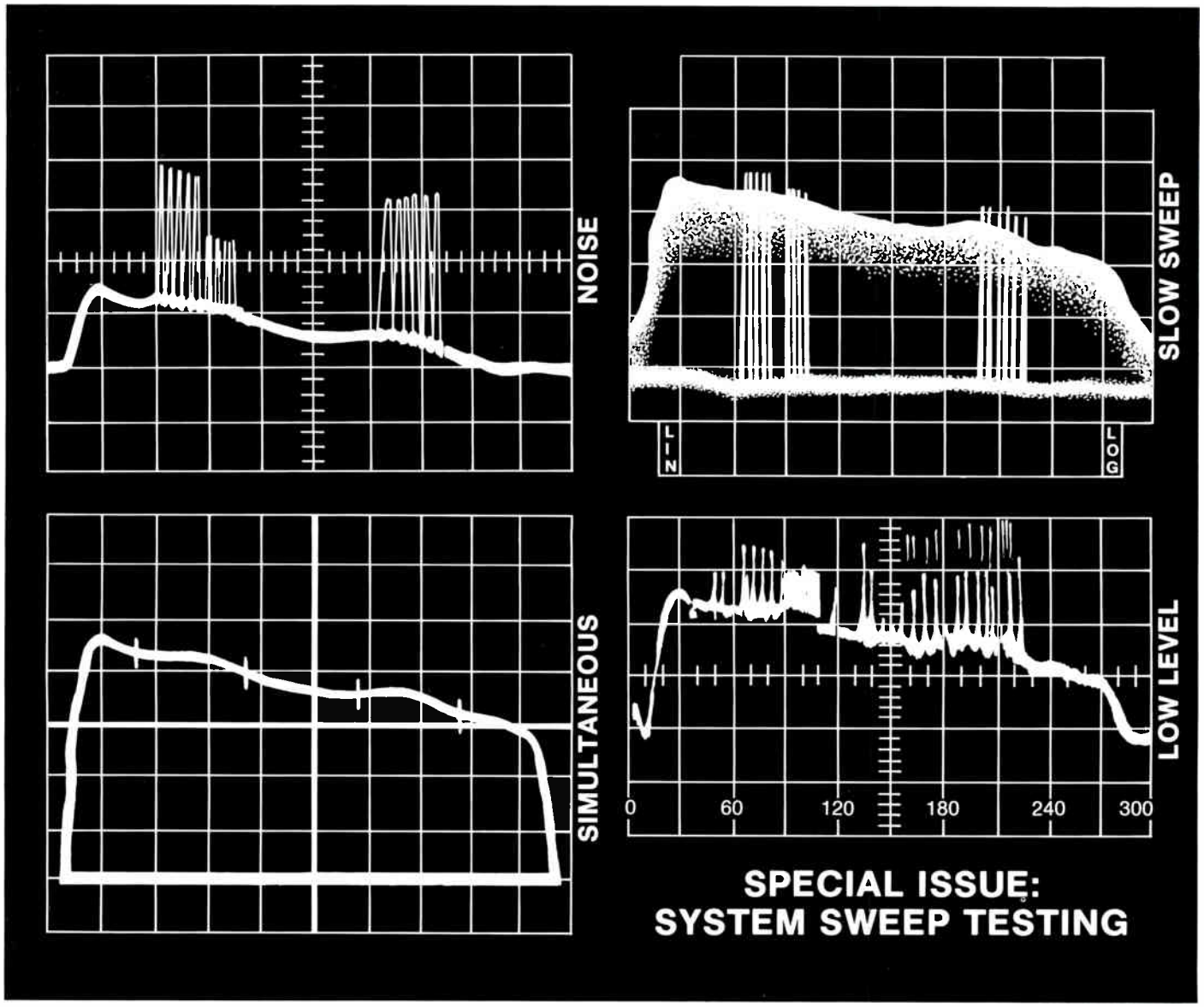
communications/engineering digest

reporting the technologies of broadband communications



september, 1976
volume 2, no.9

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But subscribers become more sophisticated. And with Sylvania CATV, you can be ready for them.

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CATV Operations, Electronic Components Group, GTE Sylvania, 114 South Oregon St., El Paso, Texas 79901.

GTE SYLVANIA

September, 1976
volume 2, no. 9

communications/engineering digest

COVER: A collage of the waveforms from the four major frequency response techniques is shown. The results are all similar, however, the equipment, resolution, and customer interference level varies with each technique.

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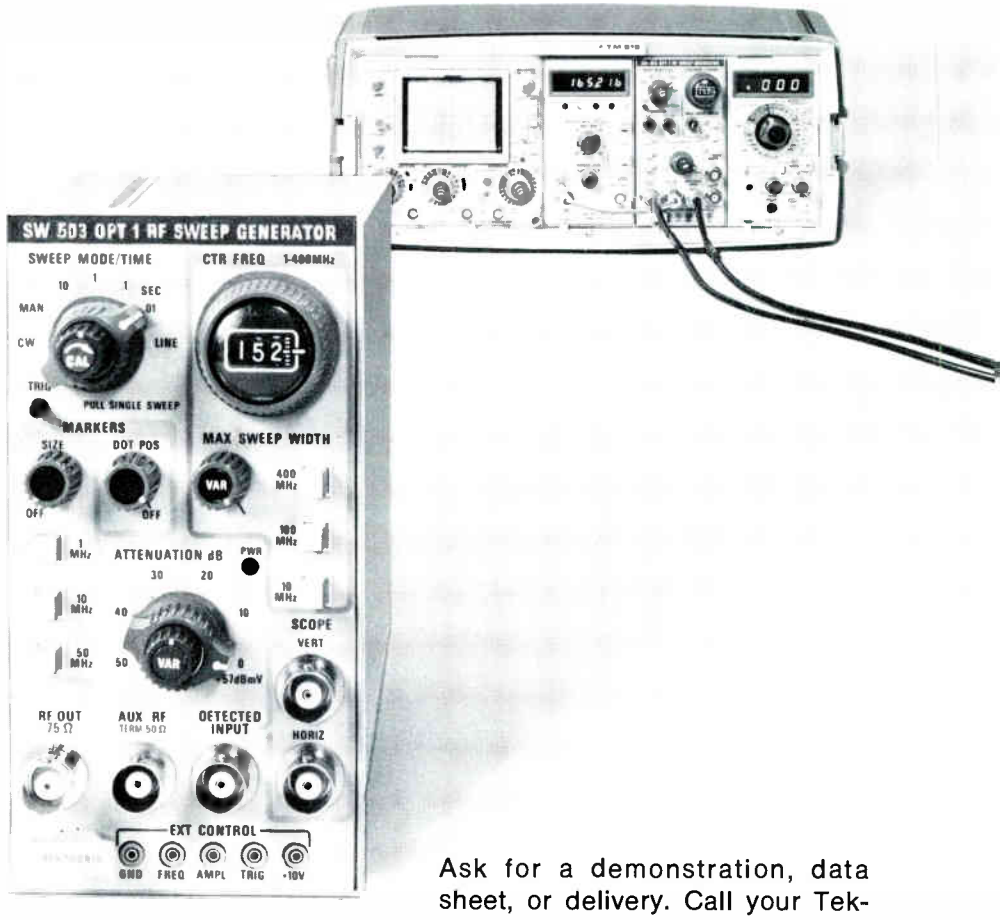
Shopping for a Sweep Generator? You may need a Sweep System...



. . . Funny things start happening when you interconnect this new sweep generator with a frequency counter, scope, and other instruments in the TM 500 system:

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opinion/editorial

Judith Baer, Associate Publisher

Okay, now it's back to business as usual. Thanks for all the good remarks on the August issue of *C/Ed* with *CableVision's Tech Review*. Everyone I've heard from was bananas about the issue. I won't bore you with production details other than saying that the entire issue was produced, directed, moved from Washington, D.C. (the C/Ed side) and pulled together faster than the speed of sound. A super magazine for a super group of people produced by supermen (and superladies). There were glitches, most of them you probably didn't notice (I hope). But, since we're in the business of publishing magazines, we noticed them and they'll be cleaned up. We do invite your comments. As both Cliff Schrock and I mentioned in our editorials in August, it's your magazine.

September is an exciting month. We're entering our second year of publishing *C/Ed;* celebrating birthdays; going out on new adventures and having toasters fixed. Mine broke since my remarks about raisin toast and standards.

September is "back to school" time. Little people pile into buses. Big people get onto airplanes. I'm not certain if it's the weather or a hangover from childhood, but a surge of adult/industry training programs seems to start over each fall.

Summer closed with Scientific-Atlanta's conference on earth stations and CATA's CCOS '76 in Oklahoma. September brings three big events for engineers and technicians with the Southern Cable Association meeting September 12-14; the NY State Cable Television Commission/Upstate NY SCTE cohosted 1976 Northeast CATV Technical Seminar on the 21st and 22nd; and then back to Washington, D.C. for the 26th annual IEEE Broadcast Symposium on the 23rd and 24th. (And they said I'd have more time to think!) Cable plays a big role in the IEEE symposium.

SCTE's chapters are meeting as always around the country. NCTA is making plans for the technical programming at the 1977 convention and SCTE is working on the 2nd Annual Reliability Conference. The Society of Broadcast Engineers holds its Third Annual Convention in NYC during November with SCTE participation and the Western Cable Television Association convenes December 1 in Anaheim with technical sessions galore.

What this shows me is that there are programs north, south, east and west and all points in-between for you to attend. There are college, university extension, junior college and correspondence courses going on all the time in your hometown locations. There are supplier seminars available all over the country. There are all sorts of places to go to learn, to re-learn or to merely update your current knowledge.

I've learned a trick that has worked for me and I'd like to share it with you. Rather than saying "I don't *have* the time to do that," how about saying "I haven't *taken* the time to do that." Having time (if you're honest with yourself) and taking time are two very different things. There is so much going on for almost everyone to take advantage of, in locations that are easy to get to and at registration fees that are more and more affordable. We have few excuses for not attending these programs and learning to do our jobs better.

Judith Baer

scte comments

Frank Bias, Western Vice President

This autumn will mark the 7th anniversary of my entry into our CATV industry. I came from a business (broadcast equipment manufacturing) which has a long professional tradition. The Institute of Radio Engineers (IRE) was founded in 1912 and in 1963 was strong enough to merge on equal terms with one of the "founder" societies, the American Institute of Electrical Engineers (IEEE). In 1969 broadcasting was represented in IEEE by a Group on Broadcasting which had their own publication and had conducted an annual Broadcast Symposium for over fifteen years. The word "television" had been added to the name of the Society of Motion Picture Engineers to make it the Society of Motion Picture and Television Engineers in recognition of the stature and professionalism of the broadcast engineer. There was an established Society of Broadcast Engineers (SBE) and a section of the Electronic Industries Association (EIA) which was devoted to broadcast equipment.

The situation in 1969 in CATV contrasted strongly. The Society of Cable Television Engineers was struggling to become established. None of the major professional societies recognized cable television engineering as a separate discipline. The engineering efforts of our trade society, the National Cable Television Association, were faltering after a good start. The technical spokesmen for the industry were not engineers but businessmen and entrepreneurs which led to the disaster of the "blue sky" days.

Now, seven years later, the situation of CATV Engineering is much improved due to the dedicated efforts of some cable people. Bob Bilodeau has almost single handedly built the SCTE from a paper organization to one of sufficient stature to sponsor technical sessions at each NCTA convention, and to co-sponsor with IEEE, the highly successful *First Conference on CATV Reliability* held in Philadelphia, February 5 and 6, 1976. Archer Taylor's pioneering article in the *IEEE Spectrum* in 1969 brought cable television to the attention of the general electrical engineering profession. Archer's efforts resulted in the establishment of an Ad Hoc Committee on Cable TV within the IEEE which was active from 1970 to 1976. Recently, IEEE gave cable television additional recognition by expanding the Broadcasting Group to be the Broadcast, Cable, and Consumer Electronics Society and by establishing a publication "Transactions on Cable Television." Delmer Ports has re-established and strengthened the engineering program of the NCTA and initiated engineering liaison with many related organizations such as the FCC, FAA, EIA, and the National Fire Protection Association (National Electrical Code sponsor).

The result of these efforts? CATV engineering is becoming recognized nationally.

This progress at the national level needs to be duplicated at the "grass roots." Perhaps the best way is through meetings of local chapters of the SCTE. In California we have found that participative meetings are best. As an example, the Avantek people set up a laboratory exhibition of their simultaneous sweep at their facility, but there were also demonstrations and discussions of other methods. At another meeting, the Catel demonstration of FM cable transmission was supplemented by a spirited discussion of the merits of the various methods of cable transmission.

Individual development is essential for cable television engineers to take their rightful place in our industry. One of the ways this growth can be achieved is through group experiences, as detailed above. To arrange for these affairs requires individual effort. Have you supported your local SCTE Chapter by taking an assignment lately?

CLIFF'S NOTES:

Twenty years ago, hardly anyone swept a system (or cared to). Ten years ago, if you wanted to sweep a system, all the channels were removed (after hours) and the system was swept by **brute force.** Today you have a lot more possibilities.

Before you choose a sweep system today, a lot of questions have to be answered. How much can you spend? What kind of resolution do you expect? How much customer interference can be tolerated? And once you figure out what equipment to use, then you have to decide how to align the system; i.e., flat to the output ports, flat to the tap, or flat to the average customer's set.

This issue contains a review of all the current sweep techniques, including the pros and cons. Also included are discussions on flatness, a new system alignment technique, and a buyers' guide to sweep equipment.

While all the techniques have been covered before in other publications, we hope you will find this single book presentation useful . . .

Now if I can just figure out how to get the water skis turned around in the water so I'm facing the boat . . .

Clifford B. Schrock
Editor

CCTA canadian column

Kenneth Hancock, Director Engineering

When Is Cable TV Not Cable TV?

In the print media, summer is traditionally the "silly season," and in Canada this tradition seems to be overlapping to the cable industry. The answer to the title question "when is cable TV not cable TV?" seems to be, at least in the eyes of the governments of the Prairie Provinces of Canada, when it is closed-circuit TV.

The background is as follows: In Canada jurisdictional responsibilities are reasonably well defined. In very broad terms, those areas that transcend provincial (state) boundaries are covered by federal jurisdiction, while those matters that can be restricted to individual provinces, fall within provincial jurisdiction. The Canadian equivalent of the FCC, the "Canadian Radio-Television and Telecommunications Commission," requlates Canadian broadcasting which, by the Broadcasting Act of 1968, includes cable television. The Canadian provincial governments can, however, and in some cases do, own and run provincial telephone companies. In particular, the government of the three Prairie Provinces, Manitoba, Saskatchewan and Alberta, own and operate provincial telephone companies.

