communications/engineering digest

reporting the technologies of broadband communications

march, 1977
volume 3, no. 3

EARTH STATION UPDATE

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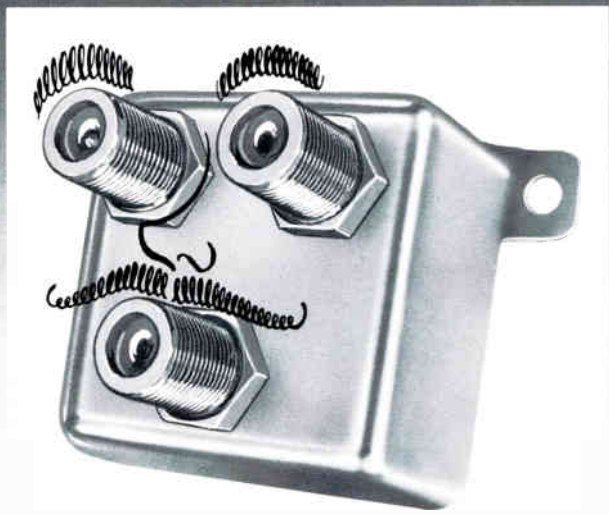

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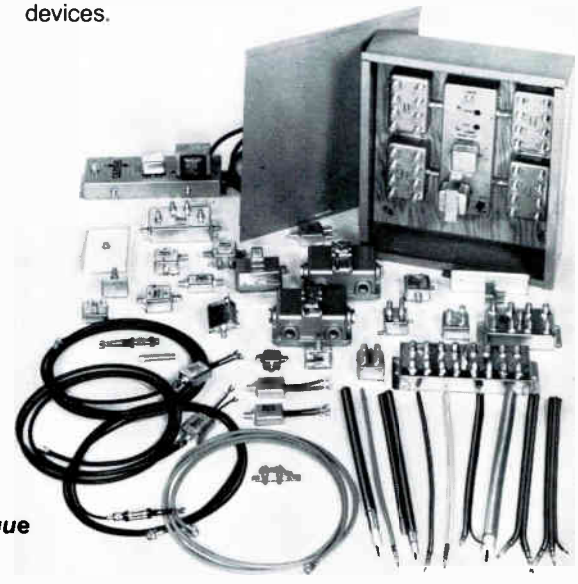

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volume 3, no. 3

communications/engineering digest

FEATURES

DEPARTMENTS

COVER: The progress over the past year in earth station usage, and price reductions, has been phenomenal. John Feight's striking painting of a large dish and horn has been provided to *C/Ed* for use as this month's cover by one of the earth station pioneers, Scientific-Atlanta.

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CCTA **canadian column**

Kenneth Hancock, Director Engineering

The Use of Channels A, B & C in Canada

In common with the situation in the United States, considerable concern has been expressed by the Canadian Ministry of Transport and other spectrum users as to the possibility of cable radiation interference to off-air radio systems caused by various shielding faults due to temperature stresses, lack of adequate installation or maintenance precautions, oxidation of mating surfaces and rupture during storms or accidents. Aeronautical safety became a central issue. The Canadian Department of Communications responded by initiating a supplementary series of laboratory and field tests to determine the effects of severe cable fault conditions on aeronautical navigation and voice communications services in the frequency bands 108-118 MHz and 118-136 MHz respectively. The band 108-118 MHz was included in the study because of a developing trend by cable operators to use this band for pilot carriers even though its use has never been authorized.

In the intervening period of time, and pending the results of these tests, the DOC decided to restrict those cable television channels falling within the ground-to-air voice communications band, thus extending the earlier restriction on the use of channel A to include channels B (126-132 MHz) and C (132-138 MHz). The DOC, in working towards a possible solution to the potential off-air interference problem to all radio users and with the cooperation of the cable television industry, also instituted a comprehensive radiation monitoring program for all cable systems operating with augmented channel capacity.

In Canada however, all this took place some three years ago and has resulted in the issuances of two documents by the DOC. The first of these issued in April 1974 was BTRP-5 "Study of Potential RF Interference to Aeronautical Radio Navigational Aids" and made a number of recommendations that resulted in March the 18th, 1976, in a further document that, with certain restraints, permitted the use of channels A, B & C by cable television operators. This document, "Notice to Broadcast Consultants, No. 47, Use of the Frequency Band 108 to 138 MHz by Cable Television Systems," established the following.

The frequency band 108-118 MHz may not be used by cable television systems for any purpose, because of the potential hazard to aeronautical safety.

Cable television systems can use channels A, B and C provided certain safeguards are adhered to. The criteria to be considered by cable television operators when applying for channels A, B and C are as follows:

1) The video and audio carriers of channels A, B and C shall be offset, from any VHF communications frequencies operated by MOT in the same general area, by at least 70 kHz plus the frequency stability of the cable television equipment used.

2) The cable television operator shall take appropriate action, by performing frequent checks, to satisfy the department that the frequency stability of criterion one is always maintained.

3) In the event that a future assignment in the VHF aeronautical communications band conflicts with criterion one for a particular cable television system, the cable operator shall, at his own expense, offset the video and audio carriers to ensure that criterion one is once again met.

The afore-mentioned criteria for channels A, B and C shall also apply when the carriage of narrow bandwidth pilot carriers in the frequency band 118-136 MHz is proposed.

Since this time a number of cable television licensees have applied for and received use of these channels and hopefully the problem seems to have been solved in a manner satisfactory to both the aeronautical users of the spectrum and to cable television licensees □

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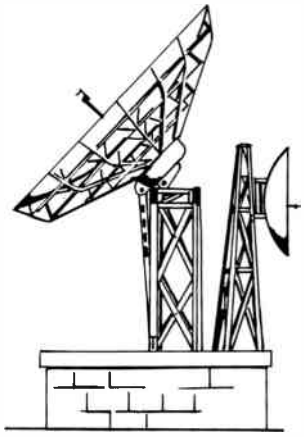

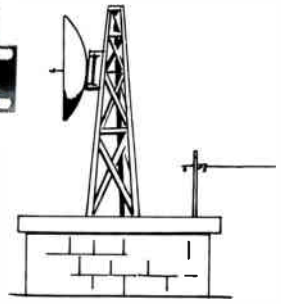

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The Boy Who Called Wolf . . . Wolf . . . Wolf . . .

By Cliff Schrock

NAB, in a predictable rebuttal to suggestions of reallocating major portions of the UHF spectrum, said they *need* all that space, and that other services' demands, such as land mobile requests for more spectrum, are based upon "unsupported current needs." NAB also "takes strong exception" to the claims that over-the-air TV will be replaced by fiber optic technology and cable by the year 2000.

System definition is bottlenecked at the FCC. It is rumored that the standards were almost set at 1,000 subs when NAB stepped in, ignoring the facts uncovered by the Cable Bureau's computer study, insisting that the proposed definition would *be a problem for TV stations*.

Seems like the NAB contradicts themselves continually with statements such as "We're concerned with the implications of small cable systems with under 1,000 subs," then on the other hand, they take "strong exception" and don't consider cable TV and the wired city to be a realizable threat. Considering that the broadcasters are the largest spectrum holders below 1000 MHz and haven't really done "diddly" with the UHF spectrum to date, we can't see the Commission stringing them along for much longer under the context of "serving the public interest."

Consider also that more UHF, or for that matter any new stations, only dilutes the advertising base for those already in the business. So one must ask who the NAB is really serving?

And, as a final note, if I were a broadcaster, I would hardly be wasting my time worrying about small CATV systems with under 1,000 subs. The NAB is ill advised to *rally the troops* for a water balloon battle with cable, when they are staring in the face a real life or death war over frequency spectrum.

While it is an aggravation to have to deal with the NAB every time they try to stop anything CABLE, it is also obvious that the attacks are coming more often and with less strategy, a sure sign that the "friendly enemy" is desperately grasping at straws, somewhat finished, slowly losing face and hopefully losing their powerful grip on the FCC.□

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Technical News at a Glance

. . . **NAB,** *in comments filed concerning the* **reduction** *of the UHF spectrum, claims that* **they still need all that channel space.** *It claims that requested use by other services, such as land mobile, are based upon* **"unsupported current need."** *NAB also takes* **strong exception** *to the claims that over-the-air TV will be largely replaced by fiber optic technology and cable by year 2000.*

. . . *Cable systems in the eastern part of the United States geared up to bring the classroom into the home in an operation set up by the NCTA called* **"cold line."** *Although few municipaliies actually took advantage of the offer,* **the cable industry was ready.**

. . . **AT&T chairman John de Butts** *has called for the formation of* **two FCCs**—*one dealing with* **broadcast** *matters; the other solely concerned with* **common carriers.**

. . . *The* **filing date** *for* **Certificate of Compliances** *for all cable systems has been extended to* **May 1st** *in response to a petition for a declaratory ruling from CATA.*

. . . *System definition is bottlenecked at the FCC. It is rumored that standards were* **almost set at 1,000 subs** *when* **NAB stepped in,** *ignoring the facts uncovered by the FCC's computer study, and* **insisted** *that the proposed ruling* **would be a problem** *for TV stations.*

. . . *The first* **small dish application** *thru the FCC was the* **4.5m** *application for* **Kalispell, Montana.** *It* **was approved** *Feb. 18th by the FCC in spite of many problems with the new rules.* **Congratulations to Kaspell and HBO!!!**

. . . **Warner** *has unveiled its* **new two-way box** *for the Columbus, Ohio, pay system. Beginning in* **April,** *Warner will offer* **interactive pay-cable** *using the "small home console" developed thru* **Pioneer** *of Japan. The box includes a* **10X3 matrix** *for channel selection and* **5 response buttons.**

. . . *The* **National Cable Television Association** *elects new board members: Comcast's Dan Aaron, chairman; CPI's Bob Hughes, vice chairman; Western Telecommunications' Ed Allen, secretary; and TCI's John Malone, treasurer. Board also approves "sliding scale" formula for associate dues.*

. . . *House Communications Subcommittee named* **Chuck Jackson** *staff engineer. Currently a special assistant to Walter Hinchman, FCC Common Carrier Bureau head, Jackson will concentrate on* **"spectrum management"** *matters.*

. . . *NCTA executive vice president* **Tom Wheeler** *lashes out at telcos and* **"Bell Bill,"** *in speech before the* **North Central Cable Television Association.** *Says the "telco ducks have been nibbling us to death at the FCC and in Congress."*

. . . *The* **Society of Cable Television Engineers** *announces plans to* **move national headquarters** *from Ridgefield, Connecticut, to nation's capital.*

Equations

Correction factor =

$$20 \log \sqrt{\frac{\text{BW measured}}{\text{BW TV system*}}}$$

*NCTA = 4 MHz,
EIA = 4 MHz,
TASO = 6 MHz,
CCIR = 4 MHz,
CTAC = 3.3 MHz,
BTL = 4.2 MHz

Thermal Noise Voltage

$E = \sqrt{4KTBR}$
R = Resistance (Ohms)
B = Bandwidth (Hz)
KT = Boltmans Constant × Temperature =
40×10^{-16} @ 68° F

R.F. (FCC)

$$C/N = \frac{\text{Carrier Sync Tip Peak}}{\text{RMS Noise}}$$

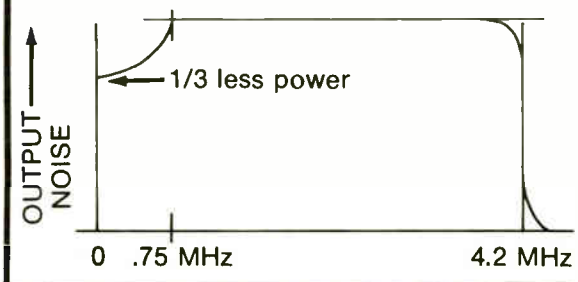
Video (CCIR)

$$S/N = \frac{\text{Blanking Level}}{\text{RMS Noise}}$$

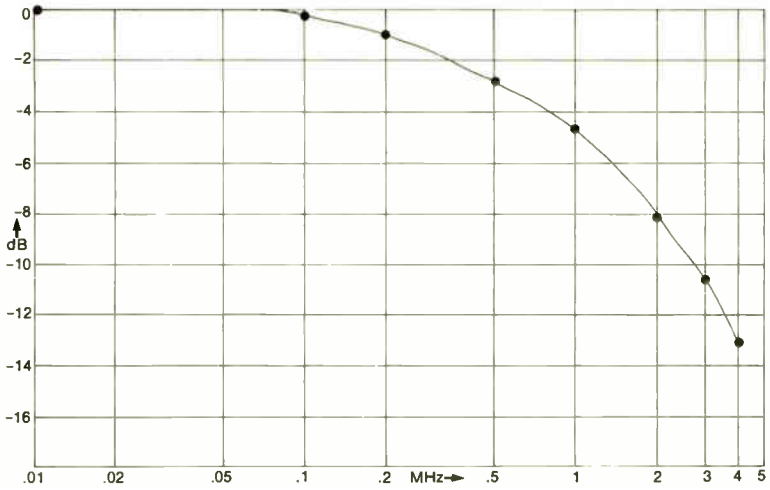
S/N WALL CHART

Spectrum of TV Receiver Noise

RF White Noise Input



CCIR Weighting Characteristic



Freq. MHz	.05	.1	.5	1.0	2.0	3.0	4.0
Loss dB	0	.3	2.8	4.7	8.1	10.8	13

Conversion Factors

Original Definition	Convert to	Add dB
FCC	TASO	-1.76 dB
FCC	BTL for weighted noise	+2.63 dB
FCC	BTL for unweighted, flat noise (equivalent)	-3.57 dB
FCC	CCIP for weighted noise	-0.1 dB
FCC	CCIR for unweighted flat noise (equivalent)	-6.2 dB
TASO	CCIR for unweighted noise, at output of envelope detector of TV receiver*	-5.05 dB

Classifications of Noise

A. Random Noise
   1. Gaussian, white, thermal.
   2. Non-Gaussian
B. Non-random Noise
   1. Impulse (ignition, welder)
   2. Burst (lightning)
   3. Intermodulation (and cross-mod)
   4. Atmospheric (sun, galtec, static)
   5. Hum (low frequency, power related)
   6. Off-air, ingress, etc.

