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THE PREMIER MAGAZINE OF BROADBAND TECHNOLOGY

November 1993

CED

Global issues ◆ Cable and LANs ◆ Cellular TV ◆ CEBus

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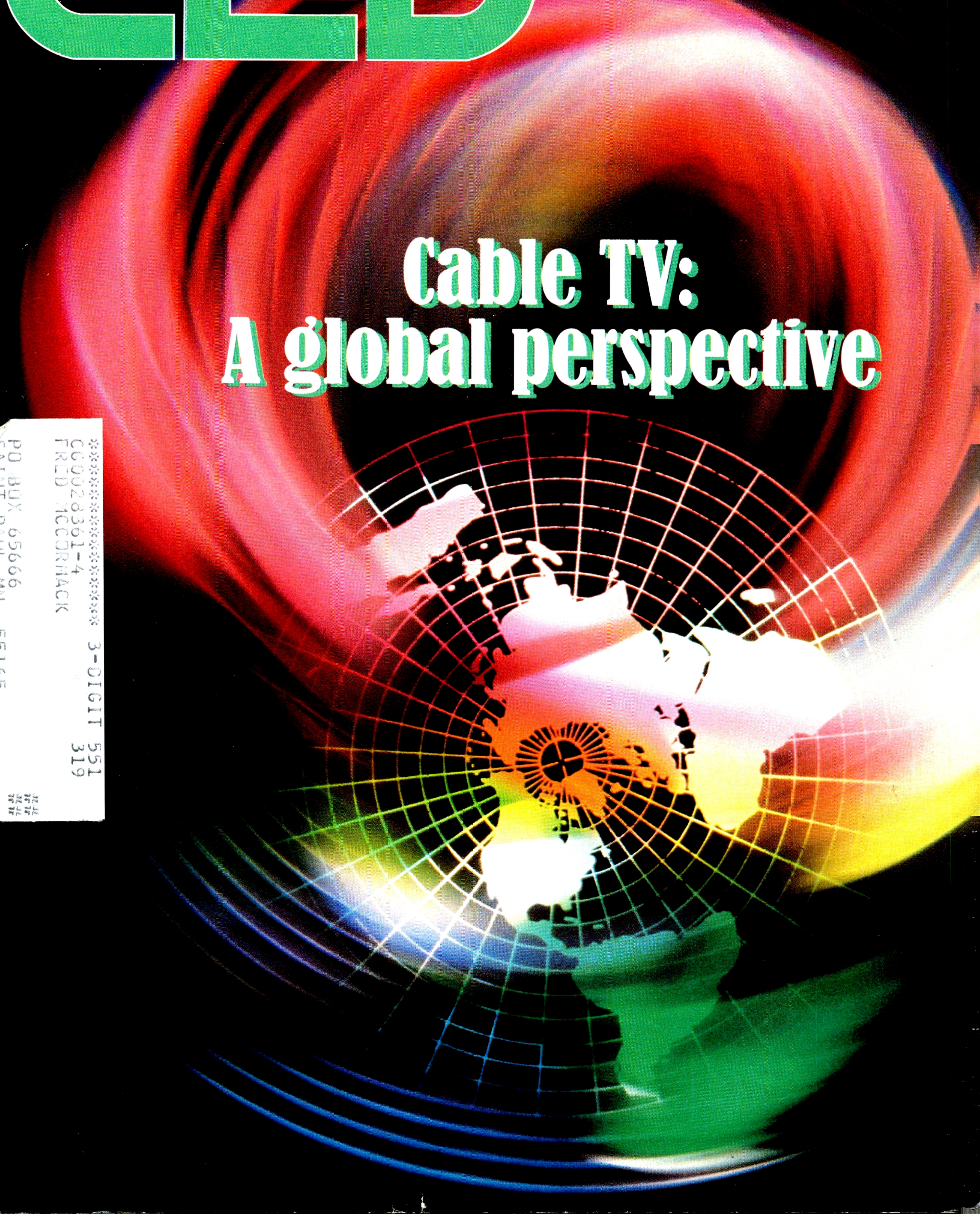

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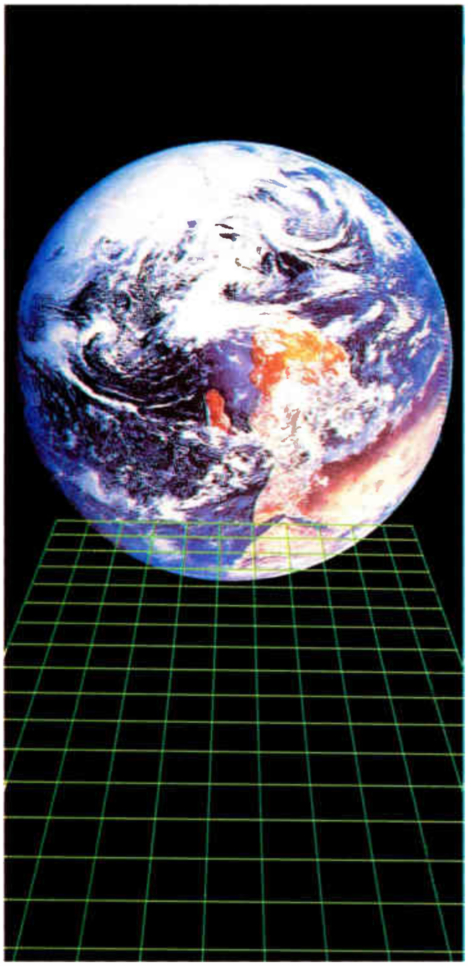

20 Cable's international presence

By Roger Brown, CED

U.S. cable operators are focusing their network upgrades on fiber, compression and advanced technologies to kick-start the interactive age. Operators around the world aren't far behind. This story describes the technology that is being successfully exported to virtually every corner of the world.

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24 Engineering opportunities in Brazil

By José Ralphe Manzoni Jr.

Cable is just a babe in the woods for operators in Brazil–and hence, so is the need for engineering expertise. Engineering design, network construction and equipment are just some of the topics covered in this article, which analyzes the work of engineering consulting firms there.

30 Powering an integrated cable/telephony system

By Jeff Geer and Greg Zediker, Alpha Technologies

Integrating a telephone system with a cable system presents an interesting challenge to network powering, considering telephone equipment needs direct current while cable gear operates with alternating current. This article explains how a new, unique power supply was developed to meet this need in the United Kingdom.

34 LAN implementation, Part 2

By Ed Zylka, Zenith Electronics Corp.

Sending digitized, non-entertainment data over local area networks is a blossoming opportunity for cable operators, according to this author. While last month's article honed in on LAN basics, this month's segment focuses on transport mediums and three operators who have made the LAN business work for them.

38 Driving the CEBus, Part 2

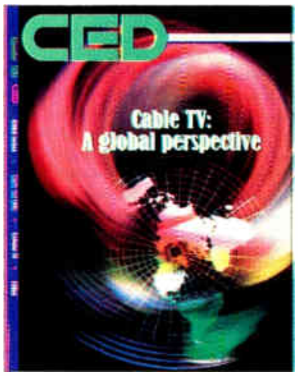
By Jud Hofmann, Panasonic Technologies Inc.

There are several players in the consumer electronics bus–and cable is one of them. This month, the author focuses on adapting products to the in-home, coaxial portion of the bus. Specific business opportunities and trends are also defined.

45 A/B switch configurations

Compiled by David Large, Intermedia Partners

Designed for cable's team of customer service reps, this ready-to-use wallchart can be posted for easy reference to phoned-in questions on proper A/B switch hookup.



About the Cover

Cable expands its global reach
Photo by The Image Bank

DEPARTMENTS

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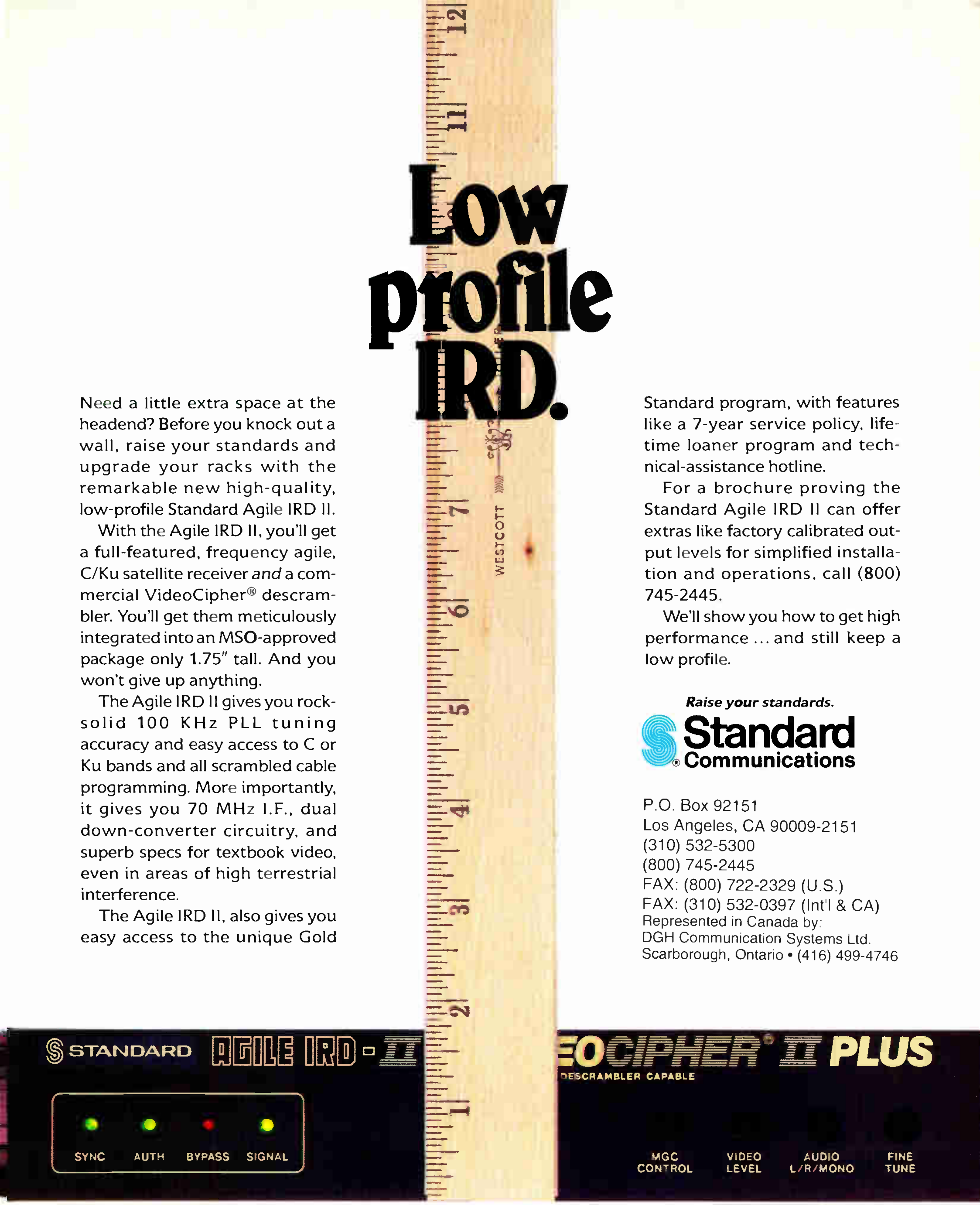

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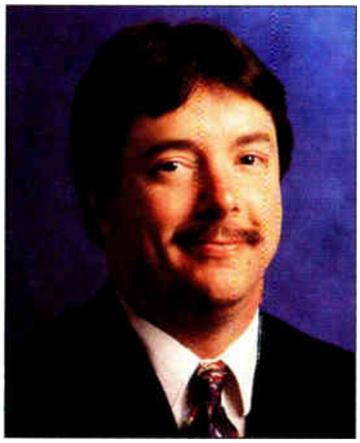

A few things to think about

Wendell Bailey was working out on his Nordic Track–and nearly fell off when he heard of the Bell Atlantic-TCI merger. In Denver, a lot of people were late to work because they stayed home to watch CNN's live coverage of the press conference. Thousands of others heard via their car radios as they commuted to work.

Just like everyone remembers where they were when JFK was murdered, the people who work for cable and telephone companies will remember where they were when the news came out.

Aside from the huge implications the merger will have on Wall Street, in Congress and, eventually, on the American public, some immediate questions come to mind:

1. When it goes to build these new full-service networks, what architecture will the company use? As recently as last month, BA was touting ADSL and ISDN and VOD delivered digitally to new set-tops. Will it go to an integrated approach, with Siamese cable?

2. Will there be more than one wire in the house ultimately? Will phone calls still be delivered over twisted pair and video over coax? Is this a key question or is it moot now that the same company will manage both services?

3. Will the new Bell Atlantic continue to contribute to CableLabs, or will all its money be funneled to Bellcore? At two cents per sub per month, CableLabs could lose more than $2.5 million annually out of a $13 million budget.

4. Does TCI cease to exist in Denver? When ATC and Warner merged, the administration and "back office" portions of the company moved to Stamford, Conn. Will TCI staffers move to Philadelphia? Or New York? Would TCI leave its engineering department in Denver, like Time-Warner did?

5. Will the Communications Workers of America and the International Brotherhood of Electrical Workers unionize cable labor?

6. How will training methods be affected? Telephone labor is well-trained, but only narrowly. Cable workers aren't that well trained, but they are generalists. Which approach will win out?

7. How will cable engineers' wages be affected? The telco industry has historically paid its personnel better.

8. Will cable installers and field service personnel be forced to wear uniforms at all times? Let's face it, the cable industry could use a better public image.

9. What affect will the merger have on the development of more cable-industry standards? Cable historically has relied on de facto standards while Bellcore defines its own.

10. Will trade shows become more integrated? The cable industry has myriad trade shows and the telecom industry has plenty, too. Does this mean there will actually be fewer shows–or more?

11. How will BA purchase equipment for its cable properties? Vendors may have to learn some new tricks.

12. What about status monitoring, intelligent networks and other features the cable companies have traditionally ignored? Will they become more popular?

The answers to these questions will come out over the next few years. It will be enlightening to re-read this list in 1996. But by then, a whole new list will come to mind, I'm sure.

Roger J. Brown

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FiberVision seeks permission to overbuild Connecticut operators

Touting its ability to start from scratch technologically, FiberVision has filed an application to build and operate a state-of-the-art cable television system in three Connecticut franchise areas, in direct competition with incumbent operators.

FiberVision has applied for permission to offer cable service in Bridgeport, New Haven and New Britain. A previous application to do the same in Hartford would make it four areas in which FiberVision would compete with fiber-rich networks feeding 78 channels of video. The company plans to build fiber to nodes serving 500 homes on average.

Pending swift regulatory approval, the company hopes to begin network construction in the middle of next year. Construction plans call for offering service to an average of 2,000 new homes per month. If approval is granted to build in all four areas, FiberVision will pass about 450,000 homes when construction is completed.

The company hinges its plans for success on delivering high-quality video and customer service at a competitive price. "We know that competing against the established cable TV operator will be a challenge, but by delivering excellence in picture quality, customer service and programming, and by offering customers a real choice in their cable service, we believe we can attract customers and keep them," said Donald Ryan, president of FiberVision.

In addition to conventional entertainment video, FiberVision plans to link area schools and libraries via a fiber ring so those institutions can share information. Schools will be able to create interactive classrooms by adding cameras and switchers.

FiberVision is headed by brothers Donald and Stephen Ryan, who own Tel-Com Construction Co., which has built more than 4,000 miles of cable plant throughout Connecticut and elsewhere in the Northeast for Sammons, United, Storer, Cox, TelePrompTer, Times Mirror and Valley Cable Vision. Tel-Com installed Times Fiber's Mini Hub system and designed and built a huge LAN for Pratt & Whitney.