In the early years of cable television in Canada, telephone companies shied away from the fledgling industry. Nevertheless, most telephone companies, including those in Manitoba and Saskatchewan, insisted upon the ownership of the coaxial cable strung to their poles, at what is considered to be a very high rate.

For this and other reasons, such as the comparatively small and widely dispersed population, cable TV has been very slow to grow in Manitoba and Saskatchewan.

In late 1973, the few small companies that had established themselves in Saskatchewan received a letter from the Saskatchewan Telecommunications Company stating that the rental agreement for the cable would not be renewed. An offer was made to purchase all plants of the system at approximately 1/10 of the balance sheet value, and to lease it back to the company at a rate that would recover this low purchase price in less than a year. This action, which was considered by many to be tantamount to an attempt at nationalization, was an indicator of things to come. In the succeeding periods, statements were made by the Saskatchewan Minister of Communications that all cable TV plants in Saskatchewan would be owned and maintained by Saskatchewan Telecommunications and that the Saskatchewan government would only permit cable television operators by nonprofit-making groups which met a number of criteria set down by the Saskatchewan government.

This conflicted with federal policy and resulted in considerable discussion between the federal and provincial governments.

In February of this year the CRTC held Public Hearings in Saskatchewan to hear applications for cable TV licenses in four major cities in Saskatchewan. The cities had not previously been licensed for cable TV; a situation almost unique in Canada for major cities. At the Hearing there were four major groups applying for the licenses. These were private enterprise cable TV companies; cooperative cable TV companies to be run on a nonprofitmaking basis, a consortium of broadcasters and, uniquely, the Saskatchewan Telecommunications Company. The latter application, for all four licenses, was directly in the face of the CRTC policy which is against ownership of cable companies by common carriers.

The decision on the licenses was made in mid-July with two of the licenses going to private enterprise companies and two of the licenses going to cooperative companies. In addition, all four licensees were directed to own as a minimum, the headend, amplifiers and subscriber drops.

One might feel that this was the end of the matter, but it was not to be so. Both the Saskatchewan government and Saskatchewan Telecommunications have taken the unusual step of filing appeals against the decision. The latest and most interesting volley in this provincial/federal battle was fired by the Saskatchewan Minister for Consumer Affairs, Ned Shillington, on the 30th of July in a statement saying the Saskatchewan government had approved nonprofitmaking groups to institute a form of cable television this winter without seeking approval from the CRTC. Mr. Shillington stated that the cable TV operations would be a form of pay-TV with films and tapes being played over what he described as closed-circuit systems. Because no programming would be picked up off-air, he stated that the pay-TV systems would not need the approval of the CRTC. As pay-TV has not yet been authorized by the CRTC in Canada, and will be the subject of Hearings in September, the statement lays down the qauntlet in no uncertain manner.

Technical News at a Glance

. . . **Rediffusion Limited of London claims their optical fiber system is first,** *serving 34,000 subscribers in the Hastings area of England. The single channel link is 1,427 meters and uses Plessey LED's. Fibers are made by Corning Glass Works.*

. . . **The Society of Cable Television Engineers has elected its four national officers for 1976-1978.** *Incumbents Robert Bilodeau, Suburban Cable; Frank Bias, TeleVue Systems; and Charles Tepfer, Tepfer Publishing, were re-elected as president, western vice-president and secretary/treasurer respectively. Ken Simons of Simons & Wydro Consultants was elected eastern vice-president, replacing Steve Dourdoufis of Vision Cable. Dourdoufis chose not to run in this election. Returns from 50% of SCTE's membership were tabulated.*

. . . *FCC Form 395 (Annual Employment Report) shows 740 "professionals" (which includes degreed engineers); 2,410 "officials and managers" (which* **could** *include degreed engineers); and 4,620 "technicians" (which includes* **no** *degreed engineers). That's out of the 17,300 jobs reported in CATV. Industry stats estimate* **total** *employment in industry lingers at about 24,300.*

. . . **Draft copy of chapter on Fiber Optics Communications is being circulated by Institute of Telecommunication Sciences** *in Boulder, CO for inclusion in special OT report. Draft is undated and makes no mention of cable industry except in broad sense. Report lists 12 "Representative U.S. Experimental/Prototype Fiber Optical Communications Systems."*

. . . *U.S. Dept. of Commerce/Office of Telecommunications has released* **A Guide to Technical Standards and Measurements for Cable Television Systems** *to NTIS for publication. Book is compilation of material published elsewhere and has no enforcement quality. Bill Hsiao,* former NCTA and DOC/OT staffer completed project more than a year ago. DOC just got around *to releasing it as Technical Memorandum. A respected engineer has said that changes in industry technology and FCC Rules make document out-of-date, useful as a guide, but nothing to get excited about.*

. . . **Bob Bilodeau, Suburban Cable and SCTE prexy, is dinner speaker at Northeast Cable TV Technical Seminar,** *Oswego, NY on September 21.*

. . . **CATA's petition** *to FCC on* **small earth stations** has been supported with comments from NCTA and at least five industry suppliers.

. . . At Washington, D.C. press conference, new OTP director Tom Houser spoke little of cable and much about reconciling differences with FCC. "National telecommunications policy document" — "It will have the public, not the cognoscenti in mind . . ." will be released in late November from OTP.

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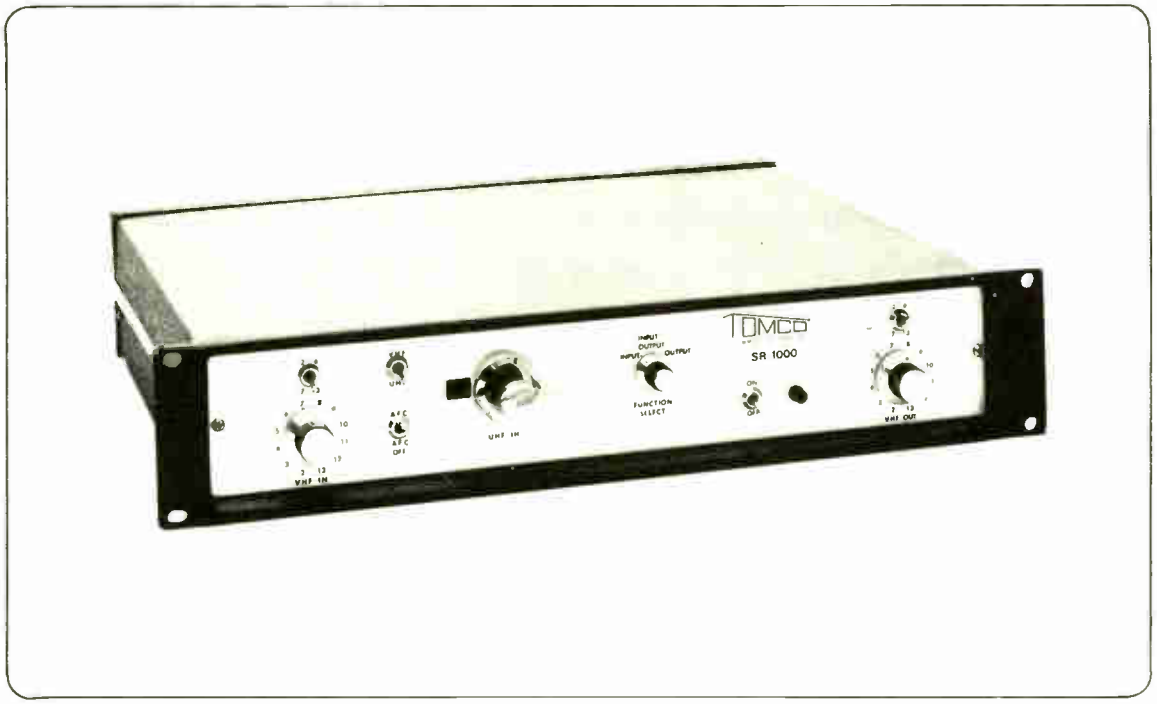

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Ad Index

news

CPB Submits Application For 13 TVRO Stations

The Corporation for Public Broadcasting submitted its "lead" application to the FCC for the first 13 of an eventual 150 ten-meter TVRO earth station facilities on August 13, 1976. This project has an estimated cost of more than $39 million which includes the 150 ground facilities, the main origination terminal (to be located outside Washington, D.C.) and five regional transmit-receive terminals. Procurement of the ground stations represents the major portion of the cost, with CPB stating ". . . receive-only earth stations and related facilities and services . . . $27.2 million." CPB, which is funded by Congress with taxpayers' dollars, has arranged an agreement with the Bank of America and various other private lenders. CPB and B of A have completed preliminary negotiations for a $32.5 million line of credit, available on a reducing basis through September 1987. Primary repayment will be from CPB's annual appropriation from Congress.

The remaining $7 million will come from CPB, the public television stations, with help from the Kresge Foundation, PBS and a grant and loan from the Ford Foundation. Individual stations are expected to contribute $20,000 each with $10,000 coming from the Kresge Foundation grant.

CPB will lease three transponders from Western Union over seven years, with a charge of $800,000 per transponder annually for the first three. When the fourth transponder is activated, the cost for that additional use is $750,000 per year. Changeover costs to the new system are estimated to be $5.5 million.

Why Not Smaller Stations?

When asked about the hardware, CPB stated that ten-meter dishes had been chosen since that was what the FCC was able to approve at this point in time. Collins, part of Rockwell International, is in the process of negotiating the contract for construction of the earth terminals. CPB stated that they did not know when the first installation would be operational but did state that they expect the program to be working by 1979. Asked if they would join in making comments on proposed rule makings before the FCC on facilities with dishes smaller than nine meters (the current FCC minimum size), attorneys from CPB and PBS stated the likelihood was great that they would respond with comments at some point in the future. It is believed, however, that neither CPB, PBS nor other participants in this program would initiate such proceedings independently. Queried about cable television operators, they responded that ". . . they are fighting the battle very well currently."

Excess Capacity/ Programming Decisions

CPB had no knowledge publicly during its press conference about the recent FCC Public Notice on cooperative use or ownership of receive-only earth station facilities by cable television operators. Again, attorneys from CPB and PBS said later that clarification of the rules is necessary from the Commission to determine if other non-profit entities may share CPB/PBS's earth stations. There are provisions for piggybacking of audio channels for public radio broadcast stations.

Regarding programming decisions, CPB is stating that individual stations will make the decisions about what programming from the various transponders they wish to carry to viewers.

Comments on the Application?

CPB was asked what sort of comments they anticipated to their application to the FCC. Henry Loomis, president of CPB, said that they anticipated no adverse comments and knew of no one who would file comments that would hold up Commission approval of the application.

S/A To Talk on Demodulator as a Tool

James Farmer of Scientific-Atlanta joins the technical sessions programmed for the Southern Cable Television Association's 16th Annual Convention and will address the topic of "The Demodulator as a Tool." Jim joins five other prominent speakers lined up for the meeting's technical sessions. The topics include "Measurement, Methods & Techniques" by David Large of Avantek; "CATV Earth Station Technology" by Carl Van Hecke of Andrew Corp.; "Satellite Receiver Technology" by Michael Balbes of Microdyne; "Reliability and Your Pocketbook" by Jim Palmer of C-COR;

and, "Update: FCC Standards & Measurements" by Bob Powers of the FCC Cable Television Bureau.

Low cost housing has been arranged for personnel who wish to attend this meeting without staying at convention headquarters at the Atlanta Fairmont Hotel. Arrangements can be made through Judy Williams at Cox Cable in Atlanta by calling her at (404) 393-0480. Registration fee for the entire technical program, a buffet on Sunday night, September 12, access to the exhibit area and attendance at an Atlanta-Houston baseball game on Tuesday evening, September 14, is only $15 if accompanied by one complete management registration. Technical personnel should speak to their management to see if someone from your company is planning to attend this meeting. Registration forms should be requested from Otto Miller, SCTA Executive Secretary, at (205) 758-2157.

Dates for the meeting are September 12-14, 1976. Technical programming starts at 9:00 a.m. on Monday, September 13.

IEEE Broadcast Symposium/ Cable To Participate

New developments in engineering technology relating to AM radio, television transmission, cable television and satellites will be highlighted at the 26th Annual Broadcast Symposium of the IEEE Broadcast Group September 23-24, 1976, in Washington, D.C.

New papers will be presented by prominent communications engineers and policymakers including "AM Stereo Broadcasting—A New Approach," by N.W. Parker and F.H. Hilbert; a discussion of "Public Broadcasting Satellite Interconnection Systems," by John E.D. Ball; and, "AREAPOP—A Broadcast Coverage Prediction Model," by E.A. Williams of the PBS.

Morning sessions on Friday, September 24, will be chaired by Delmer Ports, vice-president of Engineering, of the NCTA. Topics include "Television Transient Response Computations Using a New Simulation Program," by S.K. Goyal, C.B. Neal and E.R. Bowerman of GTE Laboratories; "Subjective Television Picture Rating—Purpose?" by Frank Bias, TeleVue Systems; "Precise Location of CATV System Ingress and Egress," by Warren Braun of ComSonics; "Data Transmission on a Cable Television System," by Alan Hahn of Manhattan Cable TV; and "Utilization of CATV Networks for Data Transmission and other Commercial Services," by Robert V.C. Dickinson, E-Com Corp.

The luncheon speaker on Thursday, September 23, will be the Honorable Lionel Van Deerlin, chairman of the Subcommittee on Communications, House Interstate and Foreign Commerce Committee.

This 26th Annual Broadcast Group Symposium, sponsored and arranged by the Washington, D.C. Chapter, is open to all persons whether or not a member of the IEEE. Registration is required for admission to all sessions. Advance registration may be made by contacting Vic Nicholson at CTIC, (202) 872-8888.

Hawaii Not Forgotten

Rumor had it that the RCA SATCOM II bird didn't deliver the promised capability of a footprint over the Hawaiian Islands. RCA "forgot" to include it and our western-most state was peeved. The truth is there *are* spot beams on SATCOM I and SATCOM II to provide coverage for the Hawaiian Islands. They are not part of the main antenna. Both beams provide sufficient power for coverage of the area. RCA reports that there was a problem with one transponder on SATCOM II and that information was reported to the FCC. The problem has been worked out and it had NOTHING to do with the spot beam for the Islands. From an engineering measurement standpoint, RCA admits that signal quality over the area is not of the same quality as that stateside. They say, however, that the signals provided are sufficient, if not more than good enough, for the average television viewer.