Signal to Noise Measurement

By Cliff Schrock

There are practically as many ways of measuring signal to noise and carrier to noise as there are different noise types. We have singled out for discussion, the 5 basic techniques used in CATV systems It is important to point out that each technique yields a slightly different answer for various reasons. However, each measurement can be used if the appropriate correction factor is applied.

The SLM is by far the most popular method used in systems for C/N measurements. The techniques are well known and involve measuring the carrier, then the noise that is left once the carrier is removed. Accuracy may be improved by using an external attenuator in front of the meter. The correction factor for the average SLM bandwidth is about 4 dB. Some modern SLMs, notable the MidState, and the new Sadelco digital have special detectors and a built in correction factor for S/N measurements. These features make the SLM one of the most fullproof methods available to the CATV technician.

Gaining in popularity is the use of a spectrum analyzer for noise measurements. While the technique is similar to the SLM method, the spectrum analyzer produces a visual display. Often, what is interpreted as noise on a SLM will be seen as intermod or some other problem with the spectrum analyzer. The basic accuracy of the analyzer is probably no greater than a SLM, however, the capability for solving noise problems is much higher.

Both the SLM and spectrum analyzer make carrier to noise measurements, that is, they measure the ratio between the RF picture carrier, and the RMS noise. This is a good indicator of system performance over which the cable operator has the most control. C/N is not, however, always related to S/N (the noise type the customer sees on his TV screen). To obtain accurate measurements of actual accumulated picture noise from the studio through the TV station and transmitter, some form of in service baseband technique is required. One of the most popular is the noise comparison system (for example, the Tektronix 147 system). A demodulator is connected through the noise comparitor to a waveform monitor. Once the relative noise levels are matched, the operator simply reads the noise directly off the knob. Noise measured by this technique is CCIR and indicates approximately 7 dB better than a comparable C/N performed with a SLM.

The most accurate noise measurement can be obtained with a power meter, however, the range of most power meters is limited to high levels of noise. Also, the techniques are cumbersome, however for laboratory calibration of other methods, a power meter is the way to go. First the noise is passed through a band pass filter with a Noise Power Bandwidth for the desired standard. Then the noise is measured directly (with no conversion factors).

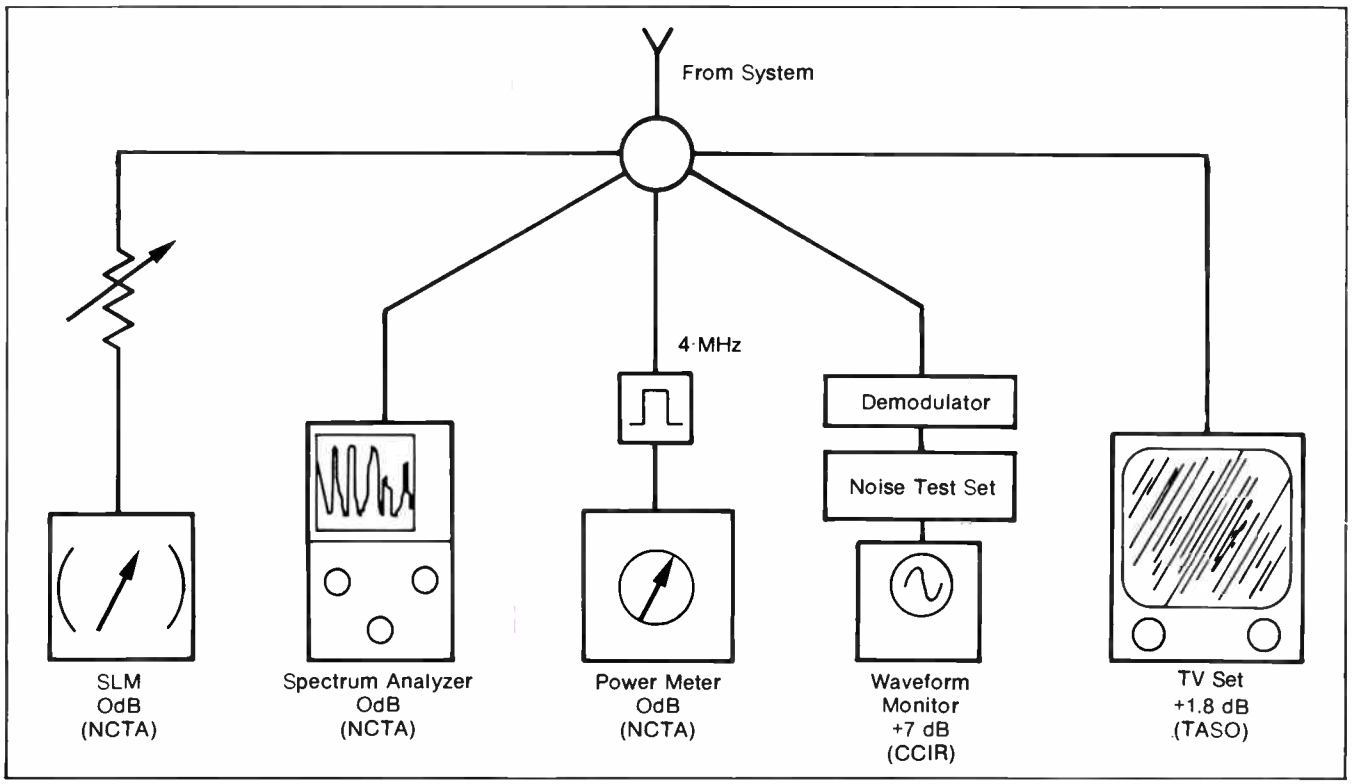
The final technique, not to be overlooked, is the visual testing with a TV set. Many of the old timers with their "calibrated eyeballs" can guess within a couple of dB, the C/N ratio. Some points on learning to guess the noise are:

1) Use one of the readily available charts as a starting point.

2) When making noise measurements with instruments, connect a TV set in parallel and watch the screen.

3) Be careful of some of the newer sets. Some of the Sonys, for instance, mask the noise making it look about 4 dB better than it actually is.

4) Keep the input level to the set constant and above 5 dBmV.



Noise in CATV Systems

By Cliff Schrock

In CATV systems, the lowest signal levels that can be permitted on a system are limited by the base noise level of the system. This base exists because of thermal noise.

Any source or load device, resistive in nature, generates noise because of random electron motion within the device. In the case of CATV, 75 ohms is the standard line impedance characteristic, and the thermal noise floor can be calculated.

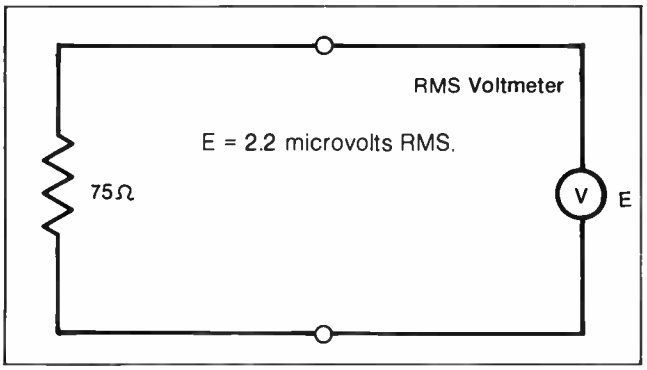


Figure 1

$$E = \sqrt{4KTBR}$$

E = Noise in volts
R = Resistance
B = Bandwidth 4 MHz
K = Boltsmans Constant
T = Temperature in Absolute

$KT = 40 \times 10^{-16}$ at room temperature of 68° F.

In a normal CATV situation, a resistor noise source would deliver half of this voltage into the line terminator.

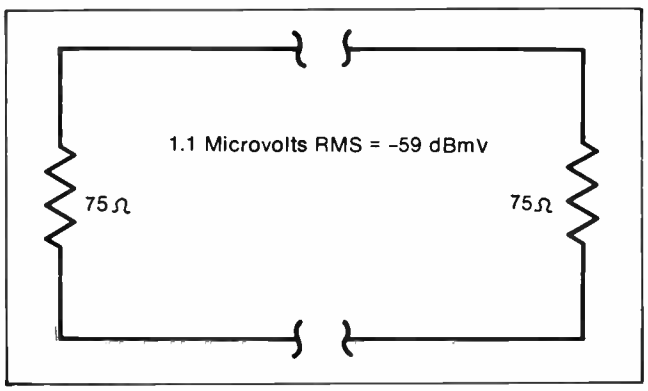


Figure 2

The noise voltage for CATV is, when converted to dBmV notation, -59 dBmV. In other words, in a CATV system, the lowest noise voltage that could exist at any point in the system, would be -59 dBmV.

Noise and Carriers

Noise and its exact relation to the television picture must be understood before one proceeds with S/N testing.

Carrier to noise ratio (C/N) can be illustrated as follows. Consider a carrier of 1 volt RMS amplitude (Figure 3).

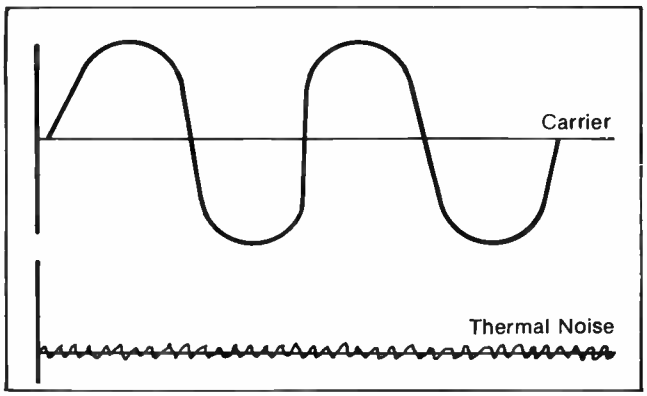


Figure 3

By removing the carrier, an infinitesimal amount of noise would remain. Comparing the RMS carrier voltage to the RMS noise voltage would yield the carrier to noise ratio.

C = RMS carrier voltage
N RMS noise voltage

Consider a situation where the noise is -59 dBmV. Most meters will not measure less than -30 dBmV. A limiting factor in noise measurements therefore is the sensitivity of the measuring device compared to the maximum C/N ratio one anticipates measuring.

VS dBmV + C/N dB = C min dBmV
VS = Maximum meter sensitivity
C = System level at test point

A normal Signal Level Meter (Figure 4) has a maximum sensitivity (VS) of -30 dBmV. Minimum acceptable C/N in CATV systems is 40 dB.

-30 dBmV +40 dB = +10 dBmV

It is obvious that minimum acceptable C/N in a CATV system could not be measured with a Signal Level Meter at a normal customer tap of 0 to +10 dBmV level.

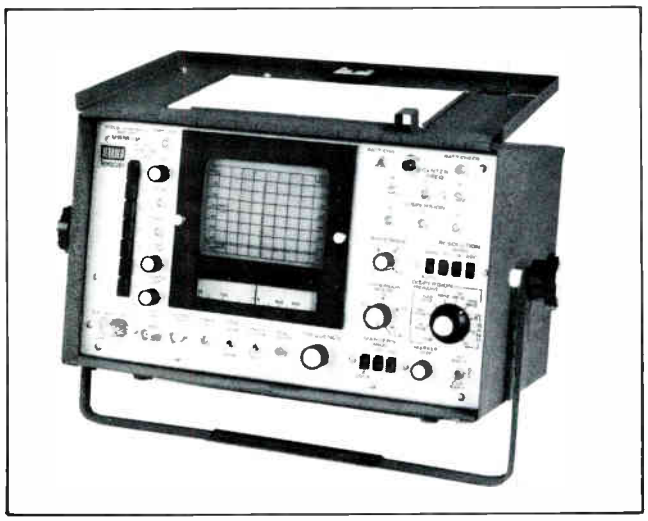


Figure 4

Hopefully, the system operator would expect better C/N figures than the minimum. Excellent C/N for television would exceed 60 dB; therefore, using the same equation, one would need a tap strength of +30 dBmV to read a 60 dB C/N ratio with a Signal Level Meter.