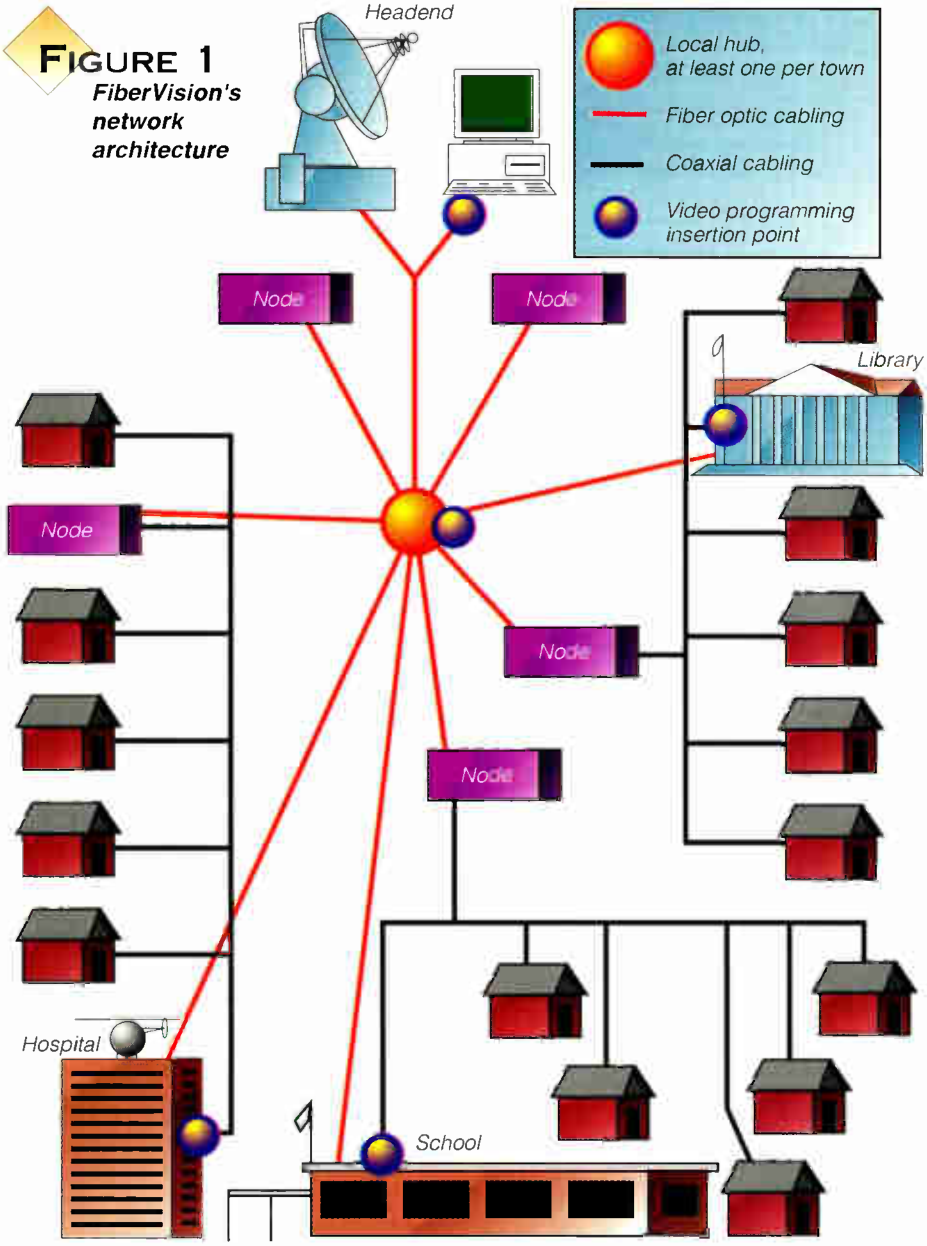


FIGURE 1
FiberVision's network architecture

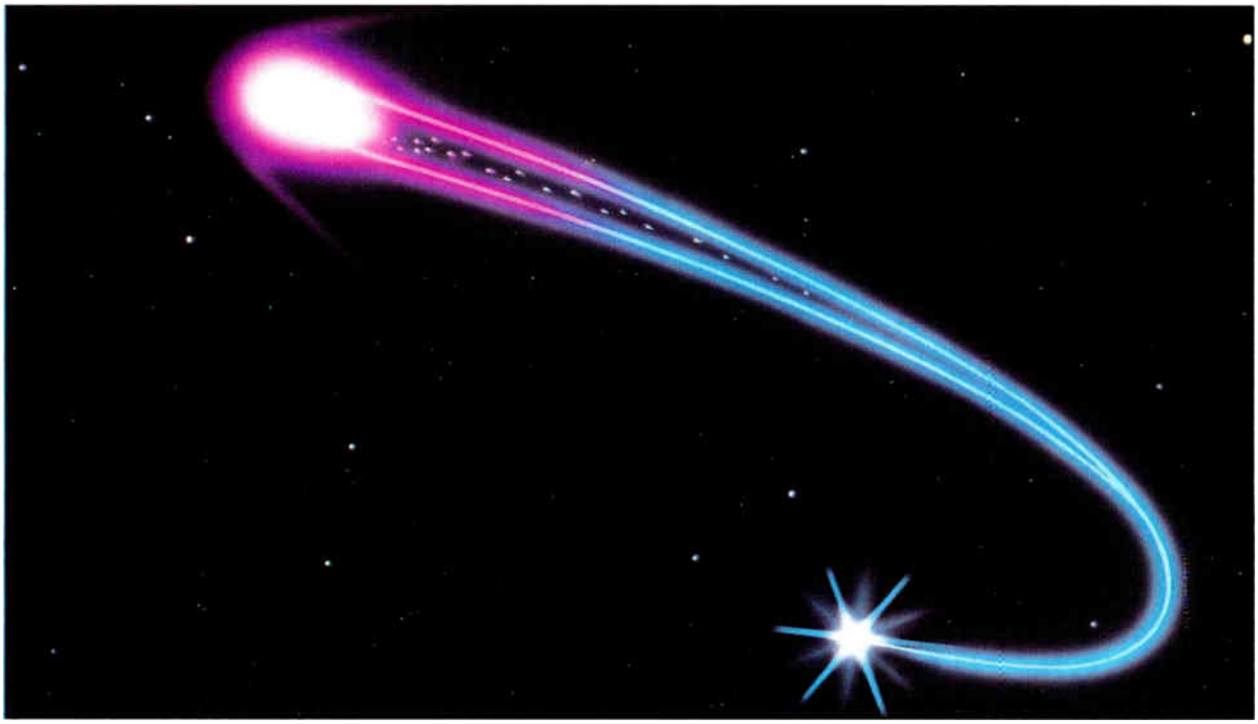
Cablevision sends PCS data via moving automobile

One of the big differences between personal communications services and cellular telephone was supposed to be that PCS was not meant for rapid cell handoffs characteristic of its cellular cousin. But Cablevision Industries, arguably the most experienced PCS company out there, has shattered that thought with a successful trial of data transfer by vehicle over its PCS network in Lynbrook, N.Y.

In the trial, an Apple Powerbook lap-top computer was used to download and transmit infomation from several sources. "While PCN is most often compared to cellular telephones, these trials highlight the wider range of applications available," said Wilt Hildenbrand, Cablevision's VP of technology.

Cablevision's architecture features strand-mounted repeaters to improve call quality, extend the radius of the cell site, enable low-power operation and vehicular-speed handoffs. The system operates parallel to the local exchange carrier and is said to cost about $50 per home passed for the radio portion of the network.

Separately, *Multichannel News* has reported that Cablevision is working with Ameritech and Motorola to test a new cable-specific PCS system developed by Motorola in Cablevision's Evanston, Ill. system. This new system, called CableComm, will help determine how well transmitters and hand-held phones work in a real-world cable system. Cablevision will also reportedly test ISDN and advanced intelligent network (AIN) equipment in conjunction with Ameritech.



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Successful tests may allow PCS operators to avoid having to build a mobile telephone switching office, which would reduce the cost of doing business significantly.

Compatibility compromise holding

It's beginning to look as though the compromise agreement on TV/cable interfaces hammered out by the EIA and cable operators, will hold up mostly intact at the Federal Communications Commission. In a 67-page report issued to Congress last month, the FCC outlined its thinking about how the conundrum can be eased and eventually solved. However, there is no guarantee that aspects of the report won't change before a rulemaking is issued.

To recap, the compromise requires cable operators to make devices like bypass units, dual descrambling set-tops and built-in timers to consumers who request them. In the future, the two sides will develop a decoder interface standard that will be incorporated into future "cable-ready" TVs (a term which will also be formally defined). TV manufacturers will improve their tuners and the shielding aspects of their receivers to allow more consumers to connect cable directly to the set.

On the surface, it looks as though the only surprise encountered in the report is the FCC recommendation that a standalone decoder be considered part of the cable plant that must be provided without a separate charge. With an anticipated cost of $50, cable operators are likely to object to this thinking.

However, comments will have to be held until the rulemaking is issued, something the FCC has promised will occur soon. By law, the FCC must issue rules by next April.

Jones to offer Internet in Alexandria system

Computer aficianados say the number of persons using Internet is growing at about 15 percent per month. It's no wonder why, then, that cable operators are hooking up with the global "network of networks."

The latest is Jones Intercable, which announced plans to offer Internet services over its Alexandria, Va. network, starting Dec. 1. That would make Jones the first operator to offer the service over cable plant (Continental plans to tie into Internet in 1994). Alexandria is presently undergoing an extensive rebuild, featuring fiber to serving areas of about 800 homes per node.

"We've got the customer base and the technical gurus to make this happen," said Chris Bowick, group vice president of engineering at Jones. Jones has established a separate entity–Jones Digital Holdings Inc.–to implement data delivery over cable plant. Jones Digital will work with ANS CO+RE Systems to provide Internet access to residents and businesses in Alexandria.

Internet will be rolled out as demand grows in Alexandria, but Jones has already identified an initial school and home to test the hardware. Although the rebuild isn't necessary to provision Internet, it will enhance the rebuild with a new service, said Bowick.

In fact, Jones has already tested access to Internet in its suburban Denver system by hooking up two schools to the network. However, there are no current plans to extend Internet services to area homes or businesses, Bowick added.

Full-featured set-top to debut in interactive trial

By integrating a CD-ROM player, a digital coder/decoder, modem and printer into a set-top terminal, a startup company called Interaxx hopes to get the jump on the beginning of the interactive video age. A test in 2,000 homes is scheduled to commence in the company's 26,000 subscriber system, Cable TV of Coral Springs, Fla.

The in-home hardware is expected to cost between $400 and $500 retail, but will be offered to subscribers for between $8 and $10 per month, according to Interaxx executives.

With CD-ROM, the terminal could store up to 150 video games or 40,000 items of merchandise in video form to enable a wide range of interactive applications. Interaxx anticipates having to transmit only a nominal amount of data to each set-top, to update CD-ROM info that resides in the device, to authorize information access or to allow purchases. The company expects to use a small amount of out-of-band frequency to communicate with the set-top.

One unique feature of the device is a built-in printer that would be used to print tickets, coupons or receipts of purchases made via the system. Another feature is a point-and-click air mouse-type on-screen navigation system that uses both icon and grid graphics.

In addition to having a system on which to test the system, Interaxx has an agreement with Channel America, a programmer serving 4.5 million cable homes and 7.5 million broadcast homes in more than 80 markets.

Jottings

Authors of technical papers have two deadlines to keep in mind: Nov. 22 and Dec. 22. The first deadline is for papers to be presented during the 1994 **SCTE Cable-Tec Expo**, slated for June 15-18 in St. Louis. Abstracts should be faxed to the SCTE at 215/363-5898. The second deadline is for abstracts to be submitted to the NCTA for the 1994 **National Show**, set for May 22-25 in New Orleans. Fax the papers to 202/775-3698 . . . If you've been thinking the equipment you've bought from **Jerrold** and **Scientific-Atlanta** is working better than ever, you're probably right. Both companies recently announced that their manufacturing facilities have earned the prestigious ISO 9001 quality certification. The rigorous certification process examines operations in 20 different areas . . . **AM Communications** and **Philips Broadband Networks** have inked a business alliance to manufacture and co-market performance and status monitoring systems for both telecommunications and cable TV. AM will develop new hardware and software for status monitoring Philips' fiber equipment and write new software to integrate Philips' existing system monitors into AM's FACTS software platform . . . Indianapolis-based test equipment manufacturer **Trilithic Inc.** has cracked the top 10 in *Inc.* magazine's list of the fastest-growing privately held companies. Over the past five years, Trilithic has grown 7,000 percent . . . Signaling a keen interest in broadband network capability, **Sprint** (the telephone company that made the pin-drop famous) has tapped cable industry veteran **Wendell Woody** to examine new business opportunities. Woody was most recently a senior VP at ANTEC and has been active in SCTE. Woody says he'll remain active in cable activities . . . While we're on the subject, **Dean DeBiase** is planning to leave ANTEC and take the post of corporate VP of marketing for **Zenith Electronics Corp.** The appointment signals a new thrust by Zenith toward cable products and the development of interactive multimedia . . . **CableLabs** named **Dr. Mario Vecchi** its new VP of network architecture, design and development. Vecchi comes from Bellcore, where he was project manager of internetworking research . . . In an effort to squelch demand for illegal set-tops, **Jerrold** has filed suit against *Nuts & Volts* magazine and its publisher for printing advertisements for such devices. Jerrold also recently filed suit against alleged pirate manufacturer/distributors in an effort to battle cable signal theft.

Compiled by Roger Brown

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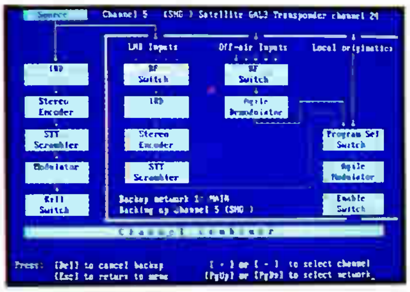

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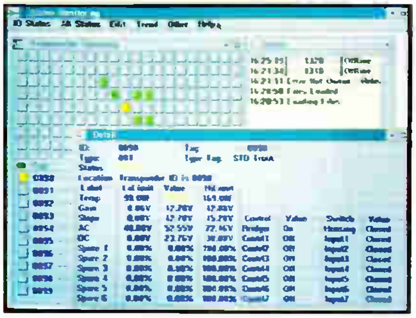

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McDonough: The cable vagabond

By Leslie Ellis

Airplanes are to Pat McDonough what a paintbrush is to a painter: a necessary tool to get the job done. One look at Pat McDonough's passport and it's clear why he's so blasé about travel. He's been just about everywhere: Norway, Sweden, Israel, Ireland, Malta and several other transcontinental destinations. Those areas he hasn't yet visited are likely on his future schedule, all in the name of cable television.

As VP of engineering for United International Holdings, this guy has just about seen it all. That's probably why the thought of deplaning in a foreign country with no cash, no hotel room and no knowledge of the local language doesn't phase this traveler. "You just work it out," McDonough says with a shrug.

Laid back he is. On the day of the interview, no fewer than three UIH execs (one of whom phoned from an airplane) approached McDonough about the international travel schedule of an employee who hadn't even started with the company. His response? A calm answer followed by a hasty retreat into his office, where photos of his four children decorate the walls, hundreds of paperback books line the shelves and country/western music plays softly in the background. "I learned long ago that you can't get intense about this kind of stuff," McDonough says.

For McDonough, "long ago" was 1970, when the native Coloradan, unemployed at the time, struck up a conversation with an installer who was hooking him up to local cable service in Pueblo, Colo. "I was absolutely fascinated by the concept of cable service," McDonough recalls. So, he headed down to the offices of then-owner Foote, Cone and Belding (an advertising agency), and applied for a job. He donned his installer gear a short time later.

Interestingly, McDonough doesn't have any formal technical training, aside from a handful of computer science and telecommunications courses at the University of Colorado at Denver. But perhaps his B.S.B.A. degree from the University of Phoenix, combined with his 20-plus years in the technical side of cable, is the perfect combination for UIH's global owned-and-operated systems.

In 1973, FCB sold out to TCI and TelePrompTer. McDonough's system fell within TelePrompTer's realm, and he accepted a transfer to California, where he and his family lived for the next seven years. "I moved around between the Bay Area and southern California," McDonough explains, noting that his Newport Beach stint placed his homestead within the serving area of John Wayne. During that time, he held a wide list of cable technical jobs, from installer up to chief tech (with a few stops in between).

However, the Rocky Mountains beckoned. In 1979, McDonough hired on as chief engineer for United Artists, where he handled "everything to do during those crazy franchising years," McDonough recalls.

Apparently, McDonough's performance during the franchising whirl paid off. United became involved overseas in 1987; McDonough started working full-time on global cable engineering projects in 1989, when United International Holdings spun off from United. "When I first got started in this, we were the guys that were out in the field, walking out the streets and counting subs–building the business from the ground up."

Now, McDonough says he's primarily involved in project development. He sees himself as a resource to the project teams positioned across the world. When he's in the office, he builds bridges between vendors and his engineering teams. When he's on the road–and he says he's trying to get his travel time down to about 70 percent–he focuses on keeping projects on track and identifying money saving opportunities.

McDonough says that economical system deployment is a constant struggle. A case in point is a trip McDonough made to a UIH system in Sweden. "The plant there is 100 percent underground," McDonough says, "but when I asked them to put in the drop, I noticed they were using a backhoe to trench it in!" The Swedes had apparently never seen a trencher before, so McDonough brought in a crew to show them the ropes. "We tend to do a lot of training," McDonough says.

No common songsheet

What makes international business so different than the U.S.-based cable industry is the lack of common ground, McDonough says. "Everywhere you go, there's a different set of rules, which makes it hard," he says. "Even countries like Sweden and Norway, which share a common border, have different sets of regulations."

Right now, McDonough is working to put the finishing touches on a 550 MHz system in Malta, an island in the Mediterranean that is comprised mostly of rock. "The island itself has posed some interesting construction problems," McDonough says, like the need for special enclosures and lockboxes that matched the color of the houses on the island. "There's some underground plant and no real aerial–no poles–everything's attached to the buildings," McDonough explains. "We had to come up with a way to attach our cable to the buildings without angering the residents."

