (175.25) for cable carriage. The mixer injection frequency is 471.25 minus 175.25 or 296 MHz. To create a 296.00 MHz injection signal, typically a 98.666 (etc.) MHz crystal is used in the converter oscillator. Many low-cost counters will read up to 100 MHz (or 150 MHz) with low cost scalers. If you tapped out of the oscillator in the 98.666 MHz section, through a 500 pF coupling capacitor, and directly into a counter, the typical RF level present at this frequency is sufficiently high to drive a ho-hum kind of counter. The tolerance permitted is +/— 25 kHz at 175.25 MHz, and since the 98.666 (nominal) MHz oscillator is tripling, that 25 kHz 'window' is divided by 3 to arrive at the tolerance allowable at 98.666 (nominal). Thus the local oscillator would have to be within +/— 8 kHz of 98.666, or 98.658 to 98.674 MHz to be 'legal'.

Life gets a little more complicated with dual conversion (i.e. incoming RF down to heterodyne processor i.f.; then i.f. back up to cable-RF using a **separate** oscillator), but it could still be done with a low cost counter.

I wonder what the FCC would say? Is this an adequate approach to making frequency measurements? It sure would cut the costs of the equipment required. And if it would fly, how about jacking up the converter (UHF to VHF and VHF to VHF) plus the heterodyne processor manufacturers to provide an LO signal test point on their gear, at some convenient spot such as the back apron where we can get to it without taking the whole box apart?"

Dick Kirn
Sarasota, Fl. 33578

Dick

76.605 (a) (2) states "The frequency of the visual carrier shall be maintained 1.25 MHz +/— 25 kHz above the lower boundary of the cable television channel. . . ." **etc. There is nothing in the rules that says you have to measure the frequency, or even check it "at cable carriage frequency." We see no reason why your technique would not work, and we agree with you. . . if you can utilize one of the low cost counters to make this annual test, you are ahead in dollars and cents. As to the manufacturers providing LO test points, perhaps they never thought of it before.**

FCC TEST DATES

"Reading with great interest your articles on the 1976 technical tests and your statement that tests for current year must be completed by March 31, 1976. However, I note that 76.601 (c) states that operators of each cable system shall complete performance tests of that system once every calendar year (but not to exceed 14 month intervals).

My intèrpretation of the above is that we did not have to do frequency tests last year, so we must complete that test by March 31, 1976; however, because we did do the balance of the tests on March 22, 1975, we are not required to complete those other tests (i.e. non-frequency-related tests) until 14 months thereafter, or, May 22, 1976. Is this a valid interpretation?''

J. B. Dyer, Manager
Tillamook Television, Inc
Tillamook, Oregon 97141

JB—
We have no problem with your interpretation at all. And we doubt that the FCC would either. In any event, we trust that if they do have a problem with your approach, that they will let us know here at CATJ and we will in turn pass the information along to the balance of the industry.

APPRECIATED IN BRASIL

''I picked up your volume I, number 1 at the 1974 annual CATV show amongst the heaps of printed matter scattered about the tables; and after scanning the issue in my hotel room, immediately placed an order for a subscription. Since then I have been following the development of CATJ with increasing interest. Please accept my congratulations on the work you are performing with so much vigor and courage; both politically and technically.

Your struggle for CATV, fighting suffocating laws and rules by the FCC, is topped by your November issue editorial ''Undoing A Wrong''. I have sent Xerox copies of several of your CATA-torials to our Ministry of Communications, which is actually engaged in ruling the Brasilian CATV industry. Our industry here is on the verge of being legalized and your CATA-torials may well help our legislators who want to avoid worn-out pathways.

I understand the CATJ is edited by people who actually own and operate CATV systems. The technical articles are written in a colorful language and they are the right balance between practical and scientific approaches. Please extend my appreciation to your technical editors.

If any of your staff should be available in Dallas at this year's convention, I should enjoy meeting with them.