Figure 5

A number of other conversions must be mentioned in C/N ratio measurements.

1) The bandwidth of the measuring device affects the noise measurement. A signal level meter has a BW (bandwidth) of approximately .5 MHz while the TV picture is 4.2 MHz wide. A conversion factor must be calculated using the equation:

$$\text{Correction factor} = 20 \log \sqrt{\frac{\text{BW (MHz)}}{4.2 \text{ MHz}}}$$

A spectrum analyzer has adjustable BW, and a conversion must be calculated for the BW used.

2) Detectors respond differently to noise. A spectrum analyzer noise reading must be converted. Subtracting 2 dB from the indicated noise will give the noise voltage.

3) Some means must be available to verify that noise is actually being measured, not beats or intermodulation products. A spectrum analyzer conveniently gives a visual display in which these products can be easily identified.

Noise and the Television Picture

Until now, we have discussed C/N ratios. The CATV operator is interested in the actual television picture and must relate C/N figures to this end.

The TV waveform is composed of both picture information and timing information. The actual picture is contained in the upper 5/7ths of the waveform and the timing information in the lower 2/7ths.

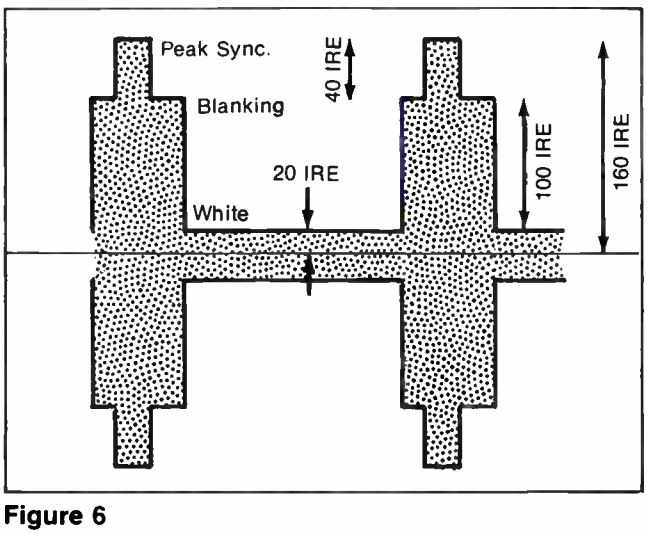


Figure 6

The modulation envelope of the carrier appears as in Figure 5. The actual picture information is approximately 4 dB less than the complete carrier. □

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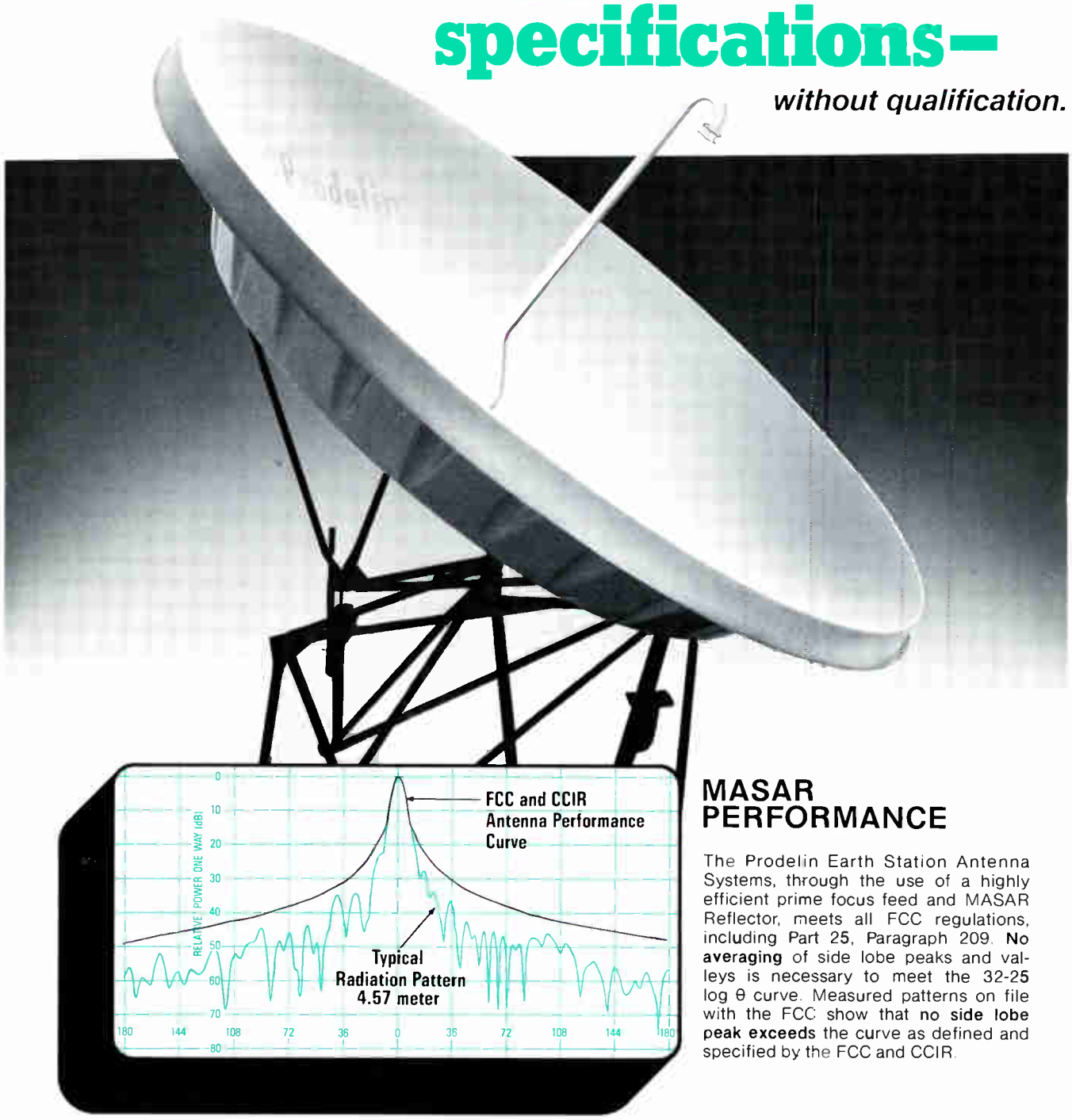

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The Prodelin Earth Station Antenna Systems, through the use of a highly efficient prime focus feed and MASAR Reflector, meets all FCC regulations, including Part 25, Paragraph 209. **No averaging** of side lobe peaks and valleys is necessary to meet the 32-25 log θ curve. Measured patterns on file with the FCC show that **no side lobe peak exceeds** the curve as defined and specified by the FCC and CCIR.

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Chronology of Earth Station Use by CATV

By Cliff Schrock

Andrew's 4.5 meter dish forms the heart of its small, low cost earth stations.

Two years ago the average person in the cable industry would have laughed at the prospect of receiving pictures from a satellite. Yet today, the industry is witnessing one of the fastest growing communications sectors ever seen, the delivery of pay and extra programming via satellite and earth station.

The growth has been phenomenal. From its start with HBO signals on September 30th 1975, now, there are over 120 earth stations serving at least that many cities across the U.S.

Home Box Office was the first company to go commercially with a satellite. On September 30, 1975, they started broadcasting pay programs to both Fort Pierce, Florida, and Jackson, Mississippi. A Mohammed Ali fight was the first program and that night persons viewed the spectacle via satellite. Today there are 86 earth stations serving cable systems with HBO, 12 hours a day.

However, being a pioneer such as HBO has not been "All Roses," as they will be first to admit. The cost alone of getting the whole thing started includes at present, a $100,000 bill per month from RCA for use of the Satcom satellite. Add to this the astronomical cost of buying first run movies, and the gamble that HBO took initially, before they knew that the idea would go, and its easy to understand how one could develop ulcers.

In spite of many roadblocks, cable TV is now heavily committed to satellite distribution of extra signals. Some of the last roadblocks came down this last year when the use of smaller (and less expensive) dishes were approved. The idea of the smaller dish was in a lot of peoples minds a few years ago, but two reasons slowed it down. First of all, the technology to produce the required preamplifier necessary for reception was new and very expensive. A year and a half ago prices like 12 to 20 thousand dollars was the going rate for a GaAs Fet or Parametric preamplifier with the required low noise figure. And the other major obstacle was that regulations for receiving earth stations only permitted 10 meter or larger dishes. This rule was of course the result of studies done years ago based upon commercial use. These early regulations did not even consider the case of an earth terminal for every CATV system.

EARTH STATION ADVANCES

First Earth Stations		
Home Box Office On	Fort Pierce, Florida	
3.2 Meter Horn Used	Jackson, Mississippi	Sept. 30, 1975
CATA Show 4.5 Meter Dishes	Mohammed Ali Fight	Sept. 30, 1975
Channel 17 (Southern Test)	Washington, D.C.	July 20, 1976
Channel 17 On	Oklahoma	August 1976
Small Dish Approval	Anaheim, California	Dec. 4, 1976
First 4.5 Meter Dish and 3.2 Meter Horn Approved	Southeast U.S.	Dec. 15, 1976
	Washington, D.C.	Jan. 7, 1977
	Kalispell, Montana	
	Gaithersburg, Maryland	Feb. 18, 1977
Total Systems served	over 120	
Home Box Office Earth Terminals	86	
Channel 17 Earth Terminals Served	40	

*As of February 15.

When the demand exists, the prices come down. In July of 1976, a demonstration of a small 3.2 meter horn as a receiving antenna was used to send TV to Washington, D.C. In August, at the COOS conference, there were TWO 4.5 meter earth stations operating. Prices were coming down and the feasibility of the smaller terminal was proven. The smaller terminal was felt to be the key in getting the price of an earth station down fom about $100,000 to the $25-35,000 range. If this could be achieved, then it was felt that even the smaller systems could afford pay and other extra services.

The hot topic of the COOS show was the small earth station. A panel with representatives of HBO, California Microwave, Andrews, Prodelin, Microdyne, and others took part. The unequivocable outcome of the session was that the industry was ready to attack the regulations.

CATA proposed the rulemaking to permit smaller terminals. The FCC was concerned about interference as the satellites were spaced closer to each other in orbit. One magic number that was passed around alot during this period was that the side lobe suppression would have to be greater than 32-20 log. It could be proven that a dish smaller than 10 meters could meet the spec. Of course, all other kinds of questions were asked by the cable operators. Why, for instance, did the FCC even care what they used for an antenna?

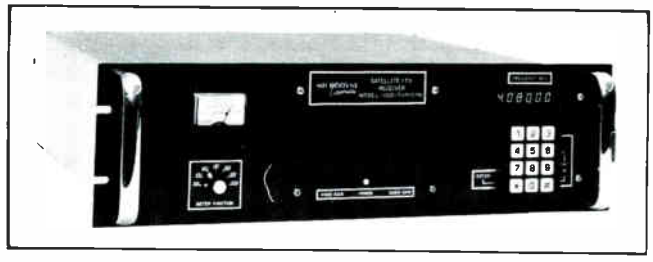
By January 7, 1977, the FCC released their decision. They would accept smaller dish applications. On February 18th, they formally accepted the applications and granted Kalispell, Montana, and Gaithersburg, Maryland for a 4.5 meter dish, and a 3.2 meter horn antenna respectively.

Parallel with the small dish battle, another program supplier was getting ready to operate. The plan by Southern Satellite was to supply an extra 24 hour-a-day channel, not for pay service, but so the subscriber would have more to watch than regular TV programs. The formula for Channel 17, as it was called, was to charge the cable company 10¢ per subscriber and let everyone on the system watch.

The first tests were seen at the Western Cable Show in December, 1976.

Southern Satellite formally was approved for operation in mid December, 1976 and as of this publication date they have about 40 systems served by satellite.

HBO is now serving about 86 earth terminals, with more systems since some are sharing a single earth station. Still waiting for approval at the Commission are another 30 applications.



Microdyne digitally tuned receiver permits rapid channel selection and excellent frequency stability.