He says technologies like compression will ultimately be helpful for UIH's international holdings, particularly in PAL environments where one video channel eats up more bandwidth than a conventional, 6 MHz NTSC channel. And, McDonough says, he's trying to design systems that will ultimately be "of the full service network type."

Onward ho to Ireland?

Although McDonough says he's already finished work on a large MMDS system in rural sections of Ireland, he has reasons to return to the Emerald Isle. Jill, his wife of 23 years, and their four (very photogenic) children, Ryan (16), Caitlin (11), Mick (9) and Carry (7) have family in that area. "I have a map to the family farm, but have yet to get there," McDonough laments.

All in all, McDonough says his international focus is rewarding. "It's a fun business. It can be a real drain sometimes–travel is *not* glamorous–but as a learning experience, it's unreal." CED

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Building the compatibility elephant

By Wendell Bailey, VP of Science and Technology, NCTA

Has it really been only one year since the final act of the Cable Law of 1992 was passed and ratified?

As you may remember, that law required many things of the cable television industry, but in particular it called for an improvement in the compatibility between consumer electronics equipment and cable television systems. It also laid out a timetable by which the FCC would bring about improvements in this compatibility. Well, it's happened.

Specifically, it happened on October 6th, the date by which the law called for the FCC to gather information and issue a report . The FCC staff duly delivered it on time.

The body of the report–the most important part–is 66 pages worth of actual problem analysis conducted by the FCC staff. Another handful of pages contains the FCC's recommendations. It is fair to say the recommendations contained on those few pages borrow heavily from the supplemental comments that were filed with the FCC by the NCTA and EIA on July 21, 1993.

The FCC's recommendations do, however, deviate in some respects from the information contained in that joint filing of supplemental material.

What did the FCC recommend?

First, let's look at what the recommendations call for on behalf of each industry. It is clear that the Commission recognized it was necessary to deal with the compatibility issue. This fact is brought about by the large installed base of existing television sets, which cannot be returned to manufacturers for retrofitting of circuitry and can only be dealt with by the expedience of existing hardware options. Therefore, the Commission made the following recommendations:

✔ A prohibition against the scrambling of signals on the basic tier of cable service.

✔ A requirement for operators to provide a consumer education program to their subscribers. This program would include notifications that might be required under the law and other, general educational information on the compatibility between cable and consumer electronics equipment.

✔ Cable systems should provide subscribers with the option of having all unscrambled signals sent directly to their TV receiver or VCR. Systems would be required to provide this only on request of the individual subscribers, and systems could comply through the use of RF bypass switches.

✔ The Commission may require cable systems to provide supplemental equipment–such as set-top devices with multiple descramblers and/or timers, and other similar equipment–to enable the use of extended features and functions of consumer electronics. Again, systems would be required to provide this capability only at the request of individual subscribers.

✔ A requirement that operators offer subscribers the option of renting a remote control unit and to notify subscribers that they may also purchase a commercially available remote control. Operators would also have to specify the types of remotes that are compatible with its equipment and permit the operation of their set-top devices with those commercially available remote control units.

Future, full compatibility measures

However, in recognizing the limitations of these approaches, it has also issued a series of recommendations which will initiate future full compatibility. First, the Commission will require cable systems built or rebuilt after a certain date to use the EIA/NCTA IS-6 channel plan and will further require all cable systems to use this channel plan after 10 years.

Cable systems would not have to activate channels for all of the channels specified on IS-6, but would be required to adhere to this frequency plan for any channels provided to subscribers.

Next, the Commission wants to adopt new standards for consumer electronics equipment that is marketed as "cable ready" or with other marketing terms intended to imply that the equipment is meant for connection to cable services. These new standards for cable ready would include a decoder interface connector, the ability to tune the IS-6 channels and improved tuner performance and shielding.

On the cable side, the Commission would require cable systems to provide service in a form that is compatible with the decoder interface and whatever equipment is used with that connector. Further, cable system operators will be required to provide the component descramblers or additional equipment that may be needed to process compressed video service through a decoder interface connector.

The point here is that if a customer buys a TV set equipped with a decoder interface connector, the cable operator is obligated to connect to it in the form that was intended.

The kicker in all of this is that the Commission further states that all such equipment shall be provided by the cable system *without separate charge for the equipment or its installation.* This is an issue that will no doubt be dealt with by a variety of parties when the Commission finally issues its Notice of Proposed Rulemaking, in which it will begin to formulate the actual Rules it will promulgate.

The law allows the FCC 180 days after the issuance of this report to promulgate rules for compatibility. That puts the implementation date in April 1994.

Altogether, it's been a very aggressive and sometimes contentious debate between the cable and consumer electronics industries. However, the mere fact that we came together and formed joint comments–and that the FCC ratified the bulk of the joint agreement–is good news indeed, to cable and consumer electronics customers (who are, notably, the same people).

The details on all of this have yet to be worked out. I am confident, though, that the cooperative effort that has been forged between the two industries can be maintained throughout the NPRM comment period.

And, ultimately, we'll have rules on the books that will help improve compatibility between our two industries. CED

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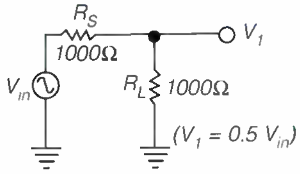
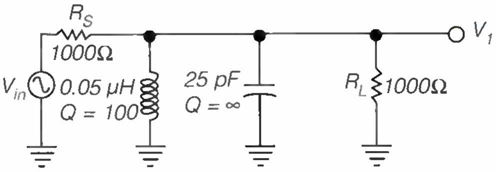
Resonant circuits, filters and traps, Part 5

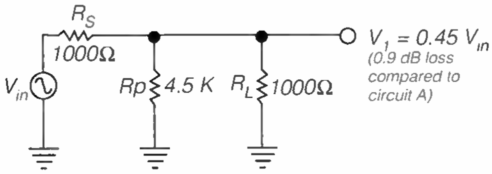
By Chris Bowick, Group Vice President/ Technology, Jones Intercable



(A) Source connected directly to the load.



(B) Insertion of a resonant circuit.



(C) Equivalent circuit at resonance.

An understanding of component Q, as it relates to the design of filters[1], leads to a much clearer understanding of one of the primary causes of the insertion loss present in any such network. In a lossless (infinite component Q) parallel circuit at resonance, for example, the impedance seen across the circuit's terminals would appear infinite.

In a lossless *series* resonant circuit, on the other hand, the impedance seen across the circuit's terminals at resonance would be zero. In a practical circuit, however, because of the component losses caused by each component's Q, there exists some finite equivalent parallel or series resistance at resonance. It is this equivalent resistance of each individual component in the circuit that creates the insertion loss with which we have become so familiar as we deploy practical filters in our networks. In addition, it can also be one of the factors that limits the depth of a notch of a trap. Because a band-stop filter, or trap, is often made up of a series of interconnected parallel and series resonant circuits, the insertion loss associated with an individual section of the filter can very quickly add up. When you consider that we often place several of these individual channel traps in series, each with its own amount of insertion loss, it's no wonder that we lose significant amounts of signal level even for those channels that we are not trying to trap. Trap vendors do an excellent job of minimizing the insertion loss of these filters, while maximizing notch depth, through the use (among other things) of high-Q components, where necessary, in their circuit designs.

This month, we'll more thoroughly investigate this concept of insertion loss in our quest for a more thorough understanding of filters[2].

If inductors and capacitors were perfect and contained no internal resistive losses, then insertion loss for LC resonant circuits would not exist. This is, of course, not the case, and as it turns out, insertion loss is a very critical parameter in the specification of any filter. Figure 1 is a *simplified* diagram that illustrates the effect of inserting a resonant circuit between a source and its load. For purposes of illustration, I have also over-simplified the following analysis.

In Figure 1A, I have simply connected a signal source with its 1000 ohm internal source resistance (R_S) directly to a 1000 ohm load (R_L). If we were to measure the voltage across the 1000 ohm load, V_1, using a high impedance instrument, we would find that the output voltage would be half that of the source voltage:

$$V_1 = V_{in}R_L/(R_S + R_L)$$

$$= V_{in}(1000)/(1000+1000)$$

$$=0.5V_{in}$$

This is the voltage division rule.

In Figure 1B, I've placed a parallel resonant circuit, consisting of a 0.05µH inductor with a Q of 100 (pretty good for an inductor) and a "perfect" 25 pF capacitor having infinite Q, between the source and load. Remember from last month's column that at the frequencies we typically deal with, it is usually the inductor that has the lowest Q and therefore causes the most degradation in a filter's insertion loss. Note that, as shown in Figure 1C, the use of an inductor with a Q of 100 at the circuit's resonant frequency of 142.35 MHz creates an effective shunt resistance, R_P, of 4500 ohms at resonance (see last month's column for the calculation). At resonance, then, the circuit of Figure 1B actually looks like the circuit depicted in Figure 1C. The inductive and capacitive resonance are equal and opposite and thus cancel (definition of resonance), leaving only the effective parallel resistance of the inductor, caused by its Q, in the circuit. The 4500 ohms, when combined in parallel with the 1000 ohm load, creates an effective load impedance of:

$$R_{eff}=R_PR_L/(R_P+R_L)$$

$$(4500)(1000)/(4500+1000)$$

$$=818.2 \text{ ohms}$$

If we then apply the voltage division rule to our simple circuit, we will see that V_1 is now only 0.45 V_{in}.

In essence, because of the Q of the inductor, only 45 percent of the source voltage is now available to the load, compared to the 50 percent that would normally be available without the resonant circuit present. By inserting the resonant circuit, we have lost some of the signal that would otherwise be available to the load. The above analysis could also be done using signal power, instead of voltage, as the measurement tool with only slightly more complexity, but perhaps would not have had the same intuitive "feel" as that presented above.

It is my hope that this series has sparked a more thorough understanding of what goes on inside of those small tubular devices we affectionately call traps (regardless of their actual frequency response characteristics). I am a firm believer that the more you know about the device you are using, including its original design capabilities and limitations, the more useful the device will become as an engineering tool.

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1. Bowick, Chris, "Component Q, From the Headend, *CED Magazine*, October, 1993.
2. Bowick, Chris, "RF Circuit Design," From the Headend, SAMS (a division of Macmillan Computer Publishing), Indiana, 1982-1991.

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It's decision time for PCS

By Jeffrey Krauss, a consultant on spectrum valuation and President of Telecommunications and Technology Policy of Rockville, Md.

Here's the latest word on the FCC's decision to allocate spectrum for Personal Communications Service (PCS). There will be up to seven PCS licensees in an area, with bandwidths of 10 MHz, 20 MHz or 30 MHz. Licenses will be awarded by auction, with the proceeds going into the U.S. Treasury. However, deciding how just much to bid will take a very complicated evaluation of financial, technical, demographic and other related factors.

The decision

The FCC decided on a channel plan with two channel blocks of 30 MHz, one block of 20 MHz and four blocks of 10 MHz. The PCS channel plan is shown in the table on this page.

Existing cellular licensees are eligible to compete for only one 10-MHz block of PCS spectrum in areas where they hold cellular licenses. Additionally, there are other complicated restrictions on cellular eligibility which are too detailed and definitely beyond the scope of this article.

A PCS licensee who is not a cellular operator can aggregate up to 40 MHz of spectrum for PCS service in any area, either by bidding for multiple channels in the auctions or by buying additional channels from other auction winners.

But a licensee with 30 MHz in the 1900 MHz band would have to buy his additional 10 MHz at 2100 MHz, and the two frequency bands are too far apart to be combined seamlessly using low-cost equipment.

The FCC also decided that a PCS operator cannot simply buy the spectrum and "warehouse" it. He must to provide service to one-third of the population within 5 years; two-thirds in 7 years; and 90 percent within 10 years. If PCS operators don't adhere to these rules, they must forfeit the spectrum.

Channel blocks C and D are set aside for minority, women and small business owners; only entities that meet this eligibility requirement (which are yet to be defined in detail) could participate in these two auctions.

Unlicensed PCS

In addition, the FCC allocated the 1890 MHz to 1930 MHz band for unlicensed equipment. This will include cordless phones, wireless PBXs and wireless local area data networks. Voice equipment will be permitted in 1890-1900 MHz and 1920-1930 MHz, and data in 1900-1920 MHz. The FCC made specific proposals for coordinating the sharing of spectrum among these unlicensed devices, and for "buy-out" procedures whereby equipment manufacturers would pay the existing microwave licensees to move to other frequencies.

Auctions

PCS licenses will be awarded through auctions. The Congressional Budget Office thinks the FCC can raise $10 billion for the U.S. Treasury by auctioning the PCS spectrum. Auction rules must be adopted by next March, and auctions must begin by next May.

Channel block	Channel size	Frequency (MHz)	Service area
A	30 MHz	1850-1865 and 1930-1945	MTA
B	30 MHz	1865-1880 and 1945-1960	MTA
C	20 MHz	1880-1890 and 1960-1970	BTA
D	10 MHz	2130-2135 and 2180-2185	BTA
E	10 MHz	2135-2140 and 2185-2190	BTA
F	10 MHz	2140-2145 and 2190-2195	BTA
G	10 MHz	2145-2150 and 2195-2200	BTA

MTA = Major Trading Areas BTA = Basic Trading Areas

How much to bid for a PCS license is by no means easy to determine.

The evaluation process is complicated, because of the service areas the FCC has chosen, and because of the existing microwave licensees who must be paid to move.

The FCC chose Rand McNally Trading Areas to be PCS service areas. The United States has been divided into about 50 Major Trading Areas, and about 500 Basic Trading Areas. The BTAs and MTAs vary widely in size and population.

Some BTAs are geographically small. For example, BTA No. 21, Ashtabula, Ohio, consists of a single county, while BTA No. 13, Amarillo, Texas, consists of 28 counties. And they vary widely in population. Many BTAs have fewer than 100,000 population, but some have more than 1 million.

The MTAs also vary widely. New York is the largest in population, with about 26 million people, but many (Tulsa, Wichita, Omaha, Knoxville, for example) have fewer than 2 million.

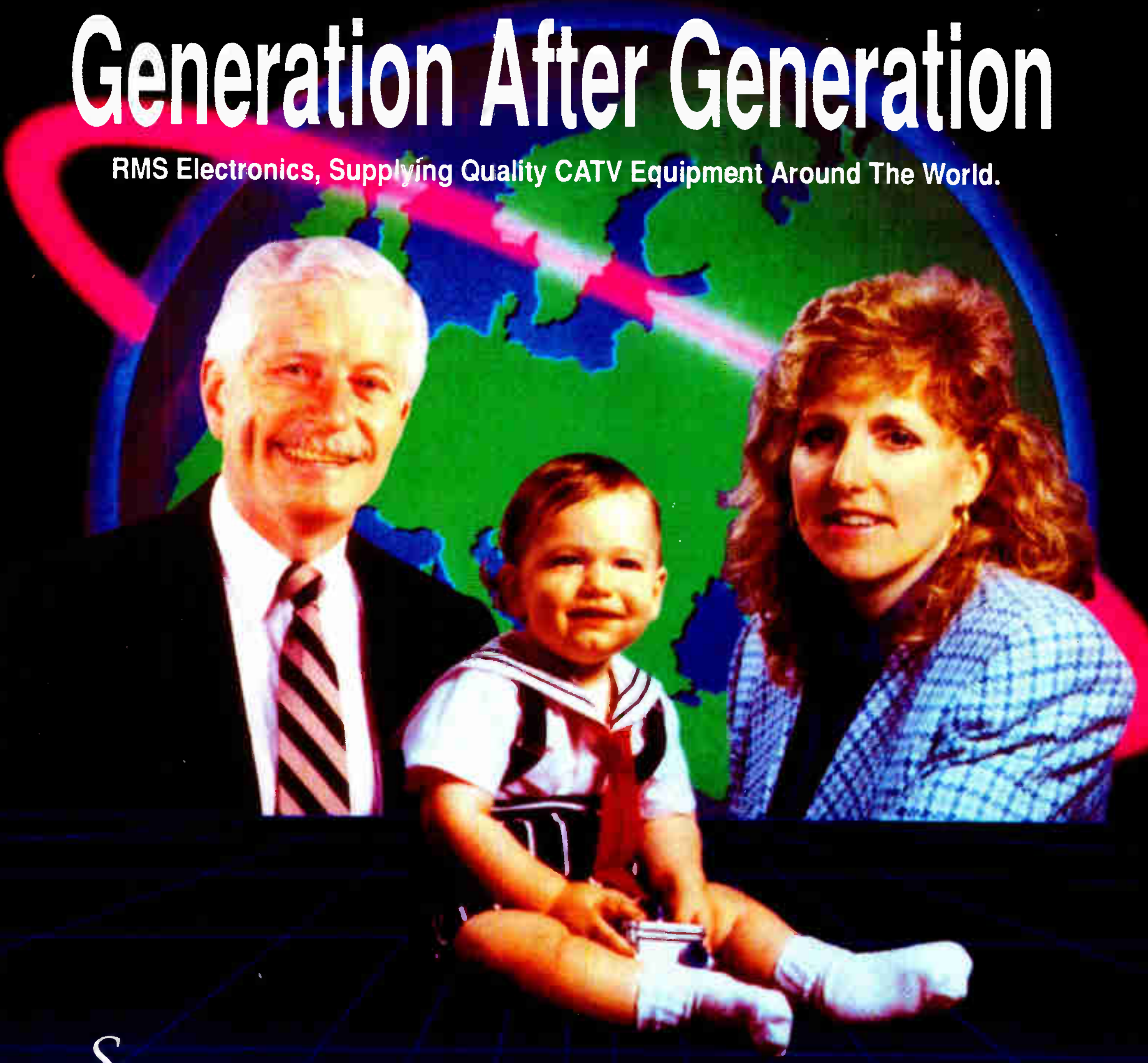
Another complicating factor is the existing base of microwave users. There are about 9,000 point-to-point microwave transmitters operating in the 1850-1990 MHz band, and thousands more in the 2100 MHz frequencies.