Industry Support for CATA

Wednesday, August 25 was the day for response comments to the *Petition for Rulemaking* or *Declaratory Statement* filed by CATA on *Amendment of the Commission's Rules and Regulations or Policies Relative to Satellite Earth Station Antennas to Permit Receive-Only "Small Earth Stations."* NCTA, and at least five industry suppliers replied with favorable response to CATA's petition. ABC filed comments asking the FCC to go back to a previous petition initiated by that company and deny this one. ABC feels that the current petition before the Commission does not properly address the issue of spectrum management and that no decision should be made regarding small earth stations until the World Administrative Radio Conference meetings are concluded in 1979.

Nearly 400 pages of technical data supporting the small earth station concept were submitted with the responses. Graphs, charts, radiation patterns and papers authored by a variety of satellite technology experts were included. Twenty days remained for replies (from the August 25 date) and the matter then goes before the Commission. There is no time limit set legally in which the FCC must decide the matter.

Included in NCTA's filing is a proposal to make licensing of all earth stations optional at the discretion of the cable system owner/operator. Operators choosing to not request licensing will be subject to any future interference that may develop from encroachments. If the installation is licensed, it should then be afforded the same degree of protection as provided by the FCC currently, regardless of whether it is a 9 meter dish, something smaller or even a nonparabolic dish.

Mueller Tells Communications Subcommittee About Cable

J.J. Mueller, president of EMCO CATV in Manchester, VT, spoke to the House Subcommittee on communications during its recent hearings in Washington, D.C. Mueller addressed himself specifically to the area of "Rural Cable Television."

Mr. Mueller has been active in the industry for more than 16 years, having built his first system in Manchester in 1960, and therefore maintaining his status as "the CATV Pioneer in Southwestern Vermont." He explained the relief that he feels is urgently needed if rural cable television is to become a viable venture.

A few years back, we introduced the first Wavetek sweep/signal generator designed specifically for the CATV industry. That was the Model 1801A—a 1- to 500-MHz instrument with an optional range of 450 to 950 MHz, 75-ohm calibrated output, built-in RF detector, and crystal-controlled birdy-marker system. It also has a simo-sweep function to test operating systems with minimum subscriber interference.

Since then, we've brought out a few other CATV instruments. Like the Model 1850/1860—an economical transmitter/receiver combination for continuous monitoring of CATV system performance. It features carrier level readings, drop cable compensation and tuned RF trigger circuit. Frequency range is 5 to 350 MHz.

All sweepers offer the unique Wavetek "tilt," pilot carrier notch filter, and five IF markers for processor alignment.

The 1053/1063 Comparison Test Set provides tilt compensation on both the loss and gain ports and is adjustable to correlate "out" connector and cable differences. The set, complete with sweep and large screen scope, is less than $2,000.

For sheer economy vs. performance, there's never been anything like our Model 1051—a 1- to 400-MHz sweeper with calibrated output, built-in detector, and Type F connectors; plus a complete crystal-controlled birdy-marker system.

Our Model 1901B X-Y Display Oscilloscope has an easy-to-read 12-inch CRT and comes in both single and dual-trace versions. It's ideal for resolution of amplifier, response cable return loss, or general sweep testing.

Finally, we have a whole series of miniature, turret-type attenuators that operate over wide frequency ranges.

Now that we've gotten that out of our system, why not get some of our equipment into yours. Just write WAVETEK, P.O. Box 190, Beech Grove, IN, 46107. Phone (317) 783-3221. TWX 810-341-3266.

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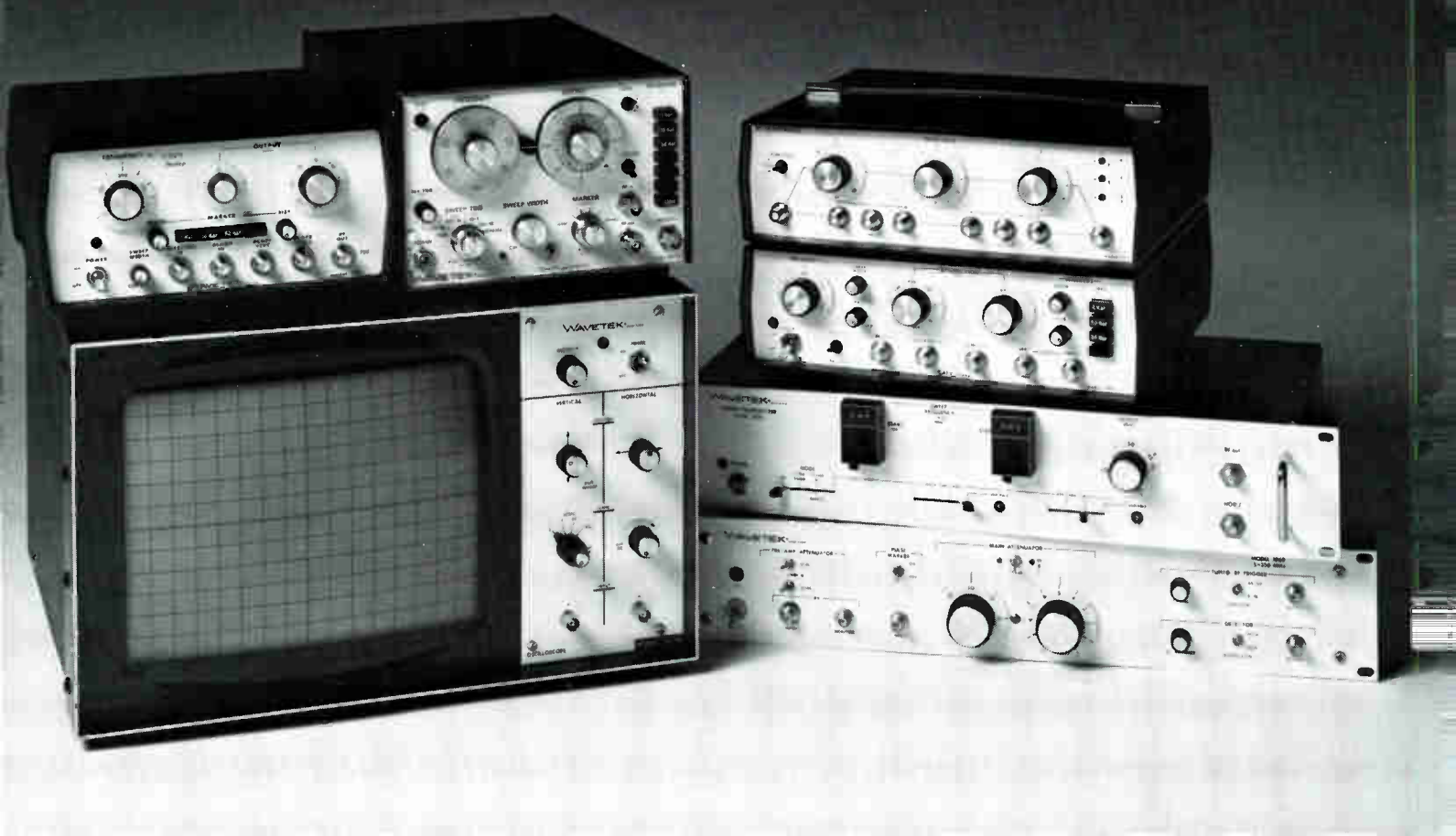
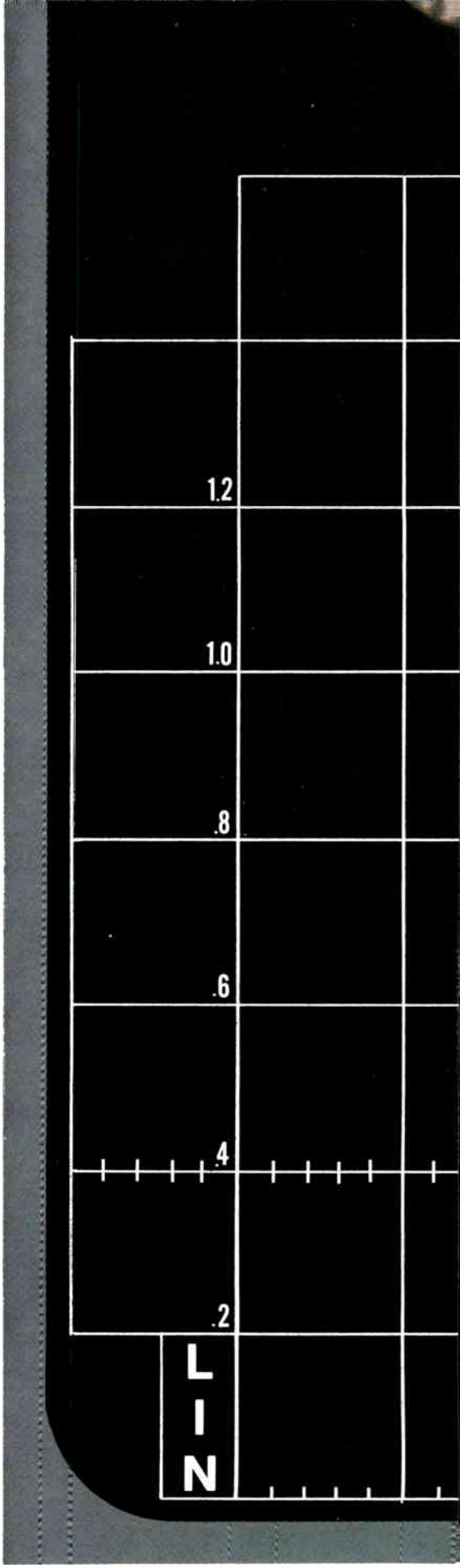


SYSTEM SWEEP TESTING

Frequency Response Testing has been claimed by many system engineers to be the single most important test they perform on their systems. Many other parameters are related to correct response and levels such as distortion and noise performance. Presented within this special section on sweep testing is a comprehensive guide to the subject. The simplest tests are the point plot and the signal off, sweeper and detector scheme. Beyond these two tests, the operator today has a variety of possibilities available. The simultaneous sweep (sleep saver) offers probably the best compromise of money versus performance for the smaller system operators. The low level system on the other hand is a true Cadillac system, but if your system can keep one going all day every day, the savings and convenience would probably pay for the unit in a couple of years. If you own a spectrum analyzer, other techniques such as the slow sweep and the noise test can be used. In addition, a number of short articles are included on subjects related to sweeping. A buyers guide is provided in the rear section to help you in selecting the sweep scheme just right for your system.



The Don Levenson Story

by Cliff Schrock
Editor

It seemed appropriate that when we started to put together this special issue on sweep testing, we go talk to Don Levenson since he was the inventor of the simultaneous sweep.

Don started with sweepers back in the 1940's while working for the government, so sweepers weren't new to him when he went to Wheeling, West Virginia and started getting serious about cable TV in the early 50's. He started sweeping with a narrowband unit (since that's all they had back then) and would use a pay phone to step the unit up to the next channel. Since they only had lowband channels 2-6, there weren't a lot of changes, and of course the channel had to be off for the sweep to be detected, but it was a start.

Next they went to a broadband sweep with all the channels off at night, and that worked OK for quite a few years, but Don knew there had to be a better way. The broadcast days were getting longer, leaving only about 3 hours (between 2 and 5 AM) to sweep, and the system was getting larger.

I asked Don what really sparked the inspiration of the Simo-sweep expecting to hear about some technical breakthrough and he told me this story: "See, One night we were out about 3:00 in the morning up the top of a phone pole fighting some old amplifier, and all of a sudden a bedroom window opened up in the yard and some guy was standing there in his P.J.'s pointin' a gun up at us. This guy asked 'What the ---- are you guys doing?' We told him we were workin' on the cable system. He responded with 'Don't hand me that line' and Don had a forced inspiration on the spot. THERE HAD TO BE A BETTER WAY!!!

Don built his first device out of an old Kruse Storke sweep generator (now Systron Donner), and triggered it with another contraption. The magic numbers of 15 dB above picture carriers and 2 ms sweep time fell into place, although it was kind of rough getting a detector that fast back then. Over the next three years, Don built two more units and finally ended up with one box and an 87^{c} GE unijunction transistor to do the sweep triggering. He also experimented with a low level system but admits that he could never get the sweep of the generator and spectrum analyzer to lock. Besides, the simultaneous sweep system worked pretty good.

During the three years from 1963 to 1967, Don ran his sweep continuously and went off to the conventions and manufacturers talking about his noninterfering sweep. Don said nobody believed him and generally ignored the whole thing. Don was reminded of Mark Twain who said "A man with an idea is thought to be a crank until his idea succeeds". Trouble was, Don's invention already was a success.

Finally, in 1967, Don was going to take his son up to Harvard and threw the old sweep system in the trunk of the car. On the way back, he stopped at Jerrold and showed the thing off. Bob Bilodeau, then with Jerrold, was the first to figure out that Don wasn't crazy, and that the dang' thing worked. Eventually Lee Zemnick, the VP of Jerrold, bought the idea for use in their own cable systems. Somewhere down the line the unit was dubbed "The Sleep Saver" and the rest is history. No patents were ever granted (or filed for) and most systems today use some form of a simultaneous sweep system for alignment.

To close my talk with Don, I asked him what was the worst problem he encountered. He said most of his time was spent on the detector. Couldn't seem to get the speed up to match the 2 ms sweep rate for a long time. He also tried to figure out a cheaper way of getting a storage scope than using the old HP. Only today, are we starting to get some moderately priced storage scopes.

Figure 1 - The first sweep system using the single channel pay phone controlled sweeper.

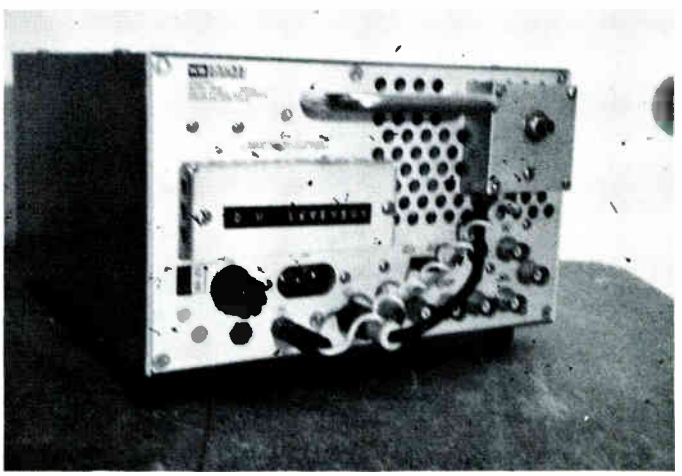


Figure 2 - The first complete simultaneous sweeper built by Don, using the old Kruse sweeper and GE unijunction (in Box).

