communications/engineering digest

reporting the technologies of broadband communications

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NOTE: Perhaps the most controversial topic discussed by the CTAC effort, and certainly one that is becoming more important to the industry—CHANNEL PLANNING is the topic discussed within each feature article.

SCTE

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opinion/editorial

I estimate that during 1975, I was personally responsible for placing at least 50,000 pieces of mail into the system. I judge that I receive a minimum of 100 pieces of mail each week (including bills!).

The minimum estimate for 1976 boggles my mind. It is projected to be about 10,000 each month by the middle of the year. Newsletters, mailings to advertisers, projected to increase to about 15,000 each month by the middle of the year. Newsletters, mailings to advertisers, promotional pieces about the magazine add to these figures. So, a fair estimate for 1976 is about 250,000 pieces of mail generated from C/ED, SCTE and other projects. It scares me to death to think of the numbers. One-quarter of a million anything is a bunch. Also, my incoming mail will increase through the year, including my bills!

The value of this assortment of paper and printed matter cannot be judged except by the readers. C/ED is a worthwhile project and a tool for industry. It also serves as a point of communication with those outside the industry who make important decisions. The SCTE newsletter is necessary to keep members up to date on the internal business of the Society. Meeting notices are necessary if you expect anyone to attend the meetings. Brochures for the promotion of seminars, programs and press releases to other trade magazines are required to advise non-members of the scheduled events. So also, are the invoices that I send out each month for the jobs that I have completed.

If I am such a good customer of the United States Postal Service, why do they treat me so poorly? Why did it take four days for a Special Delivery package to travel 400 miles over the Christmas holidays? Why do I have to stand in line for twenty minutes, and then wait for ten more to complete a transaction at the post office? If I, like most of you, am a paid up customer (is there any other way?), then why was my business mail jeopardized just because of the overly commercial aspect of Christmas. Why is business penalized because of what should have been a joyful time. We send cards to people we don't see, and probably can't remember, signed in print (some of us don't see the cards before they're mailed), with greetings that, judged by our actions the balance of the year, we don't intend to extend. Those who know me know that I enjoy cards and silly notes. But I like them better all year long and sent with some thought. Many friends are likely to open mail and find some card or note from me. But I like to do it all year long, not just at Christmas. I sent no cards in 1975.

The postal service has raised its rates, and the money is sadly needed. Sadly needed because even after its reorganization it remains the most mismanaged, and still most vital, part of doing business. It is a part of doing business that the businessman has no control over whatsoever. That is ridiculous.

Taken individually, the postal workers are nice people. I don't blame them for the mess because they haven't the tools to do a proper job. Why should it take ten minutes to look up a rate for a particular piece of mail? Why don't they tie the entire system into a central information retrieval system, push a series of buttons describing the article, the destination and the weight and immediately get a read-out of the required amount of postage. Then take a total—say every four hours, of the weights entered from all points within districts, and determine if additional help is required to keep the mails moving. Scales with out-of-date rates on them take a long time to read, rates are changing continually and their books aren't up-to-date. They have to rely upon the mails to distribute the updated charts.

Banks have similar systems (minus the manpower loading) to verify interbranch transactions. Credit agencies use such systems. Cash registers in many major chain department stores are linked into central systems for billing. Every national credit card has a method of verifying, within seconds, every individual account.

The technology seems to be available to design such a system. Cable, microwave, satellites and computer interface can provide a national network to immediately update postal rate information and schedule manpower requirements. I wish I were an engineer. I'd think about such a system and start to design it.

I choose not to communicate at Christmas because the communications system was overloaded. I can't blame the employees in the postal service since it's management's shortsightedness that cause such problems. Bad management makes for bad business—in any business.

But why do the bills continue to arrive on time, even through the holidays?

Judith Baer

Judith Baer
Managing Editor

SCTE scte comments

A Guest Editorial From
Robert Tenten
Home Box Office

A year that sticks in the mind of all cable people is 1977. A year that should also be foremost in our minds is 1979. Why 1979? The reason is simply that this may be the year cable TV comes up short again and could stay that way at least until the year 2000. You probably have received from the FCC Public Notices about meetings being held in preparation for WARC '79. These may have passed by your desk without raising very much of a stir. However, the WARC '79 (World Administrative Radio Conference) will set the frequency allocations and operating parameters for telecommunication services for the period of 1980 to 2000. Groups from all over the world will be meeting in Geneva in 1979 to represent the telecommunication policies of their country. How does cable TV get involved in such a grandiose scheme? The answer is that the United States will formulate its position based on inputs from various groups, one of which is cable television. Inputs are given by many other people that are interested in specific areas. The Radio Service Working Groups include such diverse groups as amateur radio operators, miscellaneous common carriers, AT&T, TV networks, mobile radio operators, etc., and last but by no means least cable TV as represented by the WARC Advisory Committee for Cable Ancillary Radio Services. These groups give their inputs to the functional committees who in turn input to the Steering Committee. The chair person for Cable is A. M. Rutkowski, FCC, Room 6216, Washington, DC 20554. His telephone number is (202) 632-9797.

All this is very nice, you say, but what will it do for me? The question may be not only what can it do for you, but if you don't get involved, what can it do to you?

Trying to guess the needs of Cable over the next 2 1/2 decades is not a simple task, but without getting involved and giving intelligent estimates of both terrestrial and satellite communication requirements, there will be no means of bidding for the potential spectrum that will be required. If cable services and channels increase, what will be the potential increase in the terrestrial microwave allocations? Is the CARS band sufficient to handle the needs of cable to the year 2000? Could the CARS band become a shared band with satellite transmission? Will the advent of broadcast satellites in addition to present fixed satellite service require additional terrestrial bandwidth? Will cable even be allowed to carry signals from broadcast satellites?

The number of people participating in these WARC meetings on behalf of Cable can be counted on one hand

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PROOF OF PERFORMANCE SERIES: reprinted from C/ED, entire series covers 76.605(a)1-12, $10.00/complete set, circle RSC 17.

PUBLICATIONS LISTING: pre-publication orders, shipment March '76: listing over 500 books, periodicals, papers, etc. on CATV, with addresses and ordering instructions: $15.00/copy, circle RSC 23.

CCTA

canadian column

Ken Hancock
Director of Engineering
Canadian Cable Television Association

new canadian cable tv regulations and policies

One of the problems in writing for a magazine, is the difficulty in keeping information up-to-date. The deadline for this issue that you read in February is the first of January, therefore the latest news that we can give you is that which occured at the end of last year, and so it is in this issue.

The end of 1975 was an active period for cable television in Canada, seeing the release of both new regulations and new cable television policies. On the 26th of November the Canadian Radio-Television Commission (CRTC) our regulatory body, released its long awaited "Regulations Respecting Broadcasting Receiving Undertakings (Cable Television)." This was followed on the 16th of December by "Policies Respecting Broadcast Receiving Undertakings (Cable Television)."

The Regulations contained few surprises. Most reflect CRTC policies in use over the four years since the policy statement of July 16, 1971.

Cable operators were disappointed that the Commission did not adopt the measured broadcast contour standard for establishing signal carriage priorities. While the regulations prescribe the calculated broadcast contour method, there are indications that the Commission might consider priorities more flexibly on a case-by-case basis.

The regulations formalize the practice of signal substitution where local stations are protected against outside signals carrying the same programs at the same time. Under the regulations, local stations with the highest priority on the cable system can request deletion of the signal of a lower priority station.

There is no direct mention of the more controversial subject of commercial deletion now before the courts. This requirement is attached to some licenses as a condition of the license and is now being challenged by U.S. television stations. An indirect mention of this subject is covered by "No licensee shall alter or curtail any signals in the course of their distribution, except as required or authorized by its license or by the regulations."

The mandatory community channels will carry only community programming, no advertising (except that promoting Canadian Broadcast programs) and no feature motion pictures. Audio records and program logs for community channels will be required and kept available for inspection for four weeks or eight weeks if the Commission requires. For programming of a political or contentious nature, community channels will be subject to the same kinds of fairness and time allocation rules as broadcasters.

The regulations, effective April 1, 1976, call for two classes of licenses: Class A for cable systems with more than 3,000 subscribers and Class B for systems with fewer than 3,000 subscribers.

Service is mandatory for all areas within the licensed area that have water or sewer service. Customers may be charged for full installation costs where the distance between the house and property line exceeds 150 feet, or where other additional costs are necessary.

Perhaps the most important item of the regulations for Canadian systems, is that portion of the priority rulings that now allow the demoting to "optional station" of the most distant of two local stations affiliated to the same network and carrying the same programming. Previously, the proposed regulations read that all local stations should be carried as top priority. This amendment will ease the overcrowding problem on the basic 12 channel service and in some instances allow the carriage of American stations on this service, rather than requiring the expansion of the system to mid-band operation.

The new policies covered five areas. These are: Community channel; Radio services; Augmented channel service; Special programming channels and Pay TV policy.

Canadian licensees were most disappointed at the decision to defer the introduction of pay television in Canada except for the certain closed circuit operations such as those in hotels. It is felt that this will greatly restrict the growth of our industry.

However, there were some bright points to alleviate the gloom, and the move away from the proposed mandatory use of ten percent of gross revenues for community programming is one of these. Unfortunately, there were few of these, however, and the policy prohibiting the use of off-air FM signals as background music on TV channels carrying various video services such as time and weather information is definitely a blow for many cable licensees, particularly those with smaller systems.

The policy on augmented channel service (converter service) is again restrictive and one feels that licenses to carry additional channels will, in the future, be very few and far between.

The policy on special programming channels, that is, local origination channels other than the community channel, is once more quite restrictive. The CRTC lays down as first priority for these channels the re-running of Canadian produced off-air broadcast programs complete with the original commercials. Following this priority are films or video tapes from Canadian government sources and foreign government and non-profit making agencies. The list of priorities continues, favouring films in languages other than French or English, amateur films, and in the lowest priority slot, sponsored programs providing no specific product or service advertising is included in any part of the program.

In all it seems that Canadian Cable Television is in for an era where growth is frustrated by the aim of the CRTC to protect the off-air broadcasters.

forum

international cooperation in cable television

Ken Hancock
Director of Engineering
Canadian Cable Television Association

Perhaps it is only human nature for one to consider that the area in which he works is the most dynamic, innovative and generally superior. There is much to be said for this attitude at the early stages of any project, but if the attitude is continued indefinitely, almost invariably the time will come when it is suddenly found that another group or organization, often in another country, has come up with a better way of doing things and now has the most advanced technology.

As we all know, cable television was born on the North American continent some 25 years ago, and has advanced at a tremendous pace until we now have the position where some 15% of all Americans, and some 45% of all Canadians watch their television via cable TV. As such there is perhaps a tendency on the part of some of us to consider that all that is worth knowing in cable TV technology resides on the North American continent.

Over the last decade or so, cable television has taken hold in Belgium, Holland, England, Japan and many other countries. In addition, most of the rest of the world is looking at this method of TV distribution very seriously. Many European countries have devised their own cable TV technology, with such innovative techniques as the use in Holland of a ring system, instead of the normal branch system, and the use in many European countries of UHF as the distribution medium, rather than VHF.

One of the more obvious disadvantages of the parallel development of technologies designed to fulfill the same need, is that different basic standards are developed, thus preventing the economic use of the most advanced technology other than in the area in which it was developed.

To attempt to overcome such problems, the International Electrotechnical Commission (IEC) was set up some 40 years ago. The IEC produces international standards on a wide variety of electrical and technical matters. These standards are used as a reference by all sponsoring countries, including the United States and Canada. I should like to make it clear that the use of IEC standards by sponsor countries is not mandatory but in general there must be a very good reason for national standards and regulations to be in direct conflict with IEC recommendations.

The work of the IEC is carried out through a number of committees, each covering a specific, but fairly broad field. In turn these committees break down into sub-committees, each covering a specific area of the field in question. The committee covering our general field is IEC/Technical Committee 12-Radio Communications. Up to now, any work affecting cable television has been carried out by its Sub-committee IEC/SC12A-Receivers.

In view of the expanding world-wide use of cable television it was decided approximately a year ago, to form a separate sub-committee to cover the needs of cable television. The result of this decision was IEC/Sub-committee 12G, tentatively entitled "Wired Communication Systems."

The first meeting of this sub-committee was held in The Hague, Holland, from September the 16th to the 19th, 1975. The meeting was attended by 40 delegates from eighteen nations, including of course, delegates from the United States and from Canada. This attendance reflected the world-wide interest in cable television and delegates from countries such as mainland China and Egypt were in attendance, as well as those from Japan and the majority of European nations.

The main work of this initial meeting was to decide upon a permanent title, agree upon terms of reference, and to define a plan of work together with priorities for this work.

An international meeting of this type is somewhat different from normal national meetings, insomuch that it is of great importance to very specifically define the phraseology and terminology of each motion to prevent future misunderstandings due to language and ambiguity of terms.

The majority of cable systems in Europe are owned and run by state organizations, very frequently the same organization that operates the radio TV, the telephone and telecommunication systems. As such their terms of reference are somewhat different to those given to North American delegates, and discussions at the meeting were frequently very animated and nationalistic. However, this did not prevent consensus decisions from being made and it was generally agreed that the initial meeting was most successful. The title finally agreed upon for the sub-committee was "Cabled Distribution Systems," with terms of reference "to prepare

Continued on page 12

announcements/new products

TECHNICAL LITERATURE

A new technical paper, "Design Considerations for Modern CATV Headend Signal Processing Equipment" is available on request from Jerrold Electronics Corp. The Paper is a reprint of Graham Stubbs' article appearing in the August 1975 issue of CATJ and describes the signal processing requirements of a modern CATV headend. Detailed illustrations accompany the text. The paper is available free of charge by writing to the Advertising Department, Jerrold Electronics Corp., 200 Witmer Road, Horsham, PA 19044.

1979 WARC MEETING

A meeting of the WARC Advisory Committee for Cable Ancillary Radio Services was held on Jan. 20 at the Cable Television Bureau of the FCC. Items included on the agenda were review and approval of the "Preliminary Report to the Steering Committee," identifying existing and potential services areas of spectral interest and impacts; and the establishment of further work efforts.

Numerous service-oriented working groups have been formed by the FCC to investigate the spectrum needs of the U.S. to the year 2000. The outputs of the various groups will be channeled to one or more or the four functional committees which will examine spectrum requirements and give recommendations to the FCC Steering Committee. The Steering Committee is composed of representatives of each of the Commission's Bureau's and Offices and is responsible for formulating the FCC's basic spectrum recommendations for use at the 1979 World Administrative Radio Conference.

Any member of the industry may attend these meetings or file comments with the group either before or after each meeting. Meeting notices are in the form of Public Notice. Inquiries should be directed to A. M. Rutkowski, Rm 6216, FCC, Washington, D.C., 20554; telephone 202-632-9797.

COMMISSION DELETES LEAPFROGGING RULES

Action in Docket 20487 in late December brought instruction from the FCC to its staff to delete, in their entirety, the CATV leapfrogging rules. However, under another provision of existing rules involving CATV systems carrying three independent stations, the system will continue to be required to carry one independent UHF station located within 200 air miles of the reference point of the cable community, if such a signal is available.

The leapfrogging rules generally required cable systems to select the signals they carry in an order of priority determined by the distance of each station from the cable system. Cable systems were required to carry nearer stations in preference to more distant signals in order to avoid "leapfrogging."

The action is the result of a rulemaking initiated May 15 to study the FCC's leapfrogging policies and removes restrictions on which television signals a cable system may select when carrying distant independent and network stations, and will provide cable operators a wider discretion as to signal selection.

NEW PRODUCT-PAY SOUND TRAPS

Microwave Filter Co., Inc. announces the availability of their 3355(S) series Pay Sound Traps. This trap suppresses audio at least 40 dB and is weatherized. They are recommended for selective installation in response to complaints from pay cable non-subscribers in trapped or video scrambled systems. Available for Channels 2, 3, 4 and 6, at $8.50 each in 100 quantity. Information is available from Glyn Bostick, Pres., Microwave Filter Co., Inc., 6743 Kinne St, East Syracuse, NY 13057; telephone 315-437-4529.

Microwave Filter 3355 Sound Trap

HBO TOPS 275,000 SUBSCRIBERS AT YEAR-END

Gerald M. Levin, president of Home Box Office, subsidiary of Time, Inc. announced that at year end 1975, HBO's network had expanded nationally with more than 275,000 viewer homes in over 100 cable television locations. Levin said that number had increased from fewer than 60,000 at the start of the year, with most of HBO's growth in the Northeast, particularly in the Greater New York City area.

Since Sept. 30, HBO has begun transmitting its daily 12 hour program schedule by domestic satellite and now has cable system affiliates in ten additional states - Florida, Mississippi, Alabama, West Virginia, Kentucky, Arkansas, Texas, Oklahoma, Washington and Oregon. Levin called the institution of satellite distribution "the most significant development of our year."

With service starting to Erie, PA in late Dec., HBO transmits to a total of 12 earth stations serving 14 cable systems. The largest single HBO affiliates are Communications Development Corp., with almost 60,000 pay cable

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announcements/new products continued

subscribers in Oyster Bay, Hempstead, North Hempstead and Babylon, NY and Manhattan Cable Television, with more than 32,000 subscribers in lower Manhattan.

PECA ANNOUNCES MARKETING REP

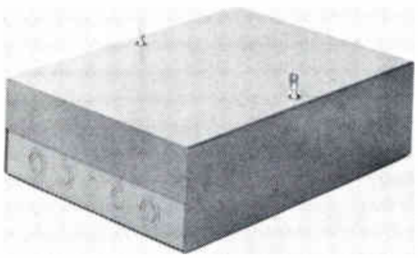
PECA (Professional Electronic Component Assembly), Inc., of Philadelphia will be nationally represented by Jim Emerson, J. B. Emerson-Marketing Associates of Fayetteville, NY. Emerson will provide marketing representation for PECA to key cable television accounts, nationwide.

PECA is headed by Ralph G. Douglass, president, and makes several unique, high-quality products and instruments for the CATV industry. Included in the line are a high-level simultaneous sweep generator ana high resolution sweep recovery system; self-terminating, high isolation diode switches for both RF and video applications; a 12-switch capacity driver for independently switching RF sources, driven from TTL or conventional DC sources; an all solid-state RF comparator; and a wideband post amplifier.

Additionally, PECA provides independent engineering laboratory and manufacturing services. Among current activities is development and production of electronic products used in educating deaf children.

TONER ANTI-THEFT CABINETS

Toner Cable Equipment, Inc. announces availability of their new anti-theft equipment cabinets for CATV and pay apartment systems, called the Super-Secure TM line. The cabinets feature flush mounting of the cable entry knockouts to either ceiling or floor and the wraparound door edges are flush to the wall surface. Two separate vending machine-type locks are used, with nonreproducible keys.



Toner Anti-Theft Cabinet

Toner says, "Super-Secure cabinets require so much time, noise and work to break open that they should stop any thief except a determined and experienced safecracker." The cabinets are custom ordered for specific size requirements, have a 3/8 in. plywood mounting surface inside and are made of painted, heavy-gauge steel. For more information, contact Toner Cable Equipment, Inc., 418 Caredean Drive, Horsham, Pa. 19044; 215-674-5510.

CHANNELMATIC AUTOMATIC PAY TV PROGRAMMERS

Channelmatic Electronics recently introduced a new series of low-cost digital programmers for VCR's. Called the TELEPRO Series, according to Bill Killion, president of the company, the new equipment provides the first economical, fully automatic solution to presenting, without interruptions, cassette-recorded programs of greater than 60 minutes in length.

The TELEPRO programmers cycle either two or three VCR's (switch selectable) and provide all necessary control signals for full "hands off" operation. Features include precise pre-roll, check rewind before play and auto rewind after play, clean audio and video switching, and operation according to manufacturer's suggested sequences. Program change is commanded by a single cue tone which is added by the user at the end of each program. An optional cue-tone generator allows the signal to easily be added to the auxiliary audio track of the tapes. Models are available with either electro-mechanical or electronic (digital) timers having the capability of pre-selecting numerous program repeat times during a 24-hour period. An option allows an auxiliary video and audio source to be inserted during the intermission period. The programmers will operate with most manufacturer's VCR's, and the basic TELEPRO 300 is self-racking, providing the most compact 3-VCR installation available today.


Channelmatic Telepro 300

Designed primarily for CATV/hotel/motel/apartment pay TV movie applications, the TELEPRO programmers are also very useful to industrial training and educational applications. Price of the basic TELEPRO 300 is $1120 and delivery is stock to 30 days; quantity discounts are available. Contact Bill Killion, Channelmatic Electronics, 1234 Adobe Lane, El Cajon, California 92021, (714) 448-6298 for complete information.

Channelmatic also manufactures a line of video, audio and pulse distribution and switching equipment, alarm-controlled surveillance switchers, and custom VCR control systems.

THETA-COM 100TH AML SYSTEM

Theta-Com of Phoenix, a subsidiary of Hughes Aircraft Company, announces the delivery of its 100th AML Microwave Local Distribution system.

The 100th AML system, purchased by Cablevision Systems Corporation, Jericho, NY, is considered the largest such system in the world with a capacity of 39 video channels.

It will initially serve the communities of Babylon, Roslyn, Syosset, Hempstead, Oyster Bay and Jericho.

"The Cablevision AML is the largest AML installation on Long Island," said Charles Maki, President of Theta-Com. "And probably the world's largest AML installation. It will feed signals to what is the largest pay cable venture in the country currently serving an estimated 60,000 customers with its 1,150 mile plant."

"Imported distant as well as locally originated signals can be distributed within the system with far less distortion and less cost than the alternatives of using cable cascades," said Charles Dolan, President of Cablevision. "Our choice of AML for this purpose was based on our engineering staff's highly satisfactory experience with this technique in other locations."

Cablevision offers its customers three different types of service ranging from simply providing local UHF and VHF stations as well as public access and news to a complete Home Box Office service and additional imported signals from New Jersey and Philadelphia and channels for FM music and shortwave, instruction and business, sports, stocks and the time and weather.

"A conventional FM microwave system would have required up to 39 receivers and an equal number of modulators at each receiving site to provide a comparable service," Dolan added. "There just isn't enough spectrum available to handle all the channels conventional methods would have required, and the cost would have been prohibitive."

"Our years of experience in the field with the AML have also shown it to be more reliable than long cable runs," Maki added. The AML concept was orginally developed on an experimental basis in the mid-1960s in the New York City area. At that time AML was designed to operate at 18,000 megahertz, but was redesigned when the Federal Communications Commission designed 12,000 megahertz as a permanent frequency allocation.

IMPROVED SURGE PROTECTION

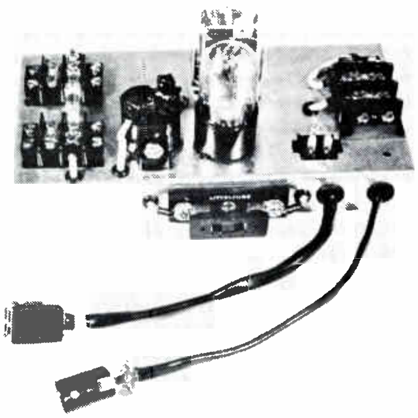
ComSonics Inc. announces significant product improvement in their Series SP-** Surge Protective Modules for CATV line power supplies enabling a price reduction. Value engineering by ComSonics own R&D laboratory is credited with removing assembly labor expense via a new, high-quality printed

Continued on page 12

announcements/new products continued

circuit sub-assembly. ComSonics' Surge Protective Modules provide secondary, re-connect protection and fail-safe operation of the primary surge arrestor.

The Series SP-** Surge Protective Modules are retro-fitted into most AC line power supplies for eliminating damage from both power surges and lightning induced transients, to the cable supply and transformer. ComSonics® units have been in volume use for over two years and are said to have saved countless manhours in resetting circuit breakers and in replacing fuses, as well as having drastically reduced system outages and equipment damage. For information, contact: Bill Edmonson at 703-434-5965 in Harrisonburg, VA.



Surge Protective Modules

CATA-MID STATE FCC TEST PACKAGE

The Community Antenna Television Association has completed arrangements to provide the "CATA 77 FCC Certification Test Program." A joint effort of CATA and Mid State Communications of Beech Grove, IN, cable operators will be provided with test equipment packages and detailed step-by-step instructions for each specific CATV system to conduct this year's annual FCC Technical Compliance Tests.

Operators will be provided with test equipment adequate for tests and a customized test procedure manual. CATA will prepare 3 copies of a test workbook from information supplied by the system operator. CATA will certify that tests were conducted properly and according to specific operating instructions and supply a certified copy of the test results to the operator for FCC records. Systems will be able to perform all 76.605(a) tests with the exception of 76.605(a) (10). A spectrum analyzer is required for intermodulation tests and the FCC has postponed the test for all grandfathered systems until further notice. A spectrum analyzer will be available for systems constructed after March 31, 1972 by special arrangement with CATA.

The equipment package is valued in excess of $5,000. CATA president Kyle Moore states that "We believe that under the terms of this program a system will for the first time be in a position to not only perform the tests required, but also be exposed to state-of-the-art test equipment procedures." Moore continues "We believe this is the first positive step this industry has taken concerning FCC test compliance to date."

David Kinley, Chief, FCC, Cable Television Bureau, has agreed that if a system is not able to obtain the CATA test equipment package prior to the March 31, 1976 deadline for the current year's tests, such systems will receive an extension of time if they have signed up for this CATA program. "Such systems may be asked by a visiting FCC inspector to show proof of having made arrangements with CATA for this test equipment" notes Moore, ". . . and we will provide such systems with a letter indicating when the system is scheduled to receive the equipment, and would therefore be able to complete the current year tests."

Five locations will be used as regional centers for the equipment packages. CATA member systems have priority call on the packages, but the program is open to all systems. Costs to CATA members are $500 for the four day test, non-members will be charged $600 for the test program. Contact CATA, 4209 NW 23rd, Oklahoma City, OK; 405-947-7664.

forum continued

International standards for Cable distribution systems primarily intended for television and sound signals modulated on a carrier, taking into account the possible move for data and reverse transmission."

A plan of action was devised including the publication of standards for cable distribution systems intended to operate between about 30 MHz and 1 GHz, and a working party was formed to consider non-linear distortions in cable distribution systems.

