CED

Signal Leakage Handbook II

A special supplement
of CED Magazine

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No kidding. The FCC *will* clamp down on cable leakage offenders. Penalties for non-compliance could literally put you out of business.

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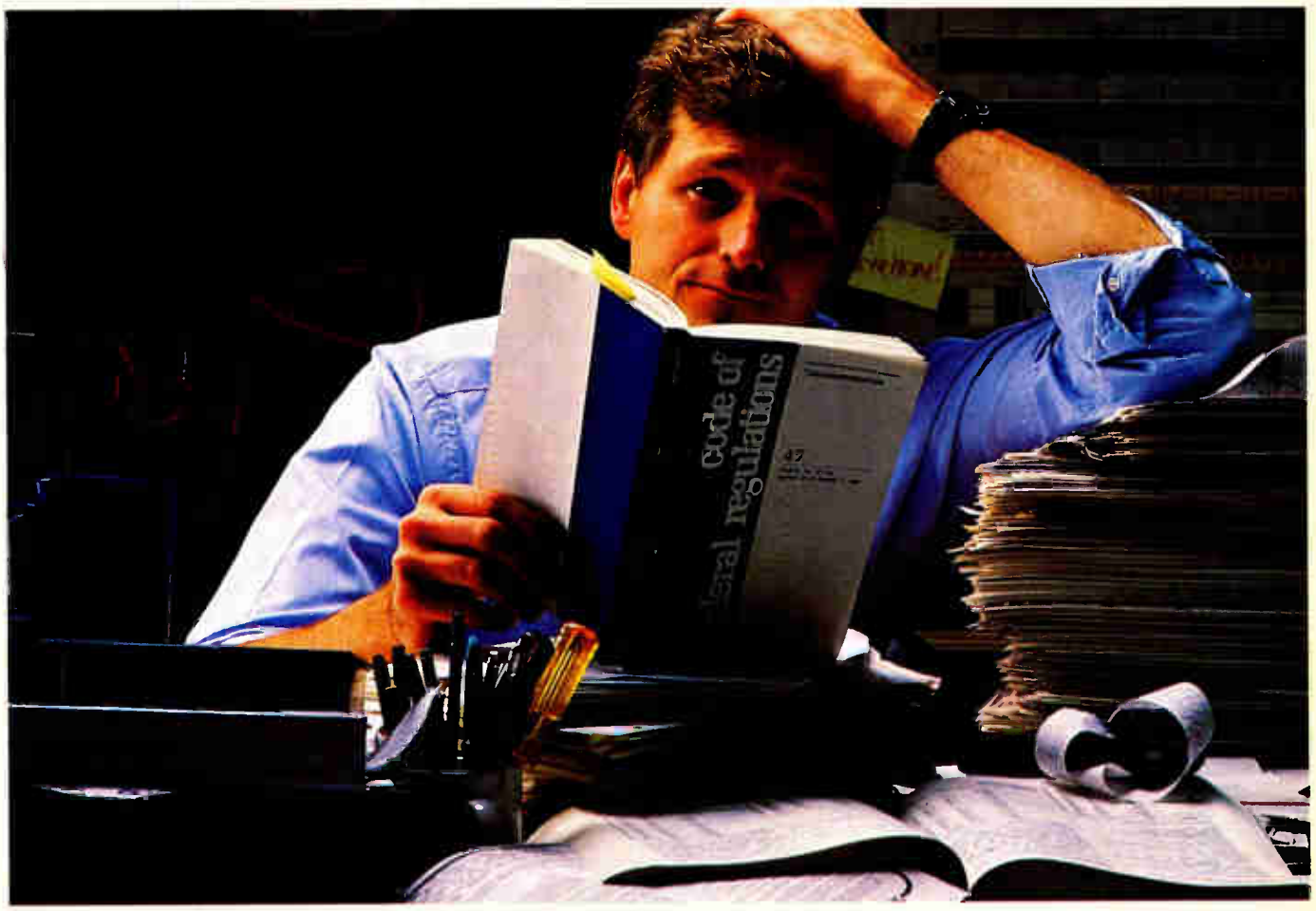

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Reader Service Number 1

y July 1, they may arrange an extension.

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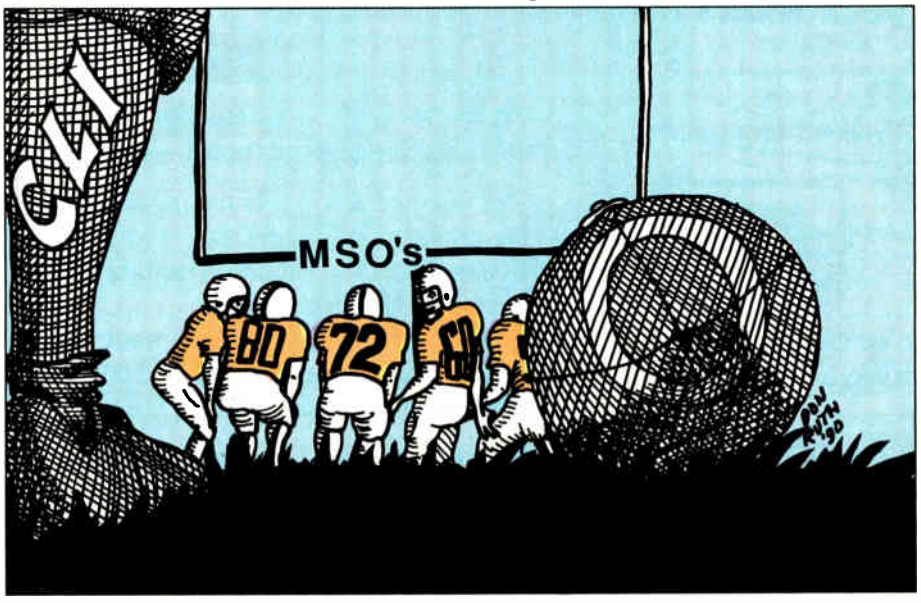
As the inaugural CLI reporting season comes to a close, we felt it timely to take a scrutinizing look back and formulate a working plan for the future management of signal leakage.

This analysis is from the perspective of a firm that has performed thousands of miles of ground-based signal leakage monitoring, repair and technical training services for many large and small cable systems throughout the country.

Riding on the enthusiasm generated by the upcoming NFL football season, the following analogy may provide the impetus and the structure to further develop your signal leakage management program for this coming season.



1990-1991 game plan

As with any championship team, the full cooperation and 100 percent commitment of every player and staff member is required to produce a winning program. As signal leakage is not a static phenomenon, neither can be the management planning process that is intended to keep the continuing problem in check.