Augustin L. Woelz
Senior Member, IEEE
Fabrica Nacional de Semiconductores
Sao Jose Dos Campos, Brasil

Augustin—
Your comments are appreciated of course. We also note with great interest your brochure explaining your CATV equipment line manufactured by your company for South American CATV. Your technology appears very advanced, and we would like to know more. We certainly do not have a corner on smarts in the United States; quite the contrary, our near-neighbors to the North (Canada) have been showing us ''how'' for more than a decade in the CATV industry!

BANKS AS COLLECTION POINTS

Many smaller CATV systems, operating in communities without a full-time CATV office (we know—that's against the rules!) have found that the local bank (even the smallest communities seem to have a bank) make excellent CATV payment collection points.

One operator told us recently he has a bank in each of his towns where the customers can come in and pay their cable bill. Signs in the bank announce this fact, and the CATV company maintains a depository account in the bank to receive the funds. The bank charges a flat $20.00 or 1% per month for this service, provides the CATV company with a duplicate copy of the deposit record each day, and from this the CATV company home office is able to check off the accounts that are paid as they are paid. This particular company utilizes 36 month coupon billing, and when a customer shows up six weeks past due, he gets a collection letter directing him to go to the bank and get caught up within ten days time.

If the customer fails to do this, the system operator schedules a disconnect for the late customer the next time he is in town (a weekly visit typically).

Other systems have taken it a step further and the bank sends out the late notices and reminder. Banks usually get a few extra cents per account to handle this phase of your collections as well.

Lest we arouse the ire of the FCC on this one, we are quick to point out that these are typically **very small** systems with 200 or so subscribers maximum (although some larger systems also employ this practice) where no resident manager could possibly be afforded. The bank then becomes the focal point for the CATV service in the town.

A third operator contacted by CATJ points out ''People seem ready to pay the local bank faster than they would send off a check or money order on their own, to a distant town or even a post office box in town. We believe the local bank collection point is very good psychologically for this very reason.''

CANADIAN NEWS SERVICE

If the present plans and applications now pending before the Canadian authorities bear fruit, cable pioneer Sruki Switzer and associates will be constructing a national network of 12 FM Class ''C'' (i.e. clear channel FM) stations which will be ''all news, all of the time.'' The 12 stations will serve virtually all of the Canadian border areas from Vancouver to the Maritime provinces. The stations will provide a uniquely Canadian news service for FM listeners, and the stations will be the proving grounds for a comprehensive trial of a national all-news network of affiliated stations.

Of special interest to CATV system operators in Canada (and near the Canadian border in the U.S.A) is what super-engineer Switzer will be doing with the SCA channel of his 12 FM transmitters. Switzer plans to offer character-generator-digital video on the sub-carrier, **free** to any and all CATV systems that want to receive the off-FM-air service and carry it on their cable systems on a channel as a ''CATV News Channel.''

The service will look just like any other character generated news feed to CATV customers, but instead of being linked to a national or regional news center such as AP or UPI **via landline**, the CATV company will install an SCA receiver, demodulate the video data and interface it with his local generator for CATV channel service.

Switzer explains that the service will be available to anyone who wants to install his own receiving equipment and generator. Approximately every 30th line in the video data received will be a commercial message (which the CATV company must agree to leave in place, intact). National Canadian companies, such as the Royal Bank of Canada, can be expected to sponsor the news in segments and they will be given a one line credit every 30th line (approximately).

At the present time Switzer and his associates are appearing at Canadian hearings to win approval for the full coast-to-coast network of 12 FM stations. Once that approval is granted, construction of the network will begin.

LOW COST POLE SUPPLIES

Throughout the United States, the Bell system (and most independents) are engaged in a national program of abandoning existing overland 'toll circuit systems.' Back in the 20's, 30's and even into the 50's, the telco's often constructed 'toll circuits' between a regional center such as Louisville and outlying regions where telco sub offices or independent telco offices were located. Many of these 'toll circuits' were constructed along railroad rights of way, although some just head out over the countryside.

At the present time, the independent telephone companies, and in particular the federally-funded (through low interest loans) small independent cooperatives, have embarked on a national program of replacing these toll circuit links with either microwave or newer **underground** landline circuits. Therefore the telephone companies, largely Bell in most areas, are 'wrecking out' the toll circuits. Here is how that works:

(1) Bell (or the master company in the area) lets a contract with a 'wreck-out' company; wherein the wreck-out people are paid so much for the job of dismantling the toll circuit, and removing all hardware, wire (often open wire) and poles.