How Flat Is Flat?

by Bob Welch
Wavetek, Inc.

The output amplitude variation vs frequency of a sweep generator is often a misunderstood and, on occasion, a misused specification. The variables directly affecting flatness are:

1) Harmonic content
2) Spurious beats
3) Monitoring system (for ALC or AGC)
4) Type of detector used.
5) Source impedance
6) Attenuator accuracy

In today's modern sweep generators, closed loop methods of automatic leveling are used. With this technique, the RF output is monitored with a high impedance diode detector. The voltage is compared to a reference and the error signal so derived maintains a constant output by controlling: oscillator B+, output amplifier gain, or the attenuation of PIN diodes.

A simplified block diagram is shown in Figure 1.

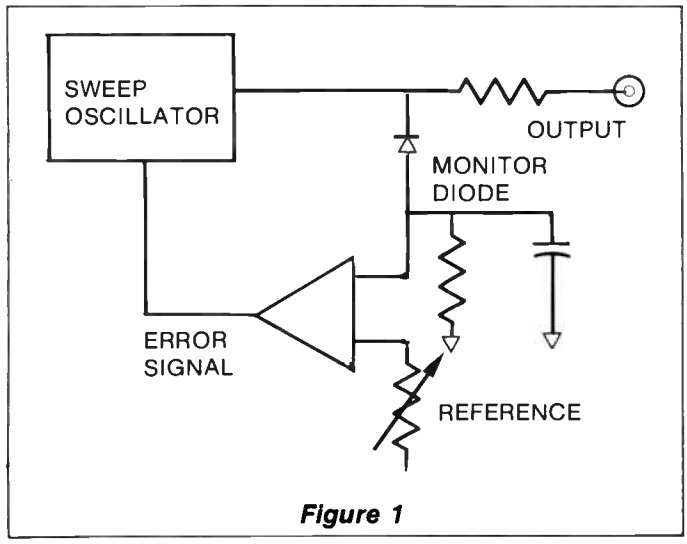


Figure 1

In this example, the monitor diode used is of a negative polarity. Therefore, the sampled voltage is the one-half wave detected and filtered negative envelope. If we *greatly* expand the possible leveling errors when using a broadband RF detector as the flatness indicating instrument, the results as shown in Figure 2 should occur. The envelope (A) in Figure 2 represents the output envelope from the sweep oscillator without leveling: (B) represents the detected output with negative leveling and a negative detector. Note the flatness of the dotted line. (C) represents the detected output of the positive side of the envelope, using negative leveling and a positive detector. Note the unflatness compared to (A).

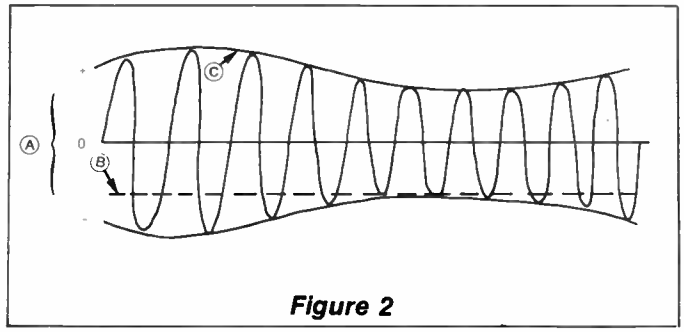


Figure 2

When the flatness specification is expressed as ± 0.5 dB, it means *almost no* error on the leveled polarity and most of the error on the unleveled polarity. The spec is generally equal to:

$$\frac{\text{Leveled polarity + unleveled polarity error}}{2} = \text{flatness}$$

As you can see, the most accurate flatness measurement results when the polarity of the detector is the same as the monitor diode. Most CATV sweepers use negative monitors, so a negative detector should be used.

On some occasions, a sweeper will use a peak-to-peak leveling system, comparing both the positive and negative envelopes. This can lead to other possible errors. Expanding the possible envelope error, we would see the response shown in Figure 3.

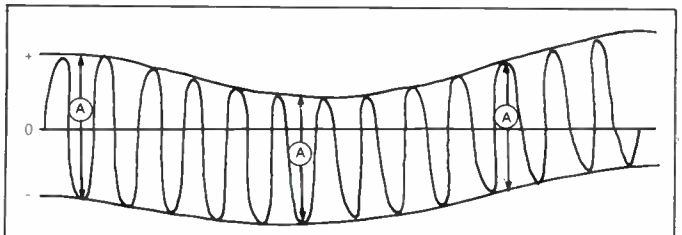


Figure 3

The error shown from the zero line to both the positive and negative envelopes is primarily caused by harmonic content.

If a peak-to-peak RF detector were used, the resultant voltage would be the difference between the positive and negative peaks. As you can see from the three arrows labeled (A), the difference is almost constant, and the resultant demodulated response would appear as shown in Figure 4a. The harmonic content and resultant unflatness is hidden. Figures 4b and 4c show the same signal using a one-half wave negative and positive detector.

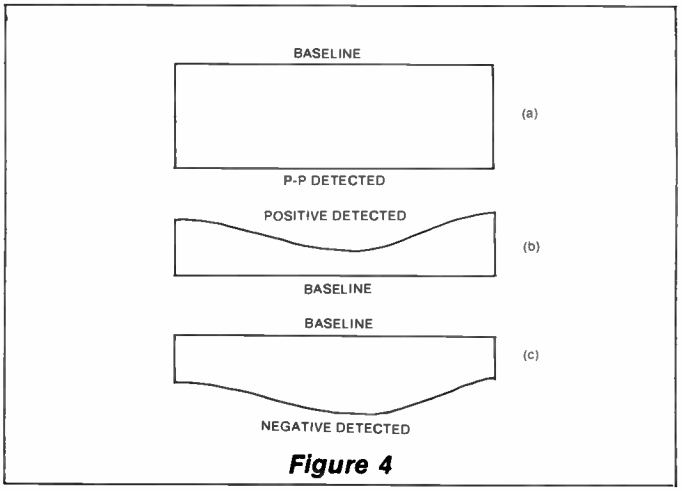


Figure 4

Summary

The commonly used negative polarity loop offers a reasonable, cost effective leveling system for most sweep generators. They can be as effective as the more complex peak-to-peak leveling systems. To obtain the maximum in performance from a sweeper, it is necessary to understand the limitations of each leveling system, and the proper detectors must be employed.

Simultaneous

The simultaneous sweep was devised to produce simple, rapid results with accuracy sufficient for system alignment. The test system described can sweep from 50 MHz to the upper limits of any system.

The simultaneous sweep system consists of two basic units: a sweep generator located at the headend, and the sweep receiver which includes a detector, a video filter (optional), a trigger source (Signal Level Meter), and a storage oscilloscope.

Editors note: Available as an alternative to the traditional sweep receiver setup is a device built by Peca that combines the detector, markers and post amplifier system all built into one convenient box. The Peca unit works with any storage oscilloscope and is available in line powered or battery operated versions.

Figure 1
Peca Simultaneous Sweep Receivers.

A simultaneous sweep consists of a 2 ms burst sweeping from 50 MHz to approximately 300 MHz. This burst is repeated at an interval of 5-20 seconds. The RF energy is present then for only 2 ms in a given period. During the 2 ms interval, the interference to each channel is approximately 100μs causing interference for 1½ lines. This interference is generally not noticeable to an untrained observer. (Figure 2)

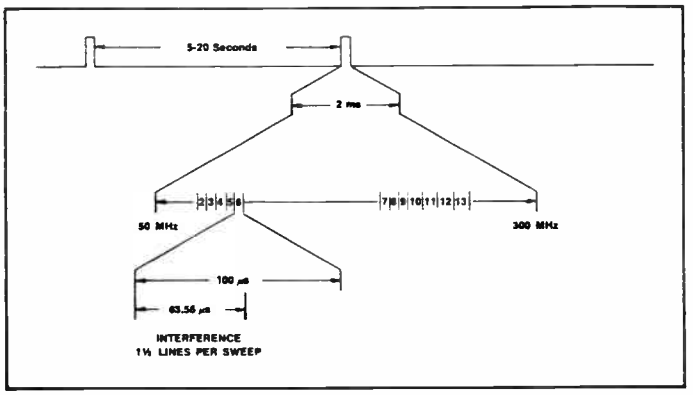


Figure 2
Timing Diagram—Simultaneous Sweep

The RF level of the sweep signal is carried +15 dB above the highest carrier on a CATV system to permit the sweep to be detected with the system in normal operation. Again, because of the short duration of the sweep pulse, interference is not objectionable.

Many variations to the simultaneous sweep system exist and can be used, however, this discussion will be limited to a typical setup where the sweep is inserted at the headend and sampling is done at amplifier test points.

The equipment can be assembled and used effectively in a bucket truck. Power requirement for the package described must include a heavy duty inverter (400 watts) or a small generator plant unless a battery operated, such as the Tektronix 214, is used.

Equipment Required:

1) Storage oscilloscope—Tektronix 5111 or equivalent.
2) Sweep generator—capable of simultaneous impulse sweep (Wavetek 1801-A).
3) Detector—Wavetek D171 or, WBE, A61/7F, equivalent.
4) Signal Level Meter (SLM)—Jerrold 727 or equivalent.
5) Video filter—15 kHz Low Pass (Optional).
6) 2-way splitter (Jerrold 1596A).
7) Attenuator 0-70 dB in 1 dB steps. Wavetek 7580 or equivalent.

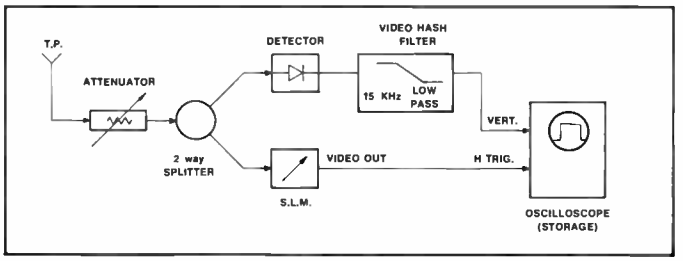


Figure 3
Connections of Test Equipment

Procedure:

1) Set up the sweep generator in the CATV headend. Generally the sweeper can be inserted through a directional coupler (DC-8) ahead of the output test point. Establish a generator level 15 dB above the highest picture carrier. In cases where the sweeper cannot provide enough output to satisfy this requirement, it may be necessary to use a post-amp or alternate sweep insertion technique. The sweep generator should be carefully handled at this point, as it can cause severe picture impairment if not properly set.

2) Establish the output level in the CW mode monitoring with Signal Level Meter on the output test point. Then set up the sweeper for a 2 ms sweep rate and select a 5 to 20 second REP RATE. The sweep should cover the 40 to 300 MHz range.

3) Observe a TV monitor in the headend and verify that the system interference is negligible.

4) Set up the van or service vehicle with the equipment as illustrated in Figure 3.

5. Select Channel 2 on the Signal Level Meter and adjust the input attenuator until the meter indicates +10 dBmV. This step should be repeated at each test point to obtain the proper input attenuator setting.

6) The Signal Level Meter video output jack can be connected to the EXT H. TRIGGER on the oscilloscope. Select 50 MHz on the SLM. The oscilloscope should be set up for a 0.2 ms/div HORIZONTAL SWEEP rate. The trigger sensitivity can be adjusted so that the scope responds to each simultaneous sweep burst with a horizontal trace. Adjust the SLM if necessary to obtain a stable trigger.

7) The oscilloscope vertical sensitivity can now be adjusted

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to give a full screen display as depicted in Figure 4.

8) The oscilloscope controls should not be adjusted after the preliminary setup, instead the input attenuator should be capable of handling the various test point levels encountered in the field.

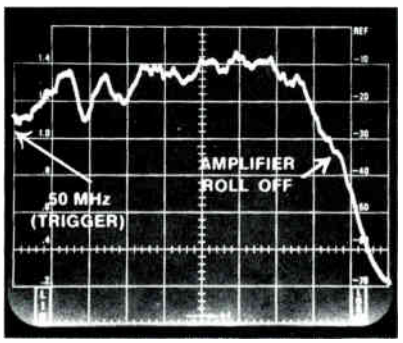

Figure 4

9) The Signal Level Meter can be used to get a rough idea of where various frequencies are located in the trace. The frequency dial selected the trigger start point. As indicated in Figure 5, 170 MHz selected on the SLM, when applied to the first

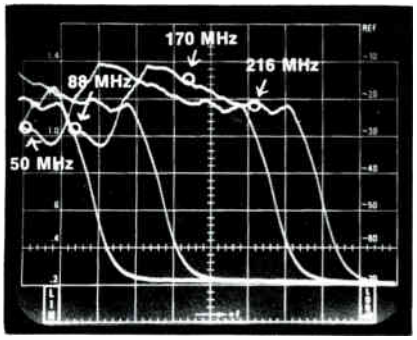

Figure 5

trace, can be used to locate the 170 MHz point (beginning of high band). Once the primary frequencies are located, these can be marked on the screen with a grease pencil.

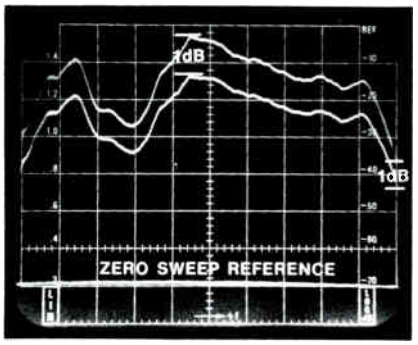

Figure 6

10) It can be helpful to use the input attenuator to generate a double trace on the screen with 1 dB separation for calibration purposes. The summation sweep display is a linear display, however, and the 1 dB reference *cannot* be interpolated across the screen. (Figure 6)

Hints and Precautions:

1) A 54 MHz marker can be incorporated into the headend sweep generator. This marker icentifies the Channel 2 band limit and the harmonics include 108 MHz (top of FM band). Also, the highband is marked at 172 MHz and 216 MHz. A marker inserted

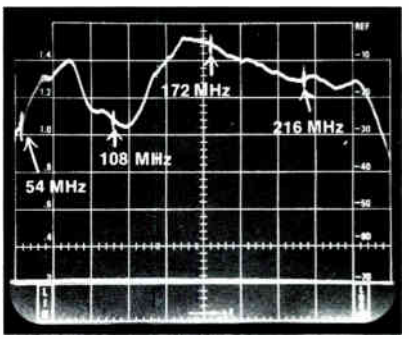

Figure 7

at the headend can be recognized 10 to 14 amplifiers into the system. (Figure 7)

2) It is important to verify the match and accuracy of the test fixtures; i.e., splitter, detector and attenuator. Flatness accuracy can only be as good as the test equipment and fixtures.