Signal leakage will always occur and will not simply go away or contain itself once a system has struggled to comply with FCC requirements. We all recognize that variables such as severe weather conditions, illegal hookups, in-house wiring, installation/construction procedures and many other causes will continue to be factors plaguing our systems with rampant leakage if not strictly managed.

In an effort to build that championship team needed to defeat signal leakage, each cable system from the largest MSO affiliate to the smallest independent system must develop and implement an all-encompassing, long-term game plan.

Spring training

It's back to the basics: hit the blocking sleds and run the tire drill. A comprehensive training program is fundamental to the development of any effective leakage management plan. Fundamentals are the backbone to maintaining leakage integrity.

Consider the following checklist when building your team roster:

- Did you have a good recruiting year? Do you have qualified installers, leakage specialists and technicians?
- Do you have the right players in the right positions? Do all of your technicians have the requisite experience?
- Is your coaching staff prepared? Do the trainers need training?

A successful season is first determined by commitment to adequate human resources. Basic skill training is then necessary to ensure accurate detection and measuring procedures.

Fundamental training components should include but not be limited to:

- Basics of signal leakage theory: How can signal reflection and standing waves affect measurements? What impact does distance have on the final measurement?
- Proper usage of detection and measurement equipment: When and how do you use monitoring vs. measuring equipment? When and how do you use a monopole vs. dipole?
- Interpretation of system engineering drawings and plant maps: How are system components identified? How are system grid maps organized?
- Requirements of FCC regulations and reporting procedures: When and how must the technician peak a signal? What data must be reported on daily logs?

Because of evolving technology and recommended field procedures, training must be an ongoing process. Procedures should be implemented to continually teach and test the technical staff responsible for leakage management.

Pre-season game

Before the regular season kick-off, it's beneficial to have a trial run with your team to shake out the kinks and to allow the coaches an opportunity to assess the effectiveness of the training camp. The pre-season game will indicate where the team needs to improve in order to ensure a successful season.

A ground-based ride-out in the early months of the season will provide management with answers to important questions. This vital information is most useful when there is still ample time to successfully react.

Play-by-play tips

The following questions will be an-

By Frederick E. Beu, Chief Executive Officer, Orion Business Services, Inc.

swered by conducting a pre-season ride-out:

- What is the current leakage condition of the plant? What efforts are required to be substantially within compliance?
- What equipment is needed for conducting an ongoing leakage program? How many detection and measurement devices are required for regular quarterly monitoring and/or for annual system ride-out (if done in-house vs. contracted)?
- How many technicians are needed to perform a system ride-out? Should trucks be staffed with one- or two-person crews? When and how do you select a reputable, special service contractor?
- How much time is required to monitor, measure and repair significant leaks? Where are the "hot" areas where greater human resources are needed? When do you select a "specialized" leakage repair contractor?
- What quality control problems do you discover? Are in-house and contracted installations done properly? Are construction and maintenance procedures within standards? Has the in-house monitoring program proven effective?
- Will data from this effort help justify a rebuild of a specific section of plant?

Whether this initial pre-season ride-out is conducted with in-house staff or by an outside firm, the primary game plan for the balance of the season can be outlined from its findings.

Regular season

A successful year is determined by the results of the regular season's activities. Champions must play like champions every day, to earn the right and the privilege to be considered champions in the end.

Daily activities of all personnel involved with signal leakage management will directly determine the level of leakage throughout a system. As with a championship football team, total organizational support must be committed and delivered to achieve the necessary and desired levels of success demanded by this issue.

The following guidelines are designed to help provide the internal organization necessary for continued compliance. Actual responsibilities will vary from system to system depending on size and organizational structure.

The corporate office and system manager must establish and effectively communicate a signal leakage abatement philosophy throughout the organization. This is accomplished through commitment and implementation of a well funded program designed to comprehensively tackle the leakage problem. Adequate human resources, investment in monitoring and measurement equipment with sufficient levels of ongoing repair and replacement components are critical for successful ongoing compliance.

The chief engineer or technical operations manager should maintain RF leakage issues as regular topics of discussion in weekly management meetings, both with field personnel and upper management. The installation, service and construction managers must closely monitor all field technicians and installers to confirm that regular monitoring procedures are followed. Equipment calibration checks with periodic review of daily leakage logs should be randomly but systematically confirmed for accuracy and completeness.

All installation, service, construction and quality control field personnel have the most critical role in the day-to-day operations of the system. It is no secret that this is where the real work gets done, and it's up to these individuals to control the level of leakage throughout all field operations.

Super Bowl—FCC annual report

If individuals on the championship team possess the basic skills, practice diligently, consistently work as one cohesive unit, and demonstrate a pattern of success, then success in the end will be a natural conclusion. Successful habits breed successful results. ■

Orion Business Services Inc. is a professional services company specializing in human resource development for communications industries. Orion's Technical Training Institute prepares installers, technicians and customer service representatives in traditional cable TV, telecommunications, fiber optics and computer local area networks. Orion has schools in Washington, D.C., Baltimore, Richmond, Va. and Flint, Mich.

Orion's Technical Services Division provides technical consulting to CATV operators and has performed thousands of miles of signal-leakage rideouts for several dozen CATV systems throughout the U.S. Detection and measurement methods specifically approved by the FCC.

Aircraft instrumentation and communication panel

course."

These radiated patterns are modulated by two different frequencies. The right side of the pattern is modulated at 150 Hz and the left side at 90 Hz. The "on-course" path is formed by equi-signal points between the two modulated pattern sides. This path narrows as the transmitter is approached. The localizer range is about 18 nautical miles, and the beamwidth of the signal is typically 5 degrees. Any deviation from the "on-course" path is detected by the aircraft receiver and depicted on the CDI.

The second component in the ILS system is the glide slope. The glide slope operates on frequencies between 329.15 MHz and 335.0 MHz (channels 41 and 42). The glide slope antenna and equipment is located approximately 1,000 feet off the approach end of the ILS runway, and about 500 feet off the centerline of the runway.

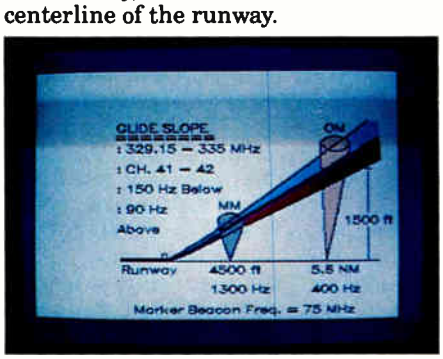


Figure 3

A dual modulated system, similar to that of the localizer laying on its side, is generated by the glide slope equipment. This pattern is projected at about 3 degrees above horizontal so that it intersects the middle marker at about 200 feet and the outer marker at about 1,500 feet. The beamwidth of the glide path pattern is approximately 1.4 degrees thick. Unlike the localizer, there is no "back course." Deviation from the glide path is detected by the aircraft receiver and is also displayed on the CDI.