What does the future hold? There is no way to predict the actual numbers, but nobody is guessing that things will level off. A lot of systems are now considering using one dish for both HBO and Channel 17 since they are sent on the same satellite. All that is required is one dish, one preamplifier and two receivers. Other systems are considering sharing earth terminals, which is permitted to the extent that a system *cannot* make money other than to cover their costs when providing signals to other systems. Other movie houses are considering going the pay-TV route via satellite. Other possibilities such as cable radio and even cable programming for minorities such as the deaf and the blind will come to pass.

Last week I heard a manufacturer is offering a complete earth station for less than $28,000. This is certainly within the reach of most operators.

Finally, and most important, the satellite is permitting cable to offer something more than off-air TV. This is just the start! □

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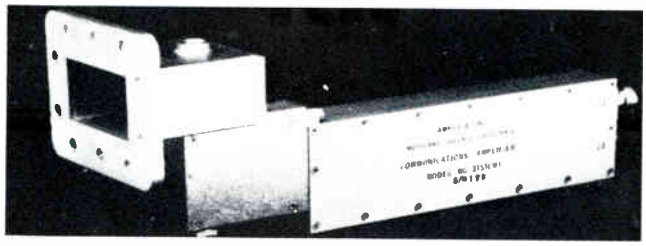
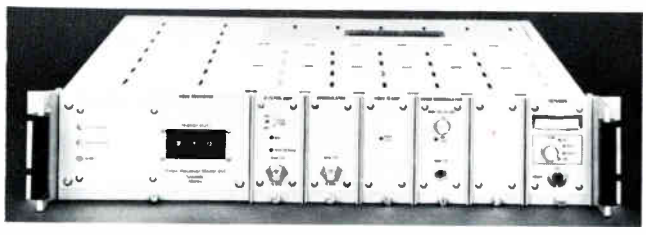
Earth Station Update: Equipment

While the program suppliers and the legislation have all paved the way for the explosive growth of satellites and use of earth stations for cable systems, the real advances have been made in the equipment.



Amplica is one of the manufacturers of low-noise figure preamplifiers.

Scientific Atlanta produces 5, 10 and 11 meter antennas. Shown is their 10 meter earth station.



New receiver designs such as this Scientific Atlanta model feature threshold extension.

Even if no new technology advances had occurred over the last 18 months, the equipment suppliers would deserve a round of applause for delivering the 100 or so domestic earth terminals.

Not only have many terminals been installed, but each day finds better performance and lower prices. A year and a half ago you could expect to pay more than $100,000 for a terminal. Today you can get one for $28,000.

On the large dish scene, tremendous breakthroughs have been made on preamplifiers (often called LNA or Low Noise Amplifier). Scientific Devices announced a preamplifier last fall for $985 that would work suitably with the 10 and 11 meter dishes. Price breakthroughs on other preamplifiers such as Parametrics have eliminated the need to spend large amounts of money.

There are still two schools of thought on whether the large or small dish is more acceptable. The large dish is more expensive because of its size; however, the preamplifier does not have to be as sensitive, so preamplifier cost on a large dish is low. The large dish has some advantages in margin, especially in difficult areas of the country such as Florida and the deep south, where the received power from the satellite is lower than normal. The smaller dish offers cost advantages due to the dish size, but the preamplifier has to have a much better noise figure to compensate for the lower antenna gain. It is probably a good idea to base your requirements upon using as large a dish as you can afford.

A recent entry in the earth station market is U.S. Tower Company's six meter antenna. This is probably an excellent compromise since the dish size is small enough to be reasonable in cost, yet large enough to permit the use of low cost preamplifiers and offers good performance in fringe areas.

Some other unique products exist. One is the Prodelin 4.5 meter fiberglass antenna. It is light weight and highly durable. Its performance has been demonstrated at many trade shows and it is quite inexpensive.

Advances in receiver design have also aided the move by cable to the use of earth terminals. Demand for multiple channel capability has prompted some manufacturers to offer digitally and remote tuned units. Another area of improvement is in the area of threshold extension. Most manufacturers offer at least 2 dB of extension, which means that an advantage in signal to noise ratio beyond the performance of the preamplifier is obtained. This advantage gives either more margin in performance, or permits the use of a less expensive, less complex preamplifier.

The future in earth station equipment for the next few years is somewhat predictable. Prices will continue to go down; however, the present price per performance ratio is probably leveling off.

We will be seeing dual terminals that handle, for instance, both HBO and Channel 17 simultaneously. This will probably mean that preamplifiers have two or more outputs to drive a number of receivers. Multiplex control signals will soon be carried to control the receivers from the main headquarters of both HBO and Channel 17. Redundancy in receiving equipment will be as important as always and automatic systems will be able to detect the best signal and choose accordingly.

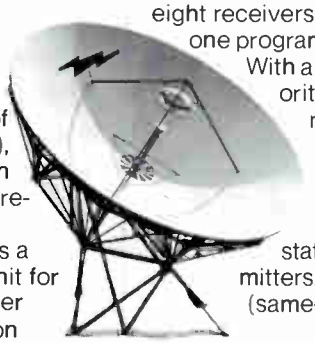
Finally, some form of scrambling will probably be used to prevent illegal use of the channels. The earth terminal usage will grow, not as wildly as it has over the past 18 months, but it will continue to grow at a very fast rate.□

TerraCom offers you the only family of satellite earth station receivers in this world.

Everyone's earth station receiver needs aren't the same. That's why TerraCom offers you more choice in receivers and controls than anyone else in this world.

Four different, but compatible, receiver models in both 4/6 GHz and 12/16 GHz bands, a family of switching units to protect against receiver and low noise amplifier problems (that also give you a variety of bridged and multiple outputs), plus a test transmitter you can purchase or lease for testing receiver performance directly.

And only TerraCom builds a versatile channel selection unit for remote control operation either through a wire interconnection or by a normal telephone call to the receiver or through the satellite to the receiver as part of the satellite transmission.



Many combinations are available. For example, a TerraCom system can provide automatic protection for up to eight receivers (of all models) with just one programmable backup receiver. With a selectable channel priority. And it allows manual remote override channel control of any one of the receivers.

There's a lot more to the TerraCom earth station story, like up-link transmitters, excellent customer service (same-day dispatch of free loaner equipment), a two-year warranty, high performance, low price and easy maintenance.

But see for yourself. Whether you need receivers that are fixed tuned or tunable, or programmable channel selection with either single or dual conversion units, or combinations of these models working together, you can see them when you visit our operational satellite earth station in San Diego. Call Bruce Jennings or Bob Boulio at (714) 278-4100. Let us show you some equipment that's out of this world.

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news

Second Reliability Conference

ATLANTA, GEORGIA—Ninety-one technical cablemen traveled to Atlanta late last month for the Second Annual Conference on CATV Reliability. The conference, sponsored by the Society of Cable Television Engineers and the Broadcast, Cable and Consumer Electronics Society of the IEEE, was deemed by most a successful one.

Twelve papers were presented, ranging from the status of European reliability, to interference and leakage problems, to improving cable FM. There were less papers presented this year in order to allow each speaker more time to develop his thesis fully.

Thursday morning's sessions were standing-room-only, while Bob Dickinson of E-Com Corporation delivered his paper on the status of the interference problem presently plaguing the industry. The last session on Thursday afternoon featured an open panel on the importance of reliability, with Kevin Gossman of Teleprompter, Bud Campbell of ATC, Gay Kleykamp of UA-Columbia and Jim Grabenstein of Potomac Valley TV Cable, as penel members.

Harry M. "Chip" Shooshan, speaking at Wednesday's luncheon, invited the engineering society to "voice their opinion, and use any channels open to them," that will allow maximum input to the staff members and congressmen of the House Communications Subcommittee. The subcommittee is gearing up for the rewrite of the '34 Communications Act, and he said, needs the technical help of the industry's engineering people.

Judith Baer, executive director of SCTE, announced that a southeastern chapter of the society has been formed. At the recent Georgia Cable Television Association meeting, 11 new members were solicited, and anyone interested in joining is asked to contact the SCTE office.

Cable Continues to Grow

WASHINGTON, D.C.—Two separate sources have released data on growth of the cable industry. Arbitron's TV census indicates that there are now over 10.5 million CATV households, up 1 million from last year.

The Department of Commerce in its report, "U.S. Industrial Outlook 1977," says that the cable industry reached 1775 million last year, a 15% increase over 1975. They are projecting $880 million next year and a steady 14% growth rate per year through 1985. By 1985, they project the revenues will exceed $2 billion per year.

Harrisburg System *Not* Implicated in Plane Crash

HARRISBURG, PENNSYLVANIA—A plane crash on takeoff killed nine persons February 24th over Harrisburg. The State Transportation Secretary and four employees, along with the State Republican Chairman were among those killed in the accident. The Harrisburg system abandoned all channels in the critical aircraft bands months ago after local pilots complained of voice interference. The system **cannot** be implicated in the most unfortunate incident.

The fact still remains that cable systems must be aware that they are sharing critical spectrum space, and a conscious and continual effort must be made to monitor and control cable emissions. It is ironic that this accident occurred over Harrisburg, the one system where there has been documented cable interference.

Air Interference Comments

WASHINGTON, D.C.—Both the FAA and the National Cable Television Association are busy this month preparing comments to be filed with the Commission concerning the problem of cable leakage and its effects upon aircraft voice and navigation equipment. Early in March, the FCC will work toward producing a set of rules that will permit cable and other services to live in harmony. If you have any comments on this most pressing matter, you should file them (5 copies) with the Federal Communications Commission, 1919 M Street, N.W., Washington, D.C. 20036. You should reference Docket 21006.

Filling Engineering Position Not Discussed

FORT ST. LUCIE, FLORIDA—NCTA board of directors held their annual board meeting on Feb. 14 and 15 to elect

officers for the coming year. It was noted that the subject of filling the engineering v.p. position was not discussed. Currently there are no engineering personnel on the NCTA staff.

The board has votes to restructure the dues schedule in hords of stimulating membership. A number of other issues were covered during the meeting including, a sliding scale for Associates' dues, a change in bylaws allowing no more than one member on the board per company, and the granting of $125,000 for research and consultants to help in opposing the Bell bill.

Guide to Political Cablecasting by NCTA

WASHINGTON, D.C.—The NCTA has made available a guide on how to "Reach Your Constituents via Cable." The booklet will be distributed to congressment on a one-to-one basis with special emphasis on each congressmans' district and cable availability.

The benefits of political cablecasting will give a congressman the opportunity of reaching the specific audience in his constituency. The possibilities range from "coverage of city council meetings and election returns, discussions on issues of state and local interest to year-round constituent reports."

Subcommittee Names Jackson, Sachs

WASHINGTON, D.C.—Carolyn Sachs, a consultant to the New York State Cable Commission, has been selected as a staff assistant to the House Communications Subcommittee. A Committee spokesman indicated she will handle research for cable and broadcasting, though other duties have yet to be determined.

Sachs received an MA from the Annenberg School of Communications in 1973 and joined the N.Y. Cable Commission directly upon completion of her degree. She has since worked with New York's Office of Municipal Assistance and Policy Development, which helps groups to franchise statewide telecommunications policy.

Chuck Jackson, another recent appointment to the Subcommittee, was hired as staff engineer. He will concentrate on "spectrum management" matters.

Jackson holds a Ph.D from M.I.T., and is currently a special assistant to Walter Hinchman, head of the FCC's Common Carrier Bureau.

NCTA National Program To be Unique

WASHINGTON, D.C.—Hazel Dyson informed *C/Ed* that some special new programs will be tried for the first time this year at the National Cable Television Association show to be held in Chicago April 17-20.

There will be technical breakfasts at 7 a.m. on Monday the 18th, and throughout the week. On Monday, Richard Smith of the FCC Enforcement Bureau will speak.

There will also be tours, one to the Sears Towers' broadcast facilities and the other to nearby Andrews Corp. Finally, there will be a hands-on A to Z daily system operations session throughout the show.

Sign up for the breakfasts of your choice when you pre-register. A sign-up sheet for the tours will be posted in the engineers' lounge. For further information, contact NCTA. □

The Hazard of Low Voltage Electrocution

By W. Sherwood Campbell, P.E.
Director-Systems Engineering, ATC

*Editor's Note: Many cable technicians **don't** think that the 30 or 60 volts used on most cable plants is anything to worry about. If you're one of those, then you should read this article carefully. Low voltages **can be dangerous.***

The hazards of electric shock and electrocution at AC potentials of 115 volts and higher are generally well accepted. What is not as well known, however, is that serious shock—even electrocution—can take place at lower voltages: electrocutions have been reported at 46 VAC[1] and even at 25 VAC[2].

Although one source places the maximum safe voltage at 24 VAC[1], another source recommends limits of 21 VAC for hand to hand contact and 10 VAC for an electrical path from one hand to two feet immersed in salt water[3]. It is generally accepted that 37.5 VAC can be dangerous under some conditions and that 50 VAC can be fatal[4].