3) Block tilt established in the headend should carry through the system unaffected; therefore, systems with block tilt should be aligned flat, even though block tilt exists between the high and low band levels.

4) In some instances, it may be necessary to either pre-equalize the sweep signal, or equalize the input of the simultaneous sweep receiver setup. These situations involve special spacing between amplifiers of which a system operator with special designs will be aware.

5) Most system AGC's will be unaffected by the simultaneous sweep; however, should a problem be encountered, it may be necessary to bandstop around certain pilot frequencies.

Figure 8
Convenient Portable Simultaneous Sweep Receiver Using the New Tektronix 214 Portable Storage Scope.

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Low Level S

The low level system of sweeping uses a conventional wideband sweep inserted at a low level relative to the picture carriers. Typically 35 to 40 dB below pictures is sufficient to insure that no visible interference will be observed in the picture during average program material and with typical noise present.

Figure 1
The Avantek CT/CR-2000

The trick in using a low level sweep is recovering the sweep. A broadband detector will show nothing except the demodulated picture carriers. Required is a sychronous narrowband receiver that tracks the sweeping signal exactly. Even though there is picture information present, the low level sweep can be recovered intelligibly because, at any given instant, the probability of the sweep and picture information being of the same frequency (other than picture and sync carriers) is very low. This function can be best handled with a spectrum analyzer. Synchronization is difficult, however, over the distances encountered in the normal CATV system from the headend to the field test points. A tracking generator normally associated with a spectrum analyzer would work and permit recovery of the signals, however, again the synchronization cannot be accomplished over the distance involved.

Presently, Avantek is the only company actually making a low level sweep system with a generator for the headend, the spectrum analyzer and necessary synchronization gear for the field. The units are designated the CT/CR-2000 Remote Automatic Sweep System. The cable transmitter portion produces two separate signals. The test signal is a flat signal that is swept from 5 to 300 MHz in approximately 18 ms and is 35 to 40 dB down. The combination of low level and rapid sweeps makes the test signal invisible to the customers. The other output is the reference signal, a pilot carrier at about 50 MHz that is FM modulated.

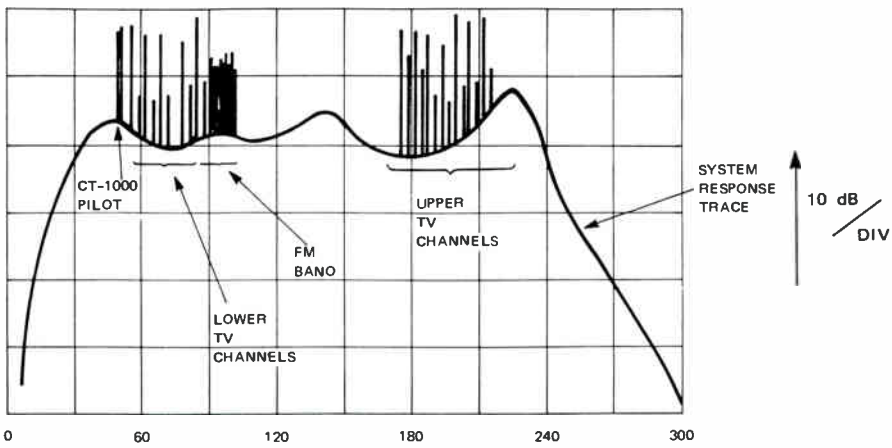

Figure 2
Typical spectrum response of a 12 channel CATV system.

The Model CR-2000 Cable Receiver contained the circuitry to decode the pilot reference signal and make the self-contained spectrum analyzer track the sweep signal being sent from the headend. The cable receiver can also be used as a stand-alone high quality spectrum analyzer. This permits the testing of spurious beats, levels, radiation and other parameters beside the sweep testing.

The sweep transmitter is inserted at the headend through a directional coupler. The level of the FM pilot (49.6-52 MHz) is set equal in amplitude to the picture carriers. The low level sweeping signal is then set just below the visible interference point as observed on a TV receiver.

The receiver should be connected to a test point in the field on the CATV system. Assuming a 12-channel system, the picture on the display of the CR-2000 should appear as in Figure 2. The system response falls off below Channel 2 and above Channel 13 because of the bandpass design of the amplifiers. The video, aural and FM carriers are a normal part of the display caused by the spectrum analyzer portion of the unit and serve to help mark the exact carrier positions on the display.

Figures 3 and 4 show an example of a fault indication, a suckout between Channels 11 and 12. The display can be expanded for finer resolution around the carriers.

System noise will begin to show at about the tenth amplifier from the headend. A thickening of the baseline will occur; however, this does not usually impair the utility of the low level sweep system.

The Avantek system represents a fine adaptation and use of the low level method of sweeping. Other possibilities will probably exist in the form of digitally controlled units in the future, but to date, this is the only choice you have and works as well as any system could expect for system alignment and maintenance.

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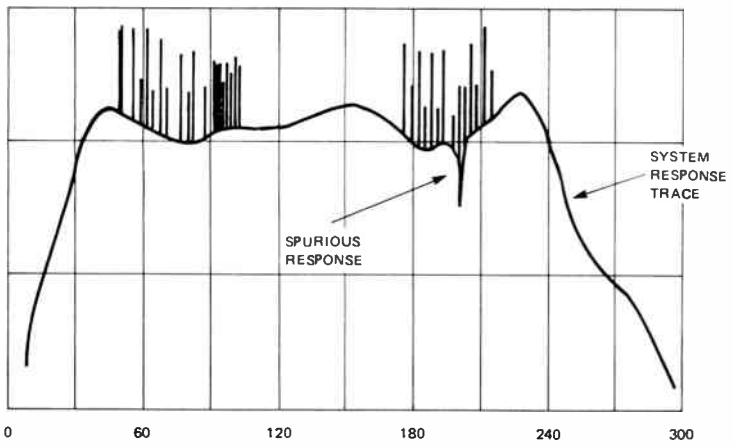

Figure 3
Same spectrum as Figure 2 but with spurious response caused by defective tap.

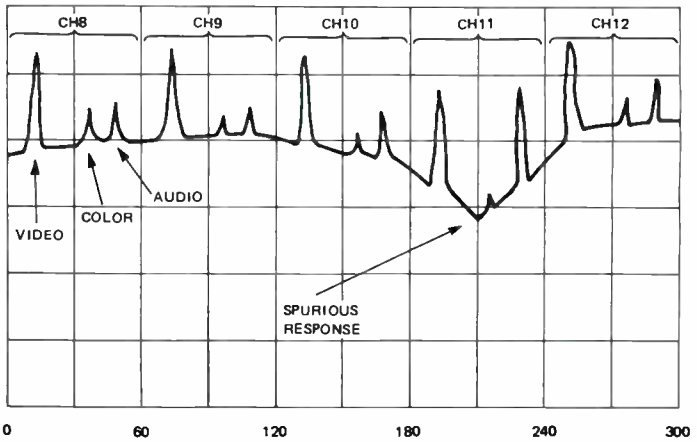

Figure 4
Expanded version of emphasizing spurious response produced by defective tap.

CR-2000 SWEEP RECEIVER

CT-2000 SWEEP TRANSMITTER

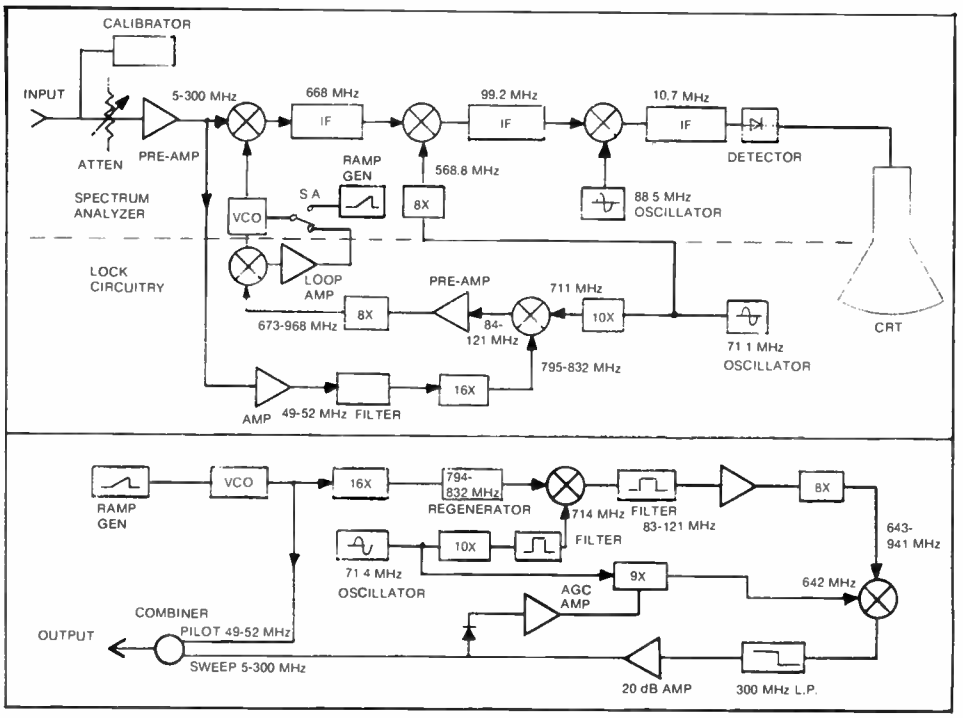

Figure 5
Simplified Block Diagrams of the Avantek Sweep System

Slow Sweep Testing

Capability:

This sweep test procedure, when properly followed, is one of the most accurate sweep methods in existence. For CATV use, amplitude resolution in the order of ± ¼dB is possible. While this is an interfering sweep, the ease with which the test can be set up is such that only one sweep is made at each test point, causing an interference span of approximately one second. The headend sweeps can be performed with an out-of-service interval of approximately 10 seconds. Because of the extreme accuracy of this test technique, it is felt that the short customer inconvenience can be tolerated. This sweep procedure is only a test tool to evaluate performance and should not be considered for day-to-day maintenance and alignment.

Procedure for Field:

1) Set up the equipment as illustrated in Figure 1.

2) The sweep generator should again be inserted through a 10 dB pad, this time into the sweep insertion test point in the headend.

3) Temporarily connect the spectrum analyzer to the setup test point.

4) Set the sweep generator output in CW to equal the low band picture channels in amplitude.

5) Set the sweep generator for a wideband sweep (0-300 MHz) with a slow sweep speed of 2 MHz/sec. At this rate, it

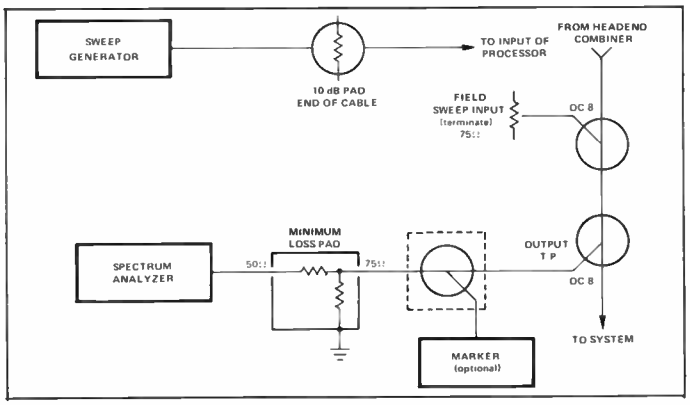

Figure 1

should take 150 seconds to cover the entire 0 to 300 MHz.

6) Use the single sweep trigger or the power switch to control the sweeper. Arrange to have someone stand by for the field tests.

7) Set up the spectrum analyzer at a field test point. Select 5 MHz/DIV .3 MHz resolution and center the low band channels as indicated in Figure 2. Put Channel 2 on the second graticule from the left.

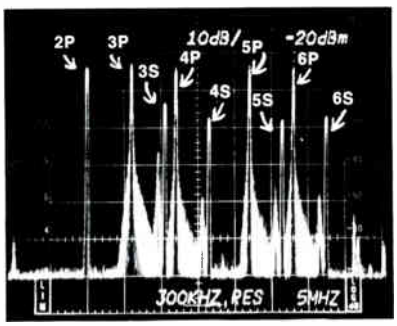

Figure 2
Reprinted courtesy of Tektronix Inc.

8) Select the 2 dB/DIV mode and signal the headend to trigger a single sweep.

9) Increase the persistence or use storage to hold the display as in Figure 3.

10) As the low band is completed, rapidly photograph the results and move to the high band, centering the Channel 7 carrier on the first graticule from the left.

11) Again, using 2 dB/DIV and storage, results will be obtained similar to Figure 3.

12) Additional channels in the mid-band and super-band can be handled in the same manner. It is recommended that the 5 MHz/DIV be used as each band or group of channels is swept.

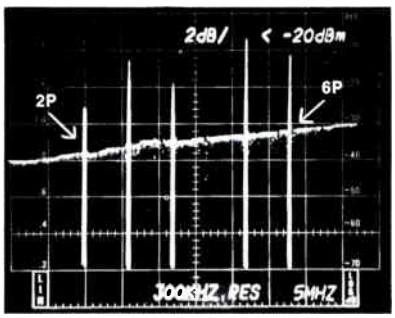

Figure 3

Hints and Precautions:

1) HIGH TIME/DIV rates on the analyzer will produce higher resolution traces.

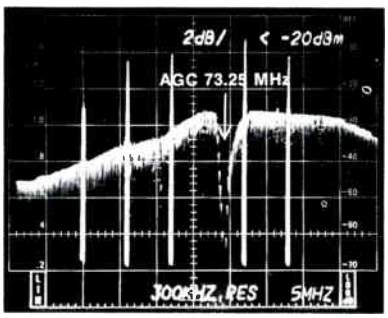

Figure 4

2) System AGC frequencies will be shown on the response traces as a notch (Figure 4); however, the slow sweep speed circumvents the need for special filters.