In most ILS systems two marker beacons are used. These operate on a frequency of 75.0 MHz. The antenna arrays project an elliptical and fan-shaped pattern directly upward. The outer marker is located from 4 to 7 nautical miles (typically 5.6 miles) from the airport on the localizer front course. It is modulated at 400 hertz. Its purpose is to indicate a position at which an aircraft, at the proper altitude, will intercept the glide path.

The middle marker is located approximately 3,500 feet from the end of the ILS runway threshold, on the center of the localizer front course. It is modulated at 1,300 hertz.

It is important to note that each of these ILS signals is amplitude modulated. In addition, the relative low frequency modulation scheme renders the receiving system prone to interference by, on or near frequency radiation. Heterodyning can cause erroneous CDI displacement, which can prove fatal in an ILS approach.

Communication is vital to all aspects of flying. It is virtually impossible to fly today without minimal radio communications equipment. Both VFR and IFR flight depend on information provided by the FAA and the National Weather Service. With the reduction of FAA flight service stations, such information is now often provided by automated facilities. Automated Terminal Information Service (ATIS) is one such example providing current wind, temperature, altimeter and runway information.

The most critical communications frequencies are those reserved for emergency communications. These are 122.5 MHz (VHF) and 243.0 MHz (UHF). These frequencies are utilized by Emergency Location Transmitters (ELTs) aboard nearly every aircraft. These frequencies are monitored by SARSATs (Search And Rescue Satellites), all commercial airliners, most FAA facilities, military aircraft and airfields, and various other stations. Interference here is not taken lightly. A cable leak "masking" an ELT signal could delay search and rescue efforts, resulting in the loss of life for a downed air crew.

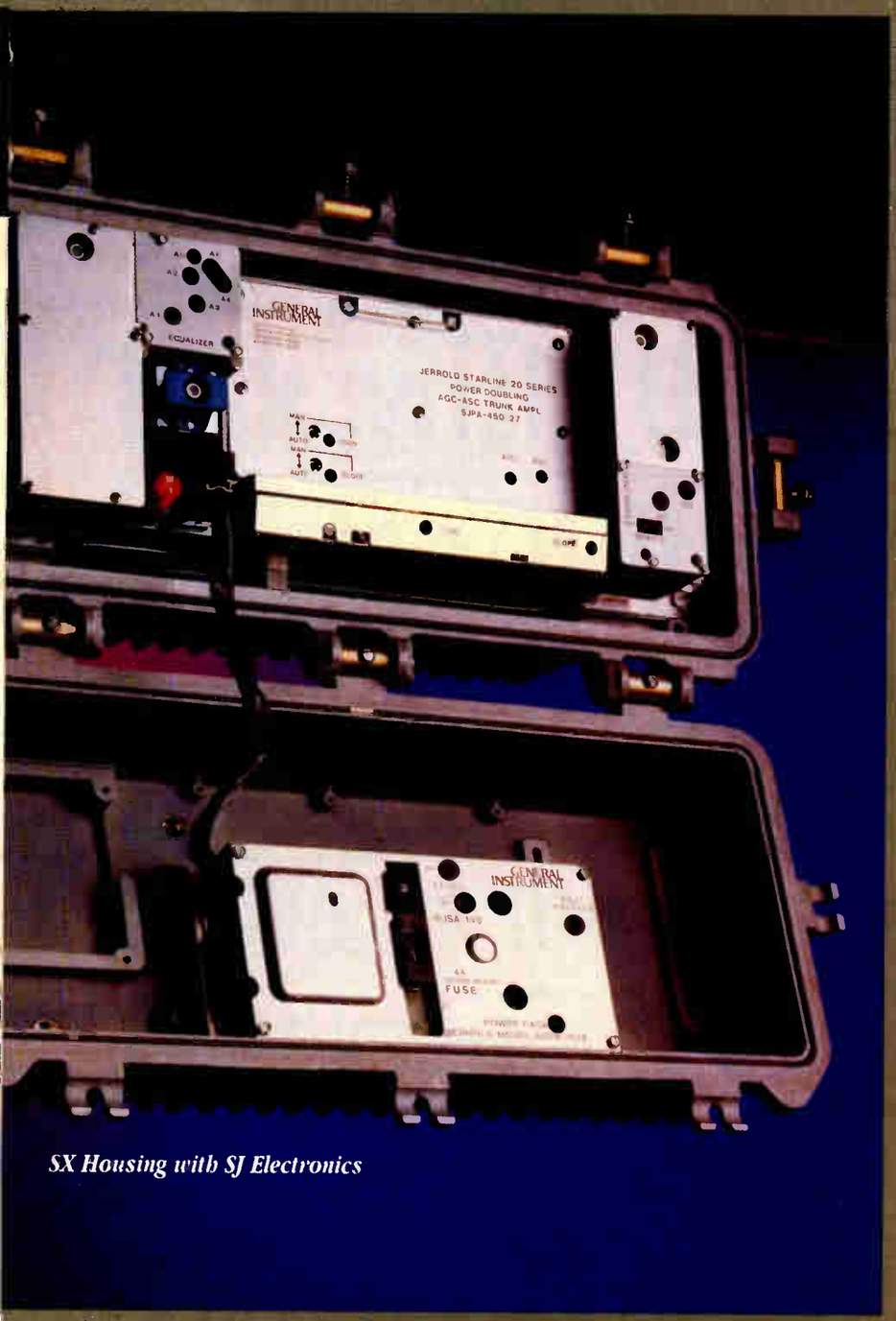
Current status

All systems are now subject to inspection under the revised rules. There have been a number of inspections over the past few years which have resulted in severe fines to the cable systems involved. Today, the technology exists for the FCC to conduct aerial inspections economically. Additionally, budget restraints at the FCC and the resulting staff reductions make aerial inspections most feasible. Operators can expect "spot checks" of various systems to be a regular occurence.

What is at stake for cable operators is the loss of up to 34 channels, coupled with stiff fines, should a system be found not to be in compliance. What is at stake for engineering managers may well be the subject of the latest joke to circulate the industry—"What disappears quicker than a snowball in a microwave oven? A cable TV engineer whose system fails a CLI inspection!"