It is hoped that this and future meetings will enable realistic international cable television standards to be issued which will allow the use of the best cable television technology on a world wide basis.

proof of performance timetable

when to do it — how to do it . . .

subpart k visual signal level to system noise

Glenn Chambers
Regional Engineer
American Television & Communications
North Central Division
Appleton, Wisconsin

76.605 TECHNICAL STANDARDS

a(9) The ratio of visual signal level to system noise, and of visual signal level to any undesired co-channel television signal operating on proper offset assignment shall be not less than 36 decibles. This requirement is applicable to:

(i) Each signal which is delivered by a cable television system to subscribers within the predicted Grade B contour for that signal, or

(ii) Each signal which is first picked up within its predicted Grade B contour.

This ruling will cover almost all signals received, either off-the-air or by microwave. If you have fairly late model processors and amplifiers, receive relatively noise-free signals and have a short trunk amp cascade, you probably will greatly exceed the minimum specs. Some older systems may have to do some clean-up work before compliance is possible.

Noise measurement can be fairly simple. All you are really doing is measuring the ratio of signal levels to noise levels.

EQUIPMENT REQUIRED:

An accurate, recently calibrated signal level meter, a low noise, high gain preamp and jumper cables.

PROCEDURE

For total system signal to noise measurements, readings must be taken at system extremities. If signal-to-noise readings are poor on some channels, processors can be the cause. If time permits, I usually record the output noise of the processor first for future reference.

Actual measurement of signal-to-noise is simple but preparation and calculations can be quite time consuming. Since measurement of noise requires checking all active devices, including preamplifiers and converters, for many of us this means a tower climb. A pair of handy-talkies for this use are a good investment.

While the tower man is going up, the other person should read and record all preamped or converted signal levels. Read the levels BEFORE any pads, traps or filters but AFTER the power supply. Have the tower man disconnect the input fitting on a preamp or converter and terminate the input port on the device with an accurate 75 ohm terminator. Switch out attenuators on the SLM until you have a reading between Ø and +10 on the meter scale. Record this reading without tuning the meter and record the needle position on its scale. Reconnect the antenna and proceed with the next one to be tested. These readings will be added to system readings later.

Adjust the manual gain control on each processor so that the output is the same in manual as it is in AGC. Leave one person at the headend (with two-way communication) and proceed with the field tests.

Since signal levels at the tap test points previously set up will not usually be high enough for accurate noise measurements, you have at least two choices. Either put a fitting directly on the distribution cable or use a low noise preamplifier to raise the levels. If a preamp is used, the gain and noise figure MUST be known in order to finish your calculations later, if you wish to know exact signal-to-noise figures. Putting on a fitting is usually much simpler.

If a preamp is used and gain and noise are not known, they are easy to determine. Measure the signals before and after the preamp, this will give you the gain. Terminate the preamp input with an accurate 75 ohm terminator and measure the noise. Subtract the gain of the amp from this number and add your meter correction factor. This gives you the amp noise figure. Most SLM manufacturers include a meter correction chart in their instruction manuals. The chart for a Jerrold Model 727 meter is shown in ***Chart 1.***

Record the signal level on all channels. Tune the SLM back to the first channel to be measured. Contact the headend man and have him disconnect the input lead to that processor and switch to manual gain. The substitution oscillator should not come on in the manual position. Have him terminate the processor input port with an accurate 75 ohm terminator. **Note:** You may have noticed that I keep specifying an ***accurate*** 75 ohm terminator. Since noise measurements are all calculated across exactly 75 ohms, measurement accuracy depends on the terminator. Many times I have gone through several hundred F terminators with a ***good*** ohm meter before finding the one that's even close to 75 ohms.

Continued on page 14

proof of performance timetable continued

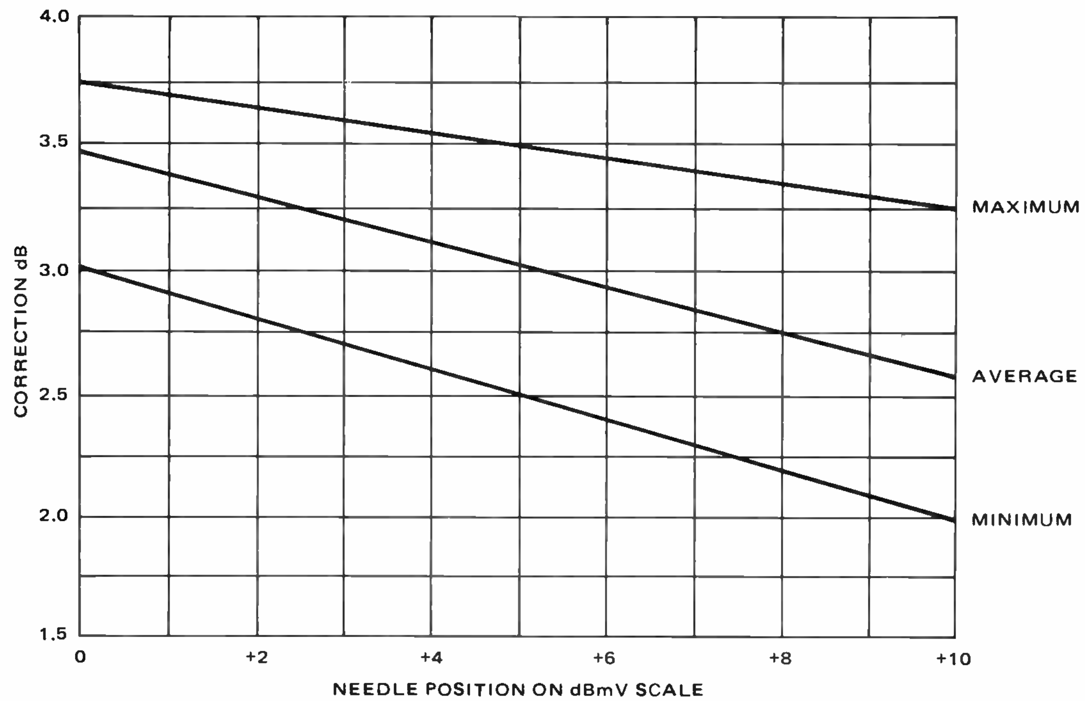


Chart 1

Read the noise level as if it were signal. DO NOT TUNE THE SLM! Record this level (hopefully it will be very low) and proceed with the other channels to be measured. Remember, the position of the meter on its scale must be known, either from your readings or in a separate notation. Meter position determines the correction factor of your SLM.

When measurements are complete, calculations may be started. On the correction chart, locate the point corresponding to the needle position for this channel. There are usually three lines on the chart, maximum, minimum and average. Unless you have previously calibrated the noise readings on your meter, use the average figures. There are two main reasons why a correction chart is necessary:

1) Noise levels are usually specified for a 4 MHz bandwidth (noise power is proportional to bandwidth) and SLM bandwidth is usually around .5 MHz. This will give a reading that is about 8 dB low.

2) Most SLMs in use today use a peak detector. The detector responds to the peak noise and we are concerned with the RMS noise value. This gives you a reading which is higher than true RMS.

After locating the correction figure from the chart, ADD this reading to your noise reading. The difference between this total and your signal level is the signal-to-noise figure.

Example:

Measured signal = +10.3 dBmV
Measured noise = -29.6 dBmV
Correction factor
(from chart) = 2.63 dBmV
-29.6 + 2.63 = -26.97
-26.97 to +10.3 = 37.27 dBmV signal-to-noise

On the channels that were preamped and/or converted, further calculations will be necessary. Noise adds as power, so *Chart 2* will simplify the computations. First, determine the signal-to-noise of the preamp just as you did for

EXAMPLE COMBINING TWO CARRIER TO NOISE RATIOS OF 56 & 48.4 dB, DIFFERENCE IS 7.6 dB. FROM CHART BELOW COMBINING FACTOR IS 0.70. COMBINED SIGNAL TO NOISE RATIO = 48.4 – 47.7 dB.

CARRIER TO NOISE COMBINING FACTOR CHART

dB DIFFERENCE	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0.0	3.01	2.95	2.91	2.86	2.82	2.77	2.72	2.67	2.63	2.58
1.0	2.54	2.50	2.45	2.41	2.37	2.33	2.28	2.24	2.20	2.16
2.0	2.13	2.09	2.05	2.01	1.97	1.94	1.90	1.87	1.83	1.80
3.0	1.76	1.73	1.70	1.67	1.64	1.60	1.57	1.54	1.51	1.43
4.0	1.46	1.43	1.40	1.37	1.35	1.32	1.29	1.27	1.24	1.22
5.0	1.19	1.17	1.15	1.12	1.10	1.08	1.06	1.04	1.01	0.99
6.0	0.97	0.95	0.93	0.91	0.90	0.83	0.86	0.84	0.82	0.81
7.0	0.79	0.77	0.76	0.74	0.72	0.71	0.70	0.68	0.67	0.65
8.0	0.64	0.62	0.61	0.60	0.59	0.57	0.56	0.55	0.54	0.53
9.0	0.51	0.50	0.49	0.48	0.47	0.46	0.45	0.44	0.43	0.42
10.0	0.41	0.40	0.39	0.39	0.38	0.37	0.36	0.35	0.35	0.34
11.0	0.33	0.32	0.31	0.31	0.30	0.30	0.29	0.28	0.28	0.27
12.0	0.26	0.26	0.25	0.25	0.24	0.24	0.23	0.23	0.22	0.22
13.0	0.21	0.21	0.20	0.20	0.19	0.19	0.19	0.18	0.18	0.17
14.0	0.17	0.16	0.16	0.16	0.15	0.15	0.15	0.15	0.14	0.14
15.0	0.13	0.13	0.13	0.13	0.12	0.12	0.12	0.12	0.11	0.11
16.0	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.09
17.0	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.07
18.0	0.07	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06
19.0	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.04
20.0	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03

Chart 2

the system. Next, subtract the system signal-to-noise on that channel from the preamp signal-to-noise. Note the difference in levels in dBmV.

Locate this difference in the left column on *Chart 2.* The other columns are headed by 0.0, 0.1, 0.2, etc. Move to the proper column (12.8 would be under the 0.8 heading) and read the number. Subtract this number from the system signal-to-noise figure for the combined signal-to-noise of the preamp and the system.

Example:

Preamp signal-to-noise = 53.0 dBmV
System signal-to-noise = 40.2 dBmV
Difference in levels = 12.8 dBmV

From *Chart 2,* 12.8 dBmV = .22
40.2 - .22 = 39.98 dBmV signal-to-noise

If an amplifier was used to increase signal levels from a tap, its noise contribution must also be calculated and ***subtracted*** from the system noise. Calculations are the same as described except that when the amplifier's noise is removed, the system signal-to-noise is improved.

scte comments continued

with some fingers leftover. On the other hand, no pun intended, the networks, common carriers, PBS, etc. send representatives to serve on working groups that serve their interests. Quite honestly we are badly outnumbered. In addition to being outnumbered, it is unfair and unwise to place the responsibility for decisions on matters of such importance in the hands of so few people no matter how smart, dedicated, and conscientious they may be. I say that, even though I have been among the handful that have attended these meetings. We need your help, and in fact you need your help. Let's not get to the year 2000 and find out that we forgot to shut the barn door in 1976 to 1979.

Channel Planning: CTAC Panel 5

CTAC Panel 5 was chartered to:

"Evaluate possible frequency assignment plans for Class I and Class II cable television channels with due consideration for the following factors, among others which may be added during the course of the study:

(a) TV receiver design.
(b) Compatibility with off-air reception and protection of public investment in existing receivers.
(c) Cable transmission problems.
(d) Cost per user.
(e) Direct pickup interference.
(f) Interface adapter requirements.
(g) Allowance for Class III and IV non-TV channels."

Panel 5 took exception to the word "assignment" since "assignment" was defined by the Panel as a specific authorization to use a designated frequency. In lieu of "assignment" the Panel substituted "channeling plans."

The Panel decided early in its activities that other factors must be considered in making recommendations for appropriate frequency plans, namely:

- carriage of FM radio signals (aural)
- provision for carriage of AM radio (converted to FM) ultimately required
- cable system radiation and its potential effect upon other radio spectrum services
- the subjective nature of interference and its relationship to the degree of interference tolerance permitted within any of the frequency plans to be considered.

The work contemplated by the original charter and its necessary initial expansion was quickly recognized to be far larger than originally estimated. Of even greater significance remained the obvious, and in many cases the subtle, interdependence of the work of Panel 5 and the ongoing work assigned to other CTAC Panels:

Panel 3, Receivers;
Panel 2, Subjective Measurements;
Panel 6, System Operations;
Panel 7, Interconnections;
Panel 9, Bidirectional Systems.

Panel 5 assigned priorities to its activities to:

- Determine the near term (within five years) consequences of modification of channeling plans currently in use.

- Analyze potential adoption of a single, uniform plan which could be implemented during the intermediate future (five to ten years).
- Consider in detail the effects for the next decade of not developing recommendations of uniform frequency plans.
- Identify the factors impinging upon creation of suitable frequency plans over which the Panel has little or no control or no concrete knowledge or expertise but which it intuitively assumes will have a significant effect upon future planning.

PANEL MEMBERSHIP AND ORGANIZATION

CTAC Panel 5 consisted of 23 members, including the chairman and six permanent observers. Although observers did not vote in matters appearing before the Panel, in all other aspects they were considered part of the working roster and contributed significantly to the Panel's deliberations.

Industry representation included system operators, equipment and receiver manufacturers, researchers, consultants, engineering societies, government agencies and trade associations. Ten meetings of the Panel were convened during the period November, 1972 through November, 1974. Attendance averaged 57 percent of the roster. Many Panel members and observers were members of the subcommittee on frequency allocations of the Coordinating Committee for Cable Communication Systems of the Institute of Electrical and Electronics Engineers (CCCCS-IEEE). The subcommittee's function closely parallels the charter and function of CTAC Panel 5.

Position papers were solicited to crystallize members views with respect to both the prioritization of the Panel's work within the scope of its charter and individual perspectives which would affect future activities. Contents of the position papers made it apparent that polarization existed within the Panel and that this polarization predominantly reflected the professional activities of individual members as well as their industry bias relative to the cable television industry. In order to operate on a consensus basis, to minimize voting on potentially divisive issues, work groups reflecting specific broad interests were formed. Work group chairmen were appointed and made responsible for coordination of views within each group.

Essentially, the focus of each of the Work Groups was as follows:

- ***CATV System Operators.*** Economic and operational impact of selected frequency plans upon cable system operators and potential effect upon subscribers.
- ***CATV Equipment Suppliers.*** Operational effect of selected frequency plans upon cable system performance with particular emphasis on degradation due to beats, moving background, channel capacity and local signal leakage.
- ***Television Receiver Manufacturers.*** Design and marketing effect of selected frequency plans upon the planning of a cable television receiver. This work group maintained a very close liaison with the Cable Television Systems Committee (CTSC) of the Electronic Industries Association and with CTAC Panel 3.
- ***Theoretical Engineering Analysis.*** Theoretical analysis, with computer support, of selected frequency plans with emphasis upon potential interference problems caused by cable carriage of twenty or more television channels.
- ***Subscriber Converters.*** The role, transitional and permanent, of an interface converter connected between the cable system and the subscriber's television receiver. Effect of selected frequency plans upon the operational characteristics and performance of both tunable and block converters was contemplated.

HISTORICAL REVIEW

Until the advent of more than twelve channel cable system capacity the CATV industry adopted defacto the FCC VHF television frequency plan (54-88 and 174-216 MHz). The industry made little use of system channel capacity existing outside the VHF TV spectrum, except for occasional use of sub VHF as an intercity transport to link distant antenna receiving locations or diverse large city distribution hubs. Service to subscriber receivers was provided on TV channels 2-13. Except for sparing usage in large metropolitan area MATV[1] systems the UHF band (470-890 MHz) has not been utilized in U.S. or Canadian cable TV systems.[2]

Recognizing the paucity of engineering information on hand concerning suitable frequency channeling plans for cable systems which wished to augment standard VHF allocations, the Wire Communications Committee of IEEE recommended preparation of a report[3] to be accomplished by the IEEE Cable Television Task Force outlining recommended frequency plans to be employed on CATV systems. This recommendation resulted in formation of the frequency allocation subcommittee of the IEEE-CCCCS.

During its active deliberations—January, 1971 through May, 1972—the subcommittee identified and defined the frequency allocation problem, analyzed nine potentially useable frequency plans, organized further research into cable system radiation interference with other radio spectrum services and published its tutorial report to the parent CCCCS-IEEE in May, 1972. It is this report which served as the keystone reference work for members of CTAC Panel 5.

In particular, the subcommittee identified many problems still affecting the cable system industry, including:

- the inherent deficiencies of commonly available television receivers operating in a strong radiated field environment when connected to broadband cable systems.
- the paucity of current operating data involving bidirectional use of broadband cable systems.
- inadequacy of both theoretical and empirical data affecting the potential use of other than VHF for distribution of NTSC television to cable connected subscribers.
- the potential interference with Air Traffic Control and navigation services caused by excess radiation from broadband cable systems.
- the all important need to evolve suitable transitional plans to minimize the inevitable economic consequences of any change in allocation to both the cable industry and the subscribing public—and the overriding necessity to induce the television receiver industry to develop a cable-compatible receiver.

As part of its deliberations, and in recognition of the complexity of the allocations problems, the subcommittee adopted for its own reference the allocation plan for VHF cable systems in Table I. This plan was also adopted by Panel 5 for identical reasons.

The prior work of IEEE-CCCCS should be considered essentially as the tutorial phase of the deliberations of Panel 5. Its final report serves as the transitional bridge to the activities of Panel 5; accordingly the Powers report dated May 16, 1972 was incorporated into the proceedings of this Panel by reference.[4]

In August, 1972 the Cable Television Systems Committee (CTSC) of the Electronic Industries Association (EIA) was formed as a joint undertaking of the EIA Broadband Communications Section of the Communications and Industrial Electronics Division and the CATV subcommittee (R-4.2) of the Consumer Electronics Group. Its membership consists predominantly of equipment manufacturers, both television receiver and cable system, and includes within its roster many CTAC Panel 5 members.

Within its charter and scope of activities, the EIA CTSC concentrated on the problems peculiar to creation of a cable-compatible television receiver. Its deliberations included analysis of various frequency plans as such plans would affect cable subscriber interface and more particularly the television receiver.

LIAISON WITH GOVERNMENTAL AGENCIES

U.S. and Canadian agencies represented as observers on the Panel included the FCC, Office of the Chief Engineer, the Canadian Department of Communications, and the U.S. Department of Commerce, Office of Telecommunications.

The IEEE-CCCCS subcommittee on frequency allocations identified and explored the possibilities for interference with certain radio spectrum services which could arise from excess signal leakage emanating from malfunctioning cable systems. Air traffic control (ATC) and air navigation frequencies in the spectrum 108-137 MHz were of particular concern.

An ad hoc task force qualified in cable engineering, air navigation and piloting and radiation measurements, investigated and evaluated the problem. In cooperation with the Federal Aviation Agency (FAA) and the Office of Telecommunications Policy, the task force enlisted aid from the Office of Telecommunications Department of Commerce to engage in specific and detailed experiments structured to provide sufficient data for a meaningful recommendation.

The OT/DOC work has not been completed, but two reports of an intended three covering its investigations have been published.

OTHER INTERFACES

Virtually all of the Panel roster was composed of practicing engineers who are members of one or more professional societies. This informal liaison provided a continuous input to the Panel and served as a valuable conduit for accumulating timely and relevant reference material.

Certain professional societies and industry associations were specifically represented by individual Panel members and observers, namely IEEE, NCTA and CCTA. The Panel maintained formal and continued liaison with EIA/CTSC as well as CTAC Panels 3, 6, 8 and 9. The final report of Panel

TABLE I

Frequency Band (MHz)	Allocation	Possible Uses
Below 54	Experimental	Television Subscriber response signals Telemetry Facsimile Control of monitoring signals
54 – 72	Television	Cable television classes I and II
72 – 76	Experimental	Pilot signals Control signals
76 – 88	Television	Cable television, classes I and II
88 – 108	Aural Broadcast	FM Broadcast signals AM Broadcast signals, remodulated to FM Local origination, FM
108 – 120	Experimental	Subscriber interrogation signals Control signals Pilot signals
120 – 174	Television	Cable television, classes I and II
174 – 216	Television	Cable television, classes I and II
216 – 270	Television	Cable television, classes I and II
270 – 300	Experimental	Cable television, classes I, II and III Facsimile
300 – 400	Experimental	Cable television, class IV Telemetry Subscriber response signals Monitoring signals
Above 400	Not Allocated	

5 is due in considerable part to inputs received from these external organizations.

Panel 5 for the major part continued the work begun by its predecessor, the IEEE-CCCCS subcommittee on frequency allocations, and attempted to analyze plans originally considered by the subcommittee in light of its own charter and the expertise of its Panel members. It also probed the current state of the art to determine whether any conclusive findings had been obtained from the several experimental frequency plans which were being adopted in a limited number of systems in the United States and Canada.

IEEE-CCCCS in its final report summarized characteristics of nine frequency channeling plans. The subcommittee did not make recommendations with respect to any of the plans; the declared purpose of the subcommittee being the collection of engineering data for tutorial purposes. Of the nine plans considered by the subcommittee, eight involved the use of single cable transmission and distribution systems, one required multiple, independent cable facilities.

Early on, CTAC Panel 5 recognized the potential impact its decisions and recommendations would have, if adopted, upon a number of major industries, all of which are involved in a symbiotic relationship addressed primarily to providing television programming to the public. Cable industry hardware manufacturers would be affected to some degree but not nearly so much as those supplying television receivers, converters and other consumer terminals. The greatest impact would probably be upon the viewing public itself, since it would not necessarily be guaranteed that any devices purchased for attachment to cable systems would either be compatible with the present broadcast system or with other cable systems to which the subscriber might at some later time be desirous of interconnecting.

Given the current state of uncertain economic well-being, the Panel analyzed and recommended whatever frequency plans might be implemented to the best advantage of the cable and related industries within the shortest transitional period of time. The Panel kept clearly in mind the inherent disadvantages of premature standardization.

The IEEE subcommittee indicated the complex problems to be addressed when also planning for non-TV signals, or TV signals in a bi-directional mode within cable systems. The following situations were recognized as ultimately requiring resolution:

- Carriage of FM radio signals, especially in large metropolitan systems.
- Distribution of non-television Class III and Class IV signals especially when such signals are carried bidirectionally.

FM radio signal carriage is almost universal practice within the cable industry. Normally little difficulty is experienced when these signals are carried within the band 88-108 MHz at signal levels within the system approximately 15 dB below television visual carriers. However, in large metropolitan markets where strong local radiated fields from many stations cause excessive signal leakage into cable-connected receivers, local stations cannot be carried on frequency. This poses a frequency congestion which may require the use of additional FM band capacity to accommodate both the large number of local as well as more distant stations desired. The Panel did not address these conditions in detail except to recommend continued use of the band 88-108 MHz.

The lack of knowledge with respect to the specific operational characteristics of many of these futuristic non-television services, but the intuitive realization that certain bidirectional services would be developed in the near term future led to the adoption of the allocation plan in Table I.

Panel 5 concurred in this previous work and adopted the same allocation plan. However, in the interest of a pressing need to concentrate on the evaluation of plans which either were appearing in more frequent usage or were being tried experimentally (the emphasis being on increasing television channel capacity and concurrently improving the quality of the picture and sound) the Panel elected to forego consideration of these other services until "down stream" television channeling plans had been resolved.

WHY REVIEW THE FCC PLAN?

It is appropriate to review the need for the development of any frequency channeling plans other than that adopted by the FCC (RR 73.603(a) and 73.699 Figures 5 and 5A). FCC frequency allocations affecting VHF and UHF television bands were adopted by the fledgling cable TV systems industry without modification. So long as no more than twelve channels were delivered to cable system subscribers, the entire VHF spectrum was utilized to provide service. This condition is practical only where no strong local stations are co-located with the cable television system since direct pickup by cable connected receivers of off-the-air signals creates an intolerable interference problem. Interference is displayed as a strong leading ghost (synchronous signals) or as unstable co-channel (non-synchronous and non phase-stable signals). In either case the result is to void use of the cable channel being affected by the local TV transmitter. It was the emergence of cable TV service in large metropolitan areas which included, in some instances, a number of cities having multi-channel assignments, which quickly made evident the need for a means to combat the loss of cable channel capacity.

The first and still almost universal solution is employment of a frequency converter interposed between the cable system interface[5] and the subscriber's television receiver. No alternative in general use exists today which otherwise permits the full utilization of the cable VHF TV spectrum. Loss of a substantial portion of cable system channel capacity affects operation of systems in all metropolitan areas. Moreover as requirements have grown for cable channel capacity in excess of the twelve VHF TV channels, the need for both a subscriber converter and a frequency plan to accommodate more than twelve channels has become a high priority item for the industry. The problem was brought sharply into focus by the FCC Second

Report and Order decreeing mandatory twenty channel cable capacity in all systems constructed within major television markets after March 31, 1972 [FCC RR 76.251(a)(1)].

Since the FCC never contemplated adjacent channel or co-channel allocations within its frequency plan [FCC RR 73.606 and 73.610(a) and (b)], the television receiver industry has produced millions of both monochrome and color receivers displaying less than suitable performance within high ambient signal fields, particularly when connected to cable systems delivering adjacent color channels.[6] As systems proliferate within major television markets, the problem becomes more acute. Receiver manufacturers are currently producing more than 10 million receivers a year, the bulk of which are destined for major markets. Cable system operators are connecting an ever-increasing number of subscribers to systems within these same markets. The need for a suitable receiver capable of providing excellent quality reception of both off-the-air as well as cable signals is now mandatory, since the converter adds both technical complexity and cost to providing metropolitan area cable service. Should the receiver industry produce a cable-compatible receiver which is offered for sale through its normal high volume marketing channels throughout the country, the need for frequency standardization becomes acute. In fact, without it, likelihood of mass produced cable-compatible receivers would be almost zero.

AUGMENTING THE SYSTEM

This chicken-egg situation would have an almost intolerable effect upon a cable industry attempting to prove itself in larger markets. Lacking availability of a free market in suitable television receivers, cable operators would be forced to purchase and provide to their subscribers a converter for each cable-connected subscriber receiver. This capital outlay would be staggering given the current predictions for the growth of the cable industry within the next decade.

Since the FCC rules [RR 76.605 (a)(1)] prescribe that cable channel boundaries delivered to the subscriber fall within VHF or UHF FCC allocations, it essentially limits the number of channels which can be provided the cable subscribers without utilizing UHF channels. Cable system technology today falls far short of operating large systems having an extended bandwidth in the UHF spectrum; VHF signal delivery is universally used. Moreover, the Commission does not specify any frequency channeling plan or allocation within the cable system itself, and prefers to concern itself with frequencies and relevant frequency tolerances which appear at the subscriber interface [FCC RR 76.605(a)(1)(2)(3)].