Many, probably most, of these will have to be moved to higher frequencies, because of the likelihood of interference between microwave and PCS systems. Under the FCC rules, the PCS operators will pay for this.

So, what to bid for spectrum should be determined by the estimated revenue (related to the population of the service area), the cost of PCS cell site equipment, the cost of buying out the microwave systems, and the bidder's required rate of return.

But the costs will be different for every BTA and MTA, and different for every channel block within a BTA or MTA. For example, Channel Blocks F and G will have different values in the same BTA, even though the PCS operators may use the same technology and compete for the same customers, because there will be different microwave buy-out costs associated with each channel block.

So, what am I bid for 30 MHz in New York? Lots. What am I bid for 10 MHz in the Ironwood, Michigan BTA, population 33,000 and falling? Not much. Does it all add up to $10 billion? We'll see. CED



Cable's global technology push

U.S. companies export advanced gear and knowledge

By Roger Brown

As recently as a year ago, cable equipment manufacturers and distributors were enthused about the prospect of exporting their technology to overseas markets by unearthing local "hot spots" of activity they hoped to keep secret from their competitors.

This year, the enthusiasm is still there, but all the secrets are gone. Vendors and suppliers have effectively fanned out across the globe, offering state-of-the-art hardware for multi-channel video distribution. They're in attendance at the growing number of international trade shows, they've signed up distributors virtually everywhere and created new business units with sales staffs to support the new users around the globe.

Although the cable industry abroad has a lot of catching up to do to emulate those found in North America, operators in South America, Europe and the Far East, in particular, are keenly aware of what's happening in the United States and plan to follow the path blazed by MSOs like Tele-Communications Inc., Time Warner, Continental and others.

Technology is a challenge because there is no one "right" design for every system.

Specifically, the fiber-rich networks that deliver video to nodes serving hundreds of homes are being deployed throughout the world by operators who have cut their teeth on such networks in North America. The challenge now is to design cable systems for viewers who may not be accustomed to paying for television while at the same time accommodating emerging technologies and services like compression, switching, interactivity, telephony and data delivery.

"Technology is the challenge," says Patrick McDonough, vice president of engineering at United International Holdings (UIH), a U.S.-based operator of cable systems overseas. UIH is presently operating in six countries, delivering cable to more than 800,000 subscribers. In addition, it is actively evaluating markets throughout Latin America, Europe and Asia.

Technology is a challenge because there is no one "right" design for every system–the approach taken depends on a variety of factors, including economics, culture, topography and regulation, among others. The first step is to simply deliver multiple channels of video–then the other services will follow.

Latin America

Argentina represents the largest present-day opportunity in South America. The industry is mature, with hundreds of systems already built and in operation, but the systems need to be rebuilt. Other countries, including Peru, Colombia, Paraguay and Uraguay, are beginning to embrace cable TV, but many of those countries consist of a single large city that may award several franchises. Operators are typically large media companies that are also broadcasters and newspaper publishers.

The great untapped market continues to be Brazil, which suffers from high inflation and government instability, although both of those factors have apparently eased since last year. "Brazil is still a sleeping giant, but it's beginning to wake up" because more Portugese programming is coming on line, says Doug Light, director of international sales at Jerrold-General Instrument. Consequently, Brazilian operators are looking for high-quality equipment, including set-tops with on-screen menus and other advanced features.

Technologically, systems throughout the continent are hybrid in nature, consisting of both hard wire and microwave delivery methods. In many emerging areas, MMDS is the preferred method of entering the business until a city can be wired via the capital derived from subscriptions.

Argentinian cable systems are being upgraded with fiber in fiber-to-the-feeder configurations, says Light. Operators are typically hanging 450- or 550-MHz hardware on those systems while they plan for future services like interactivity and telephony, Light adds.

Just last month, UIH, a spin-off of the old United Cable company, announced its acquisition of 20 percent of Net Sao Paulo, a Brazilian company that holds a non-exclusive license to deliver video to the city of Sao Paulo. Its partners include the largest and third-largest broadcaster in Brazil.

Although the Latin American market is "hot," capital remains expensive, which causes operators to make prudent decisions, says Stan Sands, VP of international broadband sales at Scientific-Atlanta. Sands says system designs often call for 550 MHz electronics now that more programming choices are becoming available.

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Digital compression and telephony over cable is being viewed with interest, but not for immediate deployment, says Sands. But compression is being looked at longingly by South American programmers, who see the potential of lowering their distribution costs, Light contends. Consequently, he thinks compression will roll out soon for delivery to the headend, but will take much longer to get to the house.

Europe

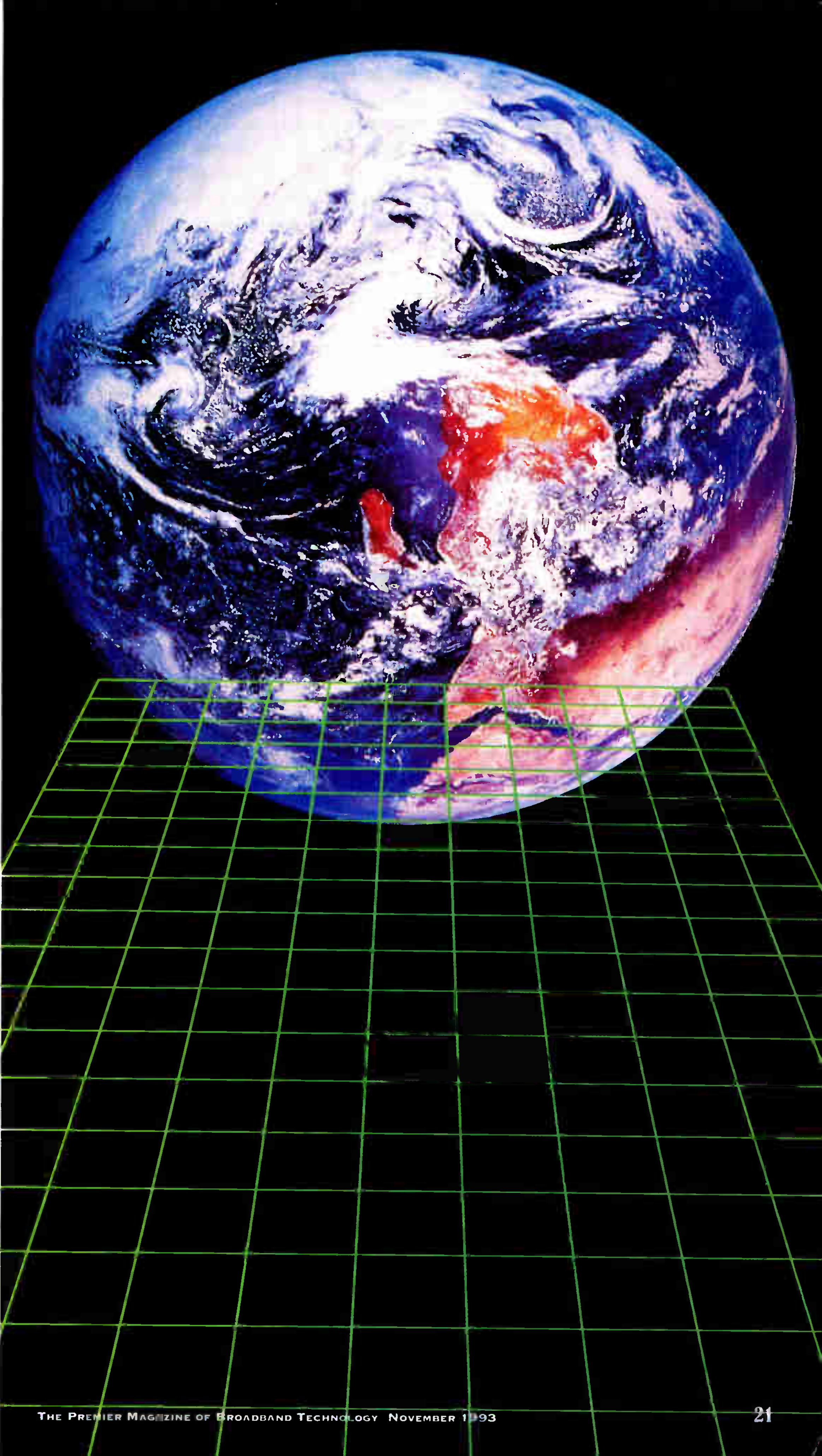
The European cable market is being driven primarily by the United Kingdom, which has enjoyed tremendous success delivering both multichannel video as well as telephony, in competition with British Telecom and Mercury. Builds are underway all over Britain, with perhaps 10 percent of all homes now passed by cable plant, says Sands. "I just couldn't say enough good things about the U.K. (market)," he says.

Currently, most operators are overlaying their broadband systems with narrowband telephony plant in order to offer both services. But that thinking is beginning to change, thanks in large part to the efforts of TeleWest, a joint venture of US West and TCI. As widely reported, TeleWest will soon be testing then deploying coaxial-based telephony to neighborhoods, where the voice traffic will then be put onto twisted pair wire for delivery to the home.

Jones Intercable is one North American operator that is evaluating the coax-based telephony approach pioneered by TeleWest. Jones, which already operates in East London and South Heartfordshire, is preparing to build 1,500 miles of plant in Leeds, the fifth-largest franchise area in the U.K. with 290,000 homes and 16,000 businesses.

Like many other builds in Britain, the plant will all be placed underground, which drives the cost of construction very high, says Chris Bowick, group VP of engineering and technology at Jones.

Internally, Jones is in the


DON RILEY

process of selecting vendors for its telephony switch (which will be co-located with the headend), billing system and cable plant.

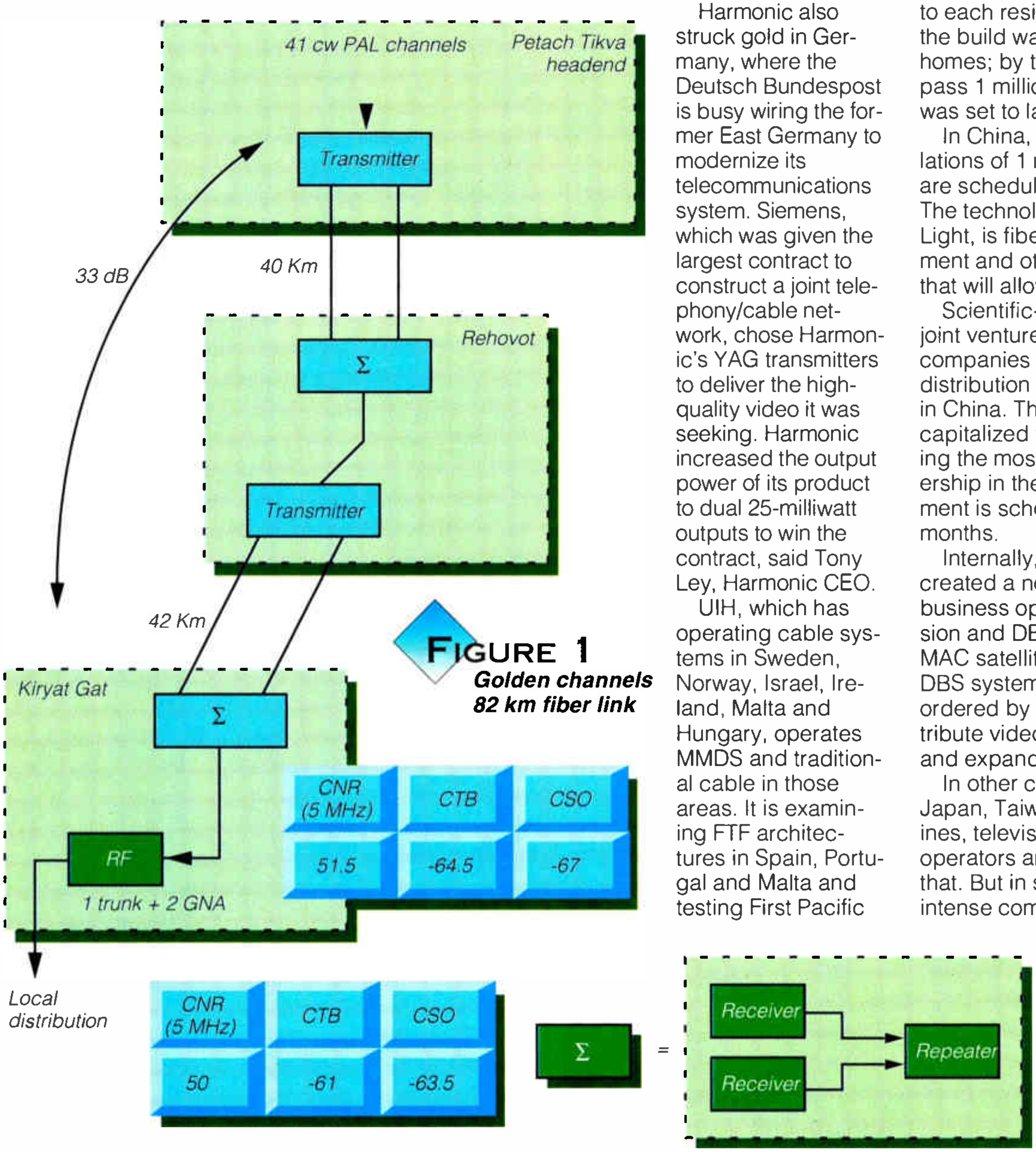
The Leeds design calls for a hybrid fiber, coax and twisted pair network to be constructed. Fiber will feed voice traffic to areas serving about 250 homes, while video will be sent over fiber to 2,500-home cells initially. Enough fiber will be placed at those cell sites to add more cells in the future, Bowick says. Two twisted pairs and a single coax will emanate from the tap to the home, he says.

Video will be delivered in the traditional way, with little need presently for a high volume of return signals. "We need to get them TV first" before worrying about a slate of advanced, interactive services, says Bowick.

Jones intends to take advantage of Britain's liberal cable/telephony regulations by aggressively pursuing the competitive access market as well. To date, telephony users have shown little churn, which makes the market attractive. "We're real excited about the U.K.," sums Bowick.

Outside the U.K., the winds of change promise new networks in countries like Spain, Italy, Romania, Bulgaria and rebuilds in Poland, Hungary and the Czech Republic.

Harmonic Lightwaves recently installed what it believes to be the world's longest analog video link–an 82-kilometer span that carries 41 channels of video over optical fiber in Israel (See Figure 1). The system, installed for Golden Channels, Israel's largest cable operator, carried signals over a fiber owned by the Israeli telephone company and repeated once. Golden Channels had been considering a digital link, but decided to go analog instead because of cost considerations.



CNR (5 MHz)	CTB	CSO
51.5	-64.5	-67

CNR (5 MHz)	CTB	CSO
50	-61	-63.5

FIGURE 1
Golden channels 82 km fiber link

Harmonic also struck gold in Germany, where the Deutsch Bundespost is busy wiring the former East Germany to modernize its telecommunications system. Siemens, which was given the largest contract to construct a joint telephony/cable network, chose Harmonic's YAG transmitters to deliver the high-quality video it was seeking. Harmonic increased the output power of its product to dual 25-milliwatt outputs to win the contract, said Tony Ley, Harmonic CEO.

UIH, which has operating cable systems in Sweden, Norway, Israel, Ireland, Malta and Hungary, operates MMDS and traditional cable in those areas. It is examining FTF architectures in Spain, Portugal and Malta and testing First Pacific Networks' telephony system in Hungary, says McDonough. But in some places, cable service is already highly penetrated and the amount of revenue to be derived is slight, making it more difficult to affordably upgrade those plants, he says.

UIH also operates a small private telephone network that serves several hotels in St. Petersburg, Russia, McDonough adds.

The Pacific and Far East

Hong Kong and China are the shining jewels in this part of the world, with literally thousands of new subscribers scheduled to be brought on line every month for the next few years.

Wharf's Hong Kong build is using a mix of 12 GHz FM microwave technology to feed clusters of densely populated apartment buildings, fiber to interconnect the buildings and coax to deliver the signals to each residence. By the end of 1993, the build was scheduled to pass 300,000 homes; by the end of '94 it's supposed to pass 1 million households. The system was set to launch last month.