So, what are the options? First, you must know where your system stands. You can determine this by the calculation process based on your routine ground-based measurements—and hope that the numbers are accurate. Or you can commission an aerial survey, which provides a current "snapshot" of your system, with "real" measurement data from the airspace above your cable plant. Regardless of the method, you must treat the data objectively. Be honest, and make sure your manager and operations executives are aware of the results. There is one option remain-

passed, and situation correction effectivity is dependent upon the ability to make a quick assessment. It does little



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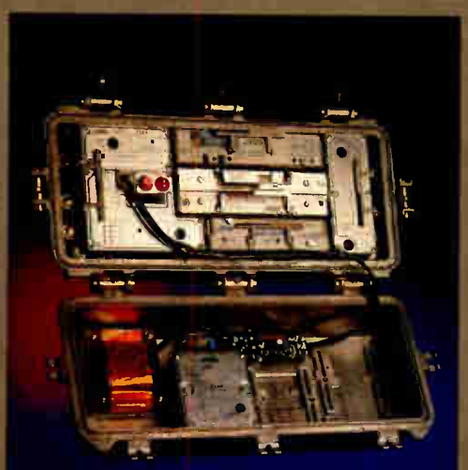

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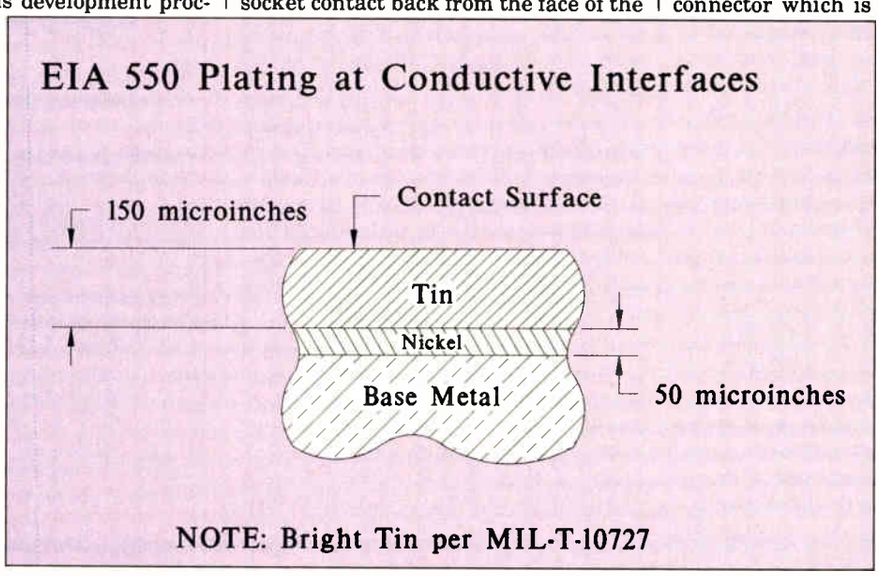
CONNECTORS

Making the 'F' connection

A comprehensive F-connector standard has been developed by an industry panel under the guidance of the Electronic Industries Association. The standards development process was motivated by two concerns: F-connector reliability (electrical, mechanical and environmental) in critical LAN applications, and limitations to international use of F-connectors due to lack of standardization. The rationales behind the EIA 550 standard will be explained, and it will be compared to other CATV industry *de facto* standards and the current F-connector standards work being done through the SCTE Interface Practices Committee.



Preface

The F-connector industry has served the cable industry well for the past 20 or 30 years. It is unlikely that cable television would have grown and prospered as it has without the widespread availability of a low cost RF connector. The F-connector was quite suitable when systems were small and rural, bandwidths were low, leakage requirements lax, and competition to video delivery nonexistent (a poor signal being better than none at all). With its small size and rugged nature, it earned its keep in the cable cosmos. It is safe to say that there are more F-connectors in use than any other type of RF connector in the world.

It seems odd that the F-connector achieved this status without a formal industry-wide description of what exactly it is. As recently as 1988, engineers were still grappling with the problem of how long to trim the center conductor[1]. It seems that different manufacturers of tap boxes still set the socket contact back from the face of the port by different lengths.

The industry is now recognizing the problems that accompany rapid uncontrolled proliferation of similar but unstandardized components. It has been estimated that the industry spends $146 million per year in drop-related service calls, due in large part to failure of the F-connector[2]. A low quality F-connector may be cheap to buy, but is expensive to maintain.

Meanwhile, cable television system architecture has caught the attention of the Local Area Network community as a good way to distribute lots of data over large areas. Standards developed under the guidance of the IEEE Computer Society (IEEE 802.4 Broadband Token Bus[3]), the Society of Manufacturing Engineers (MAP/TOP User's Group[4]), and the Instrument Society of America (PROWAY/LAN Industrial Data Highway[5]) all specify usage of F-connectors. This has been hotly debated in these groups, because the F-connector is correctly perceived as a generally low-tech, uncontrolled, unreliable connector. In addition, international protocols forbid a standard from specifying components like connectors which are not themselves standardized.

EIA-550 development chronology

This led to a need to create a comprehensive standard for an F-connector which is dimensionally controlled and reliable.

A meeting was held in September 1987 at the EIA headquarters in Washinngton, D.C. at the request of members of the IEEE 802.4 group. The F-connector users in the LAN community presented their need for an improved standard connector, and the connector manufacturers in attendance concurred. Authorization was approved to open a project in the EIA P5.3 coaxial connector standards group to write a standard for an "FD"-connector, so named to denote an F-connector for data. A preliminary specification was drafted which included electrical, mechanical, environmental and mating characteristics.

Three more meetings were held as follows:

- Nov. 4, 1987 at AMP, Harrisburg, PA;
- Jan. 22, 1988 at Raychem, Menlo Park, Calif.; and
- March 30, 1988 at Burlington, Mass.

under the leadership of the EIA P5.3 organization, where the details of the FD specification were thrashed out. Each of the major F-connector manufacturers was represented. The standard as drafted reflects the needs of CATV and LAN users for high reliability and wide bandwidth, the needs of manufacturers for producibility, and the needs of world F-connector users for standardization.

The drafted standard was then circulated for review and approval. On April 19, 1989, the standard received final approval for publication as "EIA-550: 75 Ohm Type FD Connector Interfaces,

By Bradford S. Kellar, Electrical Engineer, Raychem Corp.

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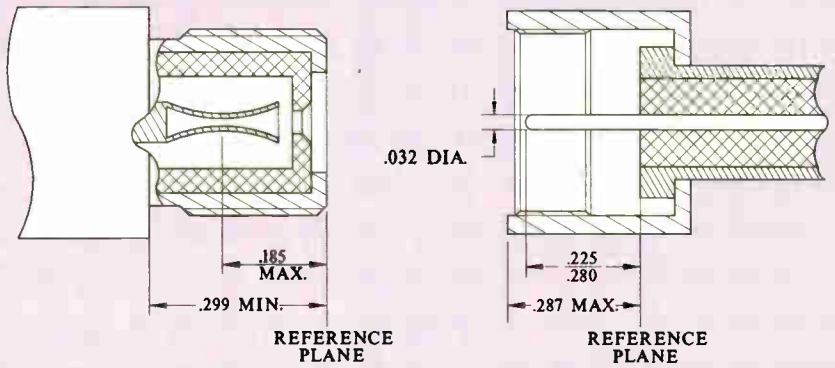
It looks like this standard will be less restrictive than the FD standard, however, because feedthrough connectors will be allowed.