Why, and under what conditions, are such low voltages dangerous? The effects of electric shock on the human body are a function of the current's magnitude and its path through the body. The most common path is from hand to hand or from hand to foot; the effects of various values of 60 hertz RMS current flowing over these paths are tabulated in Figure 1.

The shock is first felt when the current level reaches one milliampere. At approximately 16 mills, the arm and hand muscles are paralyzed and the victim can no longer voluntarily let go of the energized conductor, and at 20 to 30 mills the chest muscles become paralyzed, stopping respiration. At this point, and without aid, the victim will die from asphyxiation. Unless the power circuit includes a ground fault interrupter, the current is not high enough to trip any overload devices. If the current is shut off or if the victim is removed from the energized circuit, he should resume normal breathing and recover satisfactorily without further aid.

If, however, one of the points of contact is his head *and* gives the current a path through the respiratory center at the base of the brain, his respiration may remain arrested for several minutes or even hours after the current flow has stopped. In this case, mouth-to-mouth or mouth-to-nose artificial respiration must be begun immediately and must be continued until medical help arrives.

The most dangerous range for shock currents is approximately from .05 to 2 amperes. It is in this range that the heart can be thrown into ventricular fibrillation (weak, ineffectual twitching instead of strong, rhythmic beating). If this happens, closed chest cardiac massage must be provided to circulate the blood until professional medical help can arrive and attempt to defibrillate the heart. If breathing has stopped, mouth-to-mouth artifical respiration also must be provided to oxygenate the lungs.

At currents above about three or four amperes, the heart is paralyzed during the shock, and the blood does not circulate. If circulation has not been stopped for too long, however, the heart normally resumes normal beating on its own once the flow of current ceases. At currents much above this value, burning, both of flesh and internal organs, becomes a major concern.

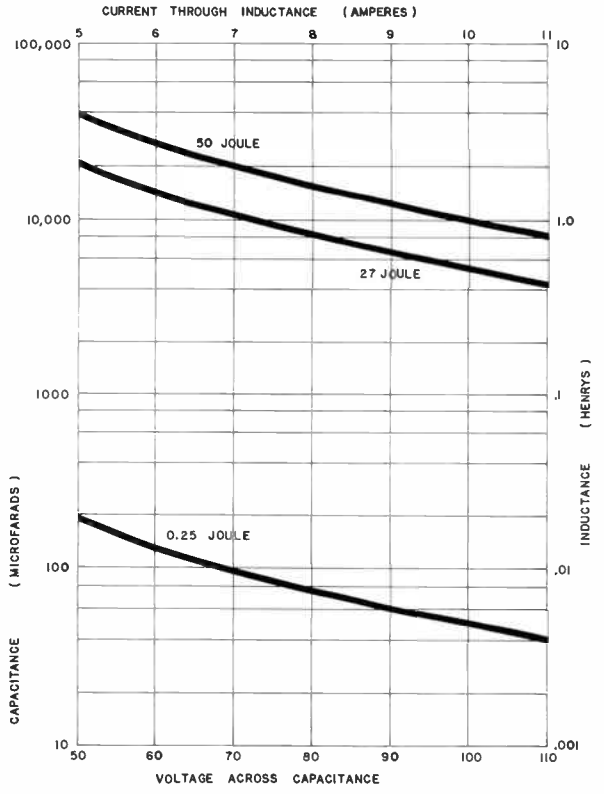


Figure 1: Effects of 60 Hz RMS currents on the human body(a)

APPROXIMATE CURRENT THRESHOLD	EFFECT
1 ma.	Perception
3-10 ma.	Painful Shock
10-20 ma.	Arm Paralysis (can't let go)
20-30 ma.	Respiratory Paralysis(b)
.05-2 a.	Heart Fibrillation (c)
4 a.	Heart Paralysis
5 a.	Tissue Burning
20 a.	Internal Organ Burning

a) For 150 lb. man. Women's perception and arm paralysis currents are about two-thirds of those for men, and children's are about one-half of those for men.

b) Caused by titanic contraction of chest muscles. Respiratory arrest caused by a shock affecting the respiratory center in the brain is possible if the current has a pathway through the base of the brain.

c) Varies with shock duration.

Figure 2: Stored energy hazards.

The preceding has dealt with the fatal consequences of electric shock. But low level, short duration shocks can also cause a person to injure himself through either surprise or involuntary muscle reactions. A fall from a ladder is one example of a non-electrical injury resulting from an electrical shock.

We are only concerned here with 60 hertz alternating currents, because direct currents are not as dangerous. At low current values, they cause muscle reflexes which tend to throw the victim clear of the contact, rather than freezing him to it. At higher currents, DC does not have AC's tendency to cause ventricular fibrillation. Incidentally, of all frequencies, 60 Hz seems to be about the worst possible choice from the standpoint of electrocution danger.

Knowing the danger of various current levels, the voltages necessary to cause these currents can be found from Ohm's Law, if the resistance of the human body is known. The internal resistance of an arm or leg is approximately 250 ohms, and the internal body resistance from shoulder to shoulder or shoulder to hip is about 100-50 ohms[4]. Generally, the more muscular the person, the lower his body resistance. The internal resistance of the human body is then, approximately, between 100 and 1,000 ohms, depending on the points of contact. It is generally assumed to be 500 ohms.

Although the skin, particularly callous skin, can add considerable contact resistance, a wet hand can easily have a contact resistance less than 2K ohms, and a foot immersed in water has a resistance of only 100-300 ohms. Even a dry hand can have a contact resistance less than 2K ohms if it is grasping a large diameter conductor such as a pipe or drill handle. Skin resistance is practically eliminated if the skin is abraded, cut or blistered or if contact is made through sweat soaked cloth gloves holding onto pipes[4].

When all these data are plugged into Ohm's Law, it is obvious that a 5000 ohm man holding onto 50 volts will carry a 10 milliamper current—from which he may not be able to release himself. If his body resistance is only 500 ohms, 37.5 volts will produce a 75 milliampere current which can, depending on its path through the body, cause fibrillation of his heart and death.

In addition to steady state currents, there is the danger of surge discharges from charged capacitors or from breaking the circuit of a current carrying inductor. Figure 2 shows three current/inductance and voltage/capacitance stored energy curves representing 50 joules (watt-seconds), 27 joules and 0.25 joules. The 50 joule energe level is considered lethal[5], 27 joules is the threshold value for heart fibrillation[3] and 0.25 joules is considered the "shock hazard" level[5]. If the discharge is into a sufficiently reactive load that the current is oscillatory, the fibrillation threshold should be reduced from 27 joules to 13.5 joules[3].

A final warning: care must *always* be exercised at potentials of 50 VAC or higher, and if you are in a wet location, are perspiring or have cut or blistered hands—you should be careful at *any* voltage! □

REFERENCES

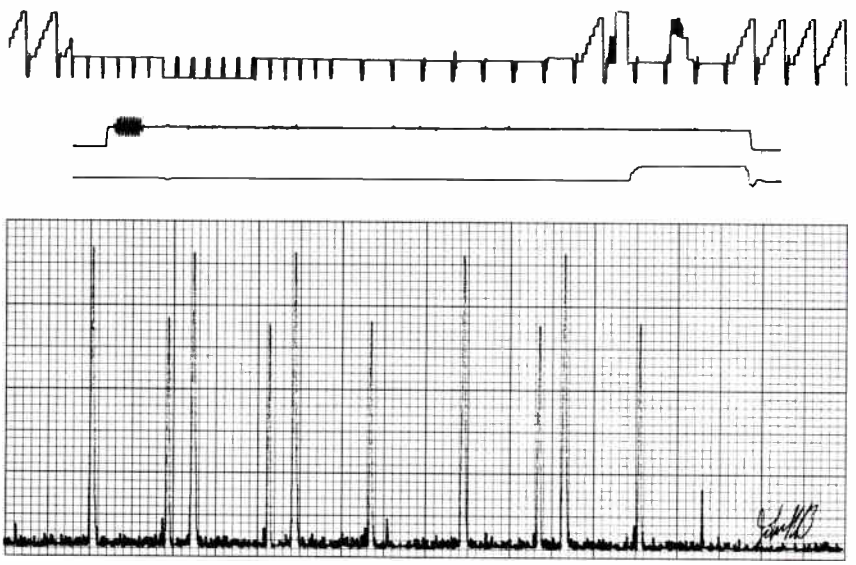
1. Kouwenhoven, W. B., "Effects of Electricity on the Humon Body," **Electrical Engineering,** Marcy 1949, 199-203.

2. Goldstein, David H., "Electric Shock," **Textbook of Medicine,** XI (1963), 1819-1820.

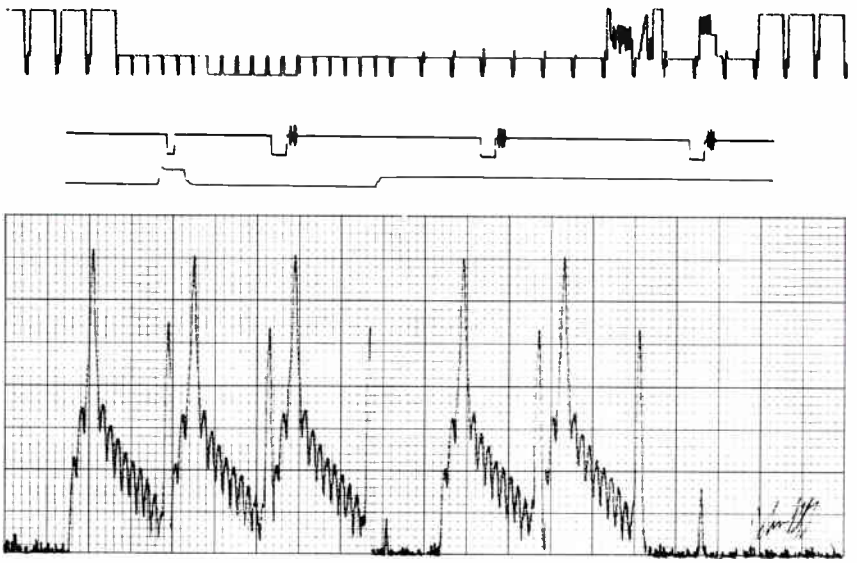
3. Dalziel, Charles F., "Effects of Electric Shock on Man," **IRE Trans. Med. Electron.,** PGME-5:44, 1956.

4. Lee, Ralph H., "Electrical Safety in Industrial Plants," **IEEE Spectrum,** June 1971, 51-55.

5. United States Atomic Energy Commission, "Electrical Hazards and Emergency Procedures," **Electrical Safety Guides for Research,** 43.



Spurious Response—Sampling each channel in the vertical interval produces a display without frequency components other than the picture and sound carriers. 30 kHz I.F. bandwidth was used. Vertical resolution is 20 dB per major block.



Picture Quality Capability—Sampling each channel during an equalizing pulse produces the serrated display.

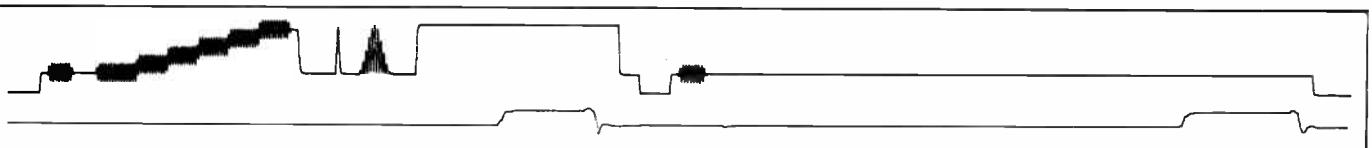
Time and Frequency Measurem Part II

Editors Note: For those of you that don't know John Huff, he is often quite outspoken and ahead of his time on measurements and instrumentation. A few months ago we ran the first part of this article which explained Johns' thoughts on the subject of Simultaneous Time (Oscilloscope) and Frequency (Spectrum Analysis) measurements.

Many of the modern cable engineers are familiar with both the oscilloscope and the spectrum analyzer, but the unique thing that John does with these two devices is that he keys into only the portion of the signal needed for a particular measurement. If he wants to measure frequency response, he displays only that portion of the Vertical Interval on the spectrum analyzer. To measure noise, he looks only at a blank portion of the TV sinc signal such as a blank line at the beginning of the vertical interval. The idea is revolutionary and the results are quite dramatic.

John has spent many years refining the technique to the point that he now can do a large portion of a system Proof of Performance with the system in service. He also has a technique whereby he records all the data in audio form on a small cassette recorder and generates the plots of the waveforms back at the shop.