In China, there are 300 cities with populations of 1 million or more persons, that are scheduled to be built, says Sands. The technology of choice, according to Light, is fiber optics, 550 MHz RF equipment and other advanced technologies that will allow these networks to evolve.

Scientific-Atlanta has already formed a joint venture with four different telecom companies in China to manufacture cable distribution equipment in Shanghai for use in China. The joint venture was initially capitalized with $10 million, with S-A paying the most because it has majority ownership in the venture. Production of equipment is scheduled to begin within 12 months.

Internally, S-A's Broadband Group has created a new unit to expand worldwide business opportunities in video compression and DBS. The new unit will market B-MAC satellite encryption, MPEG products, DBS systems like the one recently ordered by Orbit Communications to distribute video throughout the Middle East and expand the Nexus SMATV group.

In other countries, such as Korea, Japan, Taiwan, Australia and the Phillipines, television penetration is high and operators are working to capitalize on that. But in some area there is either intense competition from other video providers or a lack of government direction that has hampered cable's growth.

Even if all the secrets are gone, there are many opportunities for operators and vendors alike. "Business has grown consistently in all markets," says Light. CED

In Brazil, consultants are a must

Engineering issues that need attention

By José Ralphe Manzoni Jr.

Because it's only an emerging business in Brazil, the internal organization of a cable television company and the technical problems related to actually placing the cables into subscribers' homes still have many operators doubting its viability.

This is where the polemic starts: Are there any Brazilian experts available for consulting?

"We still do not have Brazilian professionals capable of taking on medium- or large-sized jobs," says Douglas Oaten, former director of Inbrac and a participant in the "Jardins" neighborhood project in Sao Paulo.

"We have few professionals in this area, but they are very competent," counters Walter Tassi, director of T&P, a Brazilian consulting company.

Multiple solutions

But when new networks are planned, every company has its own solution. Cabodinamica (presently known as Net São Paulo), a member of the Net Brasil group, opted for an American partner. "Our consultants are our partners (United International Holdings); they invest capital and are experienced in this market," says Antonio Salles Teixeira Neto, technical director of the company.

Multicanal chose to form a staff of American professionals. "They do everything, from the design to the supervision of the network," says Renato Cavion, marketing director at Multicanal.

Inbrac decided to seek help from the North American consulting company InterNet for the design of its system. Meanwhile, Inter Net (a Brazilian operator with an almost identical name), which is associated with Net Brasil in Campinas and has licenses in the cities of São Carlos and Franca inside São Paulo, completed the designs on its own.

"They are such small cities, therefore we do not have big problems that require additional consulting companies," says Antonio João Filho, executive director of Inter Net. The company is designing the project on computers with AutoCADD software.

At Inepar Sistemas, a company from Paraná, the experience of building more than 600 kilometers of cable plant in HTV's network in Curitiha and ATV's system in Blumenau seven months ago encouraged the company to consult for other companies.

"With all our know-how, it is only a natural path to follow," says Rigoberto Almeida Costa, systems manager for the company.

On one point, however, they all agree: the system must be "tropicalized." "Engineering is not done on paper nor at a distance of 10,000 kilometers," says Teixeira Neto. "If you send a chart to a North American designer, chances are the design won't be usable when it is sent back. Strong input from the Brazilian operators is necessary, because they are the ones who know their markets," he concludes.

Some examples of technical parameters that must be adapted to Brazilian conditions include the physical cable installation method, grounding and calculation of cable expansion. "All this results in a completely different network structure," says Teixeira Neto.

What they do

When the cable TV operator hires a consultant, he is seeking the opinion of experienced professionals to offer solutions to problems he is unable to solve. "The client does not have a very clear notion of what is necessary to make his business feasible," says Tassi of T&P, who has experience working with North American companies.

T&P's services include input about the organizational structure of the company, economic feasibility studies and detailed design for cable installation.

"The client must know whether he should build a network with .750-inch or .500-inch cables," says Tassi. "if he installs cables with smaller diameters, such as .500, he loses sight of the expansion of the system."

According to Tassi, the first step in a project design is assessment of its economic feasibility: Does the area that will be cabled have enough potential subscribers to pay for the network? This study involves understanding the neighborhood's demographics, what types of programming will be offered and how that programming fills the audience's needs. The cultural level is also important.

"If we focus our survey solely on the purchasing power of the area, we might be making a mistake," Tassi says. "We also need to know what the cultural level of the neighborhood is."

Booz Allen & Hamilton, a consulting firm employing 4,000 consultants active in 74 countries, knows how to perform economic feasibility studies. Brazil represents a real challenge, though.

"We are dealing with a new product in a market with almost no awareness, in comparison with other countries," says Moyses Aron Pluciennik, director of the company.

To him, the availability of programming, wide ranges of economic levels and expenditures are very different from any other place in the world. "In India, cable TV is a success even in the slums, but what does that mean to Brazil, where we live with "Belíndia"? (Belíndia refers to Belgium and India and refers to the sharp social differences present within Brazil.)

Once the area of operation is defined, the next step is field verification, collecting data and establishing the parameters of the project.

"The client does not have a very clear idea of what is necessary to make his business feasible."

Vision Sat, another Brazilian company, is beginning to make designs for systems via digitized maps generated by a computer. Although the maps are derived from photographs, they have to be verified for accuracy.

Inepar also developed a system to design cable TV networks with CAD stations. The company also owns a database containing the main equipment manufacturers around the world, with technical information on all the equipment, such as signal levels, frequency bands, gain and insertion loss.

The headend

The kind of network the operator intends to build is discussed only after the design is concluded. Tassi says there is great interaction between the network and the headend. "The headend is defined according to the kind of network to be built," he says.

For instance, if the system will feature home security monitoring, this means the network will be bidirectional, and the headend must be capable of recognizing the signal sent by the subscriber when a problem occurs. The same is true if the network employs status monitoring or telemetry systems; equipment capable of performing this activity is necessary.

[Brazilian] operators are often ignorant of the fact that equipment must be adjusted for high-quality images.

"The headend is the core of a cable TV system; hence the need for a careful and detailed design to get the best performance," says Rigoberto Costa of Inepar.

A headend design takes into account the quantity of channels to be received and their respective satellites and polarizations.

The number of parabolic antennas and their diameter is also planned, taking into account the signal levels of each service upon arrival at the headend.

Reception issues

After deciding which headend equipment supplier will be used, Inepar surveys the technical specifications to be used for the reception, processing and transmission of the signals to the coaxial and fiber optic network to ensure the signals will be equalized.

"Even using different components it is important to have an open system that will enable the insertion of future technologies," says Rigoberto Costa.

Tassi says that "Brazilians have the bad habit of buying closed (proprietary) systems and installing it without testing it, a practice which is not followed in the United States."

He says operators are often ignorant of the fact that for a system to work perfectly and for high-quality images, the equipment must be adjusted. Tassi's company follows the National Cable Television Association's specifications for signal quality.

Vision Sat has plans to establish a test laboratory for equipment evaluation. "All equipment is imported and so far there is no facility available (to test) its (performance). The information and technical standards must be checked," says Monteiro. The company has already measured for terrestrial interference for Cabodinâmica, because the headend is susceptible to interference from VHF and commercial transmissions, or police transmission frequencies. "This way, the practicality of the potential headend site can be defined," says Monteiro.

Hard cable or MMDS?

A continous debate is whether or not an operator should opt for hard cable or choose MMDS wireless technology. To Tassi, both alternatives are interesting and the choice depends upon business strategy.

Although the cost of MMDS is less, it is limited with regard to the number of channels it can offer and the local topography. With cable, however, a greater number of channels and services can be offered. "MMDS is advised for specific neighborhood or city or when the signal is to be distributed immediately."

"Cable will take over the large cities,

while MMDS should have a greater penetration in the smaller ones," says Olavo Concílio Ribeiro, director of Cablemaster, a consulting company from the Líder Telecommunicacões group. The company offers consulting services on MMDS, from the attainment of a license through to power, transmission, security and marketing.

Organizational structure

According to the consulting firms, it's not enough to have a good technical design. "Customers frequently overlook a simple side of the business–how to operate it," says Tassi.

T&P also organizes the overall flow of a company and guides its clients toward the integration of technical and commercial departments. This way, procedures can be created that ease the work in both areas.

T&P has been contacted by a cable company that was suffering from churn so high that the number of disconnects was exceeding connects. "The problem was solved by understanding the company's procedures and establishing new ones, like improving a technician's attitude while he's in the subscriber's home. Software alone does not solve this problem," says Tassi.

But software is important to the overall management of the company and for speeding information to the subscribers. Cablemaster offers software that allows close monitoring of cash flow, material inventory and other operational issues. It even monitors service vehicles departing to answer service calls.

Human resources

There's no denying that there are still few professionals in Brazil who understand the technical issues surrounding the installation of cable and operational management.

"Two years from now we'll have professionals worth their weight in gold," says Oaten, the former director of Inbrac.

T&P recruits specialized professionals from foreign countries and sponsors both courses abroad and training through American companies for its own workforce. Cablemaster trains its own employees and offers courses to other companies.

Inepar's technicians are trained by foreign professionals. According to Rigoberto Costa, the company has forged good relations with foreign companies and in some cases had developed partnerships, such as the one it has with General Instrument.

A consultant can cost up to five percent of the forecast investment by the operator.

"Many manufacturers offer specialized courses," he says.

At Cabodinâmica, Teixeira Neto adopted the policy of recruiting trainees who learn alongside North American and Argentine technicians. "We're developing our own professionals," he says. Multicanal brought North American professionals to work as managers and directors. "With so many licenses we need ongoing consulting," says Cavion. The company works in several cities in the interior of São Paulo and in some capitals, including Goiãnia and Campo Grande.

Olavo Concílio Ribeiro of Cablemaster says that a consultant can cost up to 5 percent of the forecast investment by the operator. On the other hand, Teixeira Neto of Cabodinâmica believes the services of a consultant couldn't cost less than U.S.$1 million for a two-year contract. CED

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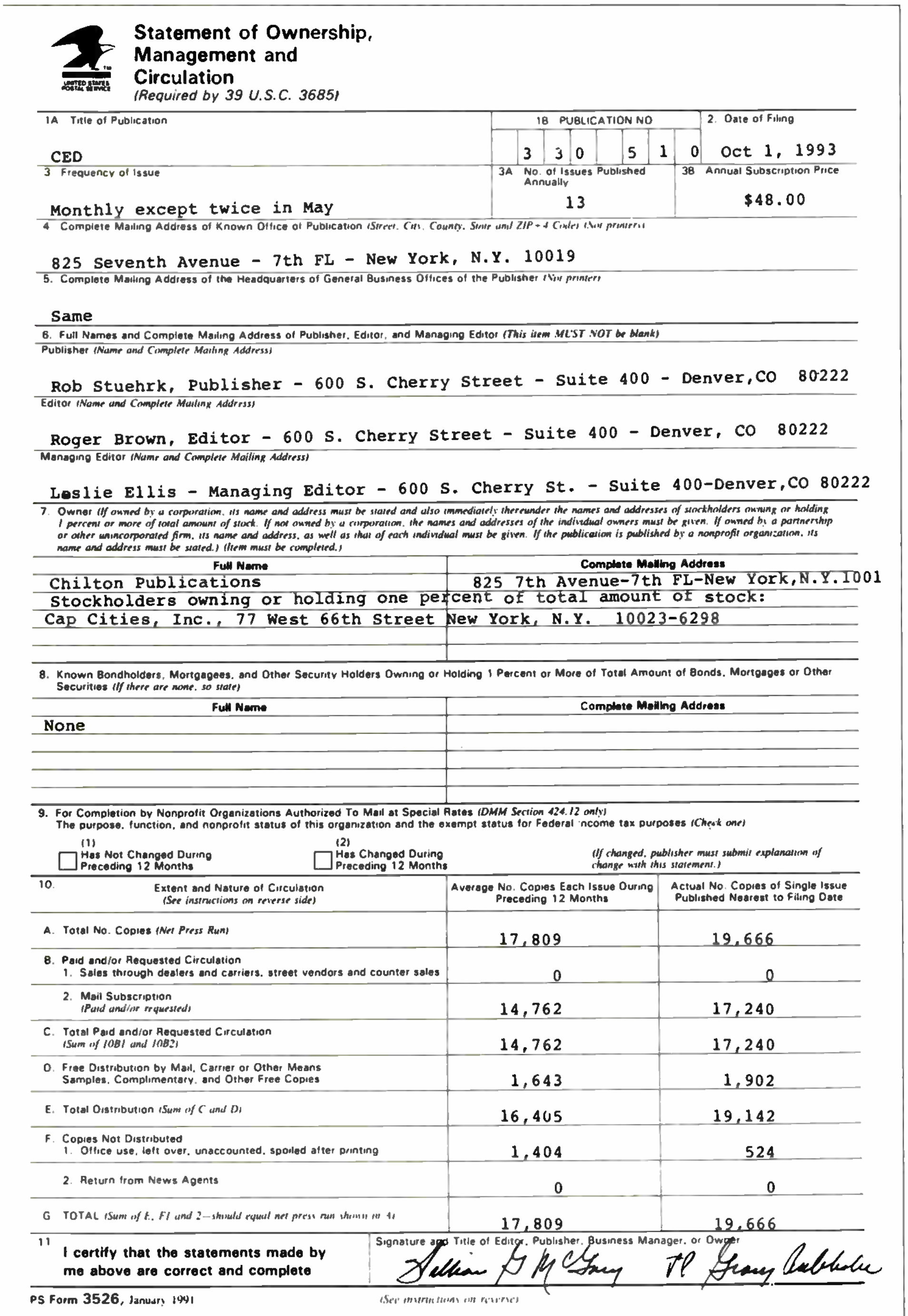

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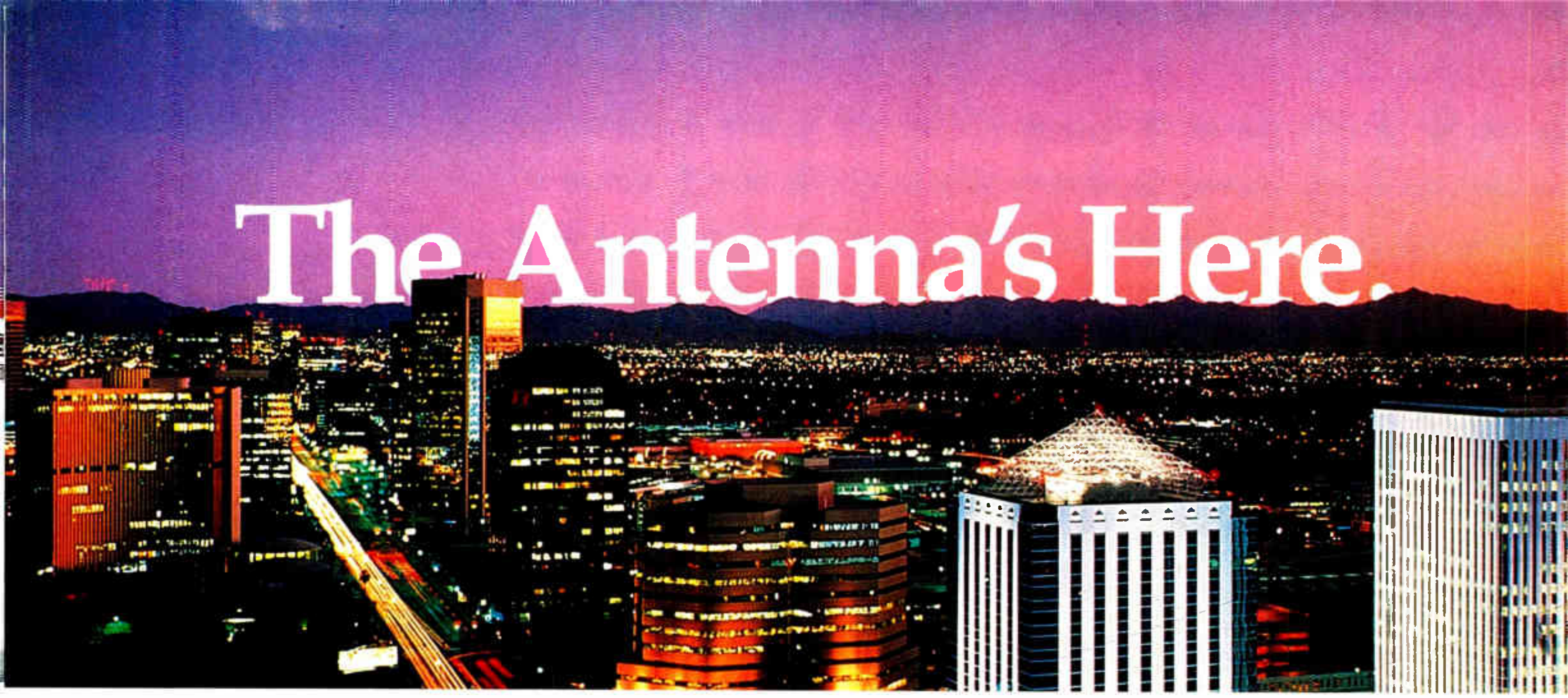


The Antenna's Here.