It is within this framework that the cable industry has attempted to augment its service capabilities by increasing system channel capacity utilizing frequencies between 108 MHz and 174 MHz (the cable mid band) and frequencies above 216 MHz (the super band). Attempts to utilize frequencies below 54 MHz in order to benefit by lower cable attenuations have generally been restricted to transmission between cities, long cable runs between distant antenna sites and system hubs, interhub links, or for "upstream" bidirectional signaling. Consequently all converters generally in use today tune the band from 54 to 270 MHz and a large number are capable of tuning to 300 MHz. Output of the tunable converters is on one VHF channel which is not locally broadcast within the affected market.

CONVERTERS

Two types of converters are presently in service – tunable and block converter. The tunable converter is essentially another tuner preceding the antenna input terminals of the TV receiver. It operates generally by heterodyning input signals within the band 54-300 MHz to a higher frequency (first I.F.) and then performing a second heterodyne to a predetermined single VHF output channel. In most instances the converter first I.F. frequencies are so chosen that local oscillator leakage is minimized in respect of its interfering effect upon other cable connected receivers or converters.

Block converters (essentially band converters) operate by converting seven super high band or mid band channels to a block of seven VHF high band signals (channels 7-13). Their use suffers from the increased possibility of adjacent channel interference and direct pickup and these consequently are in less frequent use than the tunable converters. Band selection is by means of a self-contained switch.

Tunable converters present significant operating problems to the subscriber, namely:

(a) in most cases a loss of remote control of the receiver since the receiver becomes essentially fixed tuned
(b) the need to tune both the converter and the receiver for optimum performance
(c) the resulting need for frequent retuning caused by converter drift.

OWNERSHIP, OPERATOR OR SUBSCRIBER

Converters ownership may ultimately dominate the selection of any one frequency plan for adoption as a standard.

So long as the converter is considered a part of the cable system and subscriber interface is at the output of the converter, virtually any frequency plan can be accommodated without significant effect upon the subscriber. In this instance the converter is essentially a part of the cable system and full responsibility for its operation rests, therefore, with the system operator.

This situation changes significantly, however, when converters become an item of open commerce and are available to subscribers through independent retail outlets. Standardization of the frequency plan at the customer interface (the grounding block in a single residence or wall outlet in a cable served apartment building) now becomes mandatory in order to protect the consumers' investments. Importantly, in order to protect an increasingly more mobile population, frequency standardization should be at national rather than state or local level.

Since in many cases the cable system subscriber is not the ultimate viewer of television signals, but is the owner or manager of apartment houses or managing agent for condominium properties, it may be necessary to contemplate the effect of an uncontrolled MATV distribution system upon the performance of the viewer's receiver. In many instances the multiple dwelling or motel owner provides cable services to his rental tenants/guests as part of the rent or charges levied. He buys signal service from the cable operator at a single terminating point (system interface) on his premises. An internal subdistribution system (MATV) interconnects this interface with each of the apartment outlets. In the majority of instances these independent MATV systems were not designed for augmented channel capacity since, except for the largest multi-channel metropolitan areas, twelve channel VHF capacity was more than adequate. The combination of non-system-controlled converters connected to an independently designed and maintained MATV system creates a problem of sufficient magnitude to warrant consideration of an interim frequency plan which would hasten development of a compatible cable television receiver.

MAKING THE DECISIONS

No one frequency plan considered by the Panel was deemed to satisfactorily resolve the myriad of both technical and political problems confronting an industry which is on the threshold of a new era in communications. At times during the Panel deliberations it was difficult to separate clearly the purely technical issues and address them independently. Clearly, the conclusions reached by the Panel not only reflect as penetrating an analysis of the technical issues as was feasible but are tempered with the pragmatism that develops from daily involvement with the economic dynamics of the marketplace.

Consideration was given to the specific problems affecting each component of the broadcast/cable industry and special emphasis was placed upon developing an effective compromise necessary to provide a smooth transitional period of adjustment.

Five frequency channeling plans and three variants were analyzed by the Panel as to technical merits and the impact each of them would have on the television viewer, the cable system industry, the broadcaster and the television receiver manufacturers.

TABLE II

Plan 1	Augmented FCC assignments with standard tolerances and offsets: 28 channels
Plan 2	Constant Interval assignments based on a 6N + 1.25 MHz comb: 28 channels
Plan 3	Harmonically Related Coherent (HRC) carrier assignments based on a 6N MHz comb (other frequencies close to 6 MHz were also considered): 28 channels
Plan 4	A detailed channel plan based on Plan 1 which includes specific assignments for pilot carriers, data channels, upstream carriage and special purpose channels: 36 channels
Plan 1A	Expansion of Plan 1 to provide 35 channels
Plan 2A	Expansion of Plan 2 to provide 35 channels
Plan 3A	Expansion of Plan 3 to provide 35 channels
Plan 5	Essentially Plan 2A except that precise frequency control is employed at the broadcast transmitter and the cable system antenna site; no offsets; special consideration was given to channels 5 and 6; 35 channels

Plan 5 was developed to bridge the transitional period of the next decade when the emergence of a large number of air/cable compatible receivers will play a dominant role in encouraging and stimulating cable system growth in large metropolitan areas. To help ensure development of such a receiver, which will avert proliferation of millions of interface converters, the Panel considered the total broadcast/cable system, since the two components are essentially one and the same from the subscriber's point of view. The ultimate goal of the total system is to provide the best possible pictures and sound to the viewer; therefore no one item in the chain is exempt from influence by the others. Obviously frequency planning is the keystone of benefits and deficiencies.

By and large older cable systems using single-ended electronic equipment cannot accommodate midband channels because of excessive 2nd order distortion. An experimental plan to use harmonically related coherent (HRC) carriers derived from a stable base frequency provides some relief because 2nd and 3rd order carrier distortion products fall on carrier (zero beat) and therefore produce only minor luminance change, which is tolerable. Such a plan averts necessity for total system rebuilds, especially where limited channels are to be added. However since the frequency plan requires that all carriers be precise multiples of a base frequency (6N) there is no coherence with the present FCC spectrum allocation and a converter is necessary at every receiver location.

Newer systems utilizing more linear push-pull equipments suffer less from 2nd order distortion but are essentially power limited by 3rd order distortions of the kind $F_1 \pm F_2 \pm F_3$ and $2F_1 \pm F_2$. HRC helps alleviate this problem, but makes it difficult to design and produce a marketable air/cable-compatible receiver.

CONCLUSION

Of the three basic channeling plans (nominal FCC augmented, constant-interval, and harmonically related carriers), Panel 5 concluded that constant-interval carriers ultimately be adopted for cable use. Plan 2-2A has many advantages of the HRC system (Plan 3-3A) in that many carrier frequency distortion products fall on carrier (zero beat) or at band edge and materially reduce the amount of visible interference within the video spectrum. The plan moreover is compatible with the existing FCC VHF allocation plan and creates no obsolescence of the existing millions of off-air receivers. Should an air/cable receiver be developed to provide full reception capability inherent within the plan (35 VHF channels), need for outboard interface converters would be significantly reduced.

Plan 2-2A can best be implemented, and will be more effective in reducing visible interference, if all television broadcast transmitters are placed on constant-interval, precise frequencies and cable channels slaved to them (Plan 5). In addition to providing the benefits of Plan 2-2A this will also reduce the effects of broadcast television pickup interference in cable systems, and co-channel interference in broadcast reception.

Panel 5 recommended a precise frequency, phase stable, constant-interval channeling plan be adopted for use in cable system operation and that preferably, the principle of precise frequency assignment, without offset and including a means of providing stable frequency operation also be applied generally to television broadcast transmitters and cable antenna site modulators, frequency processors and converters. Panel 5 thus considered Plan 5 as the most effective FCC VHF allocation plan to an expanded services plan providing as many as 35 channels of NTSC television capacity..

[1] Master antenna television system — an intrabuilding distribution system for apartment houses, motels, etc.

[2] Some use is being made of UHF for cable distribution in a limited number of European systems.

[3] Uthlout letter 1970.

[4] Paper: Dr. Robert S. Powers, 1972 NCTA Convention, Chicago, IL.

[5] Defined by the FCC as the terminals of the subscriber's television receiver. When a converter is used the interface becomes the grounding and entrance block/75 ohm termination.

[6] Adjacent channel operation is now almost universal on cable systems. Studies conducted by consulting firm, Malarkey Taylor Associates, for NCTA characterized receiver deficiencies.

Channel Planning: The CTAC Steering Committee

EDITOR'S NOTE:
The Cable Television Technical Advisory Committee to the Federal Communications Commission completed the major portion of its work in mid 1975. CTAC was comprised of nearly 200 technical and management people throughout the country.

In a letter expressing the Commission's gratitude to members of CTAC, FCC Commissioner James H. Quello said "We are convinced that only on the basis of a well considered set of technical standards will the broadband communications industry reach its full maturity and be able to provide the services the technology promises. Such standards will assure the safety of persons and property; assure the compatibility of cable systems, receivers, and transmission networks; and give both the buyer and seller of cable services a standard against which to measure the quality of services provided."

The Commission is making good use of the CTAC Report and the more than 1,100 pages of information presented. The subject of frequency channeling was addressed in the CTAC Steering Committee Report and two summary recommendations of the Steering Committee are reported for informational purposes:

OFFICIAL DESIGNATION OF CABLE SPECTRUM CHANNELS. Useful cable spectrum extends well beyond (and below) VHF television broadcast channel assignments. Common usage of these additional frequencies as well as prolonged studies of factors relating to frequency channel planning now permit appropriate recommendations. It is time for the Commission to officially designate and identify channels and spectrum bands for cable systems providing television signal distribution to the public.

CTAC recommends adoption of an immediate plan which retains VHF broadcast channel assignments and identifies so-called non-standard channels. CTAC also suggests that the Commission, after careful consideration of non-technical as well as technical factors involved, might choose to specify tighter tolerances on broadcast visual carrier frequencies.

ALLOCATION PLAN FOR CABLE CHANNEL USE. Along with identification of channel boundaries, CTAC identified an Allocation Plan for VHF cable television service and recommends assignment priorities for the groups of channels which carry regular subscriber signals.

Presentation of the CTAC Final Report to the Federal Communications Commission did not imply acceptance of any material contained in the report. It has been estimated that two years might be required to fully review the material presented in Volume II and that the CTAC Report will provide the basis for rulemakings concerning technical standards for the industry for the following three to four year period. The text that follows is not the complete text of the CTAC Panel 5 Final Report but represents the major portion of the document and has merely deleted redundancies. Credit for the report must be given to members of CTAC Panel 5, Cable Frequency Planning and to H. M. Diambra, Chairman of the panel.

Channel Planning was described by the Commission as the Problem of "Frequency Allocations within the Cable Network."

SOURCE: *Cable Television Report and Order, supra* **at 204, para. 170**

INTRODUCTION

Channel planning, a firm assignment and designation of use of portions of the spectrum in any shared path communications system involving the general public, is the keystone of industry expansion and mass consumer utilization. It is a means of guaranteeing equipment interchangeability; operator and use confidence, acceptance and familiarity; concentration of an incentive for design effort; development of manufacturing economies resulting from large quantity production and a stable market.

Such regulatory standardization is not required when a system is entirely under control and use of a single entity or serves a limited number of users—except to the extent that technical interference to others or public safety is involved. However, if the public, system operators and equipment manufacturers are expected to invest great quantities of money in hardware, plant and services over which they do not have undisputed control, then the stability of a standard set of conditions is vital.

Portions of usable cable spectrum include frequencies assigned to television broadcast channels two through thirteen and the FM broadcast band. The full spectrum of a modern cable television system covers a band of approximately 300 MHz.

Certain Class I and Class II television programs carried on a cable system are intended for "regular subscriber service" [1]. In the top one hundred markets the number of channels required to be carried under the Rules for regular subscriber viewing often exceeds twelve but rarely exceed twenty-eight.

When regular subscriber service is satisfied, the remaining channels are available to accommodate other classes of service. A distinction must be drawn between television channels delivered to the public and total cable system carriage capacity.

Return channels, (Class IV) require different amplification paths to separate them from "downstream" signals (Class I, II and III). Single cable systems must have suitable "cross-over" filters at all active electronic devices to provide this frequency separation. Return signals of a single-cable diplex service are more efficiently assigned to lower or upper ends of the cable system spectrum.

A harmonically related carrier (HRC) plan which seems to offer certain advantages for multi-channel carriage of television signals, requires these carriers be on exact multiples of 6 MHz. Existing television broadcast carriers are not harmonically related.

Television broadcast station carriers comply (except for Channels 5 and 6) with a Constant Interval Plan (CIP) with visual carriers located 1.25 MHz above exact multiples of 6 MHz (6n + 1.25). Present broadcast rules permit a frequency tolerance of 1 kHz and in some cases a 10 kHz offset.

Cable operators have generally adopted the CIP formula for mid and super band channels. Cable rules allow a liberal frequency tolerance.

Precise frequency control of carriers assigned in accord with CIP seems to offer many advantages of the HRC system. The state of the art is rapidly approaching the condition where sufficiently stringent frequency tolerances may soon be economically practical [2].

CTAC Panel 3 Cable Receivers, recommends present FCC broadcast standard channels and an additional sixteen non-standard channels using the 6n + 1.25 MHz plan with "precise frequency and phase control by broadcasters." Panel 3 also endorses the Panel 5 Allocation Plan.

Panel 7 Interconnect, does not find structuring "6 MHz frequency cells" inconsistent with its consideration of Spectrum Utilization. CTAC Panel 9 Two-Way, also accepts the 6 MHz channel plan.

Panel 8, Television System Coordination, repeatedly reminded the Steering Committee of the impracticality and gross hardship that would result with any substantial change in the present broadcast channel plan.

Premature structuring or "crystal ball" regulation before determining a pattern of use and an understanding of related factors is harmful and restrictive. The Commission deferred judgement in this area of the cable television rules until information is collected and developing practices observed. If provisions can be made for established patterns and flexibility retained for realistic accommodation of innovative or anticipated uses as they become established, then the time has come to formalize spectrum use assignments. The Steering Committee believes these conditions can be met for the cable television industry and that the time is now.

CLASSIFICATION OF STANDARDS

Frequency Allocation and use assignment clearly fall under regulatory standard Type 2 [3].

FACTORS

Two questions must be asked in determining cable channel planning—where? and how? Which portion of the cable frequency spectrum shall be assigned to what use?

The Commission has already identified four classes of signals as appropriate or mandatory for carriage on cable television systems. They are:

Class I Broadcast Television Signals,

Class II Cablecast Programming, not obtained from television broadcast stations,

Class III Analog or Digital Signals, intended for reception by selected subscribers and requiring special terminal equipment,

Class IV Return or Response Signals, from a subscriber to another point in the system.

§76.5(z)-(cc) of the Commission's Rules.

SUGGESTIONS AND RECOMMENDATIONS

The CTAC Steering Committee recommends to the Commission immediate interim adoption of the Panel 5 Frequency Channeling Plan 1A. This plan has a cable spectrum using present FCC television broadcast channel assignments with standard tolerances and offsets, augmented with nine television channels mid band between 120-174 MHz and fourteen television channels in the superband, 216-300 MHz.

It is strongly urged that an appropriate and penetrating analysis be made by the Commission and other qualified organizations of the benefits of requiring the Panel 5 Channeling Plan 2A for both broadcast and cable channels.

TABLE OF ALLOCATION—FREQUENCY CHANNEL PLAN, PLAN 1A

Frequency MHz	Allocation	Preferred Uses	Band
below 54	Experimental	Class III or IV*	Sub band
54 to 72	Television	Class I, II and III	Low VHF
72 to 76	Experimental	Class III non-video	Pilot and Control
76 to 88	Television/Data	Class I, II and III	Low VHF
88 to 108	Aural	Broadcast and Auxiliary	FM band
108 to 120	Experimental	Class III	Mid band
120 to 174	Television	Class I, II and III	Mid band
174 to 216	Television	Class I, II and III	High band
216 to 270	Television/Data	Class I, II and III	Super band
270 to 300	Experimental	Class I, II and III	Super band
above 300	Experimental	Class III or IV	UHF

* Class I and II signals may use this band for interconnect purposes.

Carrier frequencies are essentially identical to Plan 1A and therefore, a logical evolution of that plan. Plan 2A has constant interval carrier assignments on a 6n + 1.25 MHz comb with special consideration to broadcast Channels 5 and 6. However, there would be no offsets and frequency tolerances are several orders of magnitude more stringent than present broadcast tolerances.

Should the results of the above referenced analysis indicate a substantial benefit to the public interest (as suggested by Panel 5), then the Commission should devise a plan for simultaneously implementing Plan 2A for both cable television and broadcast television services.

The CTAC Steering Committee also recommends immediate rules for the Frequency Allocation Plan of VHF Cable Television Service adopted by the IEEE-CCCCS subcommittee and referenced by Panel 5.

Regular subscriber service signals should be assigned to cable channels in the following priorities: [4]

Priority 1—Low VHF, High VHF and Mid Band
Priority 2—When all Priority 1 channels are filled, super band channels are to be assigned in progressive order starting with the channel contiguous to Channel 13.

Signals not intended for regular subscriber service may be assigned according to the Allocation Table but without priority over regular subscriber service.

For conformity, the Commission might consider the EIA suggestion that mid and superband channels be identified by continuation of the two digit numbering system applied to VHF and UHF broadcast channels. Note however, that this might be impractical for systems incorporating more than twenty-eight channels. The cable television industry now uses alphabet identification for these channels.

In order to permit freedom of providing specialized services over which the cable operator does have full technical control, channel planning and allocation rules should not apply to any cable in a system which:

1—Does not carry regular subscriber service channels.
2—Carries signals on a dedicated cable over which an individual subscriber or user has switch or selection control.

UNKNOWNS

As suggested above, further study is necessary to determine the degree public interest would be served by precise visual carrier frequency control in accord with Plan 2A of CTAC Panel 5. This question concerns such factors as implementation cost, change-over complications, improvement in broadcast co-channel interference immunity over the offset system, economies or simplifications of receiver designs, improvements in FDM cable transmission.

Matters of further interest include study of the complication and benefits of a national frequency standard service distributed by radio or other means, for visual carrier frequency, video synchronizing signals and data clocks.

REFERENCES

[1] *Clarification of the Cable Television Rules and Notice of Proposed Rulemaking and Inquiry,* 46 FCC 2d 176, 202, para. 95 (1974).

[2] See Hellwig, H., "Frequency Standards and Clocks; A Tutorial Introduction, "Nat. Bur. Stand. (US), Tech Note 616 (Revised), 72 pages, March 1974.

[3] **TYPE 2—COMPATIBILITY AND INTEROPERABILITY**
These are standards that are necessary for compatibility or a working together of related parts. An example would be the distance between the tracks on a railroad. The exact value is not so important as is general agreement on the value chosen so that interconnected equipment performs properly. Type 2 standards are essential when large areas of service and multiple independent parties are involved.

[4] "Cable Compatible Television Receiver and Cable System Technical Standards" EIA TV Systems Bulletin No. 2., p. 5, Para IIIA, March 1975. (EIA, 2001 Eye St., NW, Washington, D.C. 20006).

Comments and Dissents:

The members of CTAC were professional people whose technical interests and background in communications guided their work on the various panels and committees. When the final draft of the report was prepared, it was anticipated that provisions would be required for comments and dissents. Part IV of the CTAC Steering Committee Report, COMMENTS AND REPLIES, followed the practice of the Federal Communications Commission and solicited comments and replies of individual Steering Committee members with regard to report text. A draft of the report was circulated to all members of the Steering Committee on March 19, 1975 with instructions for comments. A meeting was held April 15, 1975, announced by mail notice and publication in the Federal Register. Nineteen of the 27 members were present, including two alternates confirmed in writing.

After the discussion at the meeting, the Committee ruled by a vote of 15 affirmative to four negative to adopt Volume I as written except that the deadline for comments would be extended to April 25, 1975 at the close of the business day. All comments and dissenting opinions received by that date were included verbatim in Part IV of the Steering Committee Report presented to the FCC on May 21, 1975.

The comments and dissents appearing here are those specifically directed to the issue of Cable Frequency Channeling. They have been, in some cases, excerpted from lengthy comments included in Part IV of the Final Report. They are published here verbatim.

George W. Bartlett, Vice President for Engineering, National Association of Broadcasters, Washington, D.C.

The recommendations to change or study existing television transmission and receiving standards raise serious questions as they relate to public interest, frequency allocations, and potential interference.

One must accept the premise that the primary function of the cable system is the re-transmission of "off-the-air" television program material. Such a re-transmission system must assure the viewer that television signal performance through the cable system is of the same quality as when receiving such signals through the conventional over-the-air system. At the present time some 120 million television receivers are in the hands of the viewing public receiving program material transmitted via time-tested transmission standards and techniques. The public interest demands and it is the Commission's obligation to see that television program material transmitted over the cable system irrespective of origination, be of the highest technical quality and consistent with those transmission standards which have been developed over the past many years. To provide the viewing public with anything less would certainly not be in the public interest.

"The ultimate goal of the total system is to provide the best possible pictures and sound to the viewer; therefore no one item in the chain is exempt from influence by the others." CTAC Panel 5 Report

Suggestions, as reflected in Volume I of the Steering Committee Report that new transmission techniques for the broadcast industry, such as synchronous carrier operation, be studied are tantamount to restructuring the television broadcast service to accommodate the cable industry. That is certainly not within the scope of the Committee.

The public interest demands that television receivers manufactured for the consumer market be capable of receiving program material transmitted in accordance with the Commission's Rules and Regulations.

It is inconceivable that any findings or Report would vaguely suggest a plan which would produce a non-standard receiver incapable of accommodating over-the-air signals

CTAC Steering Committee

generated in accordance with the Commission's Rules and Regulations. Although the Steering Committee report does support the compatability concept utilizing channel spacing in accordance with the present system of allocations, it nevertheless suggests that consideration be given to the following cable channeling plan:

(a) shift Channels 5 and 6 upward by 2 MHz, and

(b) delete the lower 2 MHz of the public portion of the FM broadcast band to provide the additional frequency space required by the shift of Channels 5 and 6.

Needless to say, the adoption of such a recommendation would for all practical purposes delete TV Channels 5 and 6 from approximately 120 million receivers. In lieu of supporting further consideration of this concept, the Steering Committee should have rejected the proposal forthwith.

". . . recommendations should be based on sound technical data, not purely judgments. However, I also feel that the Steering Committee, in its draft of the Summary Report, made qualified rather than unconditional recommendations." Alex Azelickis, Oak Industries, April 11, 1975

The proposed use of 108-120 MHz for experimental Class III service is questionable and could conceivably create disastrous interference to the Aviation Services. On January 31, 1975, the Commission issued a Public Notice (75-103) entitled "Potential Interference to Aeronautical Radio Services Using the 108-136 MHz Band from Cable Systems." The Notice described potential interference in the 108-112 MHz band presently allocated for Instrument Landing Systems (ILS) and the 108-118 MHz band used for Visual Omnidirectional Range (VOR) stations. With the warning from the Commission that interference to these all important aeronautical naviation bands is possible, the Steering Committee should have summarily rejected this recommendation.

Victor Nicholson, Staff Engineer, Cable Television Information Center, Washington, D.C.

I concur with the Steering Committee recommendation for the immediate adoption of the Panel #5 Frequency Channeling Plan 1A.

I dissent to the recommendation for the use of 108-120 MHz band of frequencies for experimental services as listed in the Frequency Allocation Plan. My concern is based upon present use of the 108-112 MHz band for Instrument Landing Systems (ILS) and the use of the 108-118 MHz band for Visual Omnidirectional Range (VOR). The FCC showed concern about "Potential Interference to Aeronautical Radio Services Using The Band 108-136 MHz from Cable Television Systems," [F.C.C. Public Notice 75-103 (Jan. 31, 1975)].

I feel that catastrophic failures could result from interference with aircraft landing controls in the 108-118 MHz band; but that interference in the 118-136 MHz band would only affect communications.

Kenneth L. Foster, Chief, Telecommunications Division, New York State Commission on Cable Television, Albany, NY

The imposition of the channeling plan recommended (Panel 5, plan 1A) has merit and should be implemented. Manufacturers of mid band and super band equipment already are using this plan, thus no redesign of equipment is necessary. However, plan 2A presents some very serious problems.

"Obviously frequency planning is the keystone of benefits and deficiencies." CTAC Panel 5 Report

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Panel 5 has recommended that all television broadcast transmitters be operated with a rubidium frequency standard. The panel noted that there are currently 947 television transmitters in operation. No mention was made of the 2974 translators which would, of necessity, require the same precise control if the channeling plan were to be effective.

For maximum benefit to be derived, Panel 5 suggests that all CATV headends be phase-locked. Ignoring the technical problem associated with headends which do not have the capability to achieve phase-lock, the costs to subscribers for the phase-locking is enormous.

When all costs (based on the Panel 5 report), are estimated, the cost to industry and ultimately to subscribers is in excess of $173,000,000. This seems to be an unreasonable economic burden in view of the benefits to be derived.

Howard T. Head, Partner, A. D. Ring & Associates, Washington, D.C.

In the discussion of Issue B, "Channeling Plan," the Steering Committee recommends a channeling plan consistent with the present VHF television broadcasting channel structure. It goes further, however, to recommend "an appropriate and penetrating analysis" of a substantially different plan, which would:

(a) require all broadcast stations to operate with non-offset synchronous carriers
(b) shift Channels 5 and 6 upward by 2 MHz, and
(c) delete the lower 2 MHz of the public portion of the FM broadcast band to provide the additional frequency space required by the shift of Channels 5 and 6

No responsible technical person is ever opposed to meaningful testing. "Meaningful" testing cannot, however, be undertaken in a vacuum. Before really serious consideration is given to a plan involving the three factors enumerated above, adequate homework should be done. One should, for example, read the results of the testing of synchronous carrier operation reported in the March, 1950 issue of *RCA Review*. So far as is known, this is the only report of tests made by qualified personnel of the interference improvement which can be realized by means of synchronous carrier operation.

"The panel reports should stand by themselves without any attempt by the Steering Committee to summarize, rationalize, color, or inject industry philosophy or positions into them." George W. Bartlett, NAB, April 25, 1975

To summarize briefly the findings of the tests, synchronous carrier operation does, in fact, produce a significant and worthwhile improvement in interference over that due to random, unsynchronized operation on the same carrier frequency.