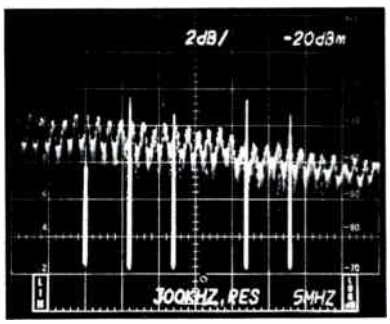

Figure 5

3) Multiple serrations, as in Figure 5, are reflections. Care should be taken to insure that the test cables are not the cause. When in doubt, 10 dB pads should be inserted at the extremities to dampen reflections.

Using Noise For Response Testing

The conventional approach to frequency response measurements is the use of a sweeping oscillator and a broadband detector. The same can be accomplished using a broadband generator and a sweeping or tuneable detector.

A good flat noise generator can be thought of as a broadband signal generator. Instead of having an adjustable frequency output, however, the noise generator has a continuous output on all frequencies at once.

A number of excellent flat noise sources are available today that can be used for a system frequency response test. In service testing it can also be considered since the noise can be inserted at a low level (provided it is above the system noise), with only slight picture impairment during the duration of the test.

Figure 1—Sadelco 260-B Noise Source and SLM Calibrator.

Some of the advantages of using a noise generator for signal response measurements are:

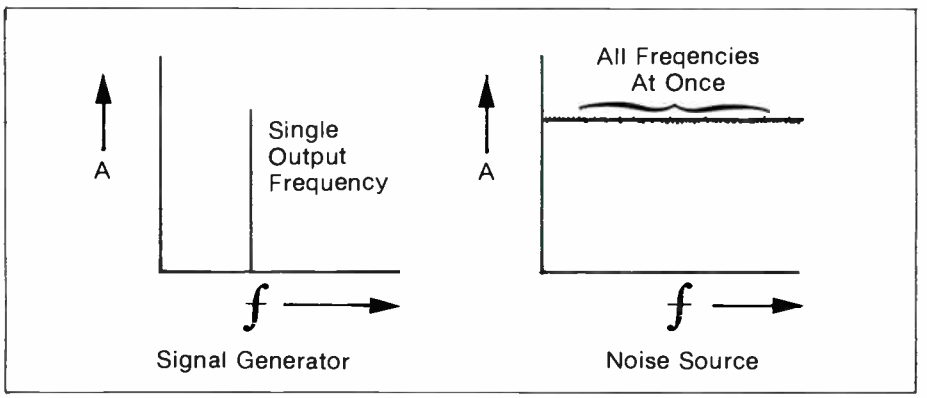

Figure 2—Difference Between Signal Generator and Noise Source.

1) The noise generator requires no manual controls. For a remote measurement, such as a tower mounted preamplifier, the unit can be connected and left unattended for the measurement. (Battery operation of the noise source enhances this application.)

2) The noise generator will not affect AGC circuits the way a sweep generator does. AGC keying is constant or, if low level noise is used, the keying will not occur.

We all recognize that a field strength meter and a manually tuned signal generator can be used to make a point plot of the frequency response. If a flat noise source is substituted for the signal generator, the need to continuously reset the generator is eliminated. A noise source and SLM is probably one of the easiest and least expensive ways to verify system response.

A spectrum analyzer can be substituted for the SLM and the video filter used to filter the noise into a clean display. The spectrum analyzer permits a finer display than can be obtained with the point plot. In service testing can also be performed with the noise at a low level.

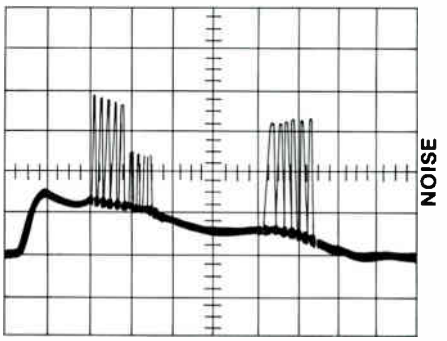

Figure 3—System Response using Low Level Noise.

There are two general precautions that must be observed when using noise on a system. First, noise represents a lot of power than can overload amplifiers at even moderate levels. Second, response measurements can be in error if the noise inserted is too low in level. The noise should be at least 10 dB above the system noise at the longest amplifier cascade.

The noise techniques for measuring response are still very new and being experimented with, however, noise offers a great potential for a relatively simple and inexpensive technique of measuring response.

An Innovative Alignment Pr

by Dave Willard, Mitre Corp.

This paper presents a technique by which a two-way, two-cable wideband distribution network can be aligned to provide minimum signal level variations across the full frequency spectrum from and to the system subscribers. The process described will interest the cable innovator because of the recently renewed development of wideband two-way cable systems and because standard alignment procedures commonly used on one-way systems do not result in minimum subscriber signal variations caused by cable attenuation slopes.

Outbound Alignment

Figure 1 illustrates the amplifier functions in the usual system where each outbound amplifier makes up for the frequency dependent attenuation characteristics of the previous section of feeder cable; i.e., each amplifier is adjusted to provide a flat frequency response at the output.

Unfortunately, each of the four subscribers have more attenuation at higher frequencies, caused by two additive components: One component is common to all subscribers—the slope caused by the drop cable between the tap and the subscriber's location. The second component is a function of the distance between the tap and the driving line amplifier on the feeder cable. The amount of slope is proportioned to this distance—the subscriber whose tap is furthest from an amplifier will suffer the largest rolloff.

Now consider Figure 2 in which each amplifier is adjusted such that the mean subscriber (halfway between amplifiers) will receive a flat frequency spectrum at the end of his drop cable.

The subscriber with the worst receive frequency spectrum slope in a system aligned as in Figure 2 will have only one-half as much difference between low and high frequencies as would the same subscriber in a system aligned as in Figure 1.

Some typical numbers may be of value at this point. Assume a typical subscriber drop cable to be 100 feet of RG-59 which exhibits a 6 dB loss at Channel 13 (216 MHz) and 2 dB loss at 30 MHz. Further assume amplifier spacing at 1,000 feet on a sparsely tapped feeder which results in a 16 dB loss at 216 MHz and 5 dB at 30 MHz on half inch extender cable (0.412).

Figure 1 alignment (flat spectrum out of each amplifier) would result in a 16 + 6 - (5 + 2) = 15 dB tilt at the worst subscriber location, just before an amplifier, becoming progressively less for each other subscriber closer to an amplifier output. The best subscriber location (just after an amplifier) would exhibit a 6 - 2 = 4 dB tilt purely from the drop cable attenuation slope.

However, Figure 2 alignment would result in the middle subscriber receiving a flat spectrum. The subscriber just before an amplifier would receive a tilted spectrum with the higher frequencies weaker by the slope, caused by *half* the extender cable length or

$$\frac{16 - 5}{2} = 5.5 \text{ dB slope (negative)}$$

The subscriber just after an amplifier would receive a tilted spectrum with higher frequencies stronger by the slope caused by the intentional adjustment of the amplifier which in turn accounts for the slope of *half* the extender cable length or

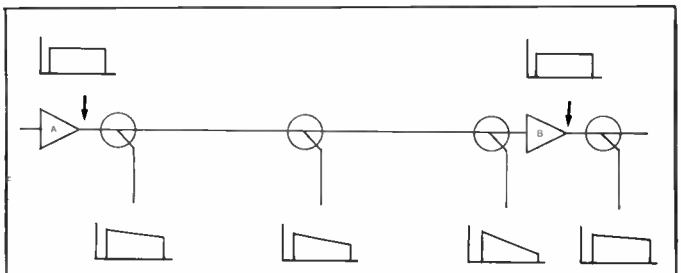

FIGURE 1—NORMAL ALIGNMENT
FLAT AMPLIFIERS
NEGATIVE TILT AT ALL SUBSCRIBERS

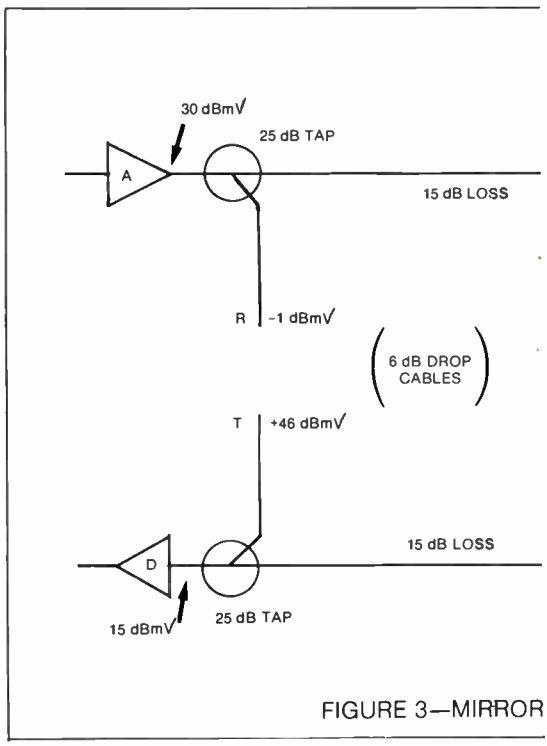

FIGURE 3—MIRROR

ocedure for CATV Systems

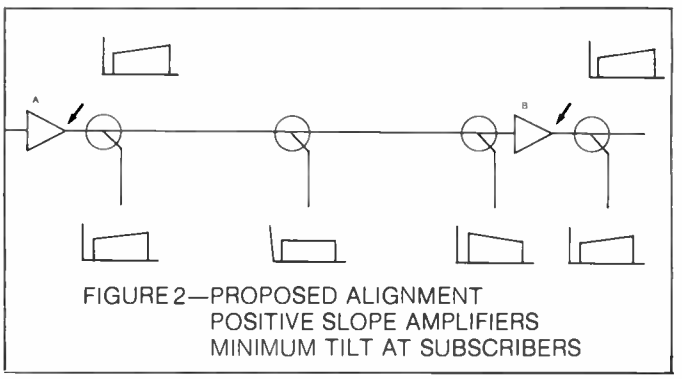

FIGURE 2—PROPOSED ALIGNMENT
POSITIVE SLOPE AMPLIFIERS
MINIMUM TILT AT SUBSCRIBERS

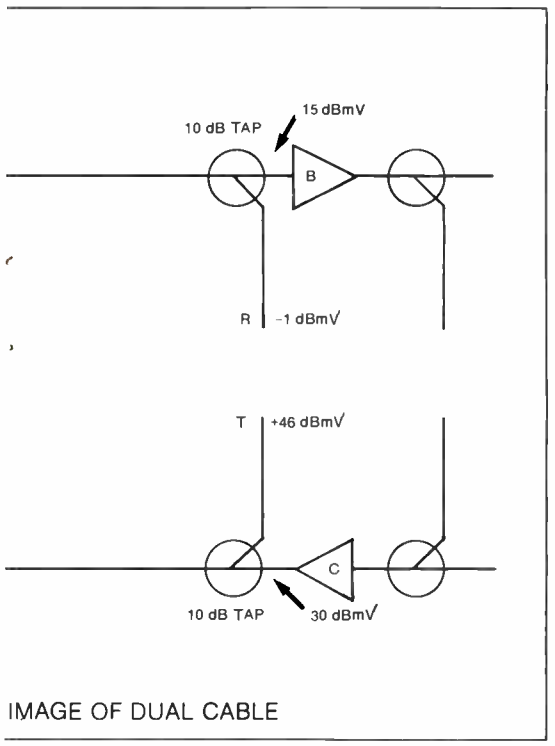

IMAGE OF DUAL CABLE

$$\frac{16-5}{2} = 5.5 \text{ dB slope (positive)}$$

Consequently, Figure 2 alignment would result in a smaller slope in received spectrum at the worst subscriber location.

How can the preferred alignment be accomplished easily? One way is to instrument the middle subscriber location with a spectrum analyzer display and adjust the preceding amplifier to obtain a flat response, repeating the process for each span in sequence. Such a process requires communication from the subscriber location back to the amplifier adjuster.

Alternatively, one person can perform the necessary alignment by first aligning the system using Figure 1 procedures; i.e., measuring at each amplifier output and adjusting for flat response in sequence, then readjusting the first amplifier for a positive slope equal to half the total span slope. If all spans of the line contain approximately equal runs of cable, Figure 2 alignment results will have been achieved. If widely different cable lengths are used, one would have to resort to a coordinated adjustment procedure between the medium subscriber location and previous amplifier.

It should be noted that in those dynamically changing cable networks in which taps are cut into existing feeder spans for growth subscribers, the amplifier slopes should not be changed—only flat gain should be provided to make up for the insertion loss (flat attenuation) caused by the additional taps.

This particular alignment procedure may not be new to some readers, but most will not have encountered the problem associated with aligning a parallel inbound cable system.

Inbound Alignment

As in aligning the outbound cable system, it is desirable to minimize the difference in amplitude of different frequency signals received at the head of the feeder network from the worst subscriber location. If the same philosophy suggested for the outbound cable is used, the worst subscriber would result in one-half the slope as would normally result. The problem is how to instrument and adjust the inbound amplifiers to accomplish this objective.

We realize immediately, of course, that contrary to the outbound case where pilot generators were left at the headend and the spectrum analyzer moved with the amplifier adjuster, the inbound alignment procedure requires the spectrum analyzer to remain at the feeder head and the pilot generators to move progressively down the cable.

In the most straightforward technique, the pilot generators would be connected at the mean-subscriber tap location of each span through a "standard" drop cable (100 feet of RG-59) and output the nominal transmit level on each frequency (+46 dBmV). The span nearest the feeder head would be aligned first by adjusting the first inbound amplifier for flat output. Then the generators would be moved to the next span mean-subscriber tap, and the second amplifer adjusted for flat output at the feeder head. This process would continue until all amplifiers are properly adjusted and the desired objective is achieved—a minimum

(Continued on page 32.)