Cable & telephony

Meeting the U.K.'s communication powering needs

FIGURE 1
Original distribution method of cable television

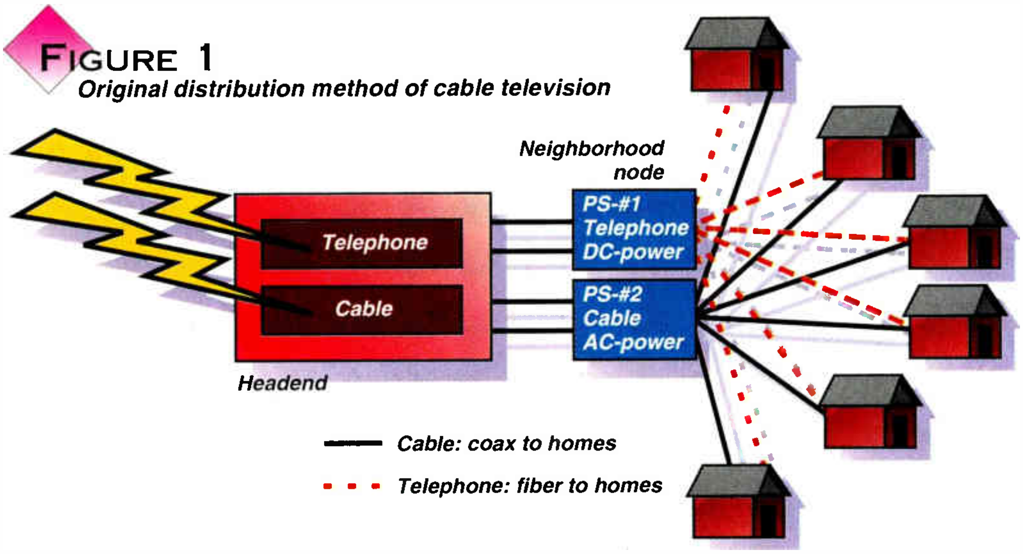
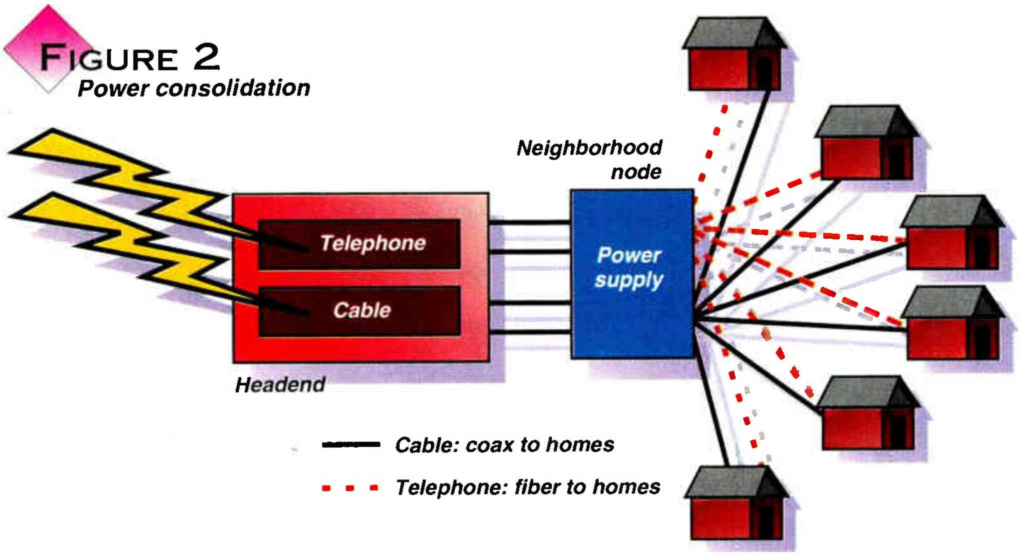


FIGURE 2
Power consolidation



By Jeff Geer, Applications Engineer, and Greg Zediker, Project Manager, Alpha Technologies

With the introduction of fiber optics in the United Kingdom, the communications industry is fast approaching one of its greatest technological achievements, and one of its greatest challenges.

As this new technology emerges, giant telecommunication and cable TV systems are competing for their share of the market. Capitalizing on the telephone industry's high connection fee, broadband cable operators–known as public telecommunications operators (PTOs)–are signing new customers by offering telecom services, and much more, at a substantially lower rate.

By combining the benefits of both telephony and cable TV, communications, high-speed data transmissions, entertainment, and interactive programming will be readily available to cable customers throughout the U.K.

What is now commonly referred to as the "information superhighway," this integrated system could be compared to a multi-lane freeway replacing a dirt road. But as all travelers know, there are occasional detours associated with any major road improvement (with apologies to Leslie Ellis at CED magazine). The same is true for this technology.

Reliable power

With the increasing demands being placed on the power utility for reliable power, one of the major hurdles has been the development of a reliable power supply that can be used in both telephony and cable TV applications. Because even the slightest interruption in power can corrupt data transmission and damage sensitive electronics, digital communications and information networks demand a high degree of clean, reliable power.

Even though uninterruptible power supplies were developed to protect equipment from spikes, surges, noise and other forms of power disturbances, there was still the challenge of meeting the unique needs of the different cable architectures being built and tested in the U.K. while remaining cost effective.

A typical system architecture employs parallel fiber optic networks which are installed in the same conduits receiving transmissions from a central office/headend and terminating in a co-located street cabinet. Within this cabinet, the network receives its power for the telephony multiplexing equipment, the fiber receiver (node) and amplification equipment. In most networks, the telephony side requires -48 VDC to power the fiber to twisted pair conversion equipment and to power the subscriber's telephone ringers.

Cable TV, on the other hand, requires 60 VAC for the fiber optic receiver (converts light to RF) and a small number of amplifiers (actives) which run in series within the distribution area.

Addressing 3 architectures

Prior to 1993, this required two separate power supplies: a 48 VDC rectifier for telephony, and a 60 VAC non-standby for cable TV which contributed to high costs and unnecessary redundancy.

The three main system architectures that had to be addressed were:

✔ Fully overlaid network. The PTO provides coaxial cable and twisted pair wire from the headend to a street-side cabinet and then on to the household or business.

✔ Fully integrated delivery. The PTO provides coaxial cable (or fiber) from the headend to a street-side cabinet and then on to the household or business.

✔ Siamese drop and hybrid delivery. The PTO provides fiber from the headend to a hub, and then coaxial cable and twisted pair wire to a street-side cabinet before continuing on to the household or business.

Reacting to the need for an innovative solution, a new, dual output, uninterruptible power supply was introduced that was capable of handling both the AC and DC power requirements of each architecture. It also provides up to two hours of backup time (depending upon loading) for the cable system, and up to eight hours of backup for the telephony network.

To prioritize emergency communication over entertainment during an extended utility power outage, the 60 VAC for cable TV is disconnected (after two hours) to provide an additional four to six hours of uninterrupted telephone service.

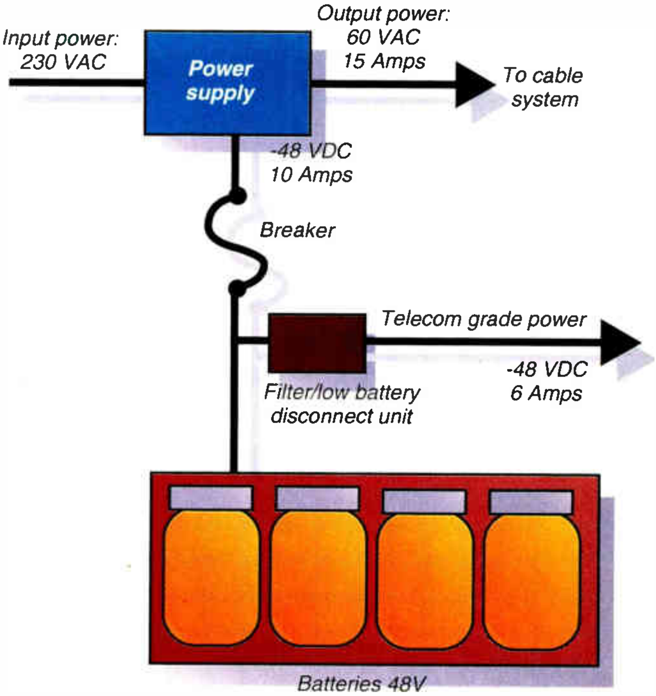
The power supply can also be equipped with a specially designed status monitoring interface to alert operators at a central office, or remote dispatch center, of any powering problems, including low and high battery conditions, breaker tripping, main power loss or any other conditions that may affect power delivery to the network. This interface connects directly to the telephony status monitoring system, already in place, and monitors telephony processed alarms.

The key concept

Innovation is the key concept in the creation of this digital network. With each step forward, new challenges are presented. Numerous companies throughout the world, recognizing the many opportunities generated by the development of this new technology, are providing innovative products as well as programming and software support to ensure its success. CED

FIGURE 3

A full service network powering solution



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Introduction to Local Area Networks–Part II

How three ops are using LANs

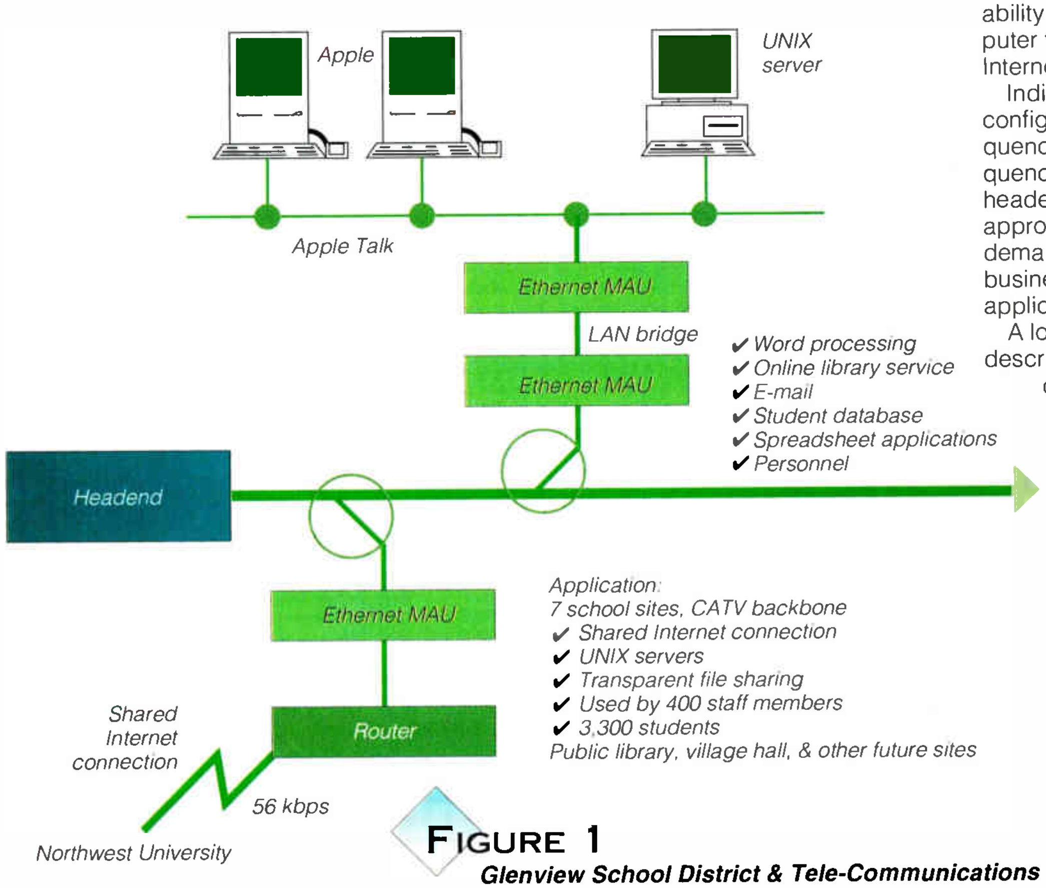


FIGURE 1

Glenview School District & Tele-Communications Inc., Glenview, Illinois

By Edward J. Zylka, Director of Marketing, Zenith Communication Products

Part I of this two-part article (presented in the October issue) defined local area network standards, medium access control protocols and technology as they apply to cable TV distribution systems. Well-defined LAN interface standards simplify the task of connecting inter- or intra-community facilities over the metropolitan community cable TV network.

For example, Ethernet and Token Ring are baseband LAN hardware standards which dominate the computer communications market and are found on campuses, hospitals, businesses and virtually every sector of the community that uses computers. A variety of cable TV-based computer communications interface hardware is available to the cable operator, such as network PC-based network interface cards, LAN bridges and routers. All provide LAN interconnectivity over cable TV backbones or permit extended distance operation of networked devices.

In addition to industry standardized baseband LAN interface hardware, another common thread for LANs is network operating software systems, which have become de facto industry standards. These include Novell NetWare, TCP/IP, MicroSoft OS/2 and others that permit the seamless integration of dissimilar computer hardware systems and LANs across metropolitan cable TV plants.

Further driving new market opportunities for the industry is the announced intent of several companies to provide interactive electronic resource service "programs" over cable TV facilities. These companies include Prodigy and Compuserve for their standard consumer services, and Performance Systems Inc. (PSI) and Advanced Networks & Systems (ANS) for access to the Internet for consumers.

Because broadband-based cable TV LANs operate in the frequency domain, many LANs can be multiplexed on a single coaxial cable with each LAN potentially supporting a different interactive service. The home subscriber will have the ability to digitally "tune" his or her computer to a Distance Learning Channel, the Internet Channel or the Prodigy Channel.

Individual LAN backbones are easily configured by assigning different frequency pairs (channels) using one frequency translator device per LAN at the headend. This individualized backbone approach permits flexible bandwidth on demand expansion, or segmentation by business, institution or interactive service application.

A look at some case studies that describe the applications developed by cable operators in conjunction with community businesses and schools show how the cable industry can take full advantage of the high-performance backbone provided by metropolitan cable TV plants.

Community business

Business-to-business data networks which require high-speed bandwidth can easily be created on municipal cable TV plants. Using the inherent multi-point architecture that LANs provide, businesses can connect PC-based file servers, mainframes and graphic workstations. High-speed graphic file transmissions would occur electronically in a matter of seconds.

This means that shared T-1 (1.544 Mbps), low-speed phone modems (1200 bps to 9600 bps) and other multiplexed telecommunications equipment could be eliminated.

A good example of business-to-business applications has been implemented by the village of Schaumburg, Illinois, in cooperation with Tele-Communications Inc. of Illinois. The village required a high-speed data communication system to link several public facilities, including the village hall, police department and four fire stations.

Three data line alternatives were available to the village's information systems division: 1) install a private fiber network, 2) use existing low-speed point-to-point telephone equipment with multiplexing modems or 3) use the municipal cable TV system's two-way institutional network for high-speed LAN data transfers.

Robert Hall, Schaumburg Village information services supervisor, said a new fiber network would be cost prohibitive and a telephone modem/mux system using a dedicated digital data service line (typically 9600 bps) performance would not allow high-speed connectivity between public service facilities (police and fire).

Instead, he said, the village turned to a cable TV-based LAN to provide multipoint connectivity between police, fire and town hall facilities. The LAN bridge permits the combined transportation of Token Ring (police) and Ethernet (fire department) data over a single 6 MHz channel on the institutional network.

Hall said the system allows village departments to access centralized file servers at the village hall, for E-Mail, calendar scheduling and high-speed file sharing.

The village safety services also utilize cable TV-based LAN systems as key components of their Computer Aided Dispatch system. The central dispatching activity of the 911 system takes place at the village hall. The administrative aspect of this system, such as records management and incident call reporting, is supported over the cable TV LAN.

Community schools

The village of Glenview, Illinois, in cooperation with TCI, is utilizing the municipal cable TV plant to network seven schools within the district. The district's computer system utilizes Unix-based server equipment at each school site, which is then connected to the cable TV LAN backbone using TCP/IP as the network transport protocol. In this network design, TCP/IP was selected to provide a "common" software platform between dissimilar hardware systems.

This computer network supports both instructional and academic applications. Apple Macintosh computers are bridged onto the LAN backbone via an Ethernet-on-broadband media access unit (MAU) connected to an AppleTalk-to-Ethernet bridge.

Teachers can share files across the network and communicate using electronic mail facilities. The electronic resources provided by the cable TV community school network can be accessed by 400 administrators and 3,000 students.

The Internet is provided to the school district network via a connection to Northwestern University using an Ethernet router device. An Ethernet medium access unit (MAU) connects to the router extending the Ethernet link, and distributes the Internet to all school facilities located on the network. This permits students and faculty members at all facilities to share the Internet connection.

Home subscriber data networks

A distance learning project is currently under development in Provo, Utah, under the Utah Valley Business/Education partnership in conjunction with TCI Cablevision of Utah. The goal is to provide home computing resources, which include Internet access, distance learning, municipal government access and other services. TCI Cablevision - Provo has developed a complete bi-directional "two-way" plant for its home subscriber network.