The EIA specification may eventually be adopted by the International Electrotechnical Commission (IEC) after sutiable review, discussion and modification. The process of coaxial connector standardization in the IEC is well documented[11]. ■

Acknowledgements

Norb Sladek of Amphenol served as chairman of the EIA P5.3 working group during the drafting of the FD specification, providing excellent guidance and direction throughout the process. Earl Whittaker of GE/Fanuc was the central motivator behind the project. He was vigilant in ensuring the FD users' requirements were met by the specification. Ken Wood and Jack Radzik of LRC, Charlie Button of Gilbert, Charles Brill of AMP, David Butchko of Pyramid, Charles Thurwachter of Industrial Technology Institute, Mike Maslied of Inland Steel, Wally Kennedy of GE/Fanuc, John Mattis of Raychem, and many others made important contributions to the creation of the specification.

EIA 550 Mating Dimensions (partial)



TYPE FD JACK

TYPE FD PLUG

NOTE: Cable center conductor shall not be used as mating pin.

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Reader Service Number 27

Making CLI ride-outs efficient

Advanced Communications Industries Inc. has been doing CLI ride-outs for various MSOs for two years and believe through the analysis of different programs, we have found the most efficient method of detection and correction.

Three step plan

This is done in three phases. In phase one, the system is surveyed and pole locations or address locations of the leaks with their level of leakage are recorded. This is done with crews of two (one driving and stopping the vehicle and the other recording leak level and address or pole locations).

In phase two, a splicer with a hand-held detector is sent to the location of the leak. The splicer qualifies the leak and corrects all tap-related leaks. If a leak is remaining through a bad drop, the drop is tagged and a work order to repair the drop is created.

If there is a remaining leak because of bad cable plant, a work order to replace or repair (if possible) the bad cable is created. Work orders are given to installers and construction crews to do follow-up repairs within three days.

In phase three, after splicing, construction and drops have been repaired, the completed area is driven again to re-record the data; the area should now be clean and tight.

Ride-out tips

In the process of determining what the most efficient ride-out program consists of, we have experienced a few problems and developed a list of "tips" to help individual operators.

- First, realize that you will never finish a ride-out if you try to repair leaks while you are trying to detect leaks.
- Detection needs to be continuous.
- Splicing materials, mainly actives and passives, have 26-week lead times for delivery.

That exceeds CLI completion deadlines if they have not already been ordered. Lead times on electronic detection equipment is 30 to 90 days and growing longer each day.

- Money budgeted for CLI is only available for disaster situations (made available only when fined by FCC or when channels have been removed). Engineers have been trying to get money budgeted for this and for the most part have had to take second position to marketing. However, unless the system passes the CLI test, all the money put into marketing becomes useless.
- MDU bulk accounts are a real problem, because they are usually wired through the master antenna system and are radiating enough to require a total rebuild. This type of correction is time consuming because property owners need to be contacted to get "Right of Entry" documents executed.
- There are additional problems relating to who maintains the remaining master antenna, which is usually totally useless after cable has been removed from it, and issues regarding what rates are chargeable to the customers now that there are two existing systems.

Side benefits

Managers of systems who have been conscientious to CLI have consistently brought significant money to the bottom line. CLI detection exercises find 50 percent of illegal theft of service. If policed and marketed properly, subscribers can be added to a system.

CLI detection programs also reduce system costs related to service calls. This cost can average 10 percent to 30 percent savings, depending on the severity of the plant's problems. CLI performance should be incorporated in qualifying a system when it is being bought or sold.

In the past, system values were based entirely on subscriber numbers. Now that July 1, 1990 has passed, those numbers may be pointless if you buy bad plant.

In the words of John Wong of the FCC "Let the buyer beware." ■

By Michael N. Johnson, President, Advanced Communications Industries Inc.

In the 90's, everyone expects revolutionary ideas and advancements in technology.

No doubt, the accomplishments made in the near future will leave today's standards to gather dust. Changes - some big and some small - are coming. The question is, how are you going to handle these changes?

The vision which started the cable TV industry is now seeking to improve the technology within. It's comforting to know you can get all the high-tech bells and whistles that will be introduced into the market without giving up old-fashioned, person-to-person service.

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The CABLE POLL

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When it comes to signal leakage compliance, system engineering personnel are even more optimistic about their chances of passing muster than even their general managers are, according to a random poll conducted by mail by *CED* magazine and CableFile Research.

Nearly 500 engineers were selected to receive a questionnaire related to CLI compliance, and more than 50 percent responded to the survey in May. The questions asked were identical to those asked in February by Ryan/Samples Research for The Cable Poll™, a scientific, telephone-based survey of industry general managers (the results of which were published in the May issue of *CED*).

The good news is that systems have apparently made significant progress toward meeting the compliance deadline of July 1. Although smaller systems showed a greater preponderance to answer negatively to questions about whether their leakage programs have been completed, it could be because they do not operate in the aeronautical bands and don't have to comply with the Rules.

However, fully 87 percent of the engineers polled said they would be able to pass an FCC inspection if it were to occur today, and as of the first week of May, 70 percent of those same engineers said correction programs had been completed already. Those numbers contrast well from the 76 percent and 50 percent, respectively, numbers presented by system managers.

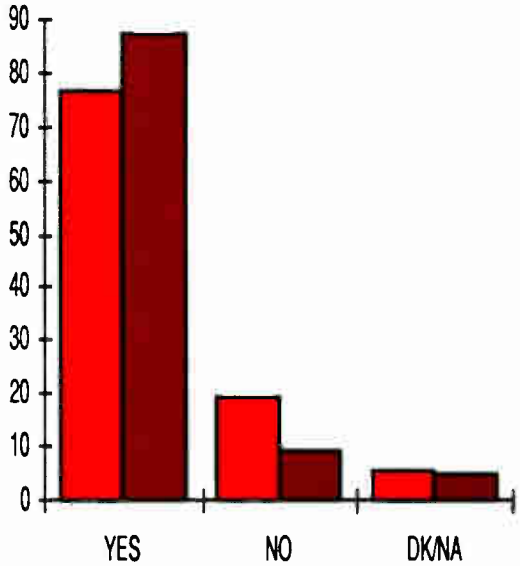
Clearly, the engineers well understand the penalties for non-compliance, too. When asked if the FCC has the power to impose fines on failing systems or temporarily restrict the use of certain frequencies, more than 90 percent correctly agreed that the FCC has that authority.