The displays are simple to interpret



Stairstep and Sine² Pulses

Blank Line with Burst

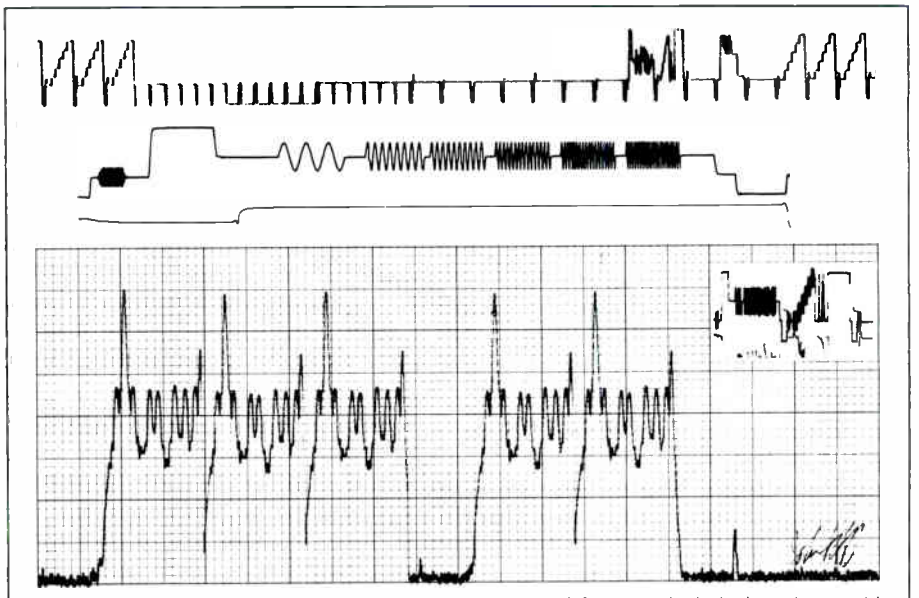
ents:

By John Huff
Tele-Vue

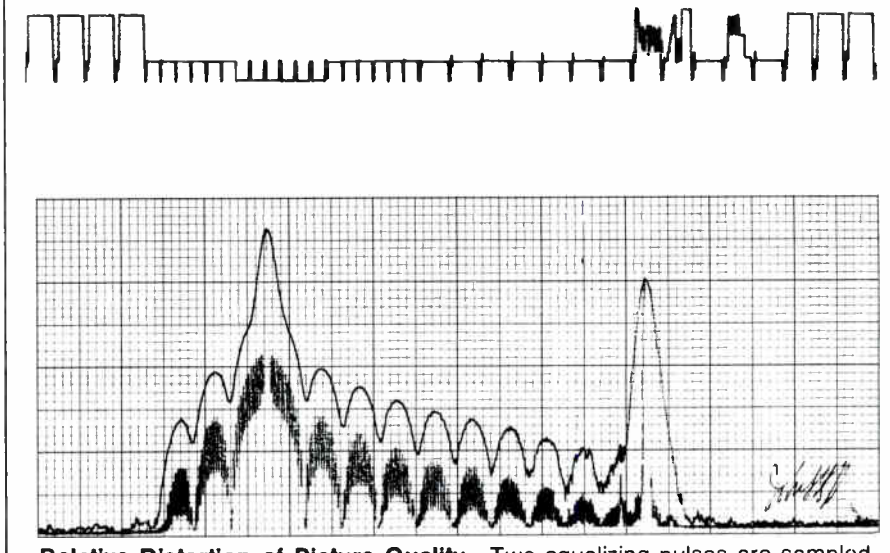
once you understand. With each spectrum trace, there is a dual trace oscilloscope waveform that many of us are used to seeing on a waveform monitor. The lower trace is a straight line with a pulse showing the point of the waveform that is keyed. Only the keyed portion is displayed on the spectrum analyzer.

Using this technique it is possible to isolate any portion of the TV waveform. The examples show isolated portions of the TV test and sinc signals. Measurements of frequency response, signal to noise ratio, picture quality, delay distortions, and intermod components can all be isolated in both the time and frequency domain.

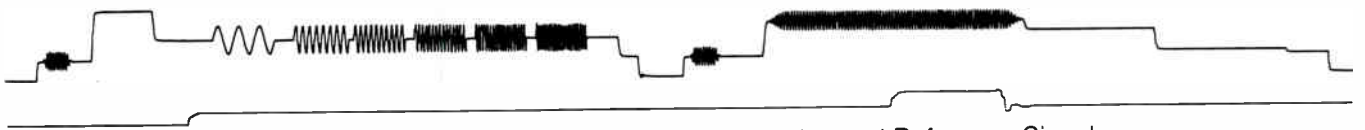
It would take a book to summarize the methods John Huff has developed over the years in both generation and interpretation of his unique displays. We are not even attempting a detailed explaination, but are instead showing some of the more dramatic and readily recognizable results. One possible result of John's work could be a Delaying Spectrum Analyzer. You have all heard of the Delaying Oscilloscope, and know the importance of that device in the modern world. If you or your company ever decides to go ahead with John's new device, just remember where you got the idea.



Frequency Response Capability—Each channel is sampled during the multiburst portion of the vertical interval. All bursts including the upper and lower sideband are shown.

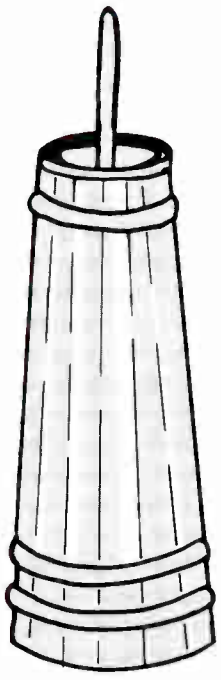


Relative Distortion of Picture Quality—Two equalizing pulses are sampled on an expanded spectrum display. Span is 100 kHz/Division.



Half Amplitude Multiburst

Vertical Interval Reference Signal



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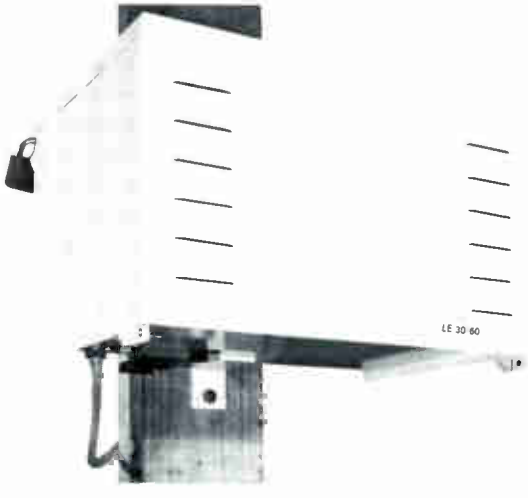

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ComSonics Sniffer 200H Specifications

The major CATV fault location system task is detection and pinpointing the sources of leakage. Measurements made with a device utilizing antennae such as a dipole or car whip can locate gross leaks, but unless the system has the inherent capability for near field analysis, leak location becomes difficult, time consuming and frustrating. Just determining there is an R.F. leak is not enough, since pinpointing and cleaning up shielding flaws is the purpose of a leakage detection system. Rapid leak location can be obtained only by equipment designed for near and far field detection, AND near field isolation.

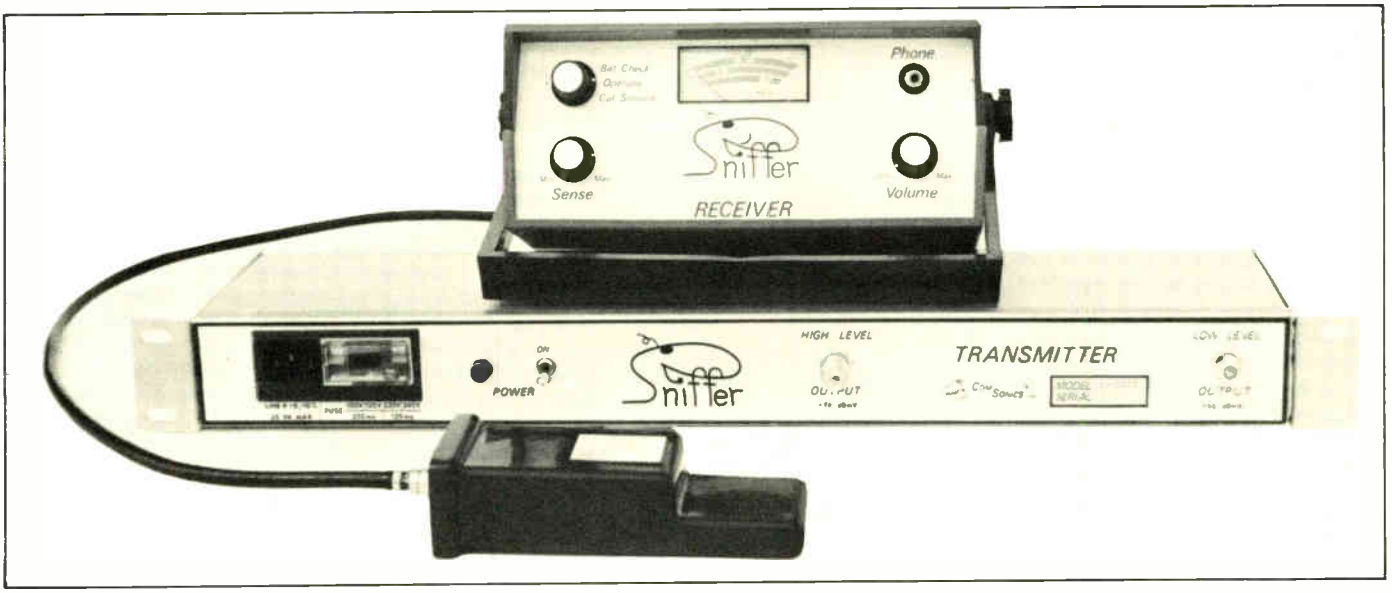
ComSonics®, Inc.'s sniffer system is the only complete, matched transmitter & receiver system with all these manpower conserving features.

The sniffer transmitter's unique narrow band modulation, programmed for greatest aural impression, coupled with a narrow predetection bandwidth receiving system enables satisfactory leakage detection with a sensitivity of 20 dB below 1 microvolt.

CATV system operating levels for the sniffer signal source can be as low as 10 dB belów the adjacent video channels for satisfactory leak detection. Its crystal controlled, narrow band signal spectrum is compatible with usual CATV system carriage.

The sniffer receiver is available in a non-calibrated and calibrated version. The latter model has an internal calibrating signal source, with a front panel meter, enabling go/no-go radiation qualification, when used with a dipole antenna.

The high sensitivity capability of the sniffer system, utilized with the accessory magnetically mounted vehicular whip, enables continuous surveillance of rear easement radiation detection at a distance of more than 200 feet from the monitoring vehicle. Having located the area of the leak, simple conversion to the sniffer near field aperature provides the unique tool to effectively pinpoint the precise location of each leak source. Sniffer owners have reported the following additional uses:



- ★ Tracing lost underground cable.
- ★ Tracing apartment cable routing.
- ★ Locating illegal connections.
- ★ Localizing system outages.
- ★ Locating points of CB interference ingress.

A substantial advantage of the proprietary sniffer system is its light weight, 8-hour rechargeable battery powered receiver.