This report goes on, however, to point out that the use of ordinary offset carrier operation (presently employed by all broadcast stations) produces a significantly greater reduction in interference than operation with synchronous carriers.

As a threshhold, any responsible proposal for the adoption of carrier operation should be based on data showing the scheme to be superior to that presently in use. Such data are not to be found anywhere in the CTAC Report, nor so far as I am aware, in any generally available technical literature.

The proposal to shift Channels 5 and 6 upward in frequency by 2 MHz is intended solely to benefit cable systems, by providing a potential reduction in intermodulation interference. The consequences of such a shift would be that 121 million television sets presently in use could no longer receive television Channels 5 and 6. In the U.S., 53 stations operate on Channel 5 and 59 stations on Channel 6. ARB data as reported in the current edition of Television Factbook show a net weekly viewing of Channel 5 in 46 million homes, and of Channel 6, 26 million homes. These statistics serve to illustrate the disruptive effect of the contemplated shift of these two channels.

Shifting television Channels 5 and 6 upward in frequency by 2 MHz would require the deletion of the lower 2 MHz of the FM broadcast band. This constitutes ten FM broadcast channels, representing half of the channels assigned to the non-commercial educational (public) FM broadcast service. The loss of these channels would displace 389 public FM stations which, with few exceptions, could not be relocated elsewhere in the FM broadcast band.

"Had the report been returned to the editorial board for a rewrite to attempt to satisfy all dissents, I believe that we would still be arguing in 1977." Kenneth L. Foster, NSYCC, April 24, 1975

The Steering Committee Report, instead of endorsing these irresponsible recommendations for further study of such a plan, should emphasize the consequences just discussed.

Isaac S. Blonder, Chairman, Blonder-Tongue Laboratories, Inc., Old Bridge, NJ

Channel Planning. Since the home and MATV receivers will far outnumber the CATV receivers for at least the next decade, the present channel assignment must be held sacred for economic reasons.

Lyle Keys, President, TeleMation, Inc., Salt Lake City, UT

On Page 4 of his comments, Howard discusses "the proposal to shift Channels 5 and 6 upward in frequency by 2 MHz." This apparently refers to the suggestion on Page 32 of the Steering Committee Report wherein they recommend that the Commission analyze Channeling Plan 2-A as a possible alternative to Channeling Plan 1-A, which the Committee recommends. While I do not have a copy of Panel 5's report, it would seem from the language of the Steering Committee Report that the constant interval carrier assignments, exempt Channels 5 and 6. For example, the Report says, "carrier frequencies are essentially identical to Plan 1-A" and "Plan 2-A has constant interval carrier assignments . . . with special consideration being given to broadcast channels 5 and 6." If Plan 2-A involves the 2 MHz upward shift for Channels 5 and 6 and, were the Commission to analyze such a change as the Committee recommends, I suspect they would determine that the benefits to be derived would not be sufficient to justify the resulting trauma. However, if Plan 2-A contemplates leaving Channels 5 and 6 at their present assignments, then it might well be an evolutionary improvement over Plan 1-A. In any event, the language of the Steering Committee Report should be clarified in this area.

". . . one must identify the factions the dissenters represent. One represents AMST, and the second represents NAB. These are broadcasting industry trade associations." Delmer C. Ports, NCTA, April 25, 1975

Archer S. Taylor, Senior Engineer, Malarkey Taylor & Associates, Washington, D.C.

With regard to criticism of the CTAC Report, Volume I, I do not believe CTAC could rationally have addressed the issues before it without examining the purposes to be served by augmented technical performance standards. Part III of Volume I of the Report properly and succinctly categorizes the three distinct objectives of regulatory standards:

1) Prevention of harm or injury to others.
2) Interchangeability; compatibility, interoperability.
3) Quality definition.

It is a fact that the primary objective of FCC radio regulation in the technical area has been, for over 40 years, to prevent or minimize harmful interference between radio users.

It is a further fact that most, if not all of the technical standards related to compatibility and interchangeability were adopted by the FCC after having been developed by industry committee such as SMPTE, NTSC, EIA, NAB and TASO.

It is also true that audio performance standards in radio and television broadcasting are almost unique examples of regulation of ***performance quality*** as distinguished from interference and interchangeability. In television, the video frequency response specification appears to be the only rule which affects quality without particular significance in interchangeability or interference.

"If the Committee were to accept the hard regulatory line and the deification of the Commission's prior actions as are seemingly advocated in Howard Head's comments, it might seriously jeopardize meaningful service, present and future, while protecting nothing more than the jobs of a few hundred bureaucrats." Lyle O. Keys, TeleMation, April 11, 1975

CTAC would not have met its obligations had it failed to call attention to economic and technical constraints, and the practical effects which members and panelists recognize on the basis of experience.

My criticism in this regard is that the report does not set forth clearly enough the difficulties and dangers of attempting to define and regulate picture quality without allocating tolerances on a system-wide basis, and without considering the competitive market factors involved.

In another area of criticism, it is, in my judgement, quite proper that competent and experienced cable engineers draw the Commission's attention to the serious technical problems created in a cable television system by the present assignments of Channels 5 and 6. Nevertheless, I concur with Howard Head that specific recommendations affecting existing TV receivers in the hands of the public, or which might impact on other services, are beyond the scope and expertise of CTAC in its present form.

On the other hand, I consider CTAC is properly responsive in suggesting that synchronized broadcast carrier frequencies be re-examined by the FCC or others, in the light of:

(a) Modern frequency control technology (viz. atomic sources).

(b) Demonstrated improvement in the quality of cable television service.

(c) Serious questions concerning the validity of the 1950-1960 tests comparing offset and synchronized carrier frequencies with regard to co-channel interference.

In addition to the 1950 RCA Review paper to which Howard Head referred, two papers serveral years later, by Middlekamp and others, should also be examined. [1,2] Middlekamp shows variations of 5 to 20 dB for changes in carrier frequency difference of one-half frame frequency, or about 15 Hz. There is no evidence in the RCA paper that this fact was recognized in 1950 when synchronized carriers were extensively tested. The significance of this omission (if in fact it was not taken into account) is that comparison was made with non-synchronized carriers whose frequency difference is not known. Had this difference been 180 Hz, for example, the effect would have been 17 dB less objectionable than if the difference were 195 Hz.

Furthermore, even the offset frequencies show fine structures deviating for example, as much as 11 dB between 10,010 and 10,040 Hz, both well within the tolerance of the 10 kHz nominal offset. Dean comments in his TASO paper [3] that, for this reason, the worst case condition should determine the grade of service. There is no evidence in the 1950 report that this factor was investigated.

For these reasons, the 1950 RCA conclusion that offset provides somewhat better co-channel protection needs to be re-examined. The decision in 1952 to adopt offset assignments was a sound one, based primarily on the difficult technical problem of accomplishing synchronization with the then existing technical state of the art.

The fact is that with modern technology, precise synchronization is technically and apparently economically feasible. The CTAC recommendation that the FCC re-examine the merits and difficulties of synchronized carrier operation is, therefore, quite in order and fully justifiable.

[1] E. W. Chapin, L. C. Middlekamp, W. K. Roberts; Co-channel Television Interference and its Reduction; IRE Transactions on Broadcast Transmission Systems; June 1958.

[2] L. C. Middlekamp; Reduction of Cochannel Television Interference by Very Precise Offset Carrier Frequency; IRE Transaction on BTS; December, 1958.

[3] C. E. Dean; Measurements of the Subjective Effects of Interference in Television Reception; Proc. IRE; June 1960, pp 1040-1041.

Alex Azelickis, Vice President, Technical Relations, CATV Division, Oak Industries, Crystal Lake, IL

Mr. Head makes reference to an article on the results of testing synchronous carrier operation as compared to offset carriers, published in RCA Review, March, 1950.

I have not been able to obtain a copy of this article yet, but I have had parts of it read to me over the telephone. I will certainly study this report, but it seems to have the following limitations:

(a) The industry was "pushing" offset carrier legislation at the time.
(b) Only two co-channel carriers were studied.
(c) Carriers were synchronized in frequency, but were not phase-stable.

Since many more than just two carriers are present in all CATV systems, a new study, as recommended by the Steering Committee, is justified.

"It is an unsupported and unsupportable conclusion that the broadcast industry should be restructured to accommodate the cable industry, rather than that the cable industry should be regulated to serve the public." Howard T. Head, A.D. Ring & Assoc., April 7, 1975

Regarding lack of supporting data for Plan 2A (CIP), I suggest that Mr. Head examine Panel 5 W.G. #4 computer study.

The problem of Channels 5 and 6 is a serious one, and Mr. Head is correct in stressing its importance. However, solutions other than shifting upwards by 2 MHz are possible. This gives further justification for the "Appropriate and Penetrating Analysis" which Panel 5 was not able to carry out.

I therefore support the not so "irresponsible" recommendations on Issue B, Volume I.

C. Bailey Neal, Manager, Advanced Development, GTE Sylvania, Batavia, NY

Contrary to the statement made in the draft cover letter from CTAC to FCC Chairman Wiley, the Committee has ***not*** "—completed its assignment." It may well have responded to the assignment to the best of its abilities, but that is not necessarily the same thing. Data necessary to establish technical standards with knowledge of their effect on system performance (including the receiver) is, in many instances, lacking. That the Committee did not find it possible to do so should be made clear at the outset.

"Operating under the consensus rule, there was unlimited freedom of discussion and respect for minority viewpoints." Isaac S. Blonder, Blonder-Tongue, April 23, 1975

The recommendation for serious consideration of a frequency channelling plan which would shift channels 5 and 6 upward by 2 MHz and delete the lower 2 MHz of the FM band does not have the attributes of a responsible proposal. Consider the havoc it would wreck in terms of obsolescence of TV receivers in the hands of the public, the necessity for new detent-type tuners with dual channels 5 and 6 if a transition were to be attempted—to say nothing of the loss of 10% of the FM band.

"The dissents were predictable. Even if they had written the text and ultimately edited the final draft, they would have dissented in the end!" anonymous, April 15, 1975

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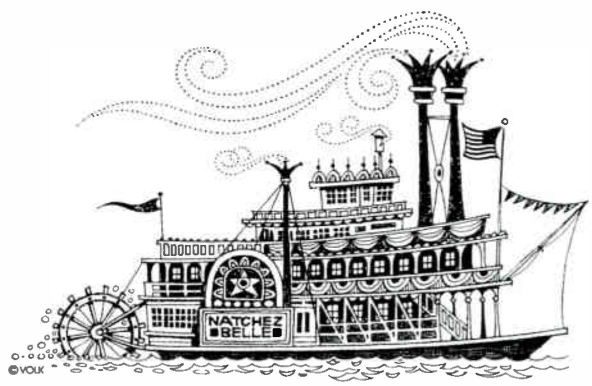

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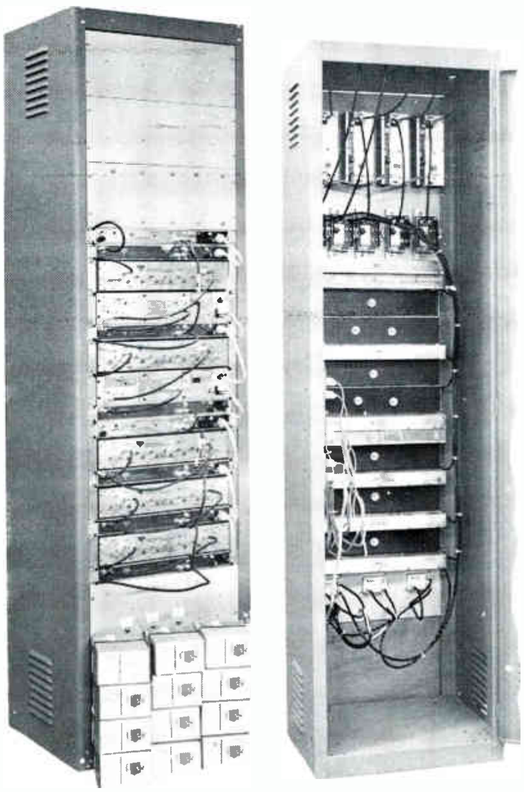

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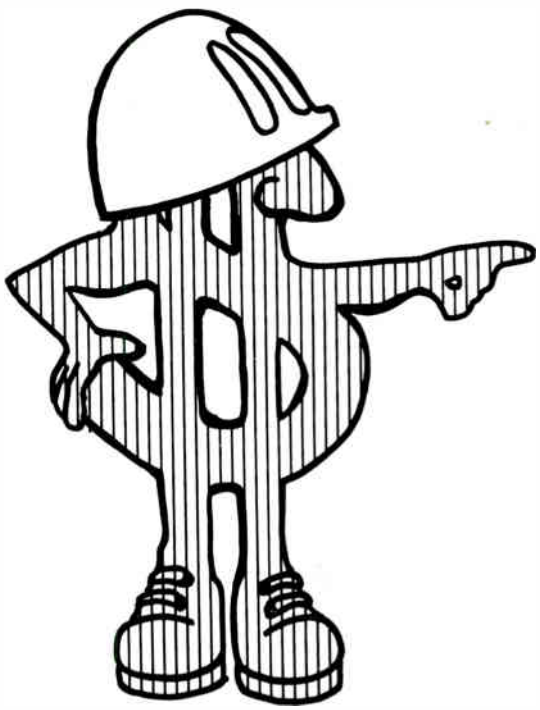

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opinion/editorial

COMMUNICATIONS/ENGINEERING DIGEST is an individual business venture. C/ED is published for the Society of Cable Television Engineers as a membership promotion but its circulation of 6,000 far exceeds SCTE membership. I tell you this so that there is no misunderstanding about what C/ED proposes to accomplish and to explain who ultimately makes the decisions. After input is received from a variety of sources, the publisher makes the final decision. C/ED is not a house organ.

I have thought long and hard before publishing an editorial in this magazine. The industry runs amok with editorial opinion. It is hard however, to either publish or edit a magazine without feeling that you have a right to air your feelings. Ego gets tangled up with judgment at times, with publishers and editors falling prey to the opportunity to become an authority on a varied number of topics. Many of the topics addressed in editorial statements are about things that the writer knows little about, since in most cases he is not part of the day to day operating industry that he addresses. I am no different. I do not, have not, and have no intention of operating a cable television system. I have been told that is different from some publishers to this industry. What I have done is worked for an equipment supplier and I have worked on the technical/engineering support side of industry for a number of years. Prior to coming into communications I spent twelve years in aerospace. Hopefully you will think I started working at the age of eleven!

I am not an authority on engineering matters, my expertise comes in the field of working with people. I am smart enough to know that I do not even know enough about that to be an authority. I do know what I wish to accomplish. I have been termed idealistic and a do-gooder.

I will not publish material that will mislead the reader. I will publish any article that has merit to the technical people working in cable. You will not see definitions of terms in this magazine unless they have been agreed upon by an industry-wide group for adopted use. C/ED does not propose to be an authority, but it does propose to be authoritative This will be the result of the varied authors who contribute material to the magazine and to the outstanding group of technical people who serve on the publication's Editorial Advisory Board. It is doubtful that you will see contests in the magazine. You will always see a Reader Service Card so that you can communicate with advertisers. You will never have an advertisement confused with a diagram within an article. The magazine is printed on matte-finish paper for a reason—glare! The magazine is black and white (except for advertising) as a result of a design decision. You will not be addressed as an engineering journal might usually choose to address its readership. You should be able to read each article and learn something from it no matter what level of education or experience you might have reached. You will not be kidded.

You will not agree with everything that I have to say. I will make you mad, and I may make you laugh. I will hereafter, say my feelings as briefly and concisely as possible. You have more to do than read magazines. I might tell you to get your head out of the sand and start communicating with associated industries, and you might not like that. I also might tell you to think about the future and the welfare of the people working for you, and you might not like that either. The only thing that gives me the privilege to tell you what I think is that I am the publisher of this magazine.

If this industry does not start communicating with the world right now, the word "wired" will best describe your frame of mind and not the communications system in this or any other country. We've got a couple of things this month (as in the first three issues), that will help you start to share ideas with others. Kenneth Hancock begins a monthly feature from Canada. Bob Bilodeau states some problems about U.S.-Canadian communications policy. I almost didn't want to print Bob's remarks, but then I asked myself again, what do I want this magazine to do? Some of you think that the IEEE is too "heavy," so, you'll continue to see material from the IEEE just so that you can learn more and do your job better. You don't have to join IEEE to benefit from its existence. Take the tools and use them properly, as all other electronics based businesses do.

Jim Richardson uses his talent at dialogue to get your attention about SERI and how it might affect the cable industry. There will be a continued appeal for participation in the WARC effort.

We must stop talking to ourselves. We must make the first move instead of being the spear catchers. Cable TV reacts when it should have been there first. We must think clearly and positively. We must have the most up-to-date technical information available, and understandable, to every person employed in the broadband/cable television industry if we are to make some very important decisions concerning the future.

There! I said it and I'm glad.

Judith Baer

Judith Baer,
Publisher and Managing Editor

scte comments

Electronic Counter Measures . . .
And Counter Measures . . .
And Counter Measures?

TENSIONS ARE INCREASING ALONG THE BORDER—SECRETARY OF STATE KISSINGER HAS BEEN ASKED TO INTERCEDE—THE SITUATION HAS CAPTURED THE ATTENTION OF MANY INFLUENTIAL MEMBERS OF CONGRESS.

Does this suggest an Asian or Middle East conflict of the type we are accustomed to in current news stories? It's not. It heralds a dispute between otherwise friendly neighbors, the U.S. and Canada, over the right to television signals crossing the border. Two focal points are Vancouver/Seattle, Buffalo/Toronto.

Canada is committed to a program of asserting its social and cultural independence. In this particular case, vis-a-vis the dominance of U.S. television. One of the techniques employed by the CRTC (Canada's equivalent to the FCC) is to require, as a condition of operation of a cable system, the deletion of commercial time from U.S. signal carriage.

In Canada, cable systems have proliferated on the "attractiveness" of U.S. programming and play a much greater role in their overall communications network.

Cable operators are reluctantly accepting the requirement of commercial deletion as a condition of survival. The general feeling is one of unfairness towards U.S. licensees. U.S. signals represent a significant part of Canadian cable packages and U.S. broadcasters assume the Canadian audience, cable and off-air, in their net circulation.

Commercial deletion practices and Network pre-release in Canada have apparently driven the Buffalo broadcasters to their point of irrationality. The have made a "serious" proposal to the FCC to allow for the transmission of jamming signals on the frequencies used by Canadian licensees in Toronto—most of whom place a B or better contour over the Buffalo area. Ostensibly the basis for this proposal is one of retaliation.

The Canadian television policies may or may not meet the test of fairness over time. For U.S. broadcasters, or the FCC, to consider this renegade use of the airways seems counter productive and definitely not in the public interest—the yardstick that should always measure such use.

The next step in this precarious process might be for Canada to establish jamming stations coincident with the U.S. frequencies. Where does it end?

The solution, whatever it might be, should not include the sinking of ships in the canal or the junking up of the spectrum with spurious signals. Television reception is already a difficult enough problem given normal operation of the system.

Robert T Bilodeau
Bob Bilodeau
President, SCTE

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CCTA canadian column

Ken Hancock
Director of Engineering
Canadian Cable Television Association

"Canadian CARS band activities"

Early in 1975 the Canadian Department of Communications, the Canadian technical regulatory body for cable TV, issued its long awaited "Proposed Radio Licensing Policy for Very High Capacity Microwave Systems used in conjunction with Broadcast Receiving Undertakings." If you are staggering slightly from this mouthful of 'governmentese,' perhaps a little translation is in order. Very High Capacity Microwave Systems, or VHCM as it is now commonly called, is familiar to most readers as the CARS Band. Broadcast Receiving Undertaking is the Canadian Government official term for a cable TV licensee.

The expanding Canadian cable television industry had long awaited the opportunity to use AML and FML Systems for trunk-line replacement and other purposes. Because of this, the new government policy has seen remarkably swift implementation, despite the fact that it is still a proposed policy and has not seen final Gazetting at this time. Because of the extreme need for VHCM to improve the performance of the larger systems, the Canadian Department of Communications took the unusual step of permitting applications and issuing licenses before the policy had been finalized. There are already a fair number of VHCM systems in operation, geographically as far apart as Niagara Falls in the east and Vancouver Island in the west. Many other applications for both AML and FML systems are being processed at this time.

The delay in the use of the 12 GHz band for High Capacity VHF modulated microwave systems was occasioned by conflicting requirements for the use of the 12 GHz band. The originally proposed allocation for this band in Canada was for future high capacity data applications, the use of which was unlikely to be required for about 10 years. Considerable discussions and negotiations with the Department of Communications took place to allow use of this band by cable TV and other video users.

There are certain differences between the VHCM policy and CARS band usage in the United States. For example, although the frequencies of initial use of VHCM is the same as that for CARS band, that is 12.7 GHz to 12.95 GHz, a further 300 MHz of spectrum, i.e., from 12.95 GHz to 13.25 GHz is held in reserve for the time when it is required in any particular area. The use of VHCM, although directed primarily towards cable TV systems is not limited to this

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announcements/new products

CTIC TWO-WAY EXPERIMENT

The Cable Television Information Center, Washington, D.C., will join the Illinois Division of Vocational Rehabilitation in an experiment in providing rehabilitation services via interactive cable to severely handicapped individuals in Peoria, Illinois.

In announcing the center's participation Sheila Mahony, executive director, noted that the project marks the center's first venture into an actual demonstration of cable technology. Stanley Gerendasy, director of applications, will serve as project manager for the center.

CTIC will be principally responsible for technical and production support in the delivery of programs, and will work closely with curriculum planners in the adaptation of program ideas to the interactive cable format.

The first year of the project will be devoted to planning, including the identification of clients, definition of rehabilitation and vocational goals, analysis of the job market and program development. Actual programming begins in the spring of 1976 and will continue for two years.

G.E. Cablevision which now serves Peoria will be the system used in the experiment.

Cable Television Information Center, a part of The Urban Institute, is a private, nonprofit advisory group which assists local governments in the development of cable television in the public interest.

Factory Testing—*Performing the factory acceptance tests for this first Canadian array of high power AML transmitters and accompanying receivers purchased from Theta-Com of Phoenix are (left to right) Alberta Government Telephone Company representatives Reg Minty, engineering acceptance; Art Lerohl, equipment installation; Leonard Klimek, engineering design; and Theta-Com's supervisor of AML quality assurance James Randolph. Tests for the equipment were performed within less than three weeks from the time the order was placed.*

FIRST CANADIAN HIGH POWER AML SYSTEM OPERABLE

PHOENIX—The first Canadian high power VHCM (AML) system, purchased by Alberta Government Telephone Company from Theta-Com was placed in operational service within 30 days after being ordered.

The system was installed and energized less than five days after the microwave gear cleared Canadian customs.

The new AML system delivers six television channels and the entire FM broadcast band to cable subscribers in four initial communities within a 23-mile range of the transmitter located in Edmonton, Alberta.

Short range plans call for construction of cable systems, fed by additional AML receivers, in other adjoining communities. Expansion beyond the initial signal carriage will be accomplished by just adding additional transmitters.

Theta-Com, subsidiary of Hughes Aircraft Company, manufactures, markets and services a complete line of CATV and microwave equipment throughout the world and also designs and constructs complete CATV systems on a turnkey basis.

AVANTEK IMPROVED TDR CABLE ANALYZER

Avantek, Inc., Santa Clara, CA in response to customer feedback and results of extensive field trials, is introducing a new version of the unique

continued on page 8

announcements/new products continued

CA-100 Cable Quality Analyzer. Several important improvements and additional features makes the new unit, the CA-100A more flexible and accurate than its predecessor.

The CA-100A, like the previous unit, detects even small high or low impedance faults in 75-ohm coaxial cable runs of up to 4,000 feet identifying the nature and severity of the fault. It will detect opens, shorts, frays and crimped cable as well as faults in splitters and can also be used to detect faults and accurately find the length of cable while still on the reel. It will "look beyond" discontinuities on a cable, or beyond several splitters or other in-line devices, to find faults further along the cable run. Unauthorized connections to CATV drops can be detected even when isolated with a splitter.

Low and high impedance faults are separately detected and displayed on unambiguous indicator lamps, making it unnecessary to interpret oscilloscope or chart recorder traces. Distance to the fault is displayed on a digital dial.

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CANADIAN COAXIAL NETWORKS SET

Canadian Communications Minister Ian Turnbull announced that the Manitoba Telephone System will proceed with construction of a Local Broadband Network (LBN) in Brandon. The decision to proceed with the LBN was made by the Board of Commissioners of MTS at a board meeting Oct. 20, 1975.

The LBN, which consists of coaxial cables centered on MTS' new 18th Street office, will be the first full-city LBN in Canada. Similar networks have been approved for Portage la Prairie and Selkirk, with a capital cost of $1 million for the three networks.

The minister said the Local Broadband Network is a new concept, and the use that is made of the non-broadcast channels on it will depend in part upon the demand for various services by community groups, businesses and institutions in Brandon, and in part upon the kind of marketing job that MTS does.

Mr. Turnbull said in the past there has been some demand for these kinds of services in Winnipeg, but the Winnipeg systems were designed in 1967 primarily for CATV use. As a result, the expense of doing the necessary modifications to the already existing plant makes the costs of bringing in these kinds of services too high.

"With the LBN concept, costs of adding non-broadcast services will be lower, so we look to the LBN in Brandon, Portage la Prairie and Selkirk as a means of exploring the parameters of public demand for some of the so-called "Wired City" services.

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A new Model 600 Radar Cable Test Set developed by the James G. Biddle Co., Plymouth Meeting, Pa., approximates the location of faults on loaded telephone lines.

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Contact the James G. Biddle Co., Township Line & Jolly Roads, Plymouth Meeting, Pa. 19462. (215) 646-9200

announcements/new products continued

SCTE CALIFORNIA CHAPTER MEETING

The No. Calif. Chapter of the Society of Cable Television Engineers will hold their winter meeting and technical seminar on Sat. January 31, 1976, in Monterey, CA. The topic of the technical presentation will be "CATV SIGNAL PROPAGATION, HOW AND WHY," presented by Prof. Richard Adler, resident at the U.S. Naval Post Graduate School in Monterey. Adler is well versed in the field of propagation and will offer information on Satellite calculations and usable data rather than the usual "buzz" word scenario.