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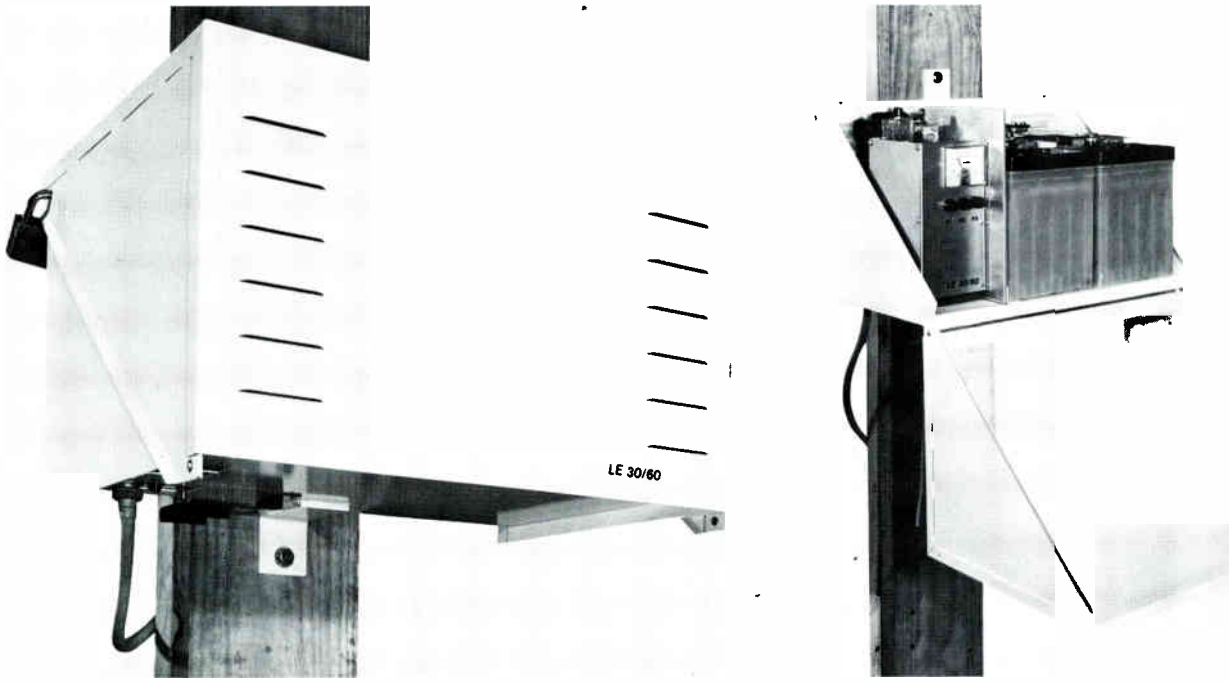

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Buyers Guide To Sweep Equipment

Sweep Generators

Make	Model	Frequency	FM Stab	Distortion	Flatness	Simo Sweep	Price	Comments
Kay	9059-B1	1-300 MHz	3 kHz	30 dB	±.25 dB	Yes	$ 845	
Tektronix	SW-503	1-400 MHz	10 kHz	30 dB	±.25 dB	No	$1,200	Simo Sweep can be provided thru extra plug-in.
Telonic	1234	1-500 MHz	20 kHz	30 dB	±.25 dB	No	$1,195	
Texscan	9550T	4-350 MHz	7-10 kHz	25 dB	±.5 dB	Yes	$ 995	Dedicated Rackmount Headend Unit
Texscan	SS80-74	1-500 MHz 450-950 MHz	7-10 kHz	35 dB 30 dB	±.25 dB	Yes	$1,632	
Texscan	WB-711	1-500 MHz	7-10 kHz	25 dB	±.25 dB	No	$ 975	
Wavetek	1051	1-400 MHz	20 kHz	30 dB	±.25 dB	No	$ 595	
Wavetek	1801A	1-500 MHz 450-950 MHz	10 kHz	40 dB-300 MHz 30 dB-500 MHz	±.35 dB	Yes	$1,445 $1,645	High Band is optional
Wavetek	1850	1-400 MHz	10 kHz	30 dB	±.25 dB	Yes	$ 795	Dedicated Rackmount Headed Unit

Sweep Receivers

Make	Model	Price	Comments
Avantek	CR/CT 2000	$9,750	Headend unit and battery operated synchronous sweep receiver. Uses low level sweep technique and receiver. Also contains high quality 0-300 MHz spectrum analyzer.
Kay	P-9020	$ 695	Simultaneous sweep receiver containing post amplifier, detector, and markers. Must be used in storage mainframe (see below).
Midstate	PA-20D	$ 125	Contains post amplifier and high speed detector. Use with storage scope.
Peca	SRS-350	$1,200	Complete receiver less scope. Contains attenuator, markers, bias detector, trigger outputs and can be powered from AC or 12VCD.
Peca	TRU-350	$ 600	Battery powered portable receiver less scope. Similar features as SRS-350.
Texscan	9550R	$1,800	Battery operated portable with scope display, variable marker, ±0.5 dB accuracy.

Noise Sources

Make	Model	Frequency	Flatness	Output	Price	Comments
HP	343A	10-600 MHz	±.3 dB-300 MHz	Excess 5 dB	$250	50 OHM unit for noise figure measurements.
Sadelco	Porta Bridge II	5-300 MHz	±1.5 dB	+6 dBmV	$195	Portable self contained noise source and bridge.
Sadelco	260B	4.5-300 MHz	±.25 dB	+10 dBmV	$595	Complete SLM calibrator and bridge.
Vitek	NVU-1	40-900 MHz	±5 over 6 MHz	-15 dBmV	$225	

Detectors

Make	Model	Frequency	Polarity	Price	Comments
HP	423B	.01-12.4 GHz	Either	$190	±.2 dB to 8 GHz, Type 'N' connectors
Kay	F982A	DC-1.5 GHz	Either	$ 45	±.25 dB, 'F' connectors
Texscan	CD 75	.1-1000 MHz	Either	$ 40	±.15 dB per 100 MHz
Wavetek	D171	.2-1000 MHz	Negative	$ 55	Up to 3V input
WBE	A33	1-500 MHz	Either	$ 55	Multiplier high output

Storage Oscilloscopes

Make	Model	Bandwidth	Battery	Price	Comments
HP	1201A	500 kHz	No	$2,300	Dual Trace
HP	184A	100 cm/s	No	$2,450	Mainframe only. Must have plug-ins.
Tektronix	5111	2 MHz	No	$1,600	Mainframe only. Use with P-9020 receiver.
Tektronix	214	500 kHz	Yes	$1,350	Compact portable scope.
Tektronix	T-912	10 MHz	Yes	$1,300	Large screen budget storage scope.
Tektronix	5111	2 MHz	No	$1,300	Mainframe only. Must have plug-ins.

Attempts have been made to show current specs and prices. However, we recommend you check with the manufacturer for the most current information □

Response Testing for Proof of Performance

CATV system response is directly related to many other system parameters such as levels, cross-modulation, signal to noise and others. Therefore, the value of maintaining proper system response is of highest priority to the CATV operator.

Ideally, we would like to see the exact system response at each amplifier test point, and, in an orderly manner, touch up the alignment to bring the system up to a flat or predetermined response. We would hope that this could be accomplished with no customer disturbance.

At present, no response test system exists that gives CATV operators exact response, with no customer disturbance. Instead, we must compromise between the two.

By dividing the requirement, we can come up with the following:

1) Exact response capability must be obtained for proof and final tests of system response. To obtain this high accuracy, sweep must be slow and of average amplitude level. This will cause moderate to heavy customer interference.

2) Maintenance sweep capability must be noninterfering, and may have to sacrifice accuracy. The use of low levels and/or fast sweeps can minimize the customer interference.

As an example, Figure 1 shows a simultaneous sweep taken at a test point. The top trace was taken during normal maintenance sweeping, the lower trace was obtained with a slower sweep (100 ms). Note the difference in resolution. In the case of severe reflections, the extreme response variations will not be displayed during a fast sweep. Similarly, other sweep systems can suffer in accuracy unless precautions are taken. The chart below was designed to aid you in getting the optimum response result for either Maintenance or Proof.

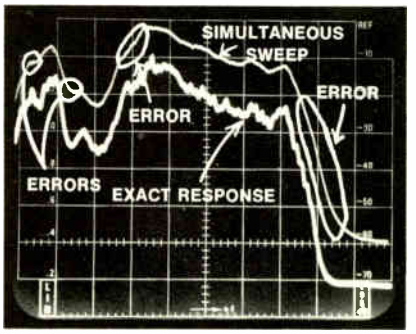

Figure 1
Sweep Rate Errors in a Simultaneous Sweep.

	Maintenance	Proof of Performance
Low Level Sweep (Avantek)	Run as described for minimum visual interference on TV monitor. 55 Hz sweep rate and 35-40 dB down sweep.	Use slow sweep and raise level of sweep to 15-20 dB below picture carrier to eliminate gap around picture carriers.
Noise Sweep	10 dB above system noise floor.	15 dB below picture carriers . Run analyzer slow.
Slow Sweep		As described in procedure.
Simultaneous Sweep	15 dB above picture carriers, 1.5 ms best rate.	
System Off Sweep		10-20 seconds per sweep —notch AGC frequencies, same level as picture carriers.
Point Plot		Every 0.5 MHz, same level as picture carriers.

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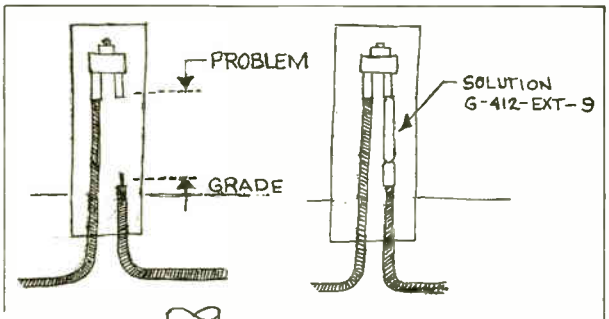

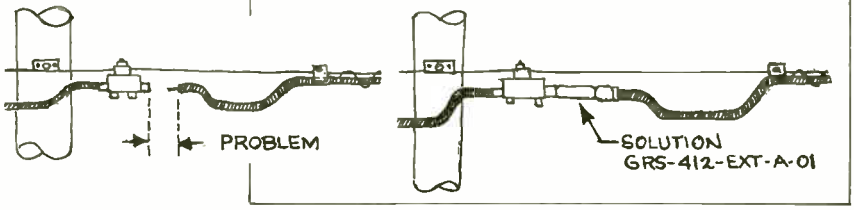

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(Continued from page 27.)

inbound slope from any subscriber is received at the headend.

Is there an easier method to achieve the same result—one that requires only one person and no communications between the level reader and adjuster? Consider the design process of the inbound cable system, especially the tap value selection. Actually there is no design process for a parallel inbound cable. One uses tap values that were selected by design for the outbound cable for that location. Figure 3 illustrates this principle.

This design process suggests that a further similarity exists between the inbound and outbound cable systems: Observe that amplifier B was adjusted to compensate for the attenuation and slope characteristics of the outbound span between A and B and that these characteristics are identical for span D-C. Therefore, why not physically substitute the amplifier B module in the amplifier C housing after it has been adjusted and put the other module in the housing and adjust it for the same characteristics? If this is done during the outbound cable adjustment process, the entire inbound cable will exhibit the desired response characteristics.

Spot checks of both inbound and outbound systems at selected subscriber locations will confirm the expected operation. These checks should be conducted at regular intervals in any event to identify degradation trends before a real problem occurs.

Again, if taps are added to the network and sufficient insertion loss requires increasing the gain of a subsequent outbound amplifier, it can be substituted for the inbound amplifier at that location and the second amplifier readjusted on the outbound cable. This will result in both systems being properly adjusted for the new insertion loss.

It is hoped that this alignment technique will be of help to cable designers and installers in that it results in a more optimum subscriber slope than is usually provided and that can be achieved by a single alignment person.

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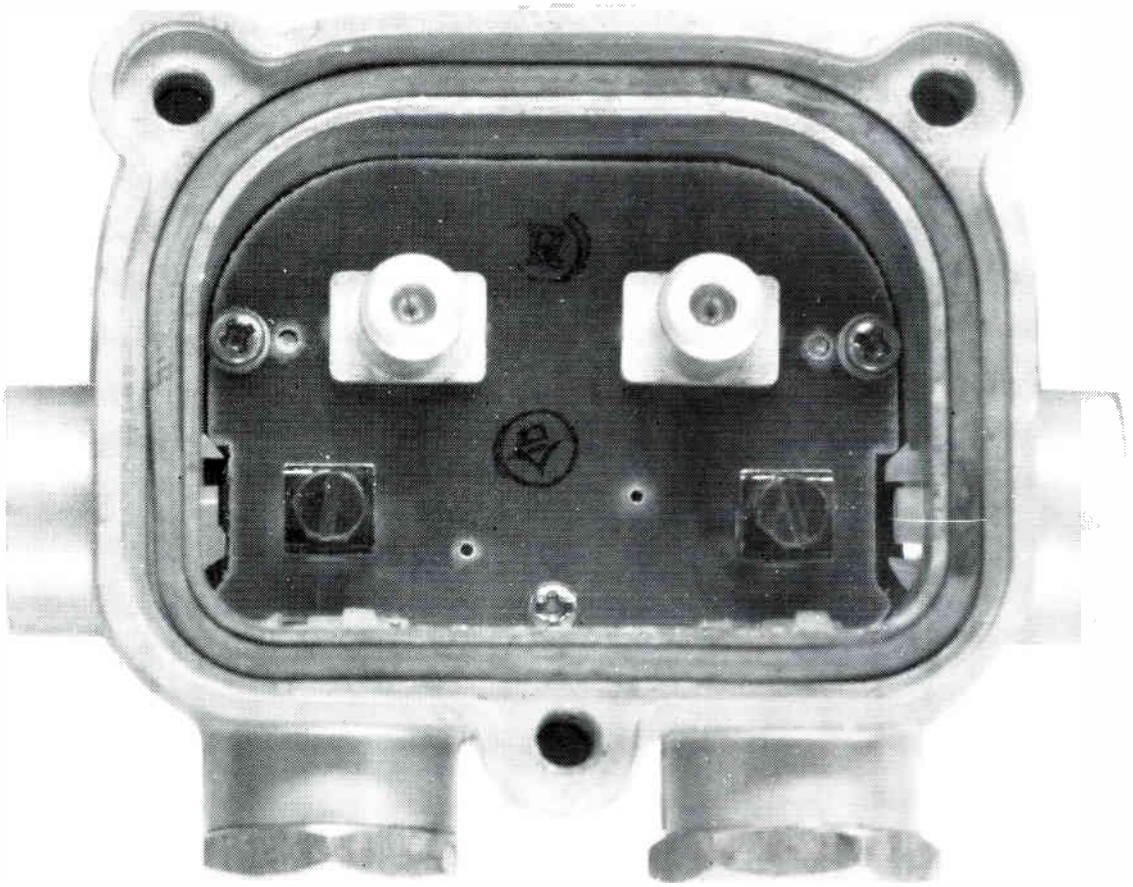

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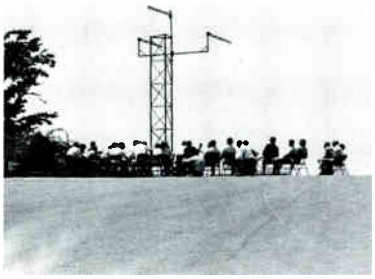


102 in the shade for Antenna Design/Test Range, a full day program led by Tony Bickel of U.S. Tower Company.