The plant utilizes a fiber optic delivery system which emanates from the headend and terminates at a neighborhood feeder node. From there, a transceiver converts the signals to electrical impulses and feeds the home via copper coaxial cable. The same cable used to provide entertainment video delivers the LAN service as well.

According to Paul Venturella, general manager of TCI Cablevision, Utah, "We are using a translated headend for the cable TV-based LAN which establishes the data network on cable channel -A2. This places cable channel 14 adjacent to the data channel, and we have experienced no "spraying" of noise from the data.

"My initial concern was that video side carriers would leak into the adjacent (LAN) channel and affect the performance of the data network, which was never the case."

Channel -A1 is currently allocated as expansion spectrum for the addition of another frequency translator to support a new LAN channel. TCI designs each node to deliver services to a maximum of 1,000 homes. Currently, the Provo cable plant supports approximately 400 homes per node. The plant has the potential to reach 21,000 homes in Provo, including a technology corridor in the Utah Valley, which is home to several "high-tech" software development companies and higher education institutions.

In the home, a new LAN gateway product was used to provide access from a personal computer (PC) in a home to a Novell NetWare-based learning server located in the TCI business office. This gateway is a low-cost, interactive PC LAN interface and radio frequency (RF) modem which provides LAN connectivity via standard home subscriber cable TV facilities.

The system permits the simultaneous transmission of entertainment video and data on the same cable. Multiple LANs or network services can be configured on a single cable, which can be accessed by tuning the RF modem, much like changing television channels.

At the heart of the field trial is a home schooling software application that uses a LAN-based server that provides the platform for the course work. Course work is available for kindergarten through 12th grade, and can be tailored to meet an individual student's needs. The learning server was configured to be used with a Novell NetWare version 3.11 file server with standard network software interface drivers to operate with Novell NetWare.

A gateway unit was installed in the file server and in each workstation for the trial. The file server was installed approximately seven miles from the cable TV headend. PC workstations were located at various sites within Provo, varying from five to 10 miles away from the headend. The connection to the home PC was a standard 5 MHz to 450 MHz passive splitter, with one connection for the cable TV convertor and the other to the LAN gateway RF modem.

TCI's program in Utah proves: 1) the viability of two-way cable TV technology for high-speed residential LANs, 2) cable TV operators can compete favorably with phone-based modem products and ISDN and 3) computer-based educational learning systems permit the extension of a classroom to the home student.

Conclusion

The recent development of high-performance, low-cost cable TV-based LAN systems as an alternative to telephone modems and ISDN systems will enable the practical implementation of low-cost and flexible metropolitan area networks using citywide cable subscriber, institutional or corporate (private) cable plants.

This new technology, along with the quest for advanced digital services, can now be implemented by cable operators to support a range of interactive applications, including work-at-home and electronic resource services, as well as distance learning from K-12 to higher education, at home, in classrooms and in dorm rooms.

The new on-line services and electronic data channels will include software distribution–eliminating CD and diskette, regional bulletin boards, professional service databases, video game software, student access to campus resources, and even interactive video links through the Internet.

The case study examples described in this article demonstrate that the convergence of analog and digital technologies, which is creating the electronic superhighway, has arrived–as said most succinctly by TCI-Utah's Paul Venturella, "It's not coming–it's here." CED

The consumer electronics bus: Part 2

Adapting products for compatibility

Editor's note: Last month, Part 1 of this paper examined the basics of the consumer electronics bus. This month, the author explains cable and business applications of the CEBus, as well as how to adapt products to a coaxial bus operation.

By Jud Hofmann, Panasonic Technologies

Products which operate on the CXBus require, at a minimum, connection to the control channel. Figure 4 shows the modifications needed to implement a CEBus-capable cable descrambler. The CEBus Network Interface, or CNI, interfaces the internal subsystems of the descrambler to the control channel on the internal cable. How this is implemented is entirely up to the manufacturer.

Commands arriving from the network intended for a particular descrambler are received by the CNI, which relays them to the particular portion of the descrambler to effect remote control of the product.

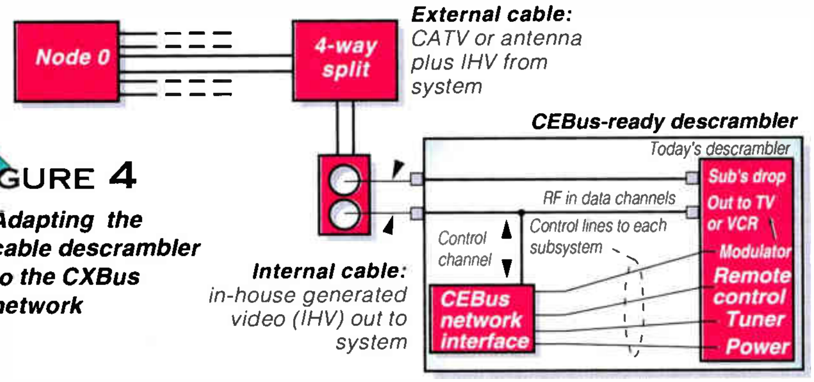


FIGURE 4

Adapting the cable descrambler to the CXBus network

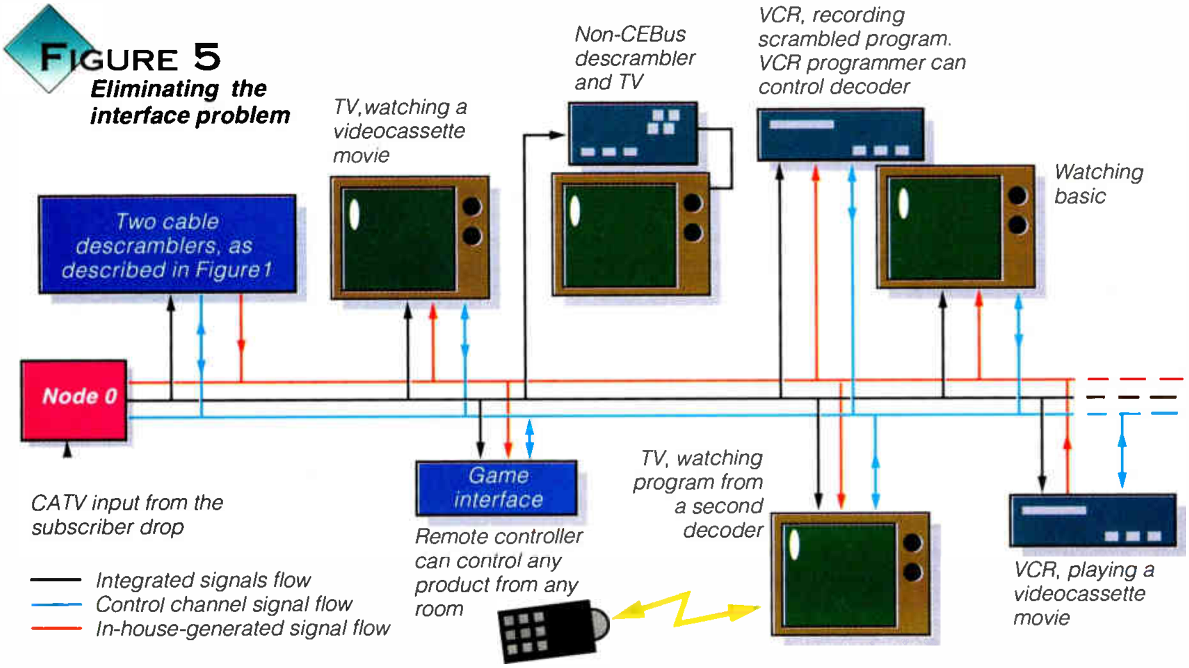


FIGURE 5

Eliminating the interface problem

Since the control channel and the CNI are bidirectional, the subsystems of the descrambler can send control channel packets to other products. This bidirectionality of the network, and the ability of the product to send its internal status to other products, should be very useful in implementing tricky services such as network-wide parental consent.

In the implementation in Figure 4, the descrambler's modulator places its output signal back on the network. Other methods of operation are possible, and are discussed in the following paragraphs. The modulator may be of fixed frequency design, or may be electronically agile which will enable it to go through the spectrum space resource allocation routine.

If an agile modulator is used, the user is not aware of the process of finding an empty data channel and making sure all receiving products are correctly tuned to the data channel. On the other hand, if a fixed frequency or manually tuned modulator is used, the user may be required to become involved in the process of defining what product is to operate on which channel.

Cable in a CXBus environment

The first part of this two-part series promised an application of CEBus and cable together which solved the cable-consumer interface problems we face now. Figure 5 shows how this can be done. But first, a cautionary note: in Figure 5, the solid, dotted, and dot-dash lines are not coax cables: they represent the signal flows in the two coax cables of the CXBus. Figure 5 shows how the cable equipment, represented by descramblers, and the consumer's equipment can be interconnected to form a transparent interface between the two networks.

There are two basic scenarios that can be used to integrate the cable descrambler into the CXBus network. The first, shown in Figure 5, places the descrambler into any convenient location in the network. This location could be in a utility room: a product placed in such a location could use a low-cost enclosure since it is not required to be decorative.

Alternatively, the product could be placed in an interface box along with other cable products such as video decompressers, etc. The enclosure could have a single power supply for multiple descramblers to effect further cost savings. Or, a descrambler might simply be sitting on top of one of the TV receivers in the home.

There are two aspects to a CEBus-based descrambler. First, through the connection to the control channel, the descrambler can be controlled from anywhere in the network. Second, it places the decoded output video signal on a CXBus data channel, making the decoded picture available to all TVs and VCRs on the network.

Operated in this mode, the descrambler operates almost the same as any other source product on the network, such as the video disk player or VCR. This solves the problem of time-shift recording by the VCR: the CEBus-based VCR on the network can remotely turn on and tune the decoder and record the resulting video placed on the network.

One of the TV receivers in Figure 5 is shown connected to a descrambler, not the network. The descrambler is connected to the network only to use it as a signal source since the complete CATV spectrum on the subscriber drop is carried on the CXBus. Thus, a descrambler without any CEBus capability can be used on the CXBus network, albeit without any of the advantages of the network.

Other business applications

The cable industry has grown so rapidly over the last few years that it begins to dominate delivery of information to US homes. Such an ubiquitous delivery service should plan to deliver services other than entertainment; and in fact, such "other services" are being investigated. Figure 6 expands the entertainment-only concept to include the delivery of security and energy management services.

In Figure 6, the CATV system is distributed through the CXBus network as has been previously discussed. The system is expanded here to include a CXBus-to-PLBus router, which transfers control channel messages between the two media. A security system is installed which uses the PLBus to allow a limited command set to come from outside the system. This allows the manufacturer to simply plug any number of control panels into the power line anywhere in the home.

But, more importantly, it also allows the security system manufacturer to design a system that can inter-operate with the lighting, heating & cooling, and AV systems to deliver many more services to the homeowner.

Of particular interest to us here is the interaction between the security system and the AV and CATV systems. The CATV system is an easy one to explain: the high level of interconnectivity in the home allows a security monitoring service to be delivered inexpensively via the CATV system.

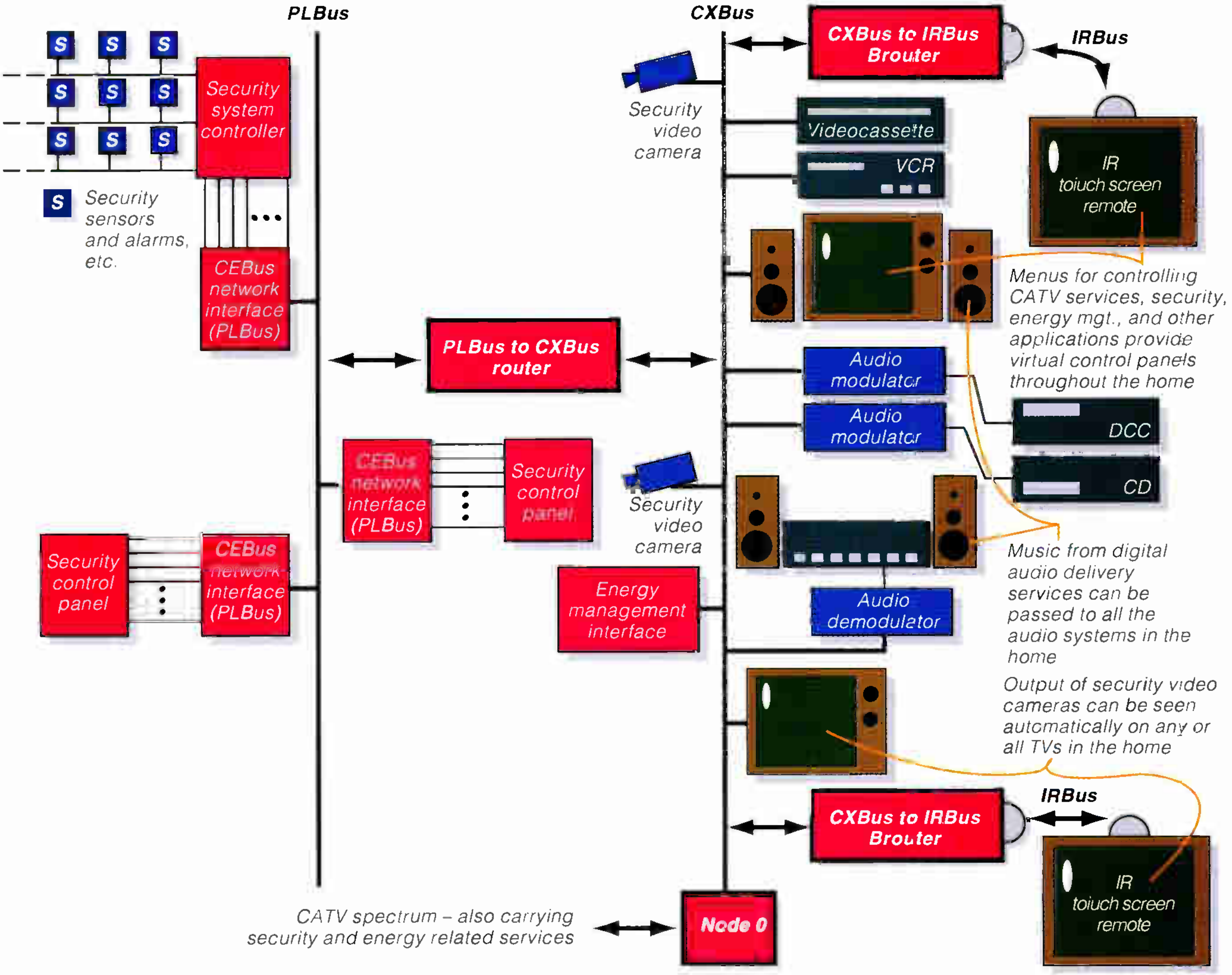
The relationship between the security system and the AV system seems a little more arcane, but turns out to be simple: by using the television's ability to show control screens and operate them by remote control transmitters, the security system can be provided with "virtual control panels" all over the home. Thus, it is no longer necessary for the security system users to walk to a physical control panel to operate the system.

The new architectures being developed in the CATV industry seem to indicate that uplink video channels should be available in a few years, assuming a viable business can be developed that requires them. Using the CATV system to provide a central security video monitoring service for upscale homes and commercial accounts could be that new business.

Finally, it appears that we all have a future in front of us that places a high priority on energy management in the home and our place of business. Utilities, primarily electric utilities, are planning to

FIGURE 6

Bringing everything together



price the cost of energy in proportion to the cost of generating it and to go to advanced technologies to limit load peaks. One of the costs of such strategies is that the electricity consumer must be provided with a communication link to the electrical energy supplier to provide such services as scheduling the use of energy and to provide the utility the ability to do load control, remote meter reading, and other programs that require an information connection to the homes of their customers. The CATV system is a natural way to make that connection.

How do we proceed?

The reader has probably noted that a CXBus installation in a home isn't going to be cheap at first, and has come to the conclusion that there is no way their system management is going to pay for such installation. On the other hand, the system operators must pay attention to second-set service as they begin to offer the new services discussed previously. This will involve upgrading the wiring in subscriber homes.

On the other side of the fence, laboratories in several consumer electronics companies have prototypes of products operating on the CEBus, as do companies in other business sectors, and it is expected that products will begin to emerge in 1994. It would seem that both cable and consumer electronic companies stand to benefit from the installation of CEBus equipment. The two industries should begin talks on cooperative methods to start the process. Perhaps a good starting point is to agree on the minimum number of components in Node 0 needed to perform the cable industry's needed tasks. The box and the reduced number of components are installed by the system operator when the home is upgraded to new services. This installation is not CEBus yet: the upgrade to full CEBus comes at the expense of the subscriber.

Certainly the CEBus multi-room AV distribution business will begin, as new consumer electronics developments usually do, in the top-of-the-line models. Those now installing multiroom AV distribution in North America now are the Custom Electronic Design and Installation Association's member companies. These installers, who target the most financially upscale families, will most likely be the first target market for CEBus system products.