Admission is free to SCTE members. Non-member charge will be $4.00. The meeting will be held at 10:00 a.m., in Room 122 of Ingersoll Hall, NPG School, Monterey, CA. The host is the Monterey County sub-chapter of SCTE, Larry Flaherty, Chairman. For information, call Larry Flaherty at (408) 373-4171 or Frank Bias, SCTE Western Vice Pres. at (415) 829-1811.

JERROLD EXPANDS PAY-TV LINE

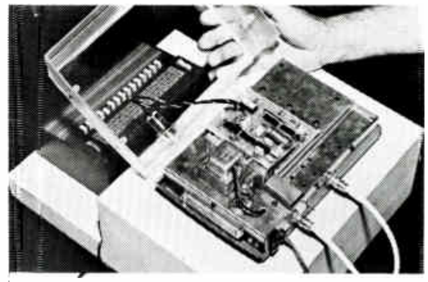
At the Western Cable TV Show in Anaheim, CA. Jerrold Electronics introduced a single-channel mid-band converter/descrambler designated model DST-1C. . ., to complement Jerrold's successful low VHF descrambler, Model DST-1.

The new converter/descrambler converts and descrambles Channel H to Channel 2 or 3.

The built-in converter is crystal controlled and the terminal is field retrofittable to permit descrambler operation in conjunction with CATV set converters in the future.

The DST-1C converter/descrambler will be available for delivery to CATV system operators in March, 1976. Jerrold's multi-level descrambler, Model DST-4, also will be available for delivery in March, 1976.

For additional information, contact John Sie, Mgr., Terminal Home Products, Jerrold Electronics Corporation, 200 Witmer Rd., Horsham, PA 19044.



NEW NCTA IOB CHAIRMAN

Mel Gilbert, an independent cable operator from Snyder, Texas, was appointed Chairman of NCTA's Independent Operators' Board December 8 at the meeting of the NCTA Board of Directors in Washington, D.C.

Gilbert, operator of Snyder Community Antenna TV, has been active in NCTA legislative and government affairs for 15 years and is currently a member of the IOB. Gilbert has twice served as president of the Texas CATV Association. He replaces Joe Kusky who resigned as IOB Chairman last month.

proof of performance timetable

when to do it — how to do it . . .

subpart k channel frequency response

Glenn Chambers
Regional Engineer
American Television & Communications
North Central Division
Appleton, Wisconsin

76.605 TECHNICAL STANDARDS

(8) The channel frequency response shall be within a range of ±2 decibels for all frequencies between −.75 MHz and +4 MHz of the visual carrier frequency.

The response of each video signal carried on the system must be flat within ±2 dB from .75 MHz below the visual carrier to 4 MHz above the visual carrier. The response of the system, the processors and the modulators must be checked. The specifications should be easy to meet or exceed on most systems. It will mean either burning the midnight oil or removing each channel from service, one at a time, for a few minutes. I prefer to do the tests in the early morning, from 1 a.m. to 6 a.m. There is less traffic and fewer irate callers.

We make our first tests at the headend, record the results, and take a photo of the response of each channel. This allows us to do any needed repairs or alignment before starting the field tests. The photo can be used as verification of the test and for future reference. I suggest marking the photo, as soon as possible and before applying sealer, with the tip of a knife or sharp tool. It should have the date, time, channel number, and amount of response deviation. See *Photo 1* for an example.

I will describe two methods of performing the tests. Method 1 uses a noise generator for the signal and a spectrum analyzer. This is a quick, easy and accurate way to make the tests. Method 2 uses standard sweep gear found in most systems. Either method is acceptable by the FCC.

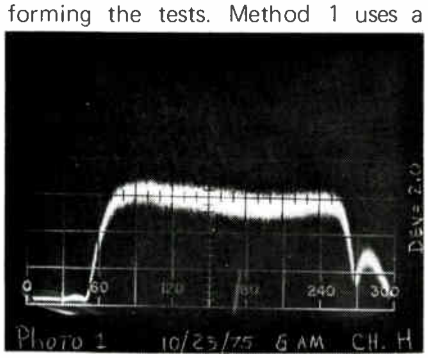


Photo 1.

METHOD 1: NOISE SIGNALS

Equipment Required:

1) A Sadelco* 260-A Analyst.
2) A variable marker or CW sweep generator.
3) A spectrum analyzer, either commercial or homemade.
4) A frequency counter. (Not absolutely necessary, but very helpful.)
5) A variable attenuator.
6) Two two-way splitters.
7) Assorted jumper cables.

For the field tests, you will need two-way communications from the field locations to the headend and an AC source.

If your system does not own a Sadelco 260-A Analyst, a pretty good substitute for this type of measuring is a flat, high-gain post amp (about 30 dBmV gain) such as the Kay 1024-A transifier. Terminating the input will give you a fairly linear noise source, if the amplifier is flat. This noise can usually be used to sweep a processor directly. If the level is too low (usually −20 dBmV) for a response, it can be amplified through another amplifier, since it is a signal. *Drawing 1* shows a "closed loop" method of connecting amplifiers to achieve a fairly high noise signal. It's kind of like pulling yourself up by your bootstraps, but it works. On some amplifiers, a pad must be inserted at the input of amp No. 2 to prevent overload and/or self oscillation.

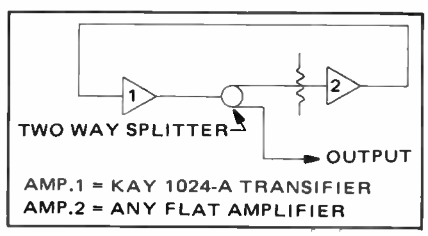
PROCEDURE:

Turn on the noise generator and connect it to a SLM. Adjust the generator output to approximately +10 dBmV. Tune the marker generator to the visual carrier frequency of the channel to be measured. Connect its output to the SLM and adjust the output to about +5 dBmV. Connect the test equipment as shown in *Drawing 2*.

Note: To obtain proper response from most processors, we have found that disabling the AGC is necessary. Since each make and model is different, consult the service manual on your equipment if disabling is necessary. The +10 dBmV noise signal will usually keep your standby oscillator turned off. If not, disable it also.

Switch in pads on the attenuator until you have a response pattern on the analyzer similar to *Photo 2*. Remove attenuation from the marker generator until the birdie is just barely visible. Too much marker signal will severely distort the trace.

continued on page 12



Drawing 1. Noise Generator

proof of performance timetable continued

With the trace centered vertically on the analyzer, mark the location of the birdie with a soft grease pencil. Switch in 2 dB more attenuation on the variable attenuator and draw a grease pencil line across the screen at the birdie point. Switch OUT 4 dB attenuation and draw a line at this point. Reinsert 2 dB of attenuation and the birdie should return to the center mark. You have now established your ±2 dB reference lines. They will be used both in the headend and the field on each channel.

Watching the frequency counter, slowly tune the marker generator to .75 MHz below the visual carrier frequency. For example, if you are checking Channel 2, the visual frequency is 55.25 MHz. You would tune down to 54.50 MHz. If the birdie is still between the two lines, the low frequency measurement is good.

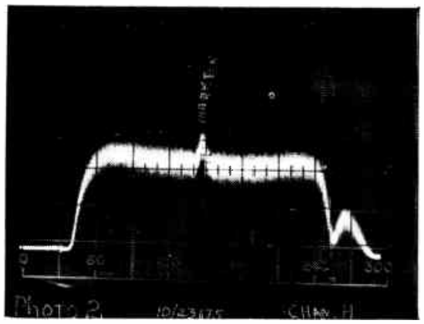


Photo 2.

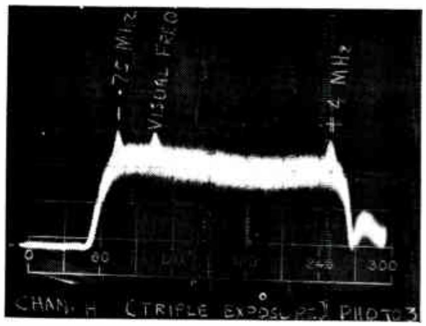
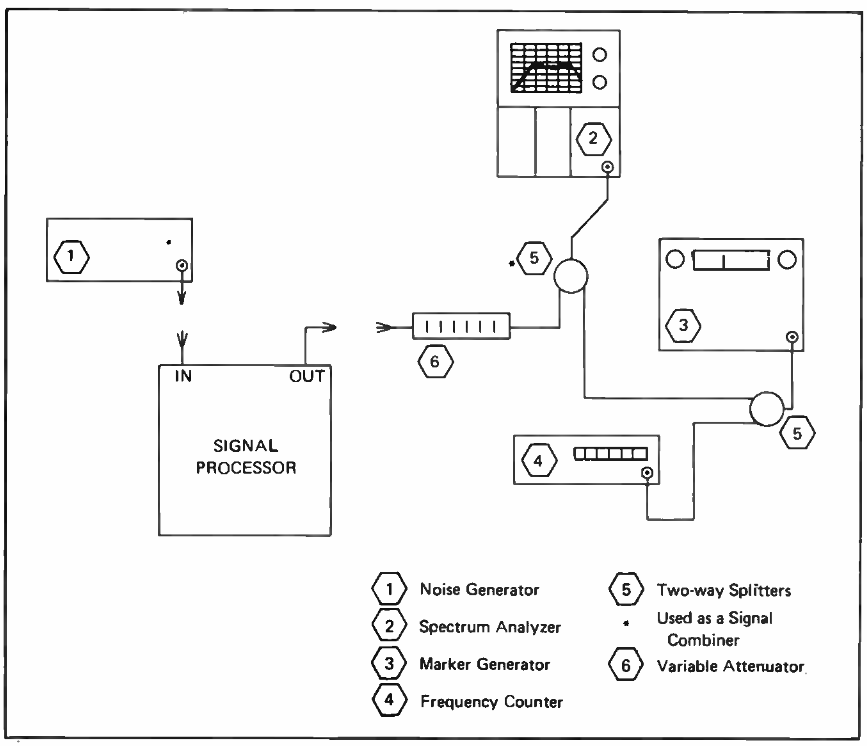


Photo 3.



Drawing 2. Channel Frequency Response

Tune the marker back past the visual frequency and up 4 MHz (to 59.25 MHz on Channel 2) and again make sure the birdie stays within the lines. If the birdie is outside the lines on either test, the processor must be repaired and/or aligned. Continue through all the processors in this manner. Record the results of each test and if possible, make a photo. ***Photo 3*** is a triple exposure showing the visual frequency marker, the -.75 MHz marker and the +4 MHz markers all at once.

When all the processors are correct, leave one man and the noise generator at the headend. You might also leave him a good book to read—this is a boring job. Drive out to the first field test point. Field connection of the test equipment is the same as for headend tests.

Connect the test equipment to your field test point and call the headend man to connect and turn on the noise generator. Proceed with the tests exactly as before until each channel has been tested and logged.

Some systems connect the noise generator to all processor inputs at once through splitters, to eliminate leaving someone at the headend. We have experienced some problems with this method. With adjacent channels, it's very hard to identify which channel you are on and in some cases, the response patterns actually interfered with each other. Also, the output of the generator is quite low, if you split it a number of times to feed several processors. The main reason for a man at the headend is that we are also performing other tests (signal-to-noise, etc.) at the same time. Besides, it's nice to know that someone else is awake and is as sleepy as you are.

METHOD 2: SWEEP SIGNALS

1) A stable sweep generator with variable sweep width.

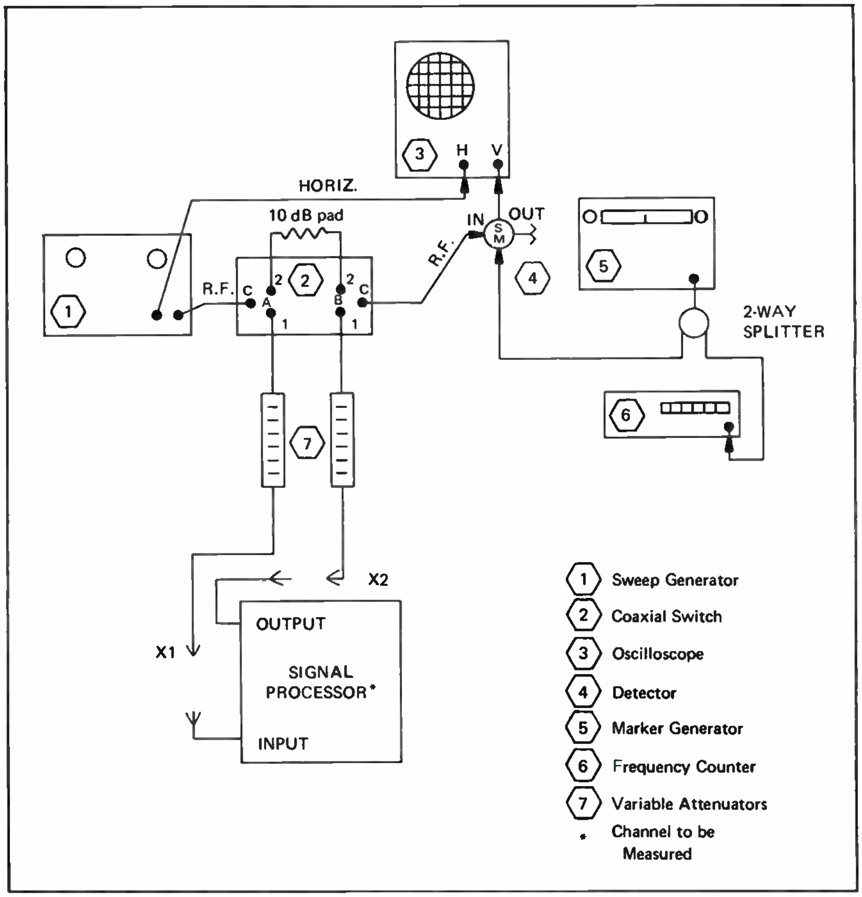
2) A variable marker generator.
3) An oscilloscope.
4) A frequency counter. (Again, not necessary, but very helpful.)
5) A detector.
6) Two variable attenuators.
7) Assorted jumper cables.
8) A coaxial switch.

For the field tests you will also need:
a) Two-way communications from each test location to the head-end.
b) A phasing unit for the oscilloscope.
c) An AC source.

This is the same equipment needed for processor or amplifier alignment. Connect the equipment as shown in *Drawing 3*.

Adjust the equipment to provide a trace on the scope screen as if for sweep alignment. Tune the marker generator to the visual carrier frequency and mark the position with a grease pencil. Follow the same measurement procedures as detailed in *Method 1*.

When performing the field tests, use a phasing unit to lock the horizontal frequency of the scope. The field tests are simply single-channel summation sweeps.



Drawing 3. Channel Frequency Response

MODULATORS:

Modulator sweeping requires the use of a special 0-6 MHz sweep generator such as the Texscan Model WB, if complete sweeping is desired or necessary. We have found that sweeping and alignment of the video input section is rarely, if ever, done in CATV systems. The usual procedure is to insert the sweep or noise source at the input to the I.F. and then test the modulator as if it were just a processor.

I would like to give special credit to one of my bright young men, Mr. Daniel Wynen, for his help, suggestions, ideas and patience on many of these articles and projects.

canadian column continued

use, and can be used by other applicants such as those requiring carriage of radar baseband signals.

It is expected that the implementation of VHCM systems in Canada will continue at a fast pace for several years using both AML and FML systems. This of course coincides with major redesign of many of the larger systems to implement hub distribution, multiple headends, two-way operation and many of the other techniques coming into use today.

ncta technical topics

what is going on in washington?

A LOT IS GOING ON IN WASHINGTON

WHEN

A lot has been going on lately. Some of it will affect us technically in various ways, depending upon each individual circumstance. This might be termed the post FCC Cable Technical Advisory Committee (CTAC) era because much of it is inspired by, and will be influenced by, the information, suggestions, and recommendations generated by that body.

WHO

The organizations involved in these recent activities include the following: The Federal Communications Commission (FCC), Electronic Industries Association (EIA), National Association of Broadcasters (NAB), Public Broadcasting Service (PBS), National Science Foundation (NSF), and, of course, the National Cable Television Association (NCTA).

WHAT

The FCC is considering the suggestions and recommendations made by CTAC, primarily with respect to the measurement requirements. NCTA, NAB, and PBS have submitted petitions and comments on petitions on a variety of technical subjects. NSF is considering supporting a project involving subjective testing of viewers' reactions to cable TV signals under typical cable operating conditions. EIA is organizing efforts under the EIA Broadband Communications Section and the NCTA Engineering Advisory Committee to develop industry standards. These standards will probably be aimed at definitions, equipment specifications, compatibilities of equipment and system interconnection, methods of measuring, and things related to good engineering practices, among other things.

I will try to identify the more interesting features of these activities.

HOW

CTAC

First, with respect to the FCC. Contained in the CTAC material are a prodigious collection of suggestions, recommendations and questions prompting further inquiries. It will take years before all of them can be appropriately considered. A set of priorities obviously must be used in selecting the order in which they will be resolved. The first ones under consideration involve isolation between subscriber taps, converter stability and subscriber signal levels. With respect to the set-top converter frequency stability, the question with respect to a reasonable length of time is being considered in place of the present frequency tolerances. This is in accordance with the recommendation made by CTAC and is more in line with realistic operating requirements. Changes with respect to the methods of measuring and recordkeeping as now reflected in the rules are being considered for the other two terms. It should be emphasized that, in any of these changes that may take place with regard to official rules, in no way do they relieve us of our obligation to exercise good judgement in maintaining good engineering practices in the daily operation of cable systems.

Non-Duplication

NCTA has filed petitions and comments on a number of technical subjects during the past few months. The first one is with respect to a logical and fair basis for justifying a waiver of the non-duplication rule. NCTA proposes that, if the primary station's signal level does not exceed a Grade B signal strength value over at least 50 percent of the community served by the cable system, the cable system be allowed to waive the non-duplication requirement. The determination of the signal strength value is to be made by actual measurements following a pro-

NATIONAL CABLE TELEVISION ASSOCIATION
918 16th Street, N.W., Washington, D.C. 20006 • (202) 466-8111
Delmer C. Ports, Vice President-Engineering • Hazel S. Dyson, Administrative Assistant

cedure that has been developed through experience with TASO and FCC activities. The proposed procedure is consistent with the present FCC Rules. With respect to the secondary station, if the signal strength from this station is more than the Grade B value, again as shown by measurements in the area served by the cable system, then again the non-duplication requirement should be waived. In communities exceeding 500,000 the Grade A signal levels are recommended as the criterion. The rationale for this is clear: non-duplication protection should not be provided where a primary station does not serve because it cannot lose what it does not have. Non-duplication service is not necessary in areas where the secondary stations serve anyway, since the TV viewer simply has to switch to his rabbit ears to get the signal. This petition attempts to provide an easily administered logical basis for adjusting two inequities due to propagation in the non-duplication rule.

Signal Strength

In another petition, the NCTA is responding to a request for comments regarding the use of fixed mileages instead of signal strength contours for the purposes of regulating the mandatory carriage of broadcast signals on cable. This inquiry was prompted by the FCC's adoption of rules, changing the method of computing predicted field strength contours for TV and FM signals. NCTA is supporting the concept of using fixed mileage zones in place of signal strength contours for those cases where the Grade B contour is now used as the criterion of required carriage. Seventy-five miles is suggested as a radius for VHF and 55 miles for UHF stations. This suggestion, however, is based on the condition that these signals be required to meet certain minimum standards of signal strength and video waveform tolerances so that the cable system is ensured of an adequate quality signal for distribution on the cable system for those signals it is required to carry. The proposal involves signal strength measurements made at the headend site and waveform measurements made on off-the-air monitors substantially in accord with present broadcast standards. They are to be made by the broadcaster requesting carriage in order to justify mandatory carriage in those cases where the cable system operator wishes to challenge the request. The measurements involve equipment normally used by TV broadcasters; thus, it will not require any substantial new investments.

The objective of this proposal is to develop an equitable balance in the sources of degradation from the origination to the viewer.

FM Aural Carriage

NCTA has also commented on petitions filed by other sources. NAB has petitioned the FCC requesting that local origination of aural programming in the FM band be restricted unless all the local FM signals are carried by the cable signal. The intent of this is to avoid any loss of listeners by an FM signal that may not be carried by the cable system when a subscriber connects to an FM tap on the system. Our rebuttal to this is that this rule is not necessary since most of the homes where FM taps are supplied have two or more FM receivers and therefore a listener is not necessarily lost to a local FM station by subscribing to the cable.

Translators

In an action involving translators, the FCC proposes to allow the use of FM microwave relays for the importation of TV signals for translator use at unlimited distances from the master station. We are proposing that this represents a class of satellite transmitters slaved to a master station and is no longer a simple translator under the original concept of translator operations. They should be governed, therefore, by an appropriate set of new rules and not simply by an extension of present translator rules.

Coded Transmission for the Deaf

PBS has filed a very interesting petition requesting that line 21 in the vertical interval of the Standard NTSC video wave format be set aside for the exclusive use of a coded transmission providing a signal carrying subtitles for deaf viewers. The population of television viewers with impaired hearing is surprisingly large and their appreciation of normal television programming is limited. With this proposal, a deaf viewer with a relatively simple decoder at his receiver could enjoy the program with the voices appearing as subtitles at the bottom of the picture. NCTA is supporting this proposal through comments by the Joint Council of Inter-Society Coordination, which is responding. We are, however, proposing that the operation be on a non-exclusive basis in order to encourage development of other uses. We are also proposing that it be permissible for a cable system to install the decoder at the headend and supply the program for deaf viewers on an alternate, unused channel so that they need only to subscribe in order to avail themselves of the service rather than having to buy a decoder. On this basis, the program would be carried on two channels—the first with the normal signal and the second with the subtitles. This would be on a permissive basis and, of course, would be usable only in those cases where channel space is available.

Channel Planning

The Constant Interval Plan discussed by CTAC is getting attention in a number of places. However, this is a very complex subject that deserves a separate discussion and will be treated in a later episode.

No one can predict how many of these actions will work out, but the next few months most certainly will be interesting.

c/ed special report: the VIR signal

THE PURPOSE OF VIR SIGNALS

The VIR signal is intended to reduce undesirable variations in color throughout the television system by assisting television producers and operators (both over-the-air broadcasters and cable operators) in adjusting various signal parameters so that different programs and program segments have similar amplitude and phase characteristics whether viewed sequentially on the same channel or on different channels. The signal is inserted during the vertical blanking interval of a color television program and is a program-related reference signal. It is associated with a particular television program as an operational tool for checking parameters of that program and is a reference for that program.

The VIR signal is not intended to provide quantitative data on transmission distortions, The Vertical Interval Test (VIT) signal provides that information.

HOW TO USE THE SIGNAL

Since the VIR signal is associated with a specific program, it is inserted into the program signal at a point in the video system only where both the correct amplitudes and phase of the composite color signal are established and artistic judgment made that color reproduction is as it should be. According to the Society of Motion Picture and Television Engineers, it is the responsibility of each production organization, operators and producers, to make such artistic judgment, and when the VIR signal is inserted in the proper manner, the signal represents a certification of and a reference for the program signal.

When the VIR signal is inserted into the program signal, it is to be handled exactly like the program signal in all equipment through which it passes. Therefore, the signal will always correspond to the program. When adjustments are required to restore a VIR signal to its proper characteristics at any point in the video system the program has been re-established to essentially the same characteristics as upon initial certification. The VIR signal inserted at the point of certification remains with the program to its final destination. The only exception to this practice would be at the point of recertification, as at an assembly point of various program segments.

SIGNAL LOCATION AND FORMAT

The Federal Communications Commission approved exclusive use of line 19 of both fields for the VIR signal. At either origination or recertification points, the proper VIR signal should be inserted in line 19. Nominal waveform of the VIR signal is shown as Figure 1 in the article titled "A Brief History of the VIR" in this issue of C/ED. Chrominance reference and program color burst have the same phase and amplitude in the format.

USING THE VIR SIGNAL WITH VIDEO TAPE RECORDERS

This is one important application of the VIR signal. The signal is used in the adjustment of a reproduced video tape recording and this use applies to all video tape formats used for broadcasting. It is important both for playback of a single tape and for sequential playback of a series of short commercials and program segments.

The signal is added to each video tape before duplication of final release copies, but after correct signal parameters are established. Any artistic judgments are made as to proper color reproduction at this point. When this has been accomplished the program is considered certified.

When the signal is present on a signal recorded on a video tape recorder, it is recorded and appears during playback at the output of the recorder. The signal as passed by the VTR is considered as reference for both manual or automatic adjustment of reproduced signal characteristics such as luminance amplitude, black-level amplitude, sync amplitude, chrominance amplitude and color burst amplitude and phase. In a quadraplex VTR, the VIR signal is recorded by only one head.

VIR vs VIT

Since the VIR signal is intended for association with a particular television program as an operational tool for checking parameters of that program, it is not intended to provide quantitative data on transmission distortions. A Vertical Interval Test (VIT) signal is the diagnostic test signal intended to monitor and measure characteristics of a transmission device or facility. The VIT signal is not associated with any individual program.

The VIR signal stays with the program from the point of insertion to final destination. A VIT signal is generally used only over portions of the television system and might be deleted and reinserted point by point.

When repeated observations of the VIR signal at a distant location show there is a consistent error, a VIT signal should be used on the transmission facility to analyze distortion condition and determine what corrective action should be taken. The VIR signal is not considered to be a substitute for a VIT signal.

Simply stated, the VIT signal gives information about errors that might exist in the transmission system through which they pass for correction in the future. The VIR signal provides necessary information to make corrections to existing program signal in order that the best possible picture may be obtained in the presence of defects. The VIR signal is treated in the same way as picture information, whereas VIT signals may be treated differently or even removed at certain parts of the system.

MORE INFORMATION AVAILABLE

Write to the Electronics Industries Association, Engineering Department, 2001 Eye Street, N.W., Washington, D.C. 20006 for more information on VIR and VIT signals. EIA has recommended practice books available on these signals.

Broadcast, Cable, and Consumer

By Howard T. Head
President, Broadcasting Group, IEEE

The recognition of the television broadcasting and cable distribution system as a unified entity took a giant step forward on January 1, 1976, when the Institute of Electrical and Electronics Engineers (IEEE) established its Broadcast, Cable, and Consumer Electronics Society. The formation of the new IEEE Society effects a merger of the existing Broadcasting Group, the Consumer Electronics Group (formerly the Group on Broadcast and Television Receivers), and the Coordinating Committee on Cable Communications Systems (CCCCS).