(2) Bell (or the owner) usually gets the copper coated wire back, as part of the deal, but it allows the wrecking company to keep ''as salvage'' the balance.

The balance includes miles of strand, boxes of 2 and 3 bolt galvanized clamps, eye bolts, straight bolts, thimble eye bolts and on and on. And it includes short pieces of 6M or 7M strand (usually up to 500 feet at a whack, or as large as the wrecking company can pull down and roll up), mile after mile of #12 high strength steel wire (not jacketed), and of course poles.

CATJ discovered one wrecking outfit in the Okahoma City area that was working on a 28 mile wreck-out. The company had salvaged around 900 poles, over 800 miles of the #12 wire, and literally tons of hardware. We found they were selling the poles for 40 cents a foot (i.e. $10.00 for 25 foot poles, pressure treated and in very good shape), but largely giving away or selling by the pound the hardware. CATJ alerted Oklahoma CATV operators to this supply source and dozens have since descended upon this company to haul away pick-up loads of hardware for a few cents on the dollar. The poles did not last long either.

How do you find such a wrecking outfit in your area?

Go to the local telephone company (i.e. Bell) and speak with the ''District Construction Foreman.'' This is the fellow who is in charge of letting contracts to 'wrecking companies' and he can provide you with a list of (1) the jobs going on at this time, (2) the jobs coming up, and (3) the company (or companies) who have contracted for this work. Then go see these companies about buying this hardware and poles et al as the Oklahoma operators have since done.

One word about the #12 high strength steel wire. We have seen dozens of miles of cable plants built in rural area, using one of the small lashing wire machines made for this size ''strand,'' to lash .412 and .500 cables to the steel wire. The steel non-stranded wire does not sway in the breeze like the stranded 'strand' does, and for the cost it can be bought for, it is worth the extra grief of having to rework pole attachment clamps to use the stuff. If you want to save some money in rural areas, this is one way to do it!

REPEATERS ON YOUR TOWER

There are probably several hundred CATV towers being co-shared by two-way radio transmitting antennas. Most of these function without interference to the CATV system and the practice is spreading. Having a 300-600 foot stick in the middle of the flat-lands is its own form of attraction.

Most CATV companies are leery of allowing the **first** two-way system onto their tower or headend site; as one operator in Missouri commented recently ''wide open CATV front ends and 25 watts to 250 watts of transmitter power simply do not mix.''

Here are some guidelines for what to watch out for when the local two-way radio people invade your office clamoring for tower rental space:

(1) **Responsibility**—Some of the 'pros' in the 2-way business have developed very polished approaches to CATV companies, in which they **promise** that their transmitter(s) will not interfere with your CATV reception. That is all well and good, but we suggest that the agreement you draw up with the 2-way operator include a provision such as follows:

(a) Whereas (that's legal talk), ABC 2-way company promises that the equipment to be installed will not in any way degrade the (CATV Company) receiving apparatus or the cable pictures delivered to subscribers, ABC 2-way herein agrees that when the installation agreed to here is completed that a one week trial (test) period will commence during which (CATV Company) will have the opportunity to inspect the quality of the CATV pictures during periods when the ABC 2-Way transmitter(s) is operating; and if, in the opinion of (CATV Company) the operation of the ABC 2-Way transmitters is degrading (CATV Company) service in any way, final full operation of the ABC 2-Way transmitters shall be postponed until such time as (CATV Company) has approved the mutual operation of the two-way transmitters ·and the cable system.

In other words, make the two-way operator **totally responsible** for the pictures you deliver to your customers vis-a-vis his two-way antennas and equipment.