The least optimistic group was respondents from systems consisting of between 25,000 and 100,000 subscribers and not owned by one of the Top-25 MSOs. Of 54 respondents, only 41, or 76 percent, believed they could pass a CLI inspection if it was held in mid-May. That contrasts sharply with systems of the same size which are owned by Top-25 companies: 94 percent of which said they could pass that same test.

All of this should come as welcome news to the industry, although the proof will have to be borne out in the coming weeks and months. If the engineers are correct in their assessments, compliance with signal leakage may not be as difficult as many have predicted. ■

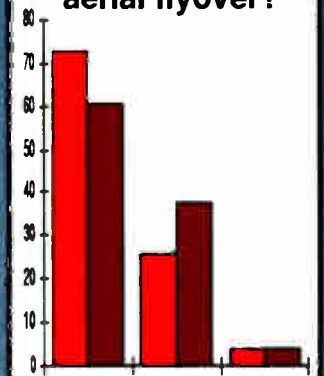
Which of the following do you believe are possible punishments that can be levied by the FCC for non-compliance? Can the FCC...

If your system was inspected today,do you think it would pass the leakage rules?

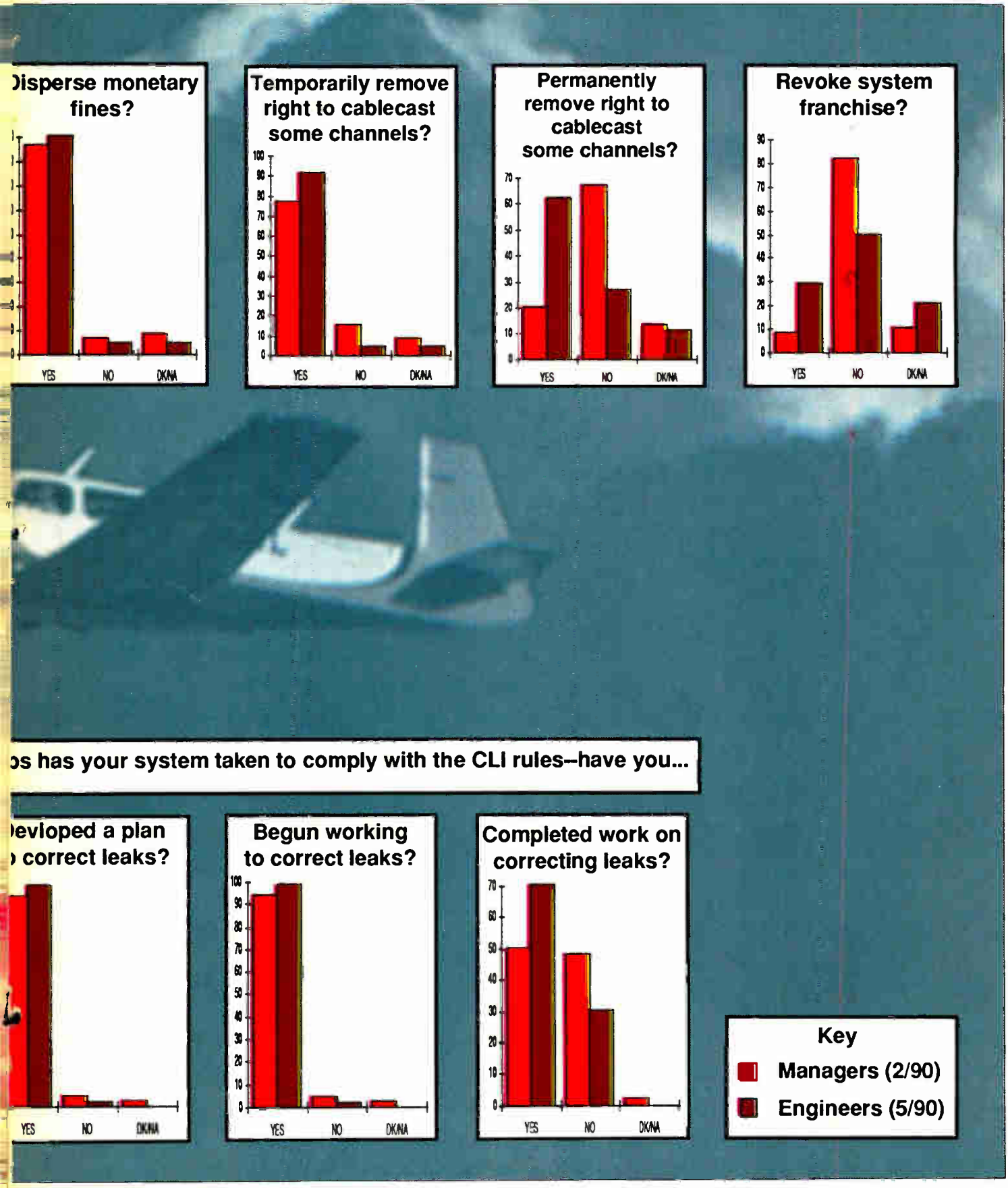


Which of the following ste

Commissioned an aerial flyover?



CABLE POLL


Disperse monetary fines?
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NO
DK/NA
Temporarily remove right to cablecast some channels?
YES
NO
DK/NA
Permanently remove right to cablecast some channels?
YES
NO
DK/NA
Revoke system franchise?
YES
NO
DK/NA
os has your system taken to comply with the CLI rules–have you...
evloped a plan correct leaks?
YES
NO
DK/NA
Begun working to correct leaks?
YES
NO
DK/NA
Completed work on correcting leaks?
YES
NO
DK/NA
Key
Managers (2/90)
Engineers (5/90)

monitoring and the TFC 450/TFC 600 for rapid frequency measurements. A full line of antennas, accessories and C.L.I.C.S. software complete the package. Only Trilithic has it all!

WAVETEK

Wavetek RF . . . . . .(317) 788-9351
Products, Inc.
FAX . . . . . .(317) 782-4607
5808 Churchman Bypass
Indianapolis, IN 46203-6109
PERSONNEL: Jim Connors, Jack Webb
DESCRIPTION: Wavetek manufactures leakage measurement and patrolling test equipment. The CLM-1000 provides complete CLI measurement and logging capability. Convenient measurements are made directly in μV, and may be logged in memory along with location, frequency, and other important information. The Wavetek CLR-4 monitors four channels on the system and is triggered when leakage is present. The Wavetek CLI product line includes these products and others with many accessories designed to make CLI compliance an easy task for the cable operator.

Services

Design & Construction

CATV Subscriber Services, Inc.