Its unique aural tone detection system eliminates the need to watch the instrument when probing the system near power lines. The sniffer near field probe has a high voltage insulated case, a vast improvement in safety over the usual metallic dipole antenna used under comparable conditions. □

Specifications

Transmitter		**Receiver**		**Sensor**	
Frequency	217.25 MHz (108-63 Optional)	Sensitivity	0.06 MV (-80dBmV)	Antenna	Fresnel Aperture
Modulation	AM	Power	7 Hour Niead	Housing	Fiberglass
Level	+60-74 dBmV	Speaker	Built in	Output	"F" fitting

TECHNICAL PROGRAM

26th ANNUAL NATIONAL CABLE TELEVISION ASSOCIATION

Convention & Exposition • Conrad Hilton Hotel • Chicago, IL • April 17-20, 1977

Monday, April 18

7:30 am to 6:00 pm **REGISTRATION**
Lower Lobby

ENGINEER'S LOUNGE
Williford Room, Parlor B

EYE OPENER SESSION
Williford Room, Parlor A

8:00 am to 9:30 am **Keynote Speaker**
Robert Goralski, Gulf Oil Corp.
Sponsored by the Society of Cable Television Engineers
Moderator/Organizer: Robert Bilodeau, Suburban Cablevision East Orange, NJ

9:00 am to 6:00 pm **EXHIBITS OPEN**

GENERAL TECHNICAL SESSIONS

11:00 am to 11:45 am **Advanced Techniques — I**
Williford Room, Parlor A
Chairman/Organizer: Robert V.C. Dickinson, E-Com Corporation, Berkeley Heights, NJ
CATV Application of Feedforward Techniques, Bert L. Henscheid, Theta-Com, Phoenix, AZ
The Ideal Modulator/Demodulator, Carl T. Johnson, Jerrold Electronics, Horsham, PA
Operational Fiber Optic System, Ronald Simon, TelePrompter Cable TV, New York, NY
Use of Automatic VIRS Correction and Automatic VITS Monitoring in a CATV Long Haul Microwave System, I. Switzer, Switzer Engineering Services, Mississauga, Ontario

10:00 am to 11:45 am **Human Reactions to TV Picture Impairment**
Williford Room, Parlor C
Chairman: Dr. Donald G. Fink, Executive Consultant, Institute of Electrical & Electronics Engineers, New York, NY
Organizer: James L. Lahey, Multipoint-Texas Inc., Houston, TX
Panelists: Archer S. Taylor, Malarkey, Taylor & Associates, Washington, DC; Robert E. Welch, University of Missouri, St. Louis, MO

12:00 n to 2:00 pm **LUNCHEON**
Grand Ballroom

6:00 pm to 8:00 pm **ENGINEERS' RECEPTION**
Waldorf Room
Presentation of Outstanding Engineering Achievement Awards

Tuesday, April 19

7:30 am to 6:00 pm **REGISTRATION**
Lower Lobby

EYE OPENER SESSION

8:00 am to 9:30 am **Special Displays and Services**
Williford Room, Parlor A
Moderator: Edward Horowitz, Home Box Office, New York, NY
An Investigation into the Problem of Character Generator Ringing or Second Image on Cable Systems, Alex Best, Scientific-Atlanta, Atlanta, GA
General Purpose Computers for Cable Television Systems, Raymond E. Daly, FCC, Washington, DC
Character Generator Program Techniques, Shirley Rohn, Cox Cable TV, Spokane, WA
Technical Description of an Automated TV Program Guide, R.E. Weiblen, Tele-Video Manufacturing, Towson, MD

SUNRISE SESSION

8:00 am to 9:30 am **Protection from Theft of Service**
Williford Room, Parlor C
Organizer: Ronald R. Simon, Teleprompter Cable TV, New York, NY
The Worth of Security, Dan Pike, United Cable Television Corp., Tulsa, OK
Addressable Control for Loop-Through Wiring, Joseph L. Stern, Stern Telecommunications Corp., New York, NY
Security of Equipment and Services —The Terminal Manufacturer's Role, Graham S. Stubbs, Oak Industries, Crystal Lake, IL

9:00 am to 6:00 pm **EXHIBITS OPEN**

GENERAL TECHNICAL SESSIONS

10:00 am to 11:45 am **Advanced Techniques—II**
Williford Room, Parlor A
Chairman: Joseph L. Stern, Stern Telecommunications, New York, NY
Systems Analysis and Design of an Optical Fiber System for CATV Applications, R. B. Chesler, F. W. Dabby and H. Berkowitz, Fiber Communications, Inc., Orange, NJ
Use of Low-Frequency Bi-Directional Digital Transmission on Cable, Michael L. Elis, International Cable Communications, San Diego, CA
Providing Life, Property and Fire Protection Through Cable Television: New Services Through Advanced Techniques, John D. Fannetti, Office of Electronic Communications, City of Syracuse, NY
A Frequency Modulation System for Cable Transmission of Video or Other Wideband Signals, Donald W. Lolli, CATEL, Mountain View, CA

10:00 am to 11:45 am **Everyday Operational Maintenance**
Williford Room, Parlor C
Organizer: Ken Walker, Magic Valley CableVision, Inc., Twin Falls, ID
Small System Trunking—A New Technique, John A. Hastings, C-COR Electronics, State College, PA
Reliable Design for Field Installation and Tests, A Lochanko, AEL, Inc., Lansdale, PA
Satellite Receive Earth Stations—A Practical Approach, Steven Rupp, Farinon Video, San Carlos, CA

12:00 n **LUNCHEON**
Grand Ballroom

2:00 pm to 5:00 pm **Hands-On Z to Z Daily System Operation**
Williford Room, Parlor B
(FCC Proof of Performance with Detailed Illustrations and the Use of Test Equipment)
Chairman: Ken Walker, Magic Valley CableVision, Twin Falls, ID
Engineers: Larry Dolan, Mid State Communications, Beech Grove, IN; Bob Welch, Wavetek, Beech Grove, IN

7:00 pm **NCTA ANNUAL BANQUET**
Grand Ballroom

Wednesday, April 20

7:30 am to 11:00 am **REGISTRATION**
Lower Lobby

9:00 am to 12:00 n **EXHIBITS OPEN**

EYE OPENER SESSION

8:00 am to 9:30 am **Small Earth Stations**
Williford Room, Parlor A
Moderator: Don Arndt, United Cable TV, Carpentersville, IL
Picture Impairments Analysis/Gray Scale Sync-Improvements of Small Earth Terminals, Jack Golin, Michael Kolcun and Marvin P. Sassler, ITT, Ramsey, NJ
Comparison of Performance Criteria of Five and Ten Meter Earth Terminals, Jim Hart, Scientific-Atlanta, Atlanta, GA
"Space 1999" and CATV, David Reiser, Microdyne Corp., Rockville, MD
Earth Stations in Smaller Packages, Carl Van Hecke, Andrew Corp., Orland Park, IL
Earth Station Frequency Coordination, Don Yost, Compucon, Dallas, TX

SUNRISE SESSION

8:00 am to 9:30 am **Pay Cable Functions and Related Problems**
Williford Room, Parlor C
Chairman/Organizer: Richard C. Hickman, Cox Cable Communications, Atlanta, GA
Information Services, Herman J. Moeller, Reuters, New York, NY
Video Tape Cassette Dubbing and Operational Improvements, Edward W. Stark, Cox Cable Communications, Atlanta, GA
Testing Video Signal to Noise Ratio Using a Modified Staircase Waveform, Robert Tenten, Home Box Office, New York, NY

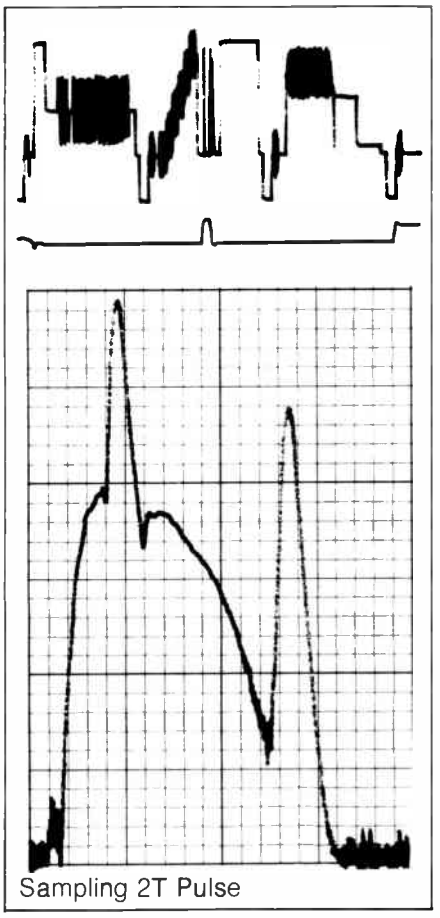
GENERAL TECHNICAL SESSION

10:00 am to 11:45 am Testing and Maintenance
Williford Room, Parlor A
Chairman/Organizer: O.D. Page, P.E., Cable Consultant, Washington, DC
Stop Dig-Ups—One Call Concept, David Punches, Claude Gray and Mike Digon, AT&T, New York, NY
Signal Leakage and Interference with Over-The-Air Radio Services, Dr. Robert S. Powers, FCC, Washington, DC
Is Your System Paying Too Much for Plant Power, James K. Waldo, Teleprompter Corp., El Paso, TX

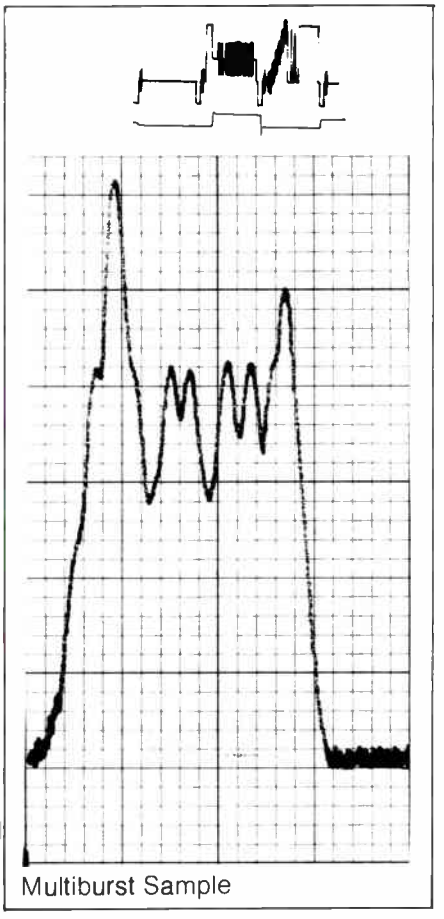
12:00 n to 2:00 pm **LUNCHEON**
Grand Ballroom

3:00 pm to 6:00 pm **ENGINEERING FIELD TRIPS**
Sponsored by the Society of Cable Television Engineers North Central Chapter
Red Tour Host: Andrew Corp. Tour of Plant and Earth Station Installation—approx. 3 hrs. Usher.
Blue Tour Host: Chicago Sears Tower. Tour to Broadcast & Television Installation. Usher. Limited to first 20 applicants.

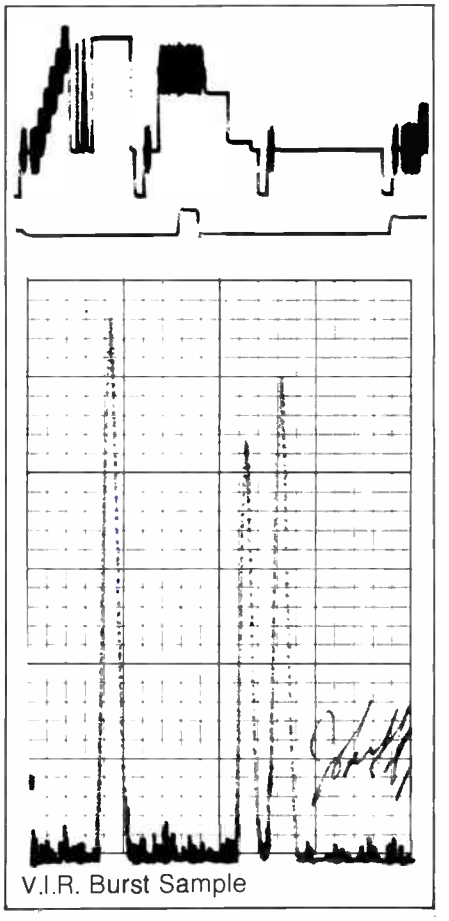
NOTE: Sign up for the tours in the Engineer's Lounge, Williford Room, Parlor B, mornings only.