But the technology must move into the mass market if it is to continue to interest the consumer electronics companies. One of the ways to decrease the cost of installations of wired systems is to develop techniques to reduce the time required to install the wiring: this can be accomplished by developing aesthetically pleasing methods of placing the cables outside the home–a technique used for years by the cable industry.

Conclusion

The CEBus environment has been described in multi-room AV distribution and other business applications. This enhancement to consumer products will begin to move into consumer homes in the near future. It has been shown that the distribution of cable signals and integrated control of cable and consumer products fit naturally into this new environment. The opportunity to seamlessly integrate cable services into the home AV environment is now available through this new development.

In the near future, a new generation of cable systems will provide consumers with many different services. These new services cannot be used simultaneously in the same room, forcing the cable industry to consider how to provide multi-room distribution and control systems in consumer homes. The CEBus should be considered by the cable industry as a way to partner with the consumer electronics industry to solve this sticky problem.

New terms: network layering

A cellular look at cable topologies

By Larry Richards,
Manager of Technical Support Services,
Philips Broadband Networks

Only a few years ago, before optical fiber became such an important transmission medium, a typical coaxial cable tree-and-branch CATV system efficiently and economically delivered up to 54 video channels to subscribers at performance levels shown in Table 1 (page 45).

As bandwidth expanded to 550 MHz, systems could deliver as many as 77 video channels. The ability to deliver so many channels fueled the growth of the cable industry. However, the tree-and-branch architecture presented–and continues to present–some disadvantages, including:

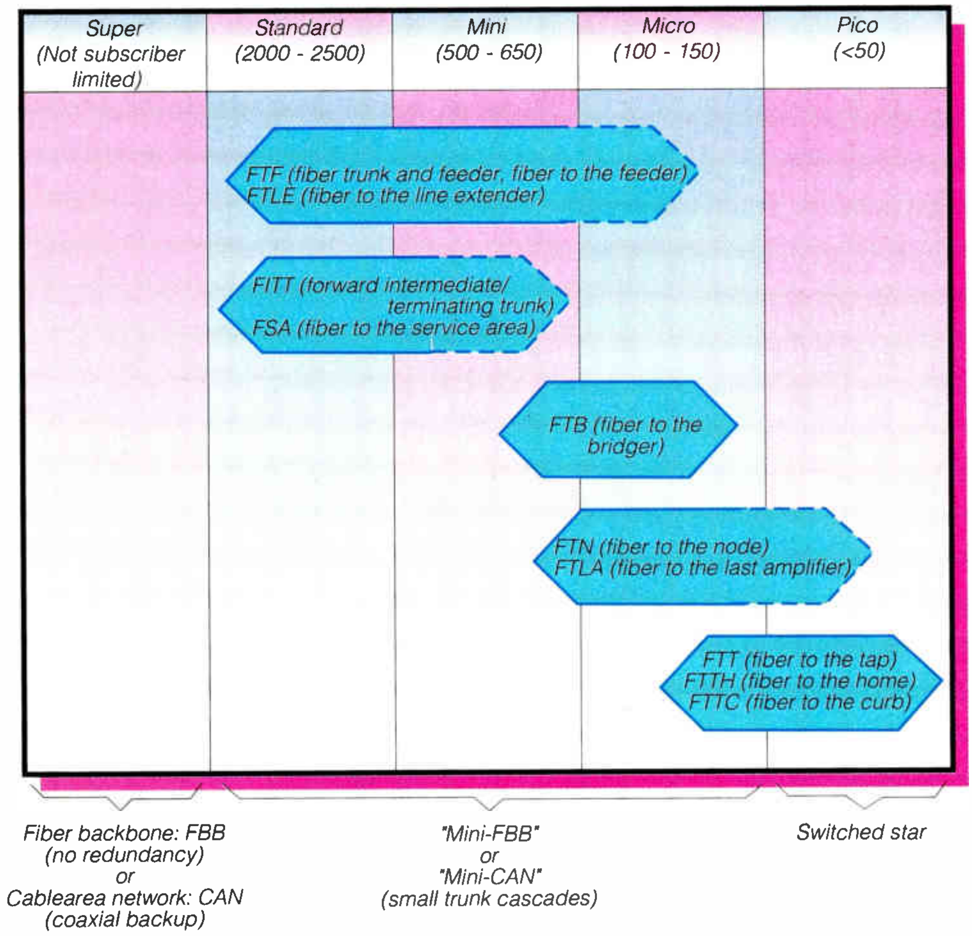
✔ The small return bandwidth limits upstream delivery.

✔ Long amplifier cascades create noise and reduce overall reliability, since a failure near the headend can affect large portions of the plant.

✔ Weighing economy against performance is a particular challenge. On one hand, to meet performance requirements at the peripheries of the system, operators must limit the number of amplifiers in cascade. On the other hand, to achieve maximum economy, they must make amplifier cascades as large as possible.

The large scale introduction of AM fiber optics into CATV plants has provided a way to overcome some of these limitations. Using optical fiber to replace parts of the trunk network reduces cascades, improves the forward return system performance and effectively increases the size of the return bandwidth (with various portions of the plant using the same return spectrum.) It also increases overall plant reliability.

FIGURE 1
How current CATV terms fit into the cell structure

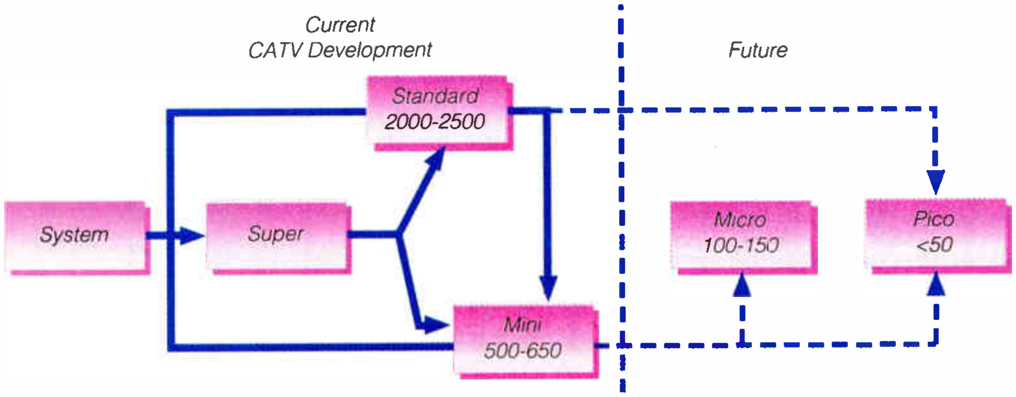


Alphabet soup

In initial applications, AM fiber optics served as a supertrunk with or without coaxial cable redundancy. As technology progressed, the decreasing cost and increasing reliability of components stimulated the development of a variety of more extensive fiber architectures for upgrades, rebuilds and new systems–each with its own name and acronym.

The lack of standard terminology for fiber architectures has resulted in an "alphabet soup" of ambiguous, confusing terms: FTF (fiber to the feeder), FTB (fiber to the bridger), FTN (fiber to the node), FTLA (fiber to the last amplifier), FTTH (fiber to the home), FTT (fiber to the tap), FSA (fiber to the serving area), FITT (forward intermediate/terminating trunk), FTLE (fiber to the line extender), FTTC (fiber to the curb) and so on.

FIGURE 2
Possible ways for cells to evolve



We Were First In The Industry To Go Down The Tubes.

Loose tube cable, that is. And the advantages of our innovation are so great, it's become the preferred fiber optic cable in the cable TV industry. As a result, other manufacturers have attempted to imitate it. But through the years, no one has offered a better loose tube cable or developed its potential more fully than Siecor, the leading fiber optic cable manufacturer.

Today, our cable meets the exacting performance specifications that make it ideal for use in your cable TV system. Its craft-friendly design is perfectly suited for fiber to the feeder applications. It offers superior lightning protection, and our dual layer buffer tubes provide superior kink and crush resistance. Our single-mode cable is always made with Corning fiber, offering the tightest dimensional tolerances in the industry, meaning lower splice and interconnect losses. And our innovative tapered design option can save considerable splicing time and system cost during installation.

On top of these advantages, you get more than the best quality cable when you come to Siecor. You get support that's recognized industry-wide. You get the backing of our first-rate R&D as well as the largest optical cable manufacturing plant, providing ample capacity for timely response. And you can always count on us to be here with the service and products you need including hardware, splice equipment, training and consultation.

So come to the company that was first to make loose tube cable and that still makes the best there is. Call us at 800 SIECOR 4 Ext. 5998.

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To avoid the confusion over terminology, it's useful to define fiber systems in terms of "cells." A cell is a service area fed by a single fiber node that is linked to a central distribution point. Cell size may be determined by the number of homes passed or by the performance requirements of the plant. The number of homes passed will probably be the most important criterion in all except very rural systems, because many potential services such as personal communications networks (PCNs) will set limits on the number of subscribers serviced.

Independent of the type of construction–new, rebuild or upgrade–the "cellular" approach to defining fiber optic systems is simple and generic. And, because future services may require cells with fewer homes passed because

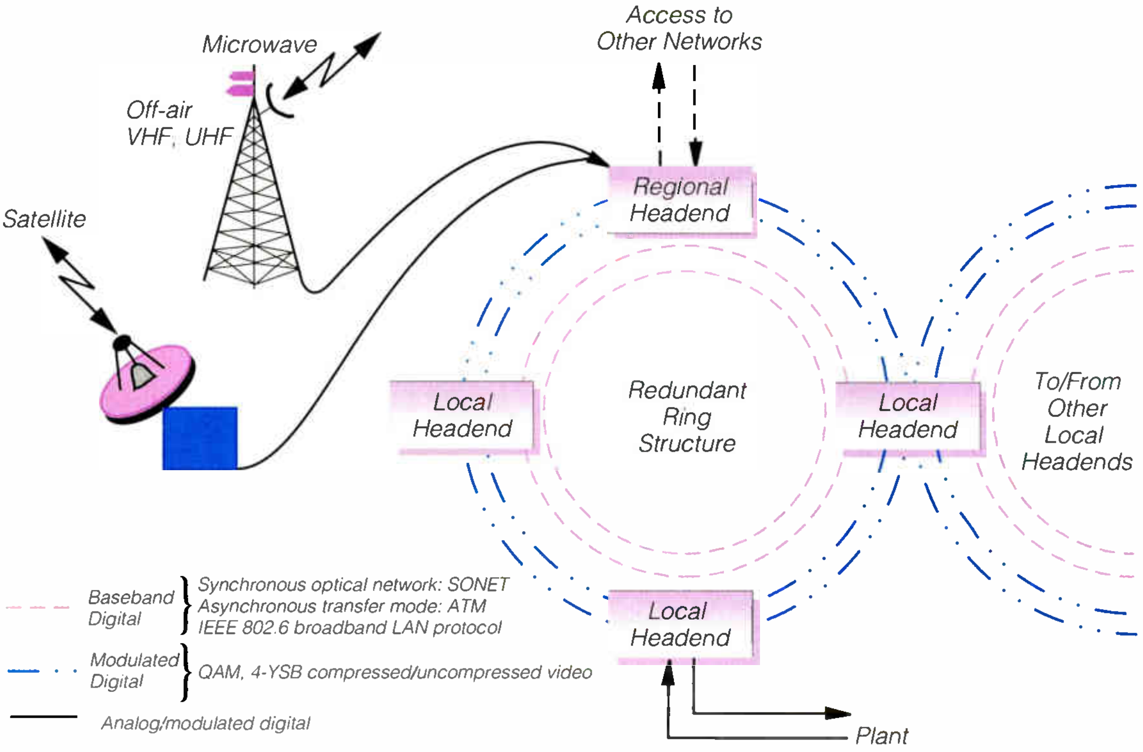
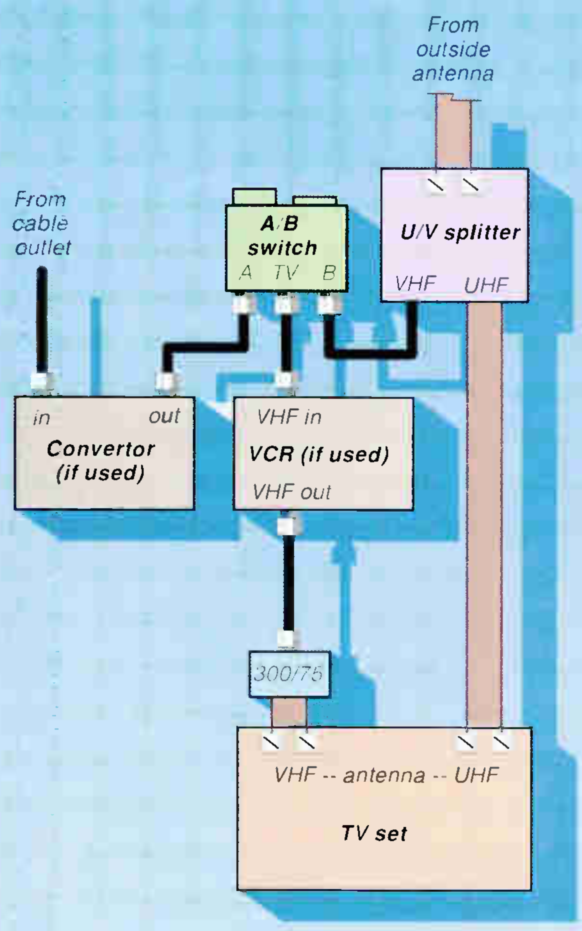


FIGURE 3

The Supra cell: Bringing systems together

COMMON


From outside antenna

From cable outlet

A/B switch
A TV B

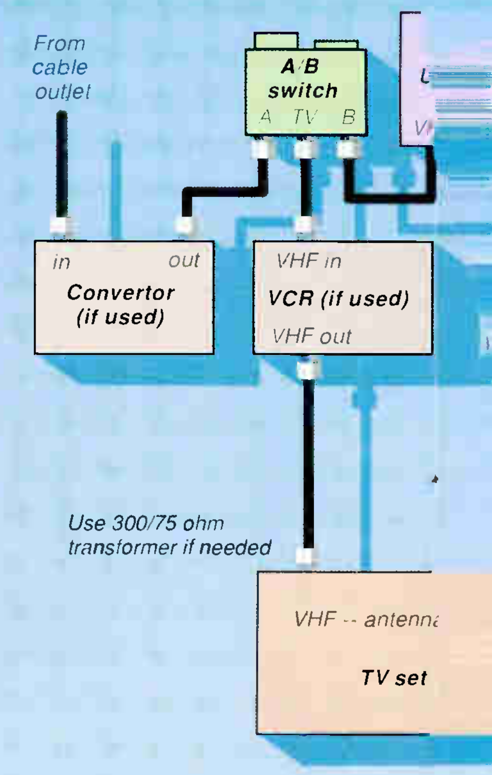
U/V splitter
VHF UHF

in out
Convertor (if used)

VHF in
VCR (if used)
VHF out

300/75

VHF -- antenna -- UHF
TV set


From cable outlet

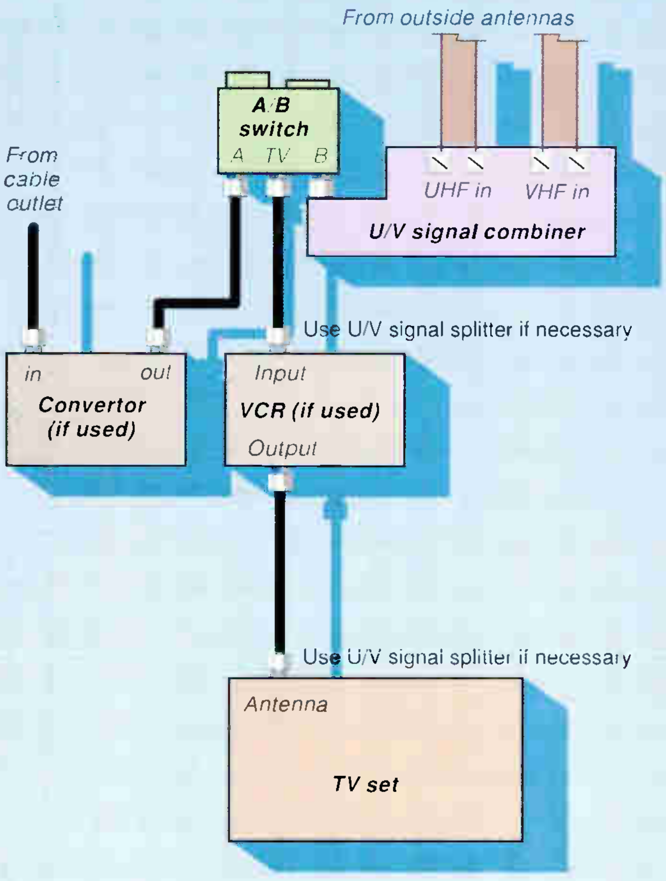
A/B switch
A TV B

in out
Convertor (if used)

VHF in
VCR (if used)
VHF out

Use 300/75 ohm transformer if needed

VHF -- antenna
TV set


From outside antennas

From cable outlet

A/B switch
A TV B

UHF in VHF in
U/V signal combiner