It is intended that the activities of the new Society encompass all technical matters beginning with the original scene to be transmitted (in the case of television), through all modes of transmission whether by broadcast, cable, or both, and concluding with the final display on the receiver kinescope in the viewer's home. The new Society's Constitution provides that "The field of interest of the Society shall encompass devices, equipment, techniques, and systems related to broadcast, cable communications and consumer electronics. This definition includes origination technology, distribution by broadcast or cable, receiving and reproducing equipment and other electronic equipment normally used by the consumer for entertainment, educational, informational or leisure time activities. The field of interest of the Society may be enlarged, reduced, or otherwise revised as the needs of the occasion indicate. Such revisions shall be processed as an amendment to this Constitution." Thus a scope of interest is provided which takes into account not only the present uses, but unfolding new developments in broadcast, cable and receiving equipment technology.

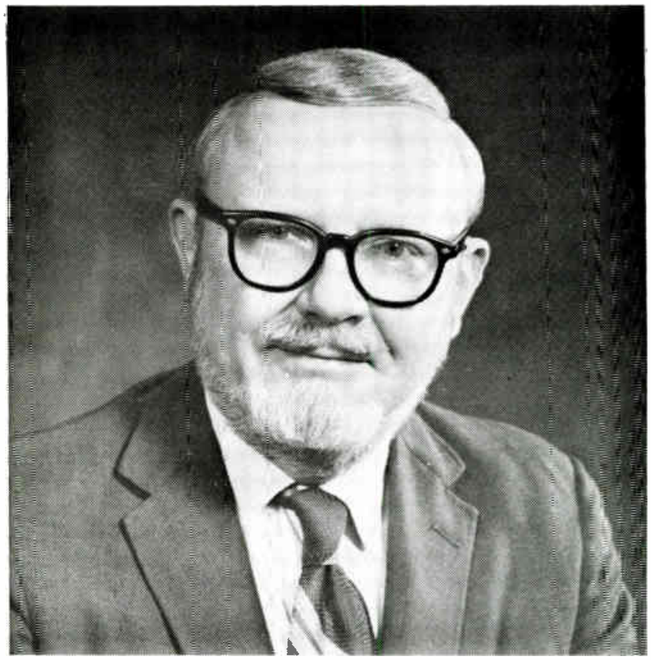
The initial membership of BCCES will consist of the present members of the Broadcasting Group, the Consumer Electronics Group, and the CCCCS. Provision is made for the participation as affiliates of other technical and professional organizations, such as members of SCTE. Initially there will be no change in the present series of annual meetings, which include the Fall Broadcast Symposium and two semi-annual Consumer Electronics Technical Conferences. The publication of the Broadcasting Transactions and the Consumer Electronics Transactions will continue, and plans are already under way for a joint newsletter to include information of timely interest to all

Electronics

persons interested in broadcast, cable and consumer electronics activities.

The management of the affairs of the new Society will be vested in a nine-man Board of Governors. Initially these nine members will be drawn equally from the present representatives of the Broadcasting Group, the Consumer Electronics Group, and the CCCCS. These administrative committees will continue to function as at the present time, subject to the supervision, oversight, and approval of the Board of Governors. Existing committees will continue to function with coordinating committees on such matters as Publications, Meetings, and Standards being established by the Board of Governors as promptly as possible.

The formation of the new Society reflects an important step in bringing about improved cooperation among the various components of the broadcast/cable system, and should lead to improved performance and operation as reflected in both quality and economy in terms of the ultimate product delivered to the viewer's or listener's home. The formation of the new Society reflects work extending over the past several years. Particularly instrumental in bringing the new Society into being were Harris O. Wood, former President of the Consumer Electronics Group, Archer S. Taylor, Chairman of the CCCCS, and Howard T. Head, President of the Broadcasting Group. All persons interested in the activities of the new Society, either as members of the IEEE or as affiliate members through SCTE, are urged to communicate with Dr. Richard M. Emberson, Director of Technical Services, IEEE, 345 East 47th Street, New York, N.Y. 10017.



Howard T. Head has been a partner in A. D. Ring & Associates, Washington, D.C., since 1953, and active in the electronics industry since 1941. He is a popular lecturer and the author of numerous technical papers. He is the Washington Editor for Broadcast Engineering magazine and authors a monthly feature, "Direct Current from D.C."

Mr. Head is a Senior Member of IEEE, a member of the Technical Activities Board, President of the Broadcasting Group, Former Chairman of the Washington Chapter of the Broadcasting Group, member of the Coordinating Committee in Cable Communications Standards, member and Past President of the Association of Federal Communications Consulting Engineers, a member of SMPTE, SBE and SCTE.

He has served on the executive and steering committees of CTAC and as Chairman of CTAC Panel 8, Television System Coordination. He is Chairman of the Cable Television Standards Committee (CTSC) of the Electronics Industry Association. He has been a member of the Television Allocations Study Organization (TASO) and various other industry committees.

A Brief History of the VIR:

C. Bailey Neal
Manager, Advanced Development
GTE Sylvania
Schenectady, NY

C. Bailey Neal completed his engineering education under a Canadian Government war-time program in 1942. Through 1946, while employed by RCA Victor, Montreal, Canada, he was engaged in the design of military and commercial communications equipment and, after the war, of radio and television receivers.

In 1963 he joined Sylvania Electric Products (now GTE Sylvania) as Engineer-in-Charge of color television receiver design, advancing to Manager of Advanced Development in 1966. During this period he has been concerned with the design and development of television receivers and flying-spot color film camera systems.

Mr. Neal is Chairman of the EIA BROADCAST Television Systems Committee, a member of the SMPTE Television Technology Committee, a member of the Subcommittee on System Colorimetry of the SMPTE Television Committee, a member of EIA Television Receiver Committees and of now inactive IEEE, EIA and FCC committees related to cable television systems and cable receivers. He has published five papers (and has one pending publication) and holds 11 patents.

As television broadcasts and consumer television receivers made the transition from monochrome to color, significant variation in color characteristics observed on home television receivers, from program to program and station to station, became increasingly evident. At the suggestion of the Society of Motion Picture and Television Engineers (SMPTE), a meeting of the Joint Committee for Inter-Society Coordination (JCIC) [1] was called in 1968 to determine the most effective way to deal with this problem. The JCIC, representing the Electronic Industries Association (EIA), the Institute of Electrical and Electronics Engineers (IEEE), the National Association of Broadcasters (NAB), and the SMPTE, agreed that an Ad Hoc Committee should be set up to:

(a) Examine the entire television system from the original scene, through all equipment, to the picture viewed in the home.
(b) Determine the origin of significant deviations in color in the received picture.
(c) Allocate to existing industry organizations questions for further investigation and resolution.

The JCIC Ad Hoc Color Television Study Committee was formed and took several steps toward resolution of the problem. One such step [1], which ultimately led to development of the VIR signal, was organization of a Signal Standards Task Force, to arrange laboratory tests which would determine the effect of video signal waveform variations, within approved specifications, on receiver performance and variations in performance among several transmitters in one city.

The Signal Standards Task Force conducted these tests December 18 and 19, 1968 at the laboratories of Hazeltine Research, Inc., Chicago, IL. Results of the tests were reported in detail in a private committee document [2] and summarized in the Journal of SMPTE [3]. These tests revealed the potential for significant variation, in color characteristics observed on home receivers, with signal specifications within the limits permitted under FCC rules. The test data was turned over to the EIA Broadcast Television Systems Committee (BTS) for further investigation and recommendations. The tests which included transmitters and propagation paths also showed definite variations in color characteristics. Additional tests were planned, implemented

Vertical Interval Reference Signal

by a JCIC Subcommittee on Transmission and Transmission Paths and results submitted in a report to the JCIC Ad Hoc Committee for Color Television Study [4].

VIR DEVELOPMENT

The BTS Committee met April 2, 1969 to consider the results of the Chicago tests and to plan a course of action. The indirect relationship between burst amplitude and chrominance amplitude, specified by FCC rules, was reviewed and a significant variation in their ratio (due to tolerance build-up) was calculated. Control of this relationship is needed because subsequent to the adoption of the FCC rules, it has become common practice to use the burst amplitude as reference for automatic chroma gain control in receivers. The development of a convenient reference through which, at locations distant from the point of program origination, the correct relationship between chrominance and burst amplitude and phase could be verified, and, if necessary, reestablished, was identified as an urgent need. A Task Force was set up to study the problem further.

The Task Force concluded that, by referencing the burst amplitude and phase to the chrominance signal resulting from a video signal inserted at the earliest practical point in the studio-transmitter chain, it would be possible to monitor and control their relationship at any point in the system from the point of insertion to the transmitter output. Although the initial emphasis was on the burst to chrominance relationship, it was evident from the outset that the luminance and black levels and the luminance to chrominance ratio were as important and that the sync to luminance and burst to sync ratios were needed for complete signal specification. After considering several alternatives, the Task Force proposed a specific reference signal which, it considered, would provide simple and convenient means for observation and measurement of the critical relationships between luminance and black level, luminance and chrominance, burst and chrominance, sync and luminance, and burst and sync.

They concluded that the reference signal should be located as close to the beginning of the picture as possible and selected line 20* as its proposed location.

The BTS Committee considered the proposal from its Task Force and decided that monitoring and control could be accomplished more accurately if the proposed reference signal was redefined so that the nominal chrominance to burst ratio was 1.0 and the chrominance phase was identical to burst. At the November 25, 1969 meeting of the BTS Committee, the Task Force was replaced by a formal Ad Hoc Subcommittee with several broadcasters as members. This Color Reference Signal subcommittee was charged with the design of a color reference signal that was suitable for insertion into an encoded program.

The Ad Hoc Subcommittee proposed various signal formats. Extensive BTS Committee discussion of these signal formats was continued into 1970. One was chosen as optimum and a generator was constructed for that signal. The rationale for the particular format of the VIR signal (***Figure 1***) is as follows:

1) The signal does not use the full excursion from blanking to reference white so that a small amount of signal compression will not affect the reference to any great extent.
2) The chrominance reference bar of subcarrier is set on a pedestal of 70 IRE units to approximate the average luminance level of skin tones in typical scenes.
3) The chrominance reference bar is placed at the beginning of the line so that phase is least affected by velocity errors in video tape recorders.
4) Amplitude and phase of the chrominance reference are identical to those of the color burst for ease of comparison.
5) The black reference allows normal setup level to be re-established.
6) A quick check of relative luminance and chrominance amplitudes can be made comparing the lower subcarrier excursion of the chrominance reference with the nominally equal luminance reference. (Valid only in the linear system.)

Various laboratory tests and demonstrations were made to ascertain the VIR signal behavior with stabilizing amplifiers, video tape recorders and actual studio situations. The

*Subsequently, when a petition to the FCC relative to the VIR Signal was prepared, it was decided to request allocation of line 19 for this purpose.

signal appeared to be satisfactory in all respects. Accordingly, three additional prototype VIR signal generators were constructed and plans for field tests were begun by the BTS Committee.

A VIR field test subcommittee was established at the BTS meeting of February 25, 1970. Objective field testing of the VIR signal commenced on the first of September, 1970 and continued for three months. The test was conducted by adding the VIR signal to certain selected TV programs on the major networks, and then obtaining measurements from the transmitting station at various other organizations. A subjective test was carried out in Portland, Oregon, on the night of Sunday, February 28, and the early morning of March 1, 1971. Five local TV stations took part in the tests. A receiving site was set up six miles from the transmitters with line of sight to the transmitters. Twenty-five skilled observers were assembled to make the subjective evaluations.

The program material originating in the studios of KOIN-TV consisted of ten 35 mm slides chosen for a wide range of average picture level and colors [3]. The VIR Signal was inserted at the output of the studio. The signal was sent from the KOIN-TV studios to the Television Operating Center (T.O.C.) of Pacific Northwest Bell and thence via a 1000 mile loop to the transmitters of the other four stations. (*Figure 2.*) At each transmitter, a stabilizing amplifier as well as waveform and vector monitoring equipment was installed. (*Figure 3.*) At the receiving site, receivers and picture monitors driven by individual demodulators and stabilizing amplifiers were arranged in a side-by-side setup with the receivers and monitors facing in opposite directions. (*Figure 4.*)

The test involved three separate judgments by the observers at the receiving site. First, the slides were transmitted without a VIR Signal, and an evaluation was made. At this point, the VIR Signal had not been passed through the system. Second, a VIR Signal was added to the program signal at the studio. The stabilizing amplifier at the transmitter, as well as those feeding the monitors at the receiving site, were adjusted to establish the correct VIR Signal parameters on the first slide. The slide sequence was then repeated with no further equipment adjustment and the second set of picture evaluations was made. Finally, a third set of evaluations was made, but in this case the processing

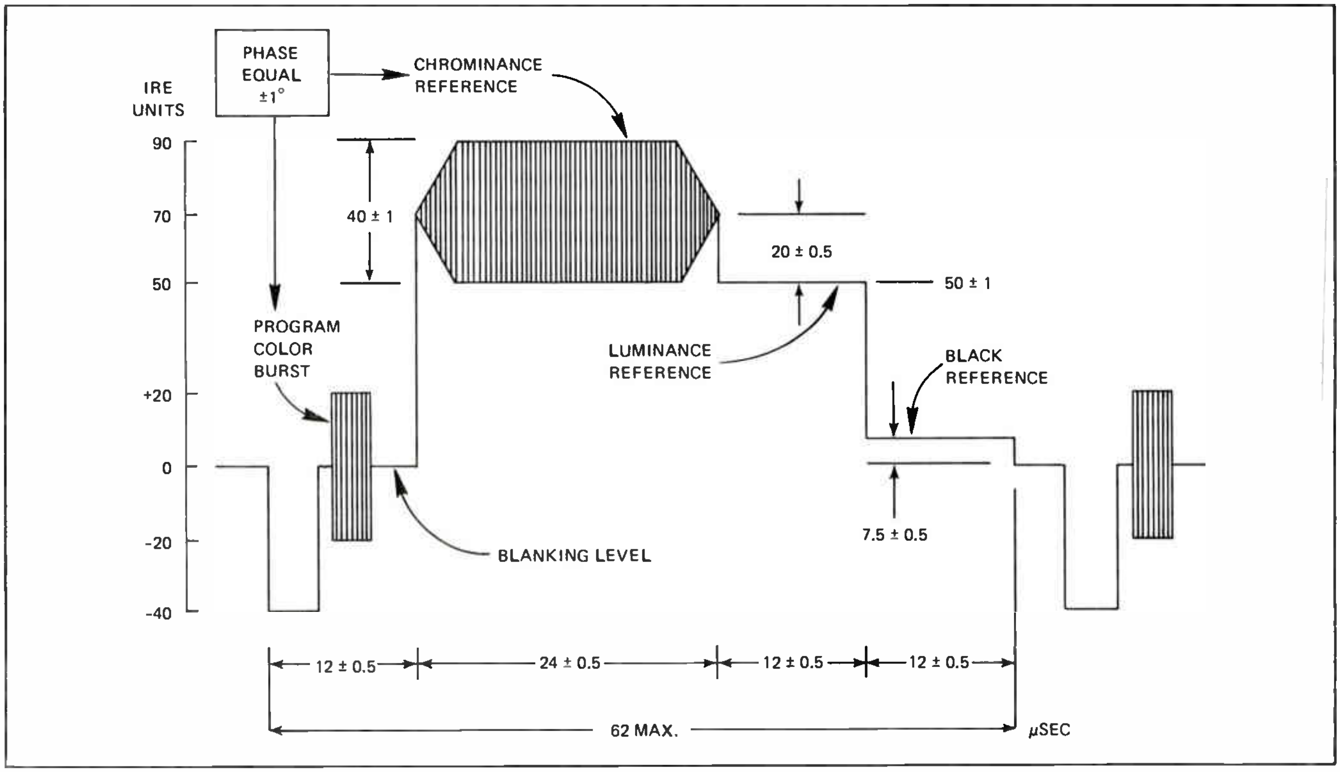


Figure 1. VIR Signal—Inserted on Line 19, Both Fields

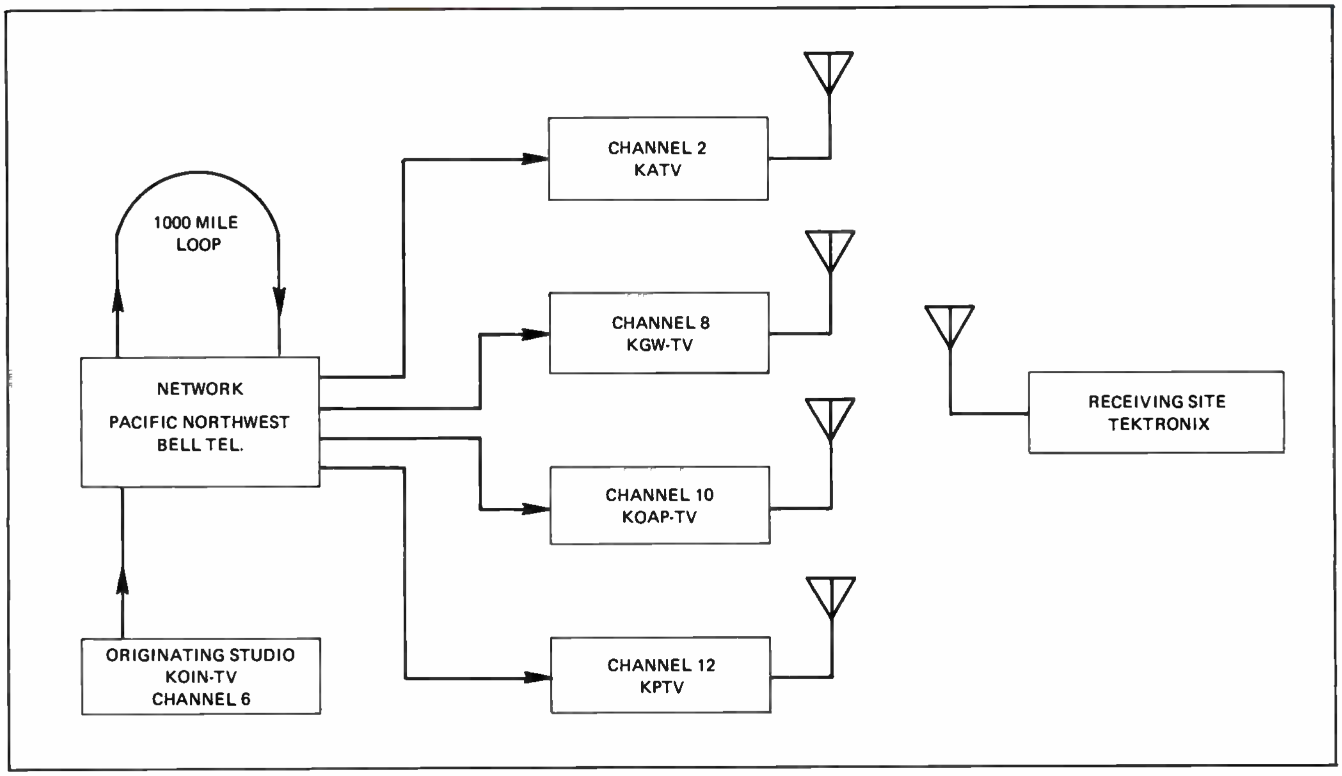


Figure 2. System Diagram—VIR Subjective Field-test

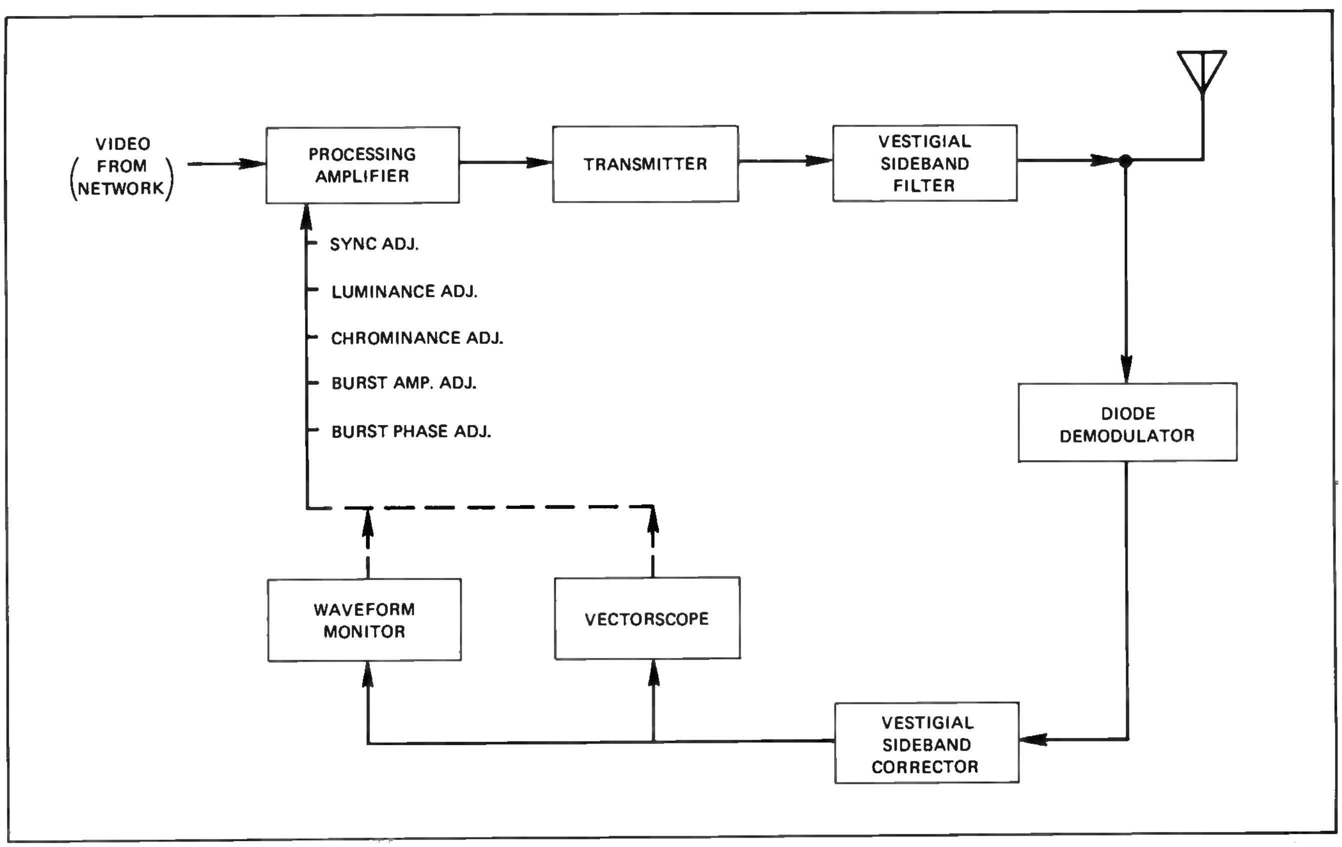


Figure 3. Equipment at Transmitters

equipment was adjusted for each slide. Each slide was transmitted with a properly adjusted VIR Signal and, while the receivers were not changed the effects of an automatic VIR Signal Corrector could be seen on the monitors as the monitor processing amplifiers were adjusted for proper VIR Signal parameters.

The results of the field tests may be briefly summarized as follows:

1) No undesirable effects attributable to the use of the VIR signal were observed at either transmitters or receivers.
2) Use of the VIR signal permitted correction at the transmitters to the degree that essentially all program material viewed was found to have zero or just detectable impairments when corrected. Prior to correction, a control run showed some of the program material had impairments sufficient to be objectionable. Complete details of the field test are presented in "A History of the Vertical Interval Color Reference Signal" [9].

In view of these favorable results, a document entitled, "EIA Recommended Practice for Use of a Vertical Interval Reference (VIR) Signal" was prepared and underwent several revisions as a result of critical reviews by the BTS Committee. The final revision was approved by the committee at its meeting of March 21, 1972 and was submitted to EIA for legal review and subsequent circulation to appropriate interested organizations for comments. The comments received were reviewed at the BTS meeting on June 1 and the draft document was modified as appropriate. The revised document has been published as EIA Television Systems Bulletin No. 1 "EIA Recommended Practice for Use of a Vertical Interval Reference (VIR) Signal" [5].

After further consideration, the BTS Committee unanimously voted to request EIA to petition the FCC for rule making which would reserve line 19 for the exclusive use of

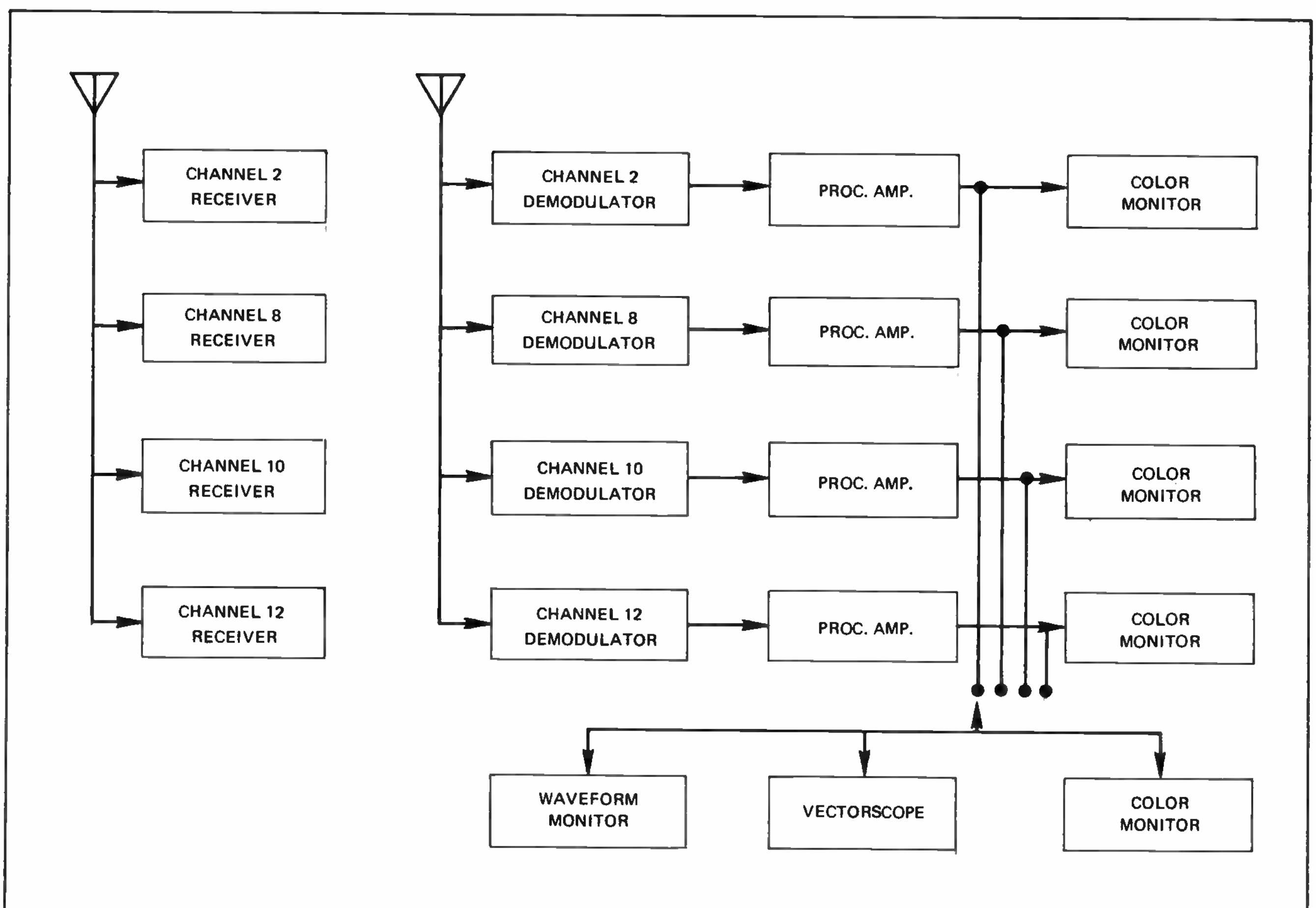


Figure 4. Equipment at Receiving Site

the VIR signal, as described in the VIR Recommended Practice, for broadcasting under jurisdiction of the FCC including CATV Class 1 transmissions. The EIA did submit such a petition [6] and the FCC responded favorably for adoption by issuing their Report and Order in Docket No. 19907 [7]. In November 1974, the Society of Motion Picture and Television Engineers issued a Recommended Practice [8] endorsing the VIR signal and describing its specific usage with video tape recorders.