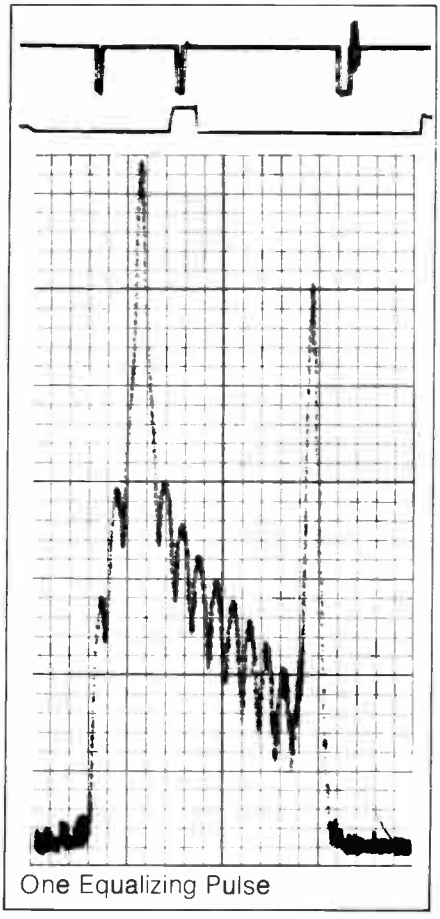
Sampling 2T Pulse



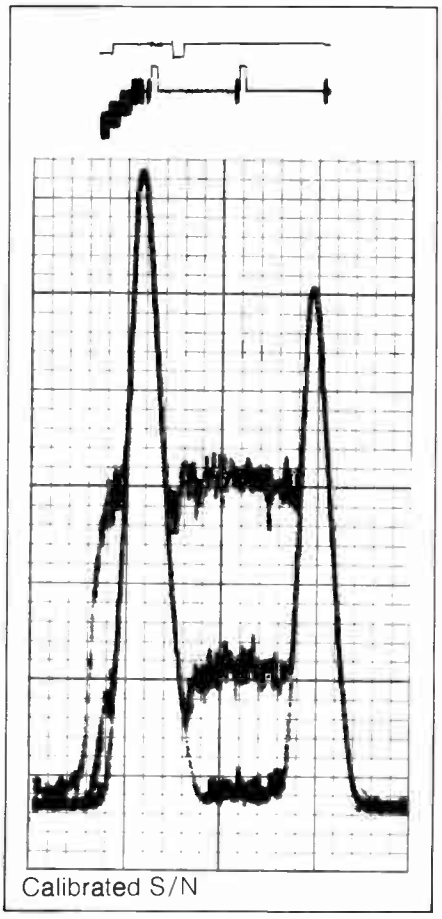
Multiburst Sample



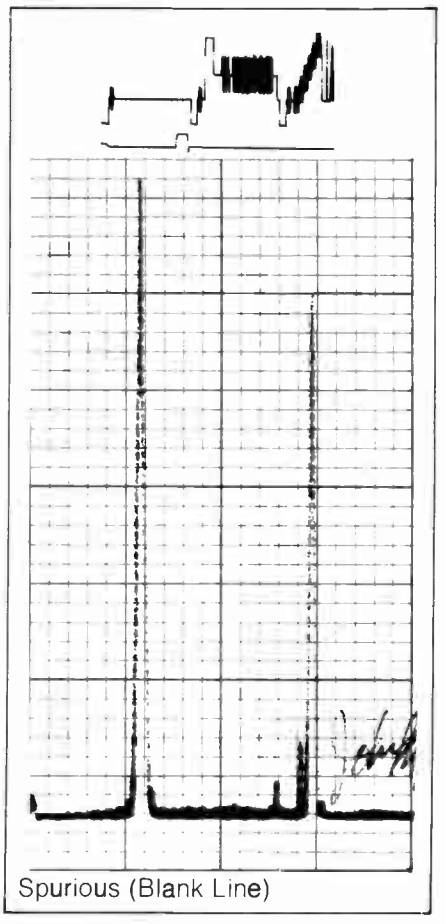
V.I.R. Burst Sample



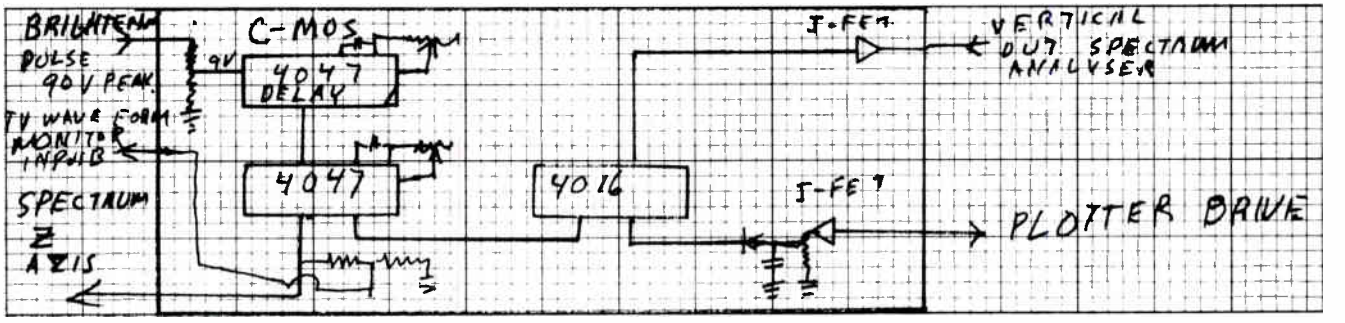
One Equalizing Pulse



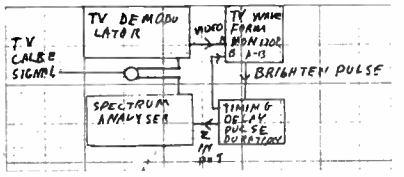
Calibrated S/N



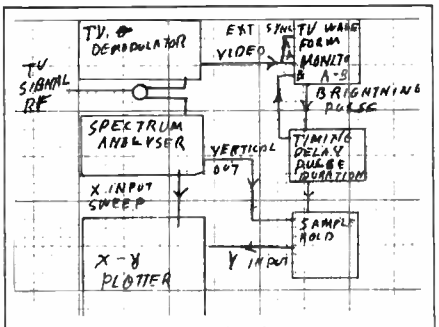
Spurious (Blank Line)



Schematic of sampling pulse generator.



Block diagram of Field Setup.



Complete block diagram for plotter time and frequency generation. □

critique/letters

Dear Judith:

The cover on the December issue of *C/Ed* struck me as being extremely useful and I was wondering how I might obtain at least one and preferably nine (one for each of my chief technicians) copies of this Off-air Interference Chart. If there are charges, I can be billed at the address below.

Jim Collins, Jackson, Tennessee.

Editors Note: Copies of the frequency chart will be available in normal and poster size for a nominal fee.

Dear Bob:

Since we complain when problems develop, it is only fair that accolades go out when your personnel prevent an embarrassing situation from developing. Lynn Cox, this past Monday after receiving our negatives, called me and explained she thought that she should check before running our new advertisement.

The negatives we had sent were unfortunately incorrect and the fact that she would one, notice the problem, and two, was kind enought to notify us, is appreciated Especially since last Monday was the 20th—the deadline for material for *communications/Engineering digest,* and I know it must have been a busy day. Lynn, however, did take the time to notify us. Please convey my thanks to her for doing an excellent job.

F. Richard Cosma, Manager, Information Services. Microtime, Bloomfield, Connecticut.

Dear Clifford:

Thanks for your letter concerning the errors in the interference chart which you published. We're happy to hear that these will be corrected.

A few further thoughts on the possible citizens band at 220 MHz: the report that there would be an interference potential to channels 11 and 13 from class E citizens radio service in the 220-225 MHz band came from the Chief Engineer's office of FCC. It was not an ARRL invention! The difference between class E citizens band and the amateur service in this respect appears to lie in the numbers of transmitters to be expected.

The League filed in favor of expansion of class D citizens radio service in the vicinity of 27 MHz. We have seen increasing interest in the amateur radio service by operators in the citizens radio service; consequently, we are making a major effort to help interested CBers get into amateur radio. For instance, there are now some thirty-thousand people, many of them CBers, enrolled in courses being conducted by some fifteen-hundred clubs that we know of. ARRL takes space at major CB shows to explain, with the help of local amateurs, what ham radio is all about, and how to get into it. We have a new beginning package, "Tune in the World," specifically aimed at bringing newcomers into amateur radio with a minimum of trouble.

Whenever someone begins to quote the difference in numbers to you, you might well want to respond with 1) No one was *born* an amateur operator and 2) No one is *barred* from becoming an amateur now. All it takes is interest. The November issue of QST has a story about two Novices—one is a five year old boy, the other, an eighty year old woman!

Perry F. Williams. Manager. Membership Services Department. American Radio Relay League, Inc., Newington, Connecticut.

Dear Clifford:

Further to my letter of November 9, a colleague points out that there were two additional things I should have touched on. A region around 900 MHz seems to me much better suited for a class E citizens radio service for a number of reasons, perhaps the most important of which is that it is remote from television and should cause little or no problems to the neighbors of CBers.

While use of 220 by amateurs is not uniform over the country, the band is heavily used in population centers: for instance, you can hit 5 220 MHz repeaters from the parking lot at ARRL headquarters! Moreover, it is the area most generally agreed upon for a "Communicator" license or its equivalent in the amateur service.

Perry F. Williams □

SCTE Minutes

Mid-Atlantic/Appalachia Chapter Meets

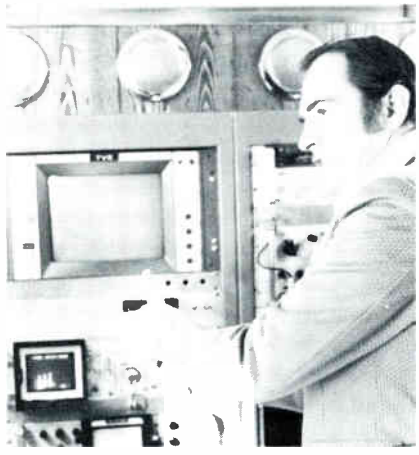
FREDERICK, MARYLAND—The Mid-Atlantic/Appalachia Chapter of the Society of Cable Television Engineers hosted nearly 100 engineers and system technicians for a two day meeting highlighting FCC compliance testing requirements.

Tuesday's events included talks by Ray Daly of the FCC Cable Television Bureau and proof-of-performance test guidelines by Glenn Chambers of ATC-Appleton, Wisconsin. Chambers, eastern vice president of SCTE, 1976 SCTE Man of the Year and author of the *Proof-of-Performance, When to do It/How to do It!* series for *C/Ed*, provided a complete test equipment set-up for the program and covered tests using the most sophisticated and expensive equipment to the "home-made" spectrum analyzers available through CATA. The first day included talks by representatives of Mid-State and ComSonics, describing the newer maintenance tools such as "cuckoo's" and "sniffer's."

Jim Grabenstein of Potomac Valley TV Cable during Wednesday's test equipment presentations.

Wednesday's programming brought out the FCC with representatives of the Cable Television Bureau and the Field Operations Bureau. The Field personnel brought along their enforcement van for a tour by the SCTE members and did a day long presentation explaining their requirements, test equipment set-ups and experiences. Bob Powers spoke to the group on such topics as future technical standards for the industry and FAA interference problems.

The program was coordinated by Jim Grabenstein, Potomac Valley TV Cable; Bob Cole, Annapolis Cable; Lew Strock, Antietam Cable; and, Fred Brown, Frederick TV Cable.



Bob Cole inside the FCC van.

Earth Station Session Hosted by HBO

NEW YORK CITY, NEW YORK—Ed Horowitz of Home Box Office hosted the January Mid-Atlantic Chapter of SCTE's meeting on Earth Station Technology. Nearly 120 people jammed into the HBO conference room for the day long sessions. Discussions included problems with the FCC's current "guidelines" for small aperture earth stations. Representatives of many manufacturing companies spoke to group and fielded questions.

HBO hosted a hospitality session immediately after the afternoon panels concluded and the discussion about earth stations, pay programming and the Commission's current positions ran-over into the evening.

Frederick, Maryland, hosted 100 engineers and system operators for the two-day Mid-Atlantic/Appalachia meeting. FCC compliance testing requirements highlighted the sessions.

SCTE Moves to Washington

WASHINGTON, D.C.—The Society of Cable Television Engineers will move national headquarters to Washington, D.C., effective April 1, 1977. "It certainly makes sense to be headquartered in the nation's capital," says Bob Bilodeau, president of SCTE. He continued, "This is a time of tremendous change for the entire communications industry, and a critical time for cable television. The rewrite of the Communications Act of 1934, the new administration, and new personnel entering the FCC, mean a chance for more participation by the Society in national affairs. Washington, D.C. is the place to be!"

The move is timely according to Bilodeau, "since SCTE's executive director Judith Baer has re-established herself as an independent business and is functioning in Washington on behalf of other organizations already." Baer, who has served as executive director of the Society for two years, will take over the day-to-day business affairs of SCTE, which have previously been handled out of Ridgefield, Connecticut, under the auspices of Charles Tepfer and Catherine Fahey.

The new address for the Society of Cable Television Engineers is 1523 O Street NW, Washington, D.C. 20005. The telephone number is 202-332-4466.

Membership Drive; $250 in Cash

WASHINGTON, D.C.—Members of the Society of Cable Television Engineers may win $250 in cash by signing up new Sustaining Members to the Society's roster, according to Bob Bilodeau, president of SCTE.

Sustaining memberships are available to suppliers, operating companies, individuals, state or regional associations and others interested in promoting the goals of the SCTE. Minimum annual dues for the Sustaining Member are $100. Application may be made by letter, and Sustaining Members will receive an attractive wall plaque showing their participation in the Society.

Members in good standing will be eligible for the contest. The count will close as of midnight on June 1, 1977. Members encouraging their companies to sponsor five new individuals to the Society will have a count of one Sustaining Member. SCTE members will find details of the contest enclosed in *THE INTERVAL*, the Society's newsletter.□

classifieds

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Dolphin DT5500 Directional Taps, 24 & 30 dB, 4-port $3.25, 8-port $8.50. New.

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Feature Issue on Amplifiers

●

Our Famous Tech Review

●

An article on Cable TV at the Smithsonian Institute

●

And a Show Preview

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RC-50 A single function system whose primary output is an isolated DPDT switch. For program switching applications, an optional SPDT VIDEO SWITCH is available at bulkhead mounted coaxial connectors. Units are stackable for expanded control. Only 3-1/2" of panel space required. Price . . . **$450.**

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RC-2000 With a system capacity of 96 crosspoints, this unit is intended for high density applications such as program routing and switching matrices. The unit is fully modularized and is field expandable. Each output module contains 8 multi-pole relays and LED status displays. 96 function price . . . **$4145.**

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