CATV Subscriber . . . . . .(919) 273-5553
Services
WATS (National) . . . . . .(800) 334-0860
FAX . . . . . .(919) 274-9734
808 Summit Ave.
Greensboro, NC 27405
PERSONNEL: Raymond Galtelli, President; Fred Robertson, Vice President
DESCRIPTION: Full service national contractor; CLI detection and signal leakage. Mapping and engineering for new builds, as-builts and upgrades. Tap audits which can also be incorporated with CLI. Aerial and underground installation. Marketing; door-to-door sales; house drop installations. Serving the cable industry since 1972.

Cable Services Company Inc.

Cable Services . . . . . .(717) 323-8518
Co. Inc.
FAX . . . . . .(717) 322-5373
2113 Marydale Ave.
Williamsport, PA 17701-1498
PERSONNEL: Vic Carlson, Chief Engineer; John M. Roskowski, VP/Turnkey Construction
DESCRIPTION: Complete in-house turnkey construction services which guarantee FCC compliance to CLI regulations. Walkout, design, engineering, aerial and underground construction individually available. Full product distributor which includes test and spectrum analyzer equipment for CLI testing.

TEA

Transamerica Energy . . .(404) 992-7003
Associates, Inc. (TEA)
FAX . . . . . .(404) 992-8432
1301 Hightower Trail, Ste. 300
Atlanta, GA 30350
PERSONNEL: Bruce Neurohr, President; James P. Worthen, Director/Eng. & Oper.
DESCRIPTION: Specializing in field engineering, fiber optic and RF broadband design, and computerized drafting, a principal part of TEA's business is cable layout for cable TV and telephone companies. Keeping in mind the ever growing demand for TV ande phone services at the personal and business level, it becomes obvious that speed, quality, and competitive prices can quickly determine the level of success.

Flyovers

CableBus® SYSTEMS CORPORATION

CableBus Systems Corp. .(503) 228-6761
3489 NW Yeon
Portland, OR 97210
PERSONNEL: Pat Robison
DESCRIPTION: CableBus offers a comprehensive flyover testing service per FCC rules utilizing dual polarization antennas and multiple frequency capability. The service provides a powerful tool to maintain systems within compliance specifications. The data is plotted on a mylar overlay map and in bar graph form for easy interpretation by the operator. The cumulative leakage compliance system is intended to automate the complex measurements required for CLI compliance, pinpointing the problem areas for the operator and provides a credible audit trail with minimum human intervention.

CableTrac inc.

CableTrac, Inc. . . . . .(215) 868-2500
125 Goodman Dr.
Bethlehem, PA 18015
PERSONNEL: Edwin L. Dickinson
DESCRIPTION: CableTrac is a supplier of nationally available aerial signal leakage testing services which provide fast and economical evaluation of CATV system signal leakage and annual certification for FCC Pt. 76.611.

ComSonics® INC.
AN EMPLOYEE OWNED CORPORATION

ComSonics, Inc. . . . . .(703) 434-5965
WATS (National) . . . . . .(800) 336-9681
FAX . . . . . .(703) 434-9847
1350 Port Republic Road
P.O. Box 1106
Harrisonburg, VA 22801
DESCRIPTION: CLI FLYOVER—Offering system operators aerial signal leakage detection and CLI reporting. This service generates a statistical summary of test data as well as indicating hot spots from grid maps.

FLIGHT TRAC INC

Flight-Trac Inc. . . . . .(708) 790-2500
FAX . . . . . .(708) 790-2562
478 Pennsylvania Ave.
Suite 201
Glen Ellyn, IL 60137
PERSONNEL: Dom Stasi, Ed Milner, Barb Kent

DESCRIPTION: AERIAL LEAKAGE MEASUREMENT. A nationwide airborne signal leakage measurement, mapping and reporting service. The exclusive US corporation licensed to operate the advanced Rogers Engineering ALM System, featured on the cover of the Jan 1990 *CED*, we operate both single and multi-engine aircraft. Our experience includes individual system and MSO-wide programs.

Repair

CATV ELECTRONICS INC.

CATV Electronics, Inc. . . . .(800) 284-4810
920 S. Wilcox Dr., Suite 12
Kingsport, TN 37660
PERSONNEL: Jeff L. Wiggs, Cathy Combs
DESCRIPTION: ***Don't get caught with your signals down! Let CATV Electronics get you in shape before the FCC forces you. Let us make the necessary repairs...*** With July 1990 upon you, let us provide, without delay, the required frequency offsets or complete channel relocation on your headend equipment now. Let us make the necessary repairs and calibration of FSM's RF detectors, or instrumentation used for CLI measurements. We are your total repair facility, call today.

CABLE ENGINEERING, INC.

Cable Engineering, Inc. (C.E.I.) . . . .(502) 589-2848
WATS (National) . . . . . .(800) 626-2715
(800) 334-9684
FAX . . . . . .(502) 589-5023
1615 Mellwood Ave.
Louisville, KY 40206
PERSONNEL: Terry Johnson, Vice President; Danny Hoover, Operations Manager
DESCRIPTION: C.E.I. is a cable television support group dedicated to engineering excellence. We have performed several thousand miles of C.L.I. Rideout and Repair, as well as more than 60,000 miles of Sweep Balance. The Wavetek CLM-1000 is our standard leakage detector. We also do C.A.D. Mapping, Upgrade, and Audit services.

Channel Communications .(414) 565-3378
(414) 565-2911
FAX . . . . . .(414) 565-2106
5430 Highway 42
Sheboygan, WI 53083
PERSONNEL: Jeff Ebersole, President; David Huff, Engineering Manager
DESCRIPTION: Complete engineering, construction, and CLI services offered, including: strand mapping, as-builts, design, CAD or manual drafting, construction, fiber installation, activation, sweep and balance, engineering assessments, and residential/multi-dwelling installation. Also fully equipped to perform CLI survey and correction to meet FCC regulations. Call today.

Other

ORION BUSINESS SERVICES, INC.

Orion Business Services, Inc. . . . . .(202) 347-5388
WATS (National) . . . . . .(800) 627-4123
FAX . . . . . .(202) 783-2152
1003 K St., NW, Ste. 825
Washington, DC 20001
PERSONNEL: Leslie Landey, Marketing Specialist; Frederick Beu, CEO; Robert Gordon, President
DESCRIPTION: **Ground-based Signal Leakage Monitoring and Repair Programs:** Service includes leak source location, calculation of CLI, and preparation of detailed, final report. **CATV Industry Training:** Orion trains cable TV installers and customer service representatives. Customized training programs including signal leakage monitoring training is available. **Publications:** Order Orion's new training manual, *Monitoring and Measuring Signal Leakage*; instructs field technicians how to monitor and report signal leakage in order to satisfy FCC CLI regulations.