Small Earth Terminal session, headliner of the show.

The barbecue, Oklahoma style.

Building a spectrum analyzer led by Jerry Laufer of Gill Cable.

Glyn Bostick's son, Daniel, describing his phenomenal new CB windshield antenna.

CCOS Show Review

CCOS-76, the first (annual) CATA convention was held this year in Oklahoma at the Western Hills Lodge which is surrounded by a large lake and located within the Sequoyah State Park. This setting was both relaxing and yet conducive to the work and learning that took place.

The programs were set up so that the sessions and workshops took place during the day, and the exhibits could be viewed each day after dinner.

The scene that first met the visitor upon arrival was two dishes located in the parking lot and pointed toward the heavens. However, unlike the Dallas NCTA show (and typical of the message at this show), the dishes were 4.5 meter units. Andrew showed a trailer mounted unit while Prodelin displayed their fiberglass dish. The largest single attraction and discussions at the show were, in fact, the small earth terminal and its future in cable TV. Once inside the exhibit hall, both California Microwave and ITT showed receivers, giving the conventioners a real feel for the performance possible with a small dish. And the performance is impressive. By using a slightly lower (better) noise figure preamplifier than used with the 10 meter dish systems, visually

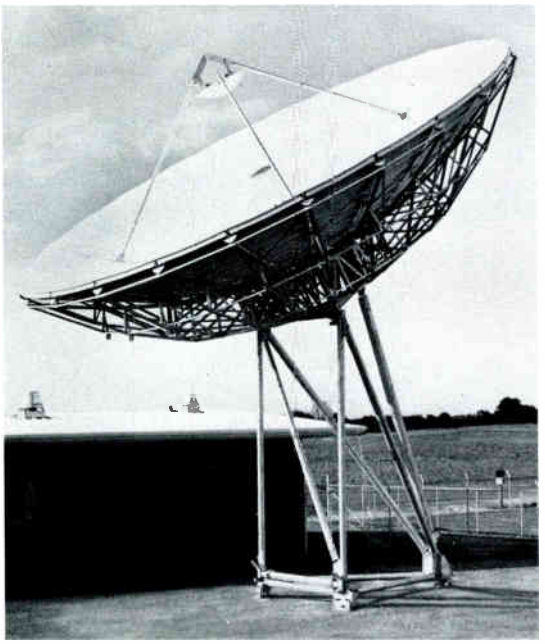
(Continued on page 36)

Pow wow at the convention hall.

Raleigh Steele delivering an informal treatise on spectrum analyzers.

Larry Dolan, MidState; Harry Sadel, Sadelco; Bob Welsh, Wavetek; Raleigh Steele, Texscan; and a personal friend of Harry's.

The Superior pay TV Earth Station



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Although you may not yet be familiar with our products and services in the CATV industry, we have delivered over two dozen INTELSAT and Domsat 11 meter satellite earth station antennas in the United States and seven foreign countries in the past two years. Our customers for these antennas have been American Satellite Corp., Cable and Wireless Ltd., Comtech Corp., Fairchild Space and Electronics Co., Harris Corp., RCA Global Communications Co. and RCA Ltd.

We will supply you a complete turn-key CATV satellite earth station to your custom specifications or our standard antenna front end only. System design assistance, installation and checkout and maintenance services are also available.

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comparable performance can be obtained with 4.5 meters in most locals within the US. Special receiver designs and improvements, wherein the threshold is extended into the actual noise regions, show promise of improving margins even more.

The exhibit area was set up rather uniquely in that each supplier was given a 10 foot space to display his wares. There were no special exhibits, and each guy from the littlest manufacturer to the largest had an equal opportunity. Admittedly, the exhibit area wasn't too flashy, but the opinions of both the exhibitors and the conventioners was that the concept for this size show was OK. For the monetary outlay, and energy expended, the exhibits were a success.

Sessions began Monday morning with classes on Headend Practice, Spectrum Analyzer Basics, and Bank Loans and Rates. The spectrum analyzer class was preparation for those who would, later in the week, build their own units from a channel converter. The banking session was excellent, describing procedures for financing either a new plant or adding onto the old with a lot of tips on preparing loan forms.

Afternoon classes covered Low Cost Plant Construction techniques, continued Headend Practice, and the third was on Signal Propagation. The low cost plant construction class discussed such undiscussables as: building with line extenders, tapping trunk lines, and even building your own amplifiers. While this might make some larger system engineers turn over in their graves, you have to remember many of the smaller plants could not be built if these cost cutting ideas were not employed. The continuing session on Headend Practice covered design of headends, and the workings of the processing units.

Tuesday was the most exciting, and most eagerly attended day of the show, featuring talks and classes on: How To Build Your Own Spectrum Analyzer, Small Earth Terminals, and Antenna Designs. The Small Earth Terminal session consisted of a panel of representatives from HBO and Channel 100, and the major TVRO and antenna suppliers, Prodelin , ITT and CMI. The panel was headed by Rick Brown, general counsel for CATA and one participant described his experiences with building a homemade earth station in his backyard. The session discussed prices and performance for the small TVRO versus the larger dish systems. Also brought up were the other alternatives such as cost sharing of a larger station by a number of small operators. Meanwhile, 25 spectrum analyzers were being assembled upstairs. By lunch most units were working, and some of the builders were producing improvements and modifications. Outside on the antenna test range (supplied by U.S. Tower Co.), with the temperature 102°F in the shade, a class was being held on phasing, mounting and designing your headend antenna site.

The afternoon had one session on controlling CB interference and was headlined with a talk by Lew McCoy of the ARRL, an old timer in ham radio. During the CB session Glen Bosticks son, an impressive young (young) man, described a new windshield mount antenna that uses the slotted line principle to produce a directional signal pattern with no protruding parts showing.

While not the end of the show, things began to unwind toward the evening of the second day. Most sessions were over by early afternoon and leisure activities took place. A lot of the system operators brought their families and spent time around the swimming pool. Bob Welch of Wavetek brought his boat and probably managed (during the 3 days) to get at least half the attendees on his boat for a trip around the lake or waterskiing. The evening ended with an outdoor banquet.

The show continued Wednesday morning covering, primarily, proof of performance and getting ready for 1977.

The CCOS show was a first of a kind deal, and while there were a few mistakes in bookings and other smaller details, we feel it was a success and has a lot to offer the attendees and the exhibitors. We will even go as far as to say that NCTA might learn a few tricks from the CATA gang about how to set up a successful show.

See you next year!!!

critique/letters

Dear Judy:

Titsch Publishing has put out some great editions but they have outdone themselves with their latest addition! I was tickled pink to hear that you have joined their group to blend your expertise and delightful approach with Bob and Paul's straight-talking excellence.

Congratulations to you and congratulations to Titsch on a fine fine merger.

Joseph L. Stern.

Dear Judy:

We missed you at the NCTA Satellite Sub-Committee meeting on Distant Signals in Atlanta.

The Wednesday afternoon Seminar Session was excellent, practical, and quite informative. Following this session, our committee met for drinks and dinner. There was a relaxed informal atmosphere around the table and the discussion flowed steadily for over two hours.

Two representatives from FCC were there, and we were able to present many questions. Everyone could hear all that was said, and free to comment at any time. Each representative of programming service had a turn to speak and answer questions. Investigative procedures by systems possibly interested in an Earth Station were discussed, as well as FCC application procedures. I kept wishing more of our operator members were there.

You will receive a report fairly soon. We have asked representatives of the various companies to send us their own description of what they have to offer; we want to list this for you.

The full NCTA Satellite Committee will meet in Anaheim, California during the Western Show the last of November. Our Sub-Committee is invited to attend.

There have been so many expressions of appreciation for the Seminar that Howard Crispin, Scientific Atlanta Vice President, said they may repeat it in October.

Mrs. M. M. Dunn, Columbus TV Cable.

Dear Bob:

Just read your new "Cablevision's Tech Review." Looks like an excellent publication and I would especially like to thank you for the coverage you gave our earth station conference.

Keep up the good work!

Scientific-Atlanta, Inc., J. H. Levergood, Division Manager, Cable Communications, Atlanta, Georgia.

Dear Judy:

I did it! Enclosed please find my membership application for SCTE.

Your publication gets better and better every month, and you convinced me that I should be a member.

Keep up the good word!

Caywood C. Cooley, Jr., Vice President-Engineering, Cable Communications Division, Comcast Corporation.

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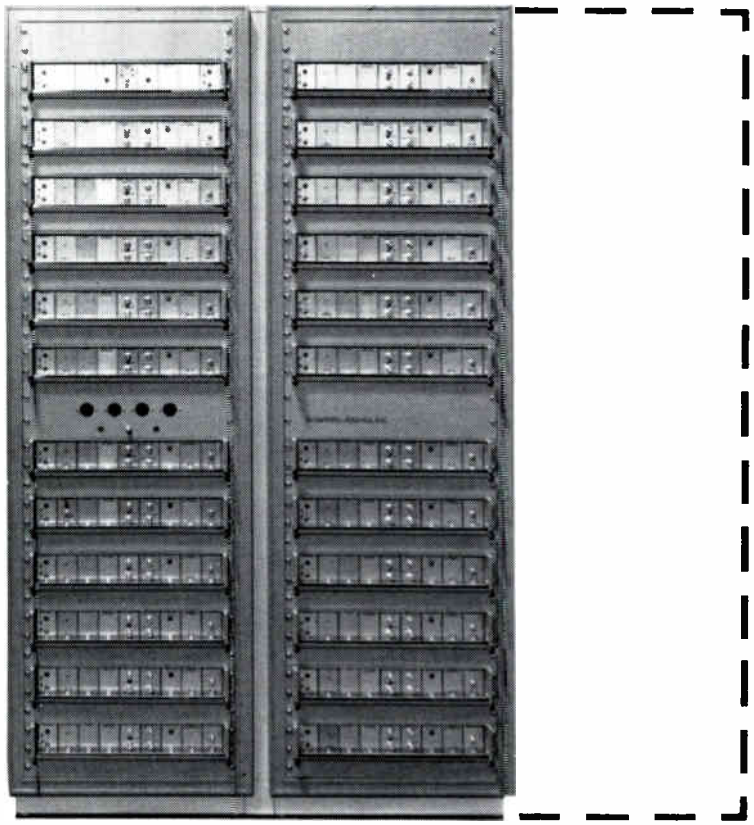

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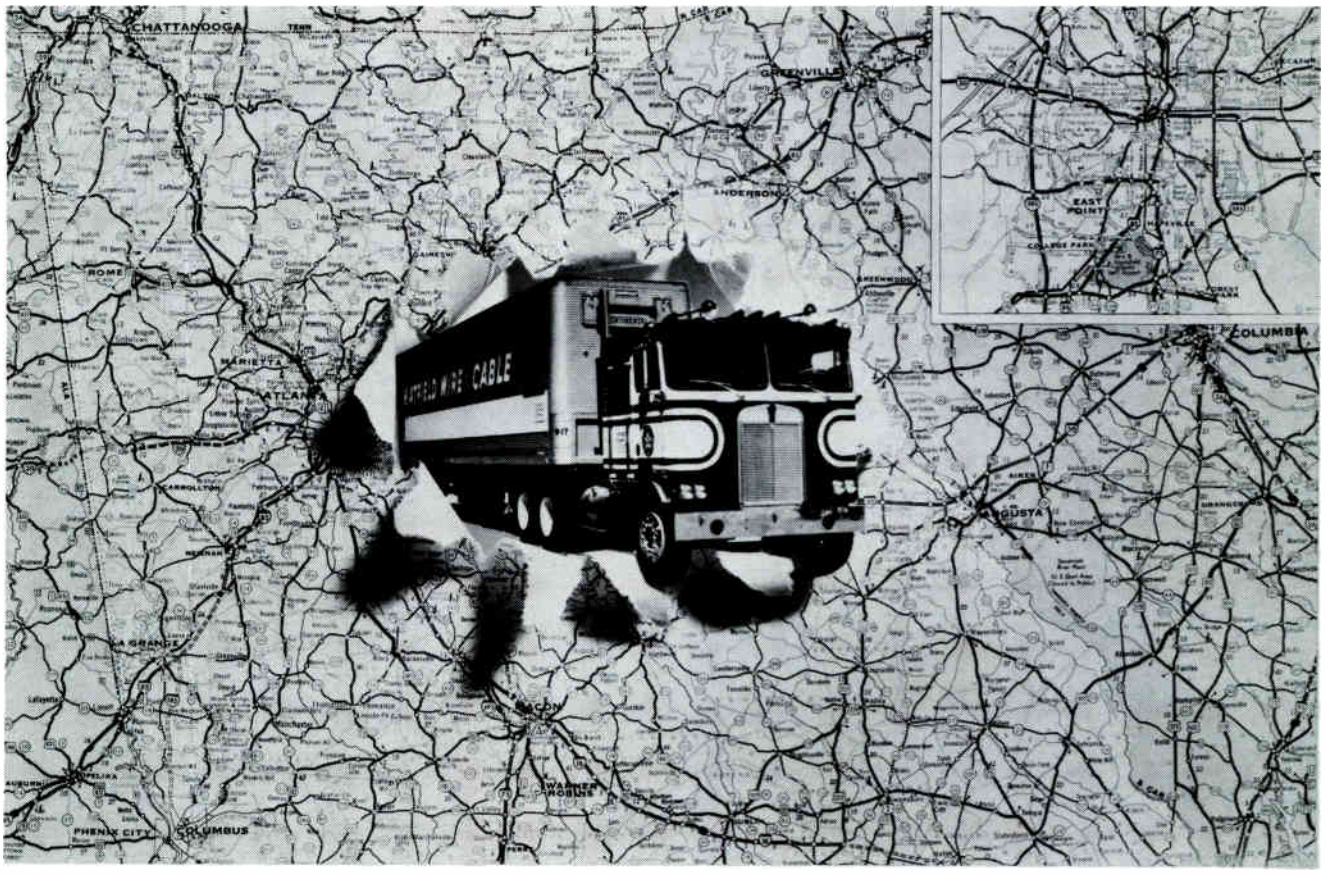

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