His antennas can create reflections; his transmitter can cause herringbone beats into one or more of your channels; his transmitter can overload (i.e. cross modulate) one or more of your tower mounted pre-amplifiers. A 250 watt 40 MHz transmitter can create havoc with the i.f. amplifiers in your heterodyne processors. A 25 watt 461 MHz transmitter can cause your 30 dB gain UHF pre-amplifier to fold up and quit. And on and on. The technical possibilities for interference are literally in the hundreds; and no-one can foresee **all of these** in advance. So to be safe, make the two-way operator totally responsible for **any** affects he causes.

He may have to buy you a new pre-amp or two. He may have to move his antennas to another part of your tower. He may have to get off your tower completely. Just remember, you are in the TV picture business and anything that detracts from the quality of your service may cost you customers.

(2) **Tricky Leases**—Tower space, with space in your headend for the two-way gear, is worth what you can get for it. Normally, if the transmitter is 25 watts or less and solid state, you are pretty safe in assuming that he will not use more than five to ten dollars a month in electricity. Beyond 25 watts, better to have the power company install a separate meter head on a separate AC power line for his specific service. If they can't or won't run a new line into your headend, simply put a separate 'AC' service in on one leg of your present AC service and install (at the two-way operator's expense) a separate meter head on it. Take your own readings and bill him accordingly.

Tower plus headend space ''leases'' generally run for one or more years; the two-way operator likes long leases, you should make it annual so you have the right to give him the boot if conditions change. Prices run from $50.00 per month to several hundred per month depending on how good your site is, how high he goes, and so on.

Back in the old days of two-way it took one antenna per transmitter for each two-way system. Now it is possible through ''diplexing couplers'' to stack several (even up to six) two-way transmitters on a single transmit/receive antenna. Often the two-way operator wants you to charge him **per antenna.** Let's say you charge him $100.00 per month for hanging a 6 dB gain 20 foot long 460 MHz antenna at the 300 foot level on your tower. He goes up to the antenna with a 1-5/8 inch transmission line. Down at the bottom by using a diplexer or two, he stacks **several** of his **own** customers on the **same** antenna. He bills each of them maybe $100.00 per month, and for his $100.00 rent to you he collects perhaps $600.00 a month. The tower space he uses stays the same, one antenna; but the headend space goes up because he is stacking new 'customers' of his own on his single antenna. Obviously you want your contract with him to reflect not only tower space plus electricity, but two-way transmitters also. One solution to this is to bill him a flat rate per antenna plus 50% of that rate for every transmitter beyond the first one.

(3) **On Going Responsibility**—Two-way radio gear gets changed out very often. The first transmitter he installs may be as clean as a whistle and you approve the installation because you see no interference. Then down the road he adds a new transmitter or two, or replaces the original one and suddenly you have herringbone lines all over channel 19.

The two-way operator **may** try to convince you that something has happened to **your** channel 19 (or whatever) equipment and the problem is **yours** to fix. Could be. . . or maybe **he did it** by changing out or adding something of his own.

The solution to this is back at the initial contract; it should simply state that anytime **any** interference develops, after the initial test and approval period, that **you** have the right to demand the problem be fixed and to shut down all of his equipment **until** he does fix it. That should keep him straight.

(4) **Headend Access**—The two-way company probably has several service people, and from time to time when they have an emergency, anyone of these people may show up at your headend to fix their gear. If you allow them in your headend to begin with, for their equipment, you are also opening up the possibility that someone not connected with your cable company will be in and out of your headend at all sorts of odd hours.

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.