Suppliers & Distributors

CATV SERVICES

CATV Services Inc. . . . . .(800) 227-3152
FAX . . . . . .(415) 651-8545
2211 Warm Springs Ct.
Fremont, CA 94539
PERSONNEL: Steve Yerdon, Bob Beall
DESCRIPTION: Your #1 Source in Wavetek CLI Equipment. Prompt delivery on CLM1000, CLR-4 and RD-1 as well as TPC's CLIDE Software for data logging, calculation and reporting. We are a full line, full service company dealing in large volume excess inventory as well as the only factory authorized West Coast Wavetek repair facility.

Cable Services Company Inc.

Cable Services Co. Inc. . . . . .(717) 323-8518
FAX . . . . . .(717) 322-5373
2113 Marydale Ave.
Williamsport, PA 17701-1498
PERSONNEL: Vic Carlson, Chief Engineer; John M. Roskowski, VP/Turnkey Construction
DESCRIPTION: Complete in-house turnkey construction services which guarantee FCC compliance to CLI regulations. Walkout, design, engineering, aerial and underground construction individually available. Full product distributor which includes test and spectrum analyzer equipment for CLI testing.

DROP SHOP LTD., Inc.

Drop Shop Ltd. . . . . .(908) 686-0788
WATS (National) . . . . . .(800) 526-4100
FAX . . . . . .(908) 686-4657
P.O. Box 284

CLI CALLBOOK

Roselle, NJ 07203
PERSONNEL: David L. Wank; Jim Mooney
DESCRIPTION: National Distributor specializing in the supply of all drop and installation materials. This includes the "SUPER-SPLITTER" series of passives; the highest RF shielding rating for passives in the industry (125 dB minimum—guaranteed!) Call any of our three locations for current stock and shipping information.

Jerry Conn Associates, Inc. .(800) 233-7600
WATS (In PA) . . . . . .(800) 692-7370
FAX . . . . . .(717) 263-1547
P.O. Box 444
130 Industrial Dr.
Chambersburg, PA 17201
PERSONNEL: Mike Harpster, John Miller, Bob Sollenberger
DESCRIPTION: Serving the cable TV industry as: Professional Sales Organization. Products include: cable, connectors, test equipment, CLI antennas (LRC and Lindsay), drop materials, fiber optic cable and equipment, modulators, amplifiers, demodulators, cable prep tools, stand-by power, plastic and metal moulding, security covers, protective casesa, plus many other miscellaneous items.

Midwest CATV .(304) 343-8874
A division of Midwest Corporation
WATS . . . . . .(800) 532-2288
FAX . . . . . .(304) 346-0624
P.O. Box 271
Charleston, WV 25321
PERSONNEL: Christopher Sophinos, President; John Johnson, Purchasing Manager
DESCRIPTION: CLI questions? Call Midwest CATV. Our full line includes: the DA 30-450 indoor distributiion amplifier with RFI gasket and filtered power cord; LRC snap-n-seal connectors, Gilbert USA connectors, Sachs SCO2M, SCO3E, and SC10 for drop installation integrity, plus our new Milenium house drop passives with die-cast housings and high RFI shielding. All Milenium ports, including the ground block, employ the CAM-port seizing mechanisms. More than supplies, solutions for CLI from Midwest CATV.

Power & Telephone . . . .(901) 324-6116
Supply
FAX . . . . . .(901) 320-3084
2701 Union Extended, Ste. 500
Memphis, TN 38112
PERSONNEL: Sonny Dickinson, Derwin Otwell
DESCRIPTION: If you demand the best from your supplier then call the one who can best supply what you demand. We have the complete line of aerial and plant products, wire and cable, hardware, drop and installation, materials, tools, and test equipment you need to stop signal leakage.

ADVERTISER'S INDEX

HIDE & SEEK.

Don't play games with CLI compliance. Rely on Trilithic for all your leakage needs.

System leaks can hide anywhere from the headend to the house. But with Trilithic's complete line of CLI compliance equipment, you'll have no trouble seeking them out.

The Searcher Plus provides vehicle mounted and handheld calibrated leakage measurements. The Searcher midband channel receiver and the FDM Series of dedicated carrier receivers offer affordable leakage monitoring. The TFC-450 and TFC-600 frequency counters insure that your carriers are on frequency. And our Cumulative Leakage Index Computing Software (C.L.I.C.S.) backs it all up.

Seek out system leaks with the most comprehensive line of CLI compliance products from Trilithic. Call your nearest Trilithic representative today for more information.

TRILITHIC

9202 East 33rd Street, Indianapolis, IN 46236
800/344-2412 Toll Free 317/895-3613 (FAX)
317/895-3600 244-334 (TLX) (RCA)

CONTACT YOUR TRILITHIC REPRESENTATIVE

Winfield Scott & Assoc.
P. O. Box 1149
Grapevine, TX 76051
817/488-0029

Horizon Cable Supply
1021-A Calle Recodo
San Clemente, CA 92672
714/361-2011

Cable Products, Inc.
288 King Arthur Dr.
Lawrenceville, GA 30245
404/962-6133

TVC Supply Co., Inc.
1746 E. Chocolate Ave.
Hershey, PA 17033
717/533-4982

Com-Tek
1710 W. 9th St.
Sedalia, MO 63501
816/826-3011

Intek, Inc.
P. O. Box 487
Daleville, IN 47334
317/759-8122

D. F. Countryman Co.
540 N. Fairview
St. Paul, MN 55104
612/645-9153

Reader Service Number 30

Leak And Ye Shall Find.

CLI compliance begins with leakage detection and measurement.

And nobody offers the cable television industry more ways to detect and measure RF leakage than ComSonics.

The industry standard. On the ground or in the air.

Our Sniffer® III is the perfect measurement tool for system drive-outs. It not only finds leaks, but its microvolt per meter display tells you how strong they are.

Exceptional sensitivity of both Sniffer II and Sniffer III allows monitoring of rear-easement plant or subscribers' homes set back from the road.

For the most complete system, use Sniffer in the field together with our crystal-controlled transmitter at the headend.

Powerful squelch and mute and narrow IF bandpass enable Sniffer to tell the difference between your signal and other RF interference.

You asked for a low-cost installer usable device, and we responded with the hand-held Sniffer Jr. to locate leaks at their source.

Detection, of course, is only part of the solution. Use our SniffWare™ computer software to turn your field data into a comprehensive leakage management program.

These patented technologies, and the knowledge and experience that produced them, are at the heart of our CLI Flyover service. We've accurately measured dense metropolitan areas and wide open rural communities. No system is too large or too small.

If you've got a leak, ComSonics has a way to find it. To learn more, call us at 800-336-9681. In Virginia, call collect, 703-434-5965.

ComSonics, Inc.

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"Sniffer" is a registered trademark and "SniffWare" is a trademark of ComSonics, Inc.

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