REFERENCES

[1] Benson, K. B., "Progress Report—JCIC Ad Hoc Committee on Color Television," Jan. 22, 1969.

[2] Unconfirmed Report of JCIC Ad Hoc Committee, Signal Standards Task Force, Laboratory Demonstration." (Private committee document)

[3] Wintringham, W. T., "Report on the Color Television Study Committee Meeting." ***Journal SMPTE***, Vol. 78, April 1969, pp. 280, 281.

[4] Morrison, W. C., "Final Report: Subcommittee on Transmission and Transmission Paths," ***IEEE Transactions on Broadcasting***, December 1970, Vol. BC-16, pp. 90-103.

[5] ***EIA Television Systems Bulletin No. 1***, "EIA Recommended Practice for Use of a Vertical Interval Reference (VIR) Signal," July 1972.

[6] ***EIA Petition For Rule Making, RM-2192***, May 14, 1973, regarding special signals within the vertical blanking interval of a television signal.

[7] Rules and Regulations regarding special signals within the vertical blanking interval of the video television broadcast signal, Federal Communications Commission Report and Order, Docket No. 19907, Adopted November 12, 1974.

[8] ***SMPTE Recommended Practice*** RP57-1974, Vertical Interval Reference (VIR) Signal, November 1974.

[9] ***EIA Television Systems Bulletin No. 3***, "A History of the Vertical Interval Color Reference Signal (VIR)," March 1975.

Stuart L. Bailey, Consultant
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Whence Came

IN THE BEGINNING. . .

Where did our 6 megahertz television channel come from? How does it happen that we have been able to compress so much information into this bandwidth? These questions come to mind as we keep packing services and monitoring facilities into a channel we thought was full in the days of black and white television.

Were the architects of the early standards omniscient in providing a channel width so adaptable? One could wish the answer is "yes," but indeed this is not the fact. The origin goes back 40 years to the technical committees of the Radio Manufacturers Association, forerunner of the present Electronic Industries Association. These committees were preparing for a hearing by the FCC to determine possible standards for a future TV service.

At the hearings in June 1936, two RMA committees submitted a joint report recommending the following:

1) Seven channels between 42 and 90 megahertz
2) Six megahertz channel width
3) 441 lines interlaced 2 to 1
4) 30 frames per second with two fields per frame
5) Double sideband transmission
6) Aural to visual carrier separation of 3.25 megahertz
7) Aspect ratio 4:3.

There we have it. Item 5 specifies double sideband transmission! It was contemplated that the video bandwidth would approximate 2.5 megahertz which immediately chewed up 5 megahertz of bandwidth. If the visual carrier was placed 2.5 megahertz above the lower edge of the band, the specified spacing for the aural carrier (3.25 megahertz) put the latter .25 megahertz below the upper edge of a 6 megahertz band.

The FCC accepted most of these recommendations and authorized experimental transmission using these standards in 1936. Today, the only surviving elements of these standards are the channel width, the frame-field rates, the aspect ratio and the location of the aural carrier with respect to the channel edge.

Then the Changes Came

The first major change occurred in 1939 when the Commission accepted a recommendation by RMA that the vestigial sideband system be adopted. As a result, there was a substantial increase in the video bandwidth and, there-

the Six Megahertz Bandwidth?

fore, picture quality. The National Broadcasting Company quickly converted the New York TV transmitter to vestigial sideband in time for the opening of the New York World's Fair on April 30, 1939.

In 1940 the united front of industry fell apart. The FCC, moving toward limited commercial operation, called a halt and asked for a set of industry-recommended standards satisfactory to all. The National Television System Committee was formed in 1940 and presented a final set of standards to the FCC at a hearing early in 1941.

Staying with the 6 megahertz channel bandwidth, the NTSC increased the number of lines to 525, confirmed the other bandwidth-determining factors including vestigial sideband transmission. Early in May 1941, the FCC announced that the NTSC standards had been officially adopted and that commercial television broadcasting based on these standards would be permitted on and after July 1, 1941. This action cast the 6 megahertz channel width in concrete but did not freeze the amount of additional information which could be crammed into the channel—witness color!

At the end of World War II, television engineers were in accord that a channel wider than 6 megahertz was required for a satisfactory color image. Just five years later, through the establishment of a second National Television Systems Committee (NTSC II), the industry was zeroing in on a compatible system providing excellent picture quality in a 6 megahertz band! The story of those intervening years has been told many times and is far too long (and painful) to recite here. Advocates of various systems demonstrated and counter-demonstrated. Phrases such as "frame sequential," "line sequential," "dot sequential," "dot sequential with mixed highs" filled the air. At one point the FCC actually authorized an incompatible "frame sequential" system with the proviso that industry forthwith produce TV receivers with a switch to change from one set of scanning standards to another.

. . .AND FINALLY

With all the heat developed in this period, it is remarkable that the NTSC II could produce the final color system and recommend it to the FCC with a fair degree of unanimity. Don Fink, writing in the Proceedings of the Institute of Radio Engineers, October 1951, states:

"The fact that an image can now be transmitted on a four-mc band which, five years ago would have required 12 mc is, in the writer's opinion, the most striking accomplishment in spectrum conservation in the history of electrical communication."

Note that Fink refers to a four-mc band which, of course, is the video bandwidth in both color and monochrome.

Later additions to the information content in the bandwidth, while not exactly trivial, pale in comparison with the color television achievement. Certain monitoring or control signals have been added during periods in the scanning sequence not normally visible to the viewer (VITS, VIRS). Slow speed alpha-numeric displays are sent on scanning lines not normally viewed (British CEEFAX and others). There seems to be no real need for another major "packing" effort at this time but, remembering the color TV story, one would be rash indeed to pronounce "It couldn't be done."

ABOUT THE AUTHOR

Stuart L. Bailey has had a 43 year career in electronics and communications, during which time, together with C. M. Jansky, Jr., he formed the nationally recognized consulting firm of Jansky & Bailey. In 1959 this firm merged with Atlantic Research Corp., of Alexandria, VA where, upon retirement in 1970, he is now a consultant.

Mr. Bailey is a Fellow and Past President of IEEE, and serves as Chairman of the Joint Technical Advisory Council. He is a member of the National Academy of Engineering and is active on the Telecommunications Committee of the Academy. He is a member of the honorary engineering societies of Sigma Xi, Tau Beta Pi and Eta Kappa Nu. He received the Outstanding Achievement Award from the University of Minnesota in 1956 for his leadership in the development of radio and television.

He received his Bachelor of Science degree from the University of Minnesota in 1927 and his Master of Science degree in 1928. He is a Registered Professional Engineer in the District of Columbia. He served on the CTAC Steering Committee and Executive Committee. He is a member of C/ED's Editorial Advisory Board, and he is one of the most well respected and nice people in industry.

Making the Two-Way Cable System Work

James B. Wright
Rockford/Cablevision, Rockford, IL

DEFINING SYSTEM CHARACTERISTICS

Before considering the technical aspects of a two-way cable system it is necessary to determine some of the non-technical objectives desired of the system, and before these determinations should be attempted, certain general characteristics of such a system should be comprehended. The first is that a cable system, by its physical nature, is most efficiently used as a means of disseminating information from a single point, or source, to a large number of points, or users; and inversely, it is also most efficiently used as a means of acquiring information from a large number of remote sources and transmitting it back to a single point. A corollary of this efficiency premise is that a cable system is least efficiently used as a point-to-point communications means.

A third feature is that a very real limit exists in the amount of bandwidth available in a given cable system; and a fourth is that this bandwidth costs a lot of money to manufacture and even more money to properly utilize. Finally, in addition to the usual frequency and time multiplexing capabilities, a two-way cable system has a unique spatial dimension which allows for several schemes of system subdivision and for a form of area multiplexing. These possibilities provide added flexibility and also provide a means of minimizing the degradation resulting from signal "ingress" interference.

SPECTRUM UTILIZATION

Assuming the validity of these observations, and the resulting limitations, we may begin to define some general types of uses to which a cable system can be put, from the standpoint of maximum utilization of the frequency spectrum available, and also, maximum utilization of the "area," or service drop, potential.

In information dissemination large amounts of information is transmitted forward to all areas of the system, whereas in information acquisition relatively minute amounts of information is collected from each home (or point) for return transmission. These considerations support the standard allocation of some 250 MHz of bandwidth to the "forward" portion of a cable system and of only 25 MHz to the "return."

The types of information presently transmitted in the forward directions include multi-channel broadcast televi-

NOTE: A functional plan for a subdivided return-path for a cable television system is developed using filters and code-operated-switching. The considerations, concepts, and premises from which the plan was devised are also discussed.

The system described was developed as part of a National Science Foundation grant to Michigan State University. It uses a specially designed home terminal for data response, a modified code operated switch concept and a headend minicomputer system.

The system was designed as a low cost information retrieval system for use with CATV and it is compatible with TeleCinema's per-program pay cable system in Columbus, Ohio.

James B. Wright is Electronics System Manager of the Rockford/Cablevision system.

sion, local origination programming, alpha-numeric video presentations of news and weather, and a number of FM radio channels. Envisioned for the near future, for the forward system, is pay cable, instructional television, and various narrow-band services such as coded carriers (used for control purposes), or specialized narrow-band voice circuits.

Use of return transmission in cable systems is minimal at present, and consists in some systems of using the return-trunk for interconnecting a remote television pick-up point to the main headend, or of status monitoring of the system maintenance points. In one pay cable system (See TVC, Oct. 74) the status, or tuning, of the customer's television receiver is monitored and this information is transmitted, in narrow-band digital format, to a data processor at its headend. Plans for future use of the return portion of cable systems seem to be few and far between, partially due to the discovery (as in the case of the "Access" channels) that such use is very expensive, but also due to the "signal ingress" (or signal intrusion) problem.

SIGNAL INGRESS

Signal ingress is a most insidious condition where the many signals from short-wave radio stations, and interference from electric lines, TV receivers, industrial equipment, electric signs, lightning, etc., all "leak" into the return cable. This "ingress" is (realistically) uncontrollable in the absolute sense that each of the tens-of-thousands of fittings in the system is a potential "leak," and that every customer service drop can be an "interference-antenna." (Note that by the innocent disconnection of a television set in a home, the customer can create a new and major point of ingress.) While initial experience with the ingress problem is discouraging, there are some positive aspects which should be considered. Two important facts have been established: one, that ingress comes primarily from the distribution or feeder portion of a cable system (as opposed to the trunk); and, two, that ingress can be kept down to acceptable levels, with the level being a function of the intensity of "de-ingress" maintenance efforts.

REVIEW BASIC SIGNALS

Before describing the return-system variations which we've devised, it is important to recall certain aspects of the information which we will be transmitting over the cable system. We presently have three basic types of signals: Visual (which is amplitude modulated); Aural (which is frequency modulated); and Data (which is usually digital and FSK modulated). The aural and data signals are relatively immune to noise and interference can provide good service with a carrier-to-noise ratio of 20 dB. The visual signal poses a much more stringent requirement and a carrier-to-noise ratio of 50 dB, more or less, is desirable, depending on the type of noise.

MAKING THE SYSTEM WORK

In the preceding paragraphs we have made several key points. (1), "ingress" is much more severe in the distribution portion of a cable system than it is in the trunk, (2), that the carrier-to-noise ratio of a digital-type of transmission can be relatively low without loss of information accuracy, and (3), that a customer home is not a substantial source of information. We also observed that several systems have been able to successfully carry television information on the trunk portion of their system. These, and other considerations (such as the economic unfeasibility of originating television in the home, and the silliness of competing with the telephone company for audio service), suggest a frequency diplexing arrangement which allows us to collect data using the feeder portion of the system, and to collect television from an occasional remote studio by insertion directly into the trunk cables. To accomplish this we subdivide the return portion of the cable system into two parts, with the trunk cables passing the full 5 to 30 MHz band and the feeder cables passing only the 5 to 11 MHz band, rejecting the frequencies between 17 and 30 MHz by 25 dB. This means that "ingress" from the distribution system, in this 17 to 30 MHz band, is reduced by 25 dB prior to being diplexed into the trunk cable. This "sub-division" is accomplished through the use of a code-operated-switch (as developed by Coaxial Scientific for the pay cable operation in Columbus, Ohio) with its filtering circuits suitably modified. (See Exhibit I.) These limitations have been imposed and accepted in the belief that there is a large potential market for mass data acquisition, and also because by this means we have "cleaned up" our trunk cable so that it may now be used for television transmission of sub-channels T9 and T10. We now have a "data-grade" distribution system and a "video-grade" trunk. Note also that the trunk cable frequencies from 11 to 17 MHz are still available for transmission of continuous data-streams and voice communications, ranging in quality from data-grade at 11 MHz to video-grade at 17 MHz due to the reject characteristic of the COS filtering.

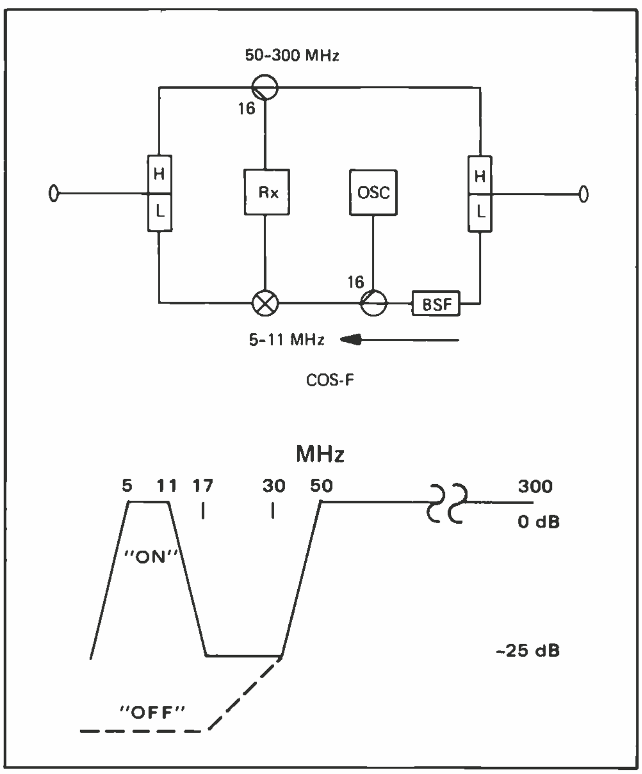


Exhibit I

A portion of the actual distribution system is shown in Exhibit II. In a retrofit situation the COS-F follows the amplifier diplexer and is in turn followed by splitters which function as "feeder-makers." This COS-F, which includes a receiver having a unique address, is "turned-on" by coded-carrier whenever interrogation of its feeder-cluster is desired, and is "turned-off" whenever an improperly coded-carrier is received, i.e., when another COS-F is being interrogated.

The trunk system (Exhibit III) is conventional except for the use of another (special) COS which isolates each special feed-point (one DC-16 per trunk amplifier), and which has been modified to pass only the sub-channels. This special COS (See Exhibit IV.) includes two unique addresses, one for "turn-on" and the other for "turn-off." This COS has been dubbed the COS-T and will have a provision for padding and equalizing the incoming television signal. These COS-T's are operated by manually, or mini-computer, controlled coded-carriers from the headend and it is therefore possible to have a number of transmitters, all operating on the T9 and T10 frequencies,

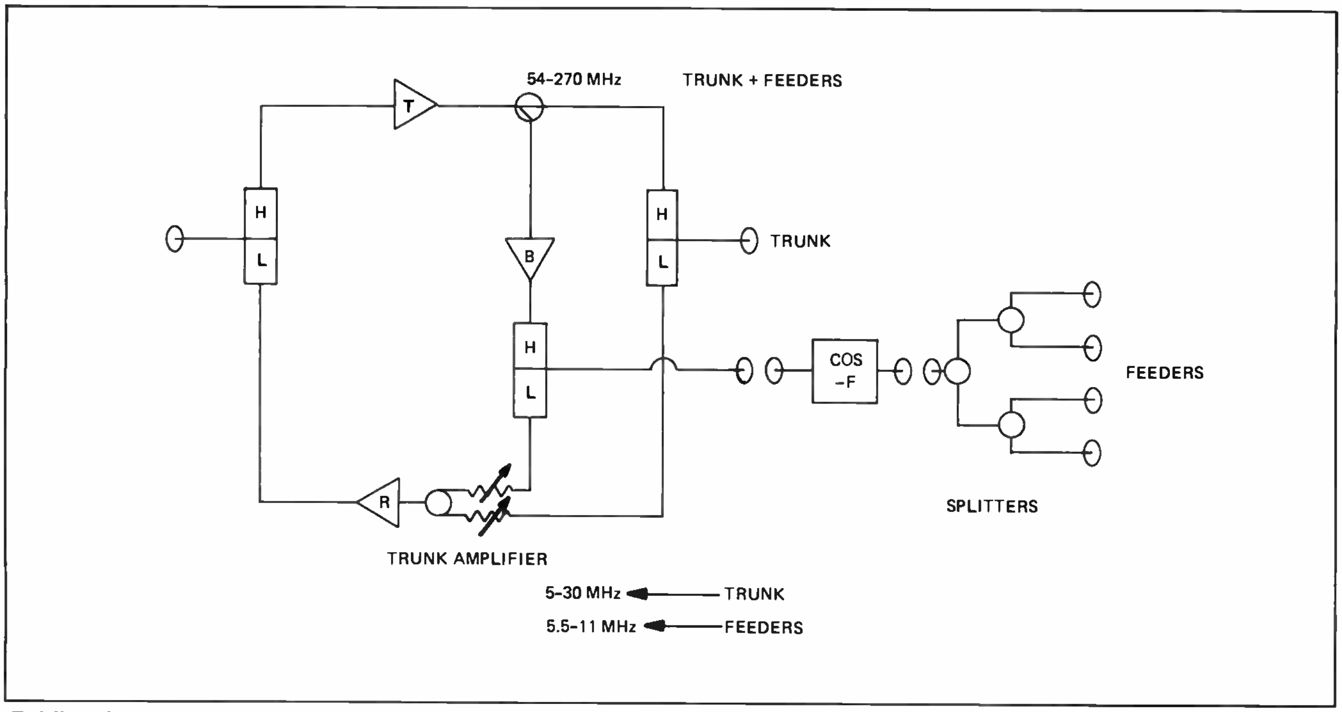


Exhibit II

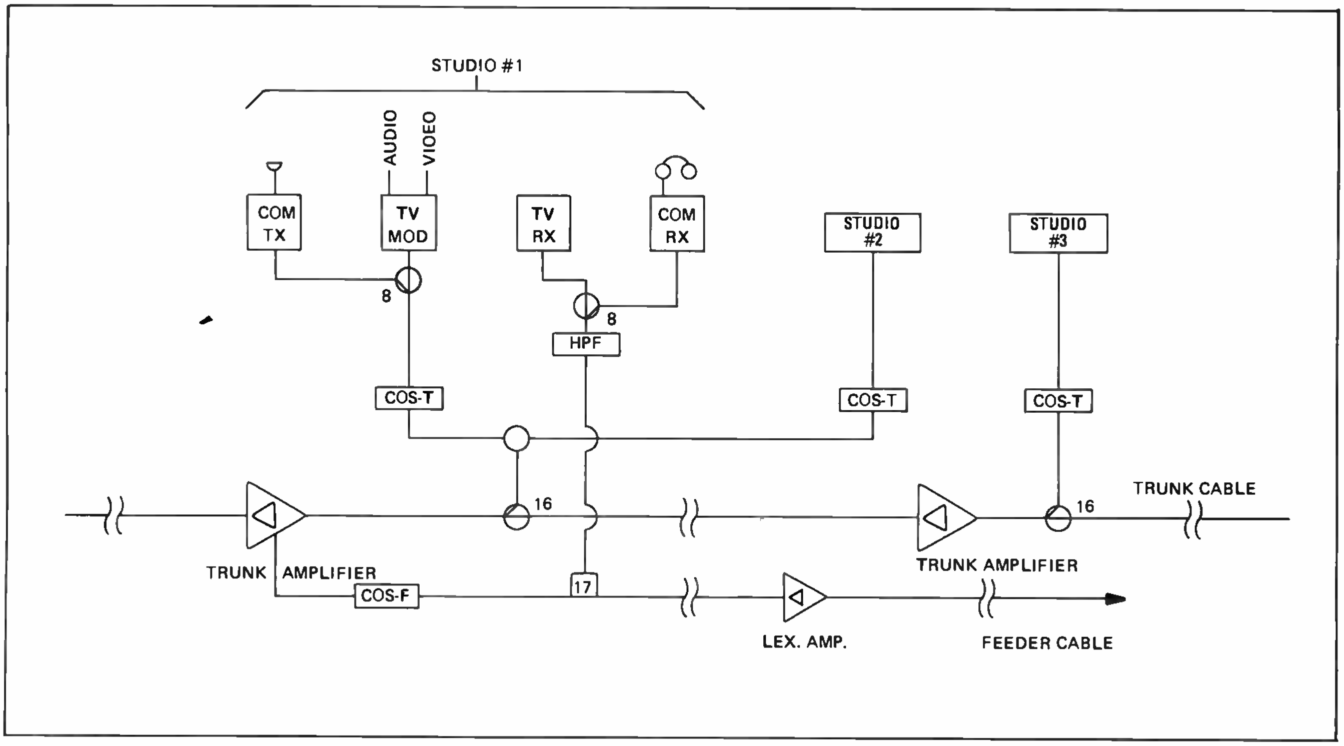


Exhibit III

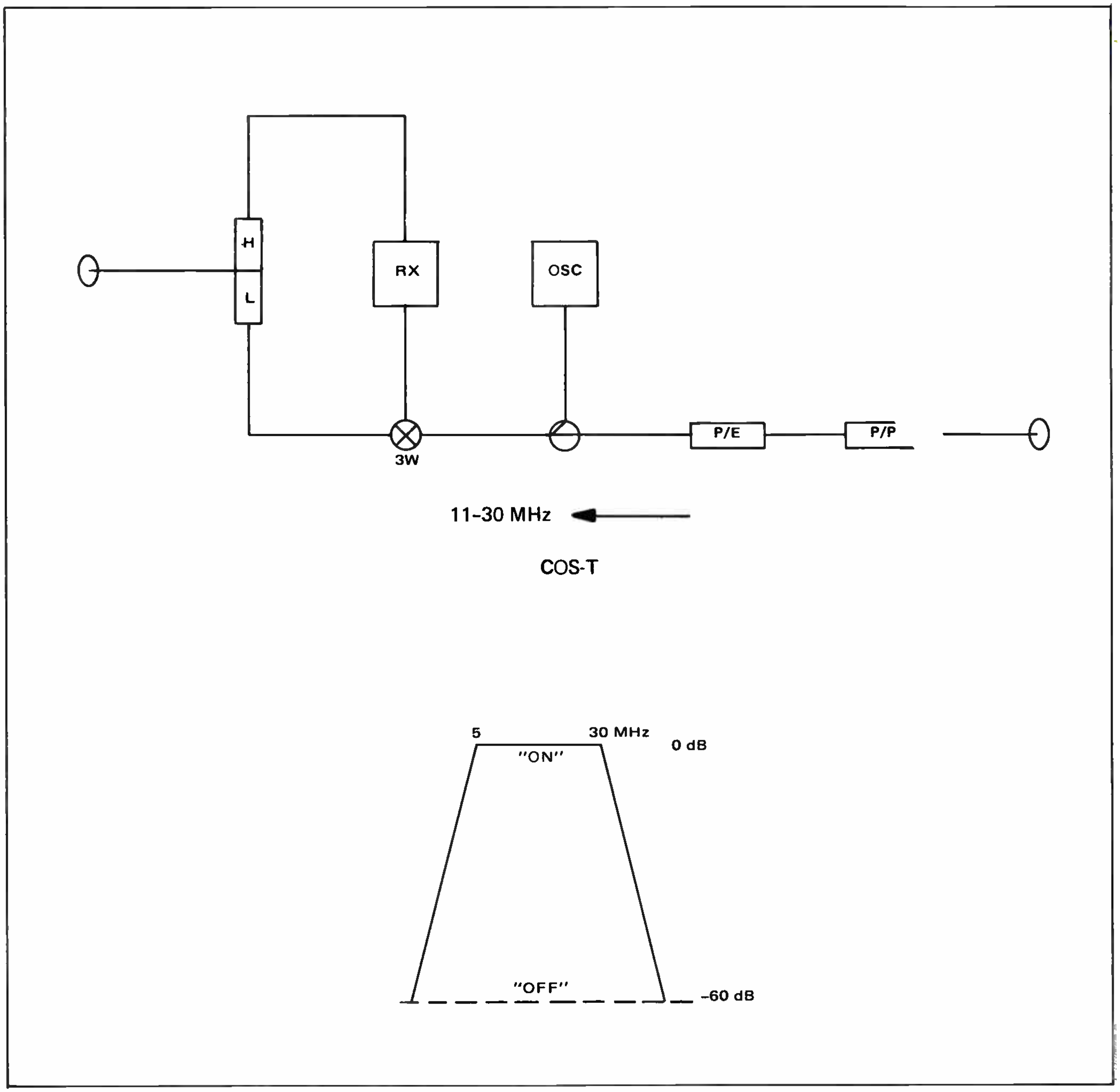


Exhibit IV

scattered throughout the cable system. A voice communication system, a necessity for remote-studio programming, is also shown in Exhibit III.

Exhibit V is a table of frequency allocations which has been assembled incorporating the frequencies as assigned by Coaxial Scientific, the frequencies in general used by the industry, and other frequencies which we've assigned for our own use. In line with our emphasis on spectrum conservation note that, while not shown, the communications channels will be 20 KHz apart, as are the Coaxial

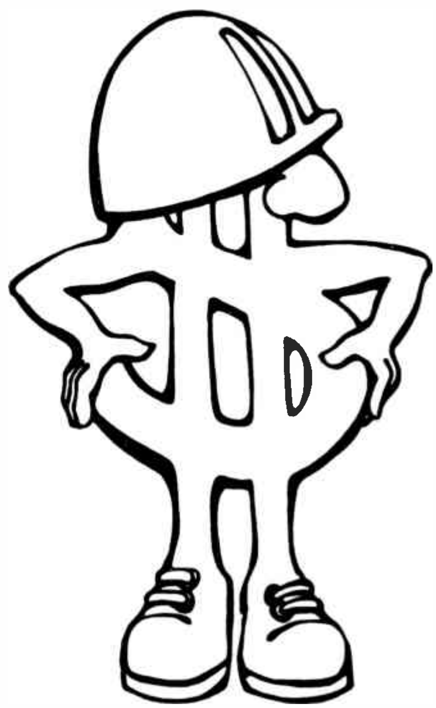
Scientific data channels. Both are FM types of transmission, FSK in the case of the data channels and narrow band FM in the case of the communications or voice channels.

A two-way cable system with its return portion reconfigured as described is being developed and installed in parts of the Rockford, Illinois cable system. The data-return from the feeder cables will be tested in conjunction with a National Science Foundation grant made to Michigan State University for an experimental study using the Rockford/Cablevision system. The television-return on the trunk is already in use in several areas of town and will be further tested while the feeder data-return is in use. It is our belief, based on our own experience as well as on what we've learned from others, that a sub-divided return system, using good construction practices, and using properly selected cables, fittings, transformers, filters, etc., can be made to work very adequately at acceptable costs. This presupposes a well-rounded preventative maintenance routine for the "return" system as well as for the "forward."

GENERAL FREQUENCY ASSIGNMENTS

Forward System (54 – 270 MHz)	
Television	54 – 72 MHz
Data	72 – 76 MHz
Television	76 – 88 MHz
FM	88 – 108 MHz
Data	108 – 115 MHz
(COS FSK Control	111 – 113 MHz)
Communications	115 – 116 MHz
Data	116 – 120 MHz
Television	120 – 270 MHz
Return System, Trunk (5 – 30 MHz)	
Feeder Data (Approx.)	5. – 10.5 MHz
Amp. Maint. Freqs.	9.455 – 9.635 MHz
COS-T Freqs.	10.275 – 10.355 MHz
Data (Steady)	10.5 – 16 MHz
Communications	16 – 17 MHz
Television	17.75 – 29.75 MHz
Return System, Feeders (5 – 10.5 MHz)	
Data	5. – 7.435 MHz
Home Terminals	7.445 – 9.435 MHz
ELO's	9.655 – 9.835 MHz
COS-F's (Secondary)	9.855 – 10.255 MHz
COS-F's (Primary)	10.375 – 10.435 MHz

Exhibit V



Wally Briscoe, for the
NCTA Safety Committee,
John Wright, Chairman
Cox Cable Communications—Atlanta GA

The National Safety Council has made us aware of hazards related to driving, swimming and other holiday-related activities by first predicting and then reporting the number of deaths during holiday periods. The numbers predicted are based on statistics compiled during like periods in previous years. This dramatic application probably results in saving lives if only because it frightens some people into staying home.

But usually accident statistics are not dramatic. Except to an actuary they are not even particularly interesting. When we talk about hazards we tend to be clinical and unemotional. We tend to identify only the obvious dangers. But let's talk about specific accidents or near-accidents and see how much difference it makes.

- Drilling through the kitchen wall, the installer felt the drill break through. He backed the bit out and fed the cable through the hole, then went inside to complete the installation. At first he could not find the cable or the hole. Re-measuring, he discovered he had drilled into the electric oven, missing the 240 Volt cable by less than an inch.
- Accepting the homeowners instructions on where to drill, the installer broke through, only to find the bit difficult to back out. When he finally retrieved it, he discovered the drag was caused by a woman's slip tangled around the bit. He had drilled into the lingerie drawer of her dresser.

OSHA, Like Castor Oil, Can Be Good for You

- A small child heard an interesting noise coming from the outside wall. As small children will, he went to investigate. Ear against the wall, he located the spot and continued to listen until the drill broke through and penetrated his eye.

Real accidents have impact. They involve injuries to real people and people can prevent them, if they recognize the hazard in time.

That's what our NCTA Safety program is all about—making the worker aware of hazards and equipping and training him to avoid them.

The Occupational Safety and Health Act (OSHA) deals basically with providing a safe environment in which to work. But it also mandates training employees in how to work safely, avoiding danger to themselves and others.

- A trainee lineman saw he would need a line to pull equipment up when he climbed a pole. He took a wet, coiled line from the truck and, instead of fastening it to his belt, threw it over the lines on the pole above him. When it touched the power distribution lines, he was electrocuted.
- Another lineman, working without a lanyard in a bucket, had not checked the locking device. As he leaned out, the bucket tilted, throwing him to the ground. He fell 14 feet, his helmet striking the curb. His neck was broken and he is paralyzed from the neck down.

Neither of these accidents should have happened—but they did—for lack of training.

Your on-the-job safety training can serve to alert your employees to hazards they might not otherwise recognize. It also conditions them to stop and think before taking unnecessary risks.

WHAT IS OSHA?

Under the Occupational Safety and Health Act of 1970, you, the employer, are responsible for unsafe acts of your employees and unsafe or unhealthy conditions in the working environment.

OSHA has imposed burdens on employers that are both expensive and time consuming. But as a result of the Act there is a new level of awareness of the importance of safety, and in some instances tangible evidence of the value of safety-conscious procedures.

For example, one cable company recently received a dividend of $14,000 on their casualty and liability insurance plan. The annual premium was $70,000. Of course OSHA cannot be specifically credited with this 20% windfall, but neither is the company going to discontinue its self-inspection and safety training program.

The unfortunate manner in which OSHA has been thrust upon employers has created antagonism that may never dissipate, but the underlying concept is sound. No one can dispute the goal of safe and healthy working conditions for everyone.

For years, many insurance companies have been working with their clients to identify and correct hazards. It is in their interest to reduce claims. It is equally, if not more, in the businessman's interest. Fewer and smaller claims result in lower premiums, less lost time and better customer and employee relations.

NCTA PROGRAMS

NCTA's Safety Committee has taken the position that its function is to inform the industry of the obligations imposed by OSHA and to assist the industry in compliance. To that end they have produced a set of checklists designed to enable the system operator to conduct his own safety inspections and determine what changes need to be made in anticipation of an OSHA visit. They have addressed the balance of their efforts to development of training materials to assist in conducting monthly safety meetings for employees.

Training aids cover the major exposures to accidental injury in CATV work and basic requirements for equipment and procedures designed to minimize risks. Slide presentations, in particular *"Think Safety,"* are directed to the employee in terms of how his paycheck can be affected by unsafe practices. *Think Safety* is recommended as the basic presentation in safety training programs. The next "must" set is called *"The Shocking Truth"* and deals with basic electrical safety. Fire extinguishers and their use is covered in two sets of slides and protective clothing and equipment in one. The remaining five sets deal with pole climbing, aerial ladders, ladder safety, and stringing strand and cable.

OSHA INSPECTIONS

OSHA recently offered to conduct inspections by invitation without penalty on the first visit. Should you invite them in? In considering it, you should know that re-inspection will follow to check on correction of violations found, and there is no assurance you will not face greater liability as a result.

DOING IT YOURSELF WITH NCTA

NCTA's Safety Committee offers another, and they believe, better idea. Conduct your own inspection and do it thoroughly—using the NCTA checklists developed specifically for that purpose. From the Committee's first-hand experience, it will be instructive, revealing, and it will probably save you money. You will also find you will have to spend some money to correct deficiencies.

Last year the Committee conducted a walk-through inspection of a large system. After initially being impressed with the general appearance and over-all good housekeeping, they began to spot violations. Without using checklists, they simply observed. After about one hour they returned to the meeting room and held a de-briefing session. Thirty-nine violations were identified!

Most of them were minor, but several things were noted that could have resulted in sizeable fines if an OSHA inspector had made the same inspection and observed the same things.

Conduct your own inspection! You might invite your insurance agent to join you, or send his company's safety specialist. The insurance company has the incentive to assist you, and an awareness of hazards that you might overlook. And—your insurance company will not levy fines for hazards discovered. Even though OSHA says it won't either, on the consultative visit you will be given a limited time to correct deficiencies and then be re-inspected. On re-inspection fines *will* be assessed if corrections have not been made.

You should be prepared for an OSHA inspection at any time. The basic things an inspector will check are visible indications of your awareness of OSHA.

THE BARE MINIMUMS

In your establishment you must have the OSHA notice posted and, when required, a copy of your annual Accident Summary Report (Form 102). You must also maintain:

- a log of recordable occupational illnesses and injuries;
- supplementary records of each occupational injury or illness; and
- Form 102 Accident Summary Report.

An OSHA inspector will want to see these files.

Also he will look for fire extinguishers, lists of emergency telephone numbers, and he may ask for evidence of first aid training. Your employees should all know where extinguishers are located and how they are to be used.

SPECIFICS FROM NCTA

NCTA's Safety Committee also directs your attention to the following:

If you do not have a procedure for handling emergencies in your establishment, it would be worth devoting one of your safety meetings to development of a procedure. For example if someone collapses, what should be done? Seconds can be critical! Anticipation and planning could save the life of one of your co-workers.

Most occupational accidents involve operation of vehicles. The Committee recommends a defensive driving course for all people in your company. Contact your local law enforcement offices for more information on developing such a program.

In addition, some common sense rules will reduce your accident rate. If vehicles were built without a reverse gear, many accidents would never occur. Where possible, avoid using reverse by parking at corners, next to alleys, driveways and no parking zones. If you can't find such a space, place a traffic cone at your rear bumper when you park. In retrieving it later, you must look behind your vehicle.

Headlights serve not only to allow you to drive normally at night, but also to make your vehicle visible to other drivers, particularly in bad weather and before sunrise and after sunset. Instead of waiting until ***you*** cannot see clearly, turn on your lights whenever light conditions are marginal so other drivers can see you. Remember that some people with otherwise normal vision do not see well in reduced light. ***Never*** use your high beams unless you must.

Better safety training can result in more careful use of equipment, better maintenance, cleaner and more orderly quarters and better employee morale.

OSHA is here to stay. Let's make it work ***for*** us.

NCTA SAFETY SAVER SERIES	35 mm color slide and audio cassette programs for automatic or slide changers.
FIRE EXTINGUISHERS & FIRE PROTECTION	What extinguishers are designed to do, and for how long. Fire is a major business hazard and proper and adequate protection can favorably affect insurance rates.
THINK SAFETY	A short and clever production telling the OSHA story in terms of dollar savings to both employer and employee. Explains how compliance saves dollars while noncompliance not only costs dollars but usually in large amounts. A special emphasis is focused on employee responsibility and personal impact of unsafe practices.
THE SHOCKING TRUTH	This is the first in a series of slide-tape productions devoted exclusively to safety in the electrical area. General industry inspections show that the most frequently cited violations are within this area. Production shows the fundamentals of electricity, the elements of grounding, basic rules for cable installation and the elements of electricity.
LADDER SAFETY	A basic piece of equipment that is too often taken for granted and which causes needless accidents and injuries resulting in loss of time and money. The slide-tape shows various types and styles of ladders, proper use, construction and maintenance as well as OSHA requirements set forth for ladder safety.
AERIAL LADDER SAFETY	A vehicle mounted aerial ladder can offer a safer and easier method of reaching pole mounted transmission lines, but it is not foolproof. Procedures and precautions are outlined.
POLE CLIMBING SAFETY	This production details the five general causes of climbing accidents and what can be done to reduce chances of accidents and injuries. This program is recommended for both new employees and veteran linemen.
PROTECTIVE CLOTHING & EQUIPMENT	Under OSHA both employer and employee have responsibilities relative to personal protective clothing and equipment. Failure to meet these responsibilities can result in serious injury and even death. This production outlines some hazards faced when the proper clothing and equipment are not used and the responsibility shared by both employer and employee.
STRINGING STRAND AND CABLE	A two part production detailing safety procedures and precautions necessary before and after reaching job sites. Instructions are outlined on how to handle an anchor machine and attach a guy as well as the procedure for preparing a proper set-up prior to the stringing of strand or cable. The presentation also shows where to place plant and how to do it without damage to plant or injury to employees.
NCTA SAFETY CHECKLISTS	A volume of material designed to address each type of hazard with special sections on pole climbing, ladders, vehicular safety, location of OSHA offices, a selected listing of OSHA publications and sources of safety equipment. This is an excellent tool for self-inspection.

NOTE: Readers may circle Reader Service Card No. 21 and NCTA will send you more information on these important OSHA Safety Saver programs.

forum

a forum is not a podium

seri

John Williams was tired. He had worked most of the night trying to debug the Energy-Flow program, and he still had no idea of what was causing the glitches. Right now all he wanted was about ten hours sleep. As he walked into his room, the message light blinked at him. He punched his identification number and the central processor opened his transponder to channel G.

"Two hours? They must be crazy." The message on his TV told him that a meeting had been called for ten a.m. that morning. He was scheduled to brief some visiting dignitaries on the status of Solar City. If he was going to have time to throw together some notes, he'd be able to catch a quick shower, a bite of breakfast and that's about all.

As he was getting dressed for the meeting he glanced at channel six. The computer time schedules for today were being run and he watched for his name.

"Four o'clock. Not bad. I may even be able to find the bug."

The office complex was only about two miles from John's villa and the day was beautiful. The temperature had begun to drop with cool evenings and warm days. He decided to take his bike instead of calling for the mini-bus. The bike was faster and it gave him a chance to look around and enjoy. John had never thought of himself as a nature freak, but being able to ride a bike to work had real advantages. He'd noticed that many of the other people on the project were using the bike trails now and it was as common to see a rack of bikes in front of a bar as cars. They even kidded each other about being too drunk to ride home and falling into one of the lagoons.

The building itself sat back from the road in among the pines. In the lagoon on the side was a baby alligator. It had been there for several weeks now and John, like many others, never failed to stop and look at it.

The room was already half full by the time he entered. A podium had been set up, and several display units were on the floor. June Cummings was in one of the front row seats, and John stopped to speak to her.

"How much background do these folks have, June?"

"Some, but you better go over the basics again for those who are new to SERI."

"You're the boss, but couldn't you have let me know about this last night?"

"John, you know I told you; you're just so wrapped up in that program of yours that you don't listen to anything I say."

"At least it's not another woman."

"Big deal. What makes you think anyone cares anyway?"

John stepped up to the podium and tested the mikes. People were still pouring coffee and drifting to their seats.

"Can I have your attention? Ladies and gentlemen, can you take your seats, please? As I'm sure you all know, SERI was set up to investigate the possibility of using solar energy to replace existing fossil fuels. The area you are in now is devoted to trying to find practical ways to inject what we learn in the labs into everyday life. It's not enough to come up with a cheap way to produce electricity. To be successful, solar energy will have to fit within the framework of our present economy and community."

The room had quieted down some. Most of the people were paying attention, though he could see that some wanted him to get on. He took his time realizing that a few words now would save him from answering the same questions over again at the end.

"I'm sure that all of you have had a tour of the solar panels so I won't go into the generation part. Our job is in distribution and use of the energy produced. About forty years ago the peak use cycles were charted, and for large groups of people we use the same basic data today that we used when TVA first got started.

"Conditions change, though, and we felt that we needed more information. To get it, Solar City was wired with a broadband data system. It carries all of the things that you expect, TV and entertainment, but it also plays a part in nearly every experiment we carry out. For the first time we are not working in the lab. Every home out there is part of the lab. My own specialty is in combining the power network with home production. We have a program here that lets us look at the demand from each home on a real-time basis. By varying the ratio of network power to home produced power we are working towards a high efficiency, flat load production situation. Other projects use the data system to generate priorities on use. For example, various appliances may be turned on and off to regulate load. Some items will work on various voltages, and the computer can control those as needed.

"The data system that we use in

Solar City is more than just an energy monitor though. Following the leads developed at a system in Arizona a few years ago, we are exploring using the data system as an alternative to transportation. Each morning, the central computer generates a schedule letting each of us know our assigned terminal time. I check the schedule before I plan my day's activities. My kids also receive updates on their homework assignments in the same way. If they have to miss school for one reason or another, they can pick up any notes on TV each night. I'm not too sure they like the idea, but it has helped.

"We also use the system for general public services. Every ten seconds my home is scanned for indications of fire. So far, at least two lives have been saved because the fire department received an early warning. The medical files for all of my family are also in the computer. Should we need help, a complete medical history is readily available at any time. Families with special problems are also listed. For example, if a call is received from a home where there is a patient with a history of heart attacks, the medical team is notified even before they leave the station.

"If you have any questions, I'll try to answer them. If not, feel free to have another cup of coffee, then we'll move on to observe some of the actual experiments."

Right now that's all fiction, but it may not be for long. The federal government is getting ready to establish a new program, similar to NASA. It is the Solar Energy Research Institute, and it has been commissioned to study production of energy directly and indirectly through solar energy. This would include development, demonstration and possibly even production.

So what does all that have to do with cable television? More than you might think. If CATV is to remain a viable enterprise, we must find additional applications for our surplus capability. SERI offers such an opportunity.

One of the most important potential uses for CATV in the immediate future is as a monitoring device. Experimentation at the Solar Energy Research Institute will quickly move out of the lab and into the field. A cable system could offer the investigators an almost unlimited, versatile medium for gathering data. Experiments could be changed, moved, or modified, and the system would be there to gather, compile, and transport the data. It would also be nearly boundless, carrying more volume and types of data than we can now imagine.

SERI can also help us to find ways to substitute COMMUNICATIONS for TRANSPORTATION. Some possibilities are in the area of dispersal. Many jobs do not require physical contact, such as data retrieval. Other possibilities would be some banking transactions (loan applications, etc.), special education, and many insurance functions.

A third area to be explored is in improving the quality of life. This could be as complex as security and health services such as fire and burglar alarms. It could also be as simple as using a character generator to provide homework assignments or a community bulletin board.

I know many of you have had ideas of what you would do if it was your system. Now here's an opportunity.

I would like to suggest that we build a system, if only on paper. The basic ground rules are as follows:

1. Area to be served: Solar Energy Research Institute.
2. Primary purpose: Monitor and control experiments.
3. Secondary purpose: Substitute communications for transportation.
4. Additional uses: Improve the "quality of life."
5. All suggestions must be economically practical.
6. All suggestions must use equipment within the present state of the art.
7. Social implications should be considered as well as economic impact on the area.

James A. Richardson
Cable Research
Hilton Head Island, SC

critique/letters

Congratulations on an outstanding first issue! ***Communications/Engineering Digest*** will, I am sure, be well received and will be a real service to the industry.
Best of Luck,

Robert Stengel
Vice President, Public Affairs
National Cable Television Association
Washington, D.C.

It's a pleasure to write the enclosed check for my membership dues in SCTE for the current year—and to reflect on the growth of that organization since it was just a wild idea ten years ago. I've just seen a copy of the new magazine—and I think it really looks professional, as befits the purposes we wanted to accomplish. I regret that business and personal pressures combined to prevent much personal involvement on my part in the past few years, but I'll always be proud to know I had a part in starting something I believe to be good for CATV.

Bob Bilodeau is doing a helluva job—and so are all of you. Keep it up.
Sincerely,

William F. Karnes
Communications Development Co.
Dallas, TX

BRAVO! Hearty congratulations are in order for your tremendous achievement in putting ***Communications/Engineering Digest*** together and making it happen.

Your new book fills a void that has existed for many years in the Cable TV industry—and you fill it so well.

As you probably already know, the industry is eagerly awaiting your next issues.
Very best regards,

Russell D. Anderson
Market Manager
CATV Products
Avantek, Inc.
Santa Clara, CA

Although Mr. Wilson, in his detailed article on Pay TV filters, (Nov. '75 C/ED) states that only expensive filters would be capable of trapping out the pay channel without severely attenuating the lower adjacent channel, our company is presently manufacturing these at only a moderate premium in price and size (still able to fit into a corner molding). We have been able to do this by using special circuitry which attenuates the lower adjacent video by only a few decibels.

In discussing the measurement of trap attenuation, some additional points need to be discussed. Trap measurement is not as simple as it appears at first glance and a number of techniques must be used to obtain accurate answers.

There are two classes of generators which can be used to measure traps, C. W. and Sweeper generators. The C. W. source is convenient but many systems do not own one and frequency measurements, necessary to accurately determine bandwidth at −46 dB, say, require additional equipment. If the generator has a built-in crystal marker, such as the more expensive Hewlett-Packard or the RCA WR-99, or if a frequency counter is owned, there is no problem.

Lacking these, or a spectrum analyzer, it is almost impossible to determine the exact bandwidth which should be in the order of several 100 KC at, say, −46 dB by reading the slight change in the generator or FSM dial.

If a sweep generator is used, filters must be inserted to stop the harmonics which will be at or above the level of the fundamental at the trap output. For example, if a Channel 5 trap is being tested, a Channel 5 bandpass filter may be used, if available, or a low pass filter which attenuates frequencies above 160 MHz by at least 35 dB. Bandwidth measurements can be made if the sweeper has 1 MHz markers by expanding the sweep presentation between 1 MHz points.

If the sweeper has only a 10 MHz marker, look carefully for the 5 MHz beat and expand that range over the oscilloscope face.
Very truly yours,

Don Dworkin
Vice President—Engineering
CORAL COMMUNICATIONS CORP.
Hoboken, NJ

Bob Luff, Chairman Wiley's Engineering Assistant recently showed me a copy of the first issue of ***Communications/Engineering Digest***. It appears to be a most useful and interesting contribution to the field.

Could you supply me subscription information?
Sincerely,

Dale N. Hatfield
Chief,
Office of Plans and Policy
Federal Communications Commission


The local Cable TV Company doesn't want an arm and a leg...
only a foot.
One foot of surplus space.
One foot of otherwise useless space. That's what Cable TV rents on poles owned completely by PG&E. At rates that return to PG&E profits far in excess of 100%. The California Public Utilities Commission has refused to regulate these rates by PG&E.
Cable TV wants rates set at a reasonable level. More importantly, Cable TV wants PG&E to make more poles available (only about 10% are now). Most importantly, Cable TV wants to compromise.
We have to if we are to survive. PG&E doesn't want to compromise. And PG&E is PG&E.
No, the local Cable TV company isn't asking for an arm and a leg. But we know someone who is.
Western Pole Committee

COMING IN FEBRUARY C/ED

- Pay Cable Upgradeability
- The VIT Signal Explained
- Frequency Channeling & CTAC Panel 5
- Forum, Comments, Special Reports, etc., etc., etc.

First Annual Conference on CATV Reliability

Sponsored by the Society of Cable Television Engineers and the Philadelphia Chapter, Institute of Electrical and Electronics Engineers

February 5 and 6, 1976

Holiday Inn
City Line, Philadelphia, PA.

Components and Product Design — February 5

- Reliability Considerations in Design & Use of RF Integrated Circuits
  James Humphrey, TRW
- Component/Equipment Statistical Performance
  Warren L. Braun, PE, ComSonics, Inc.
- Economics of Reliability
  Archer S. Taylor, Malarkey, Taylor & Associates
- Luncheon *Principal Speaker: Delmer C. Ports, Vice President, Engineering, NCTA*
- Long Term Maintenance of Shielding Integrity in CATV Systems
  Keneth Simons, Simons & Wydro, Consultants
- Stress Analysis of Aerial CATV Cable Structures
  Eric Winston, Jerrold Electronics Corporation
- Headend Concepts
  Steve Biro, B-RO Antenna
- Redundancy Aspects of AML/LDS Systems
  A. H. Sonnenschein, Theta-Com of California

Systems Design and Operations—February 6

- Legal Problems of CATV as Applied to the Consumer
  Kenneth N. Jacoby, Esq.
- System Layout Techniques for Improved Performance
  Richard Covell, GTE Sylvania
- Practices to Minimize Outages
  Robert Bilodeau, Suburban Cablevision
- Construction Practices for a Longer System Life
  M. Quarashi
- Standby Power and Surge Protection Techniques
  S. Switzer, Switzer Engineering Services
- Tower Selection Reliability Considerations
  W. M. Sohn, PE, Consulting Engineer
- Luncheon *Principle Speaker, Dr. Robert Powers, FCC Cable Television Bureau*
- Reliability Considerations in the Selection & Use of Converters
  Steven McVoy, Coaxial Scientific
- Performance Testing
  Frank J. Bias, Tele-Vue
- Maintenance and Personnel Training Programs
  G. C. Kleykamp, UA-Columbia Cablevision
- CATV Earth Station Reliability
  Carl Van Hecke, Andrew Corp.

CATV RELIABILITY CONFERENCE REGISTRATION

CHECKS PAYABLE TO: Society of Cable Television Engineers, P.O. Box 2665, Arlington, VA 22202

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Student Members :	Full Program $40.00 ________	Single Day $40.00 ________
Non-Member Rate :	Full Program $60.00 ________	Single Day $50.00 ________

Registration includes two luncheons, all coffee breaks and one copy of the conference transcripts. A no-host cash bar cocktail party will be held February 5, 1976. Each additional copy of the conference transcript will be $15.00 each.

Make hotel reservations with Holiday Inn, City Line, Philadelphia, PA.

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Circle One: SCTE IEEE

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