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)**
ComSonics, Inc., P. O. Box 1106, Harrisonburg, Va. 22801 **(M8, M9, S8, S9)**
CORAL, INC., 400 Ninth Street, Hoboken, N.J. 07030 **(M1, M4, M5, M6, M7, D3)**
DELTA BENCO CASCADE INC., 40 Comet Ave., Buffalo, N.Y. 14216 **(M4, M7, M8, D3, S8)**
Jerry Conn & Associates, 550 Cleveland Ave., Chambersburg, PA. 17201 **(D3, D5, D6, D7)**
C-COR ELECTRONICS, Inc., 60 Decibel Rd., State College, PA. 16801 **(M1, M4, M5, S1, S2, and S8)**
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)**
Q-Bit Corporation, P. O. Box 2208, Melbourne, Florida 32901 **(M4)**
QE Manufacturing Co., Box 227, New Berlin, PA., 17855 **(M9, tools & equipment)**
RMS CATV Division, 50 Antin Place, Bronx, NY. 10462 **(M5, M7)**
Sadelco, Inc., 299 Park Avenue, Weehawken, N.J. 07087 **(M8)**
SITCO Antennas, P.O. Box 20456, Portland, Oregon 97220 **(D2, D3, D4, D5, D6, D7, D9, M2, M4, M5, M6, M9)**
Systems Wire and Cable, Inc., P.O. Box 21007, Phoenix, Az. 85036 **(M3)**
TEXSCAN Corp., 2446 N. Shadeland Ave., Indianapolis, IN. 46219 **(M8, bandpass filters)**
Theta-Com, P.O. Box 9728, Phoenix, AZ. 85068 **(M1, M4, M5, M7, M8, S1, S2, S3, S8, AML Microwave)**
TIMES WIRE & CABLE CO., 358 Hall Avenue, Wallingford, CT. 06492 **(M3)**
Tocom, Inc., P.O. Box 47066, Dallas, Texas 75247 **(M1, M4, M5, Converters)**
TONER Cable Equipment, Inc., 418 Caredean Drive, Horsham, PA. 19044 **(D2, D3, D4, D5, D6, D7)**
Van Ladder, Inc., P.O. Box 709, Spencer, Iowa 51301 **(M9, automated ladder equipment)**
WAVETEK Indiana, 66 N. First Ave., Beech Grove, IN. 46107 **(M8)**
Western Communication Service, Box 347, San Angelo, Texas 76901 **(M2, Towers)**

NOTE: Associates listed in bold face are Charter Members.

Distributors:

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

Manufacturers:

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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

TRACKING ANALYZER

Texscan Corporation (2446 N. Shadeland Avenue, Indianapolis, Indiana 46219) has announced a new model 9650 RF Tracking Sweep Analyzer. The frequency range of the instrument is 1 to 350 MHz.

The package includes a tracking sweep generator, spectrum analyzer, display scope, reflection bridge, detector, gain and loss measuring attenuators, test comparator and crystal frequency markers.

The sweep width is adjustable from 10 kHz to 350 MHz, plus the CW position; the display flatness is +/— 0.25 dB over the full spectrum or +/— 0.1 dB over any 10 MHz segment; sweep rates are line sync, and variable .05 to 5 Hz and 5 Hz to 30 Hz, manual or external control; spurious and harmonic distortion is down 30 dB; frequency response is +/— 1 dB over a dispersion of 500 Hz to 350 MHz; display scaling is 20, 40 or 80 dB (log); sensitivity is —110 dBm, or 0.7 microvolt for 200 kHz resolution and the display range is 80 dB. The price is $6,600.00

SALES REPS APPOINTED

Jerry Conn Associates, Inc. (Box 444, Chambersburg, Pa. 17201) has been appointed sales reps for the REPCO Products Corporation products that include pedestals, enclosures, and accessories for the states of Delaware, Maryland, Ohio, Pennsylvania, Virginia and West Virginia.

Broadband Engineering, Inc. (535 East Indiantown Road, Jupiter, Fla. 33458) has announced the appointment of a pair of sales representatives. **MEGA HERTZ SALES, Inc.** of Englewood, Colorado will handle Broadband's product line of replacement components for CATV amplifiers in Colorado, Iowa, Kansas, Nebraska and Wyoming.

D. B. CATV SUPPLY, INC. of Hicksville, New York will handle the same representation for Broadband in Connecticut, Maine, Massachusetts, New Jersey, New York, Rhode Island and Vermont.

NEW CATALOG CONCEPT

Times Wire and Cable Company (CATV Products Group, 358 Hall Avenue, Wallingford, Ct. 06492) has announced their new full-line catalog is available for the asking. The new catalog marks the apparent first use by an American CATV manufacturer of both American and Metric standards and measurements for cable specifications. The book is a comprehensive study in CATV cable characteristics including all important electrical performance parameters, mechanical parameters, attenuation versus frequency graphs and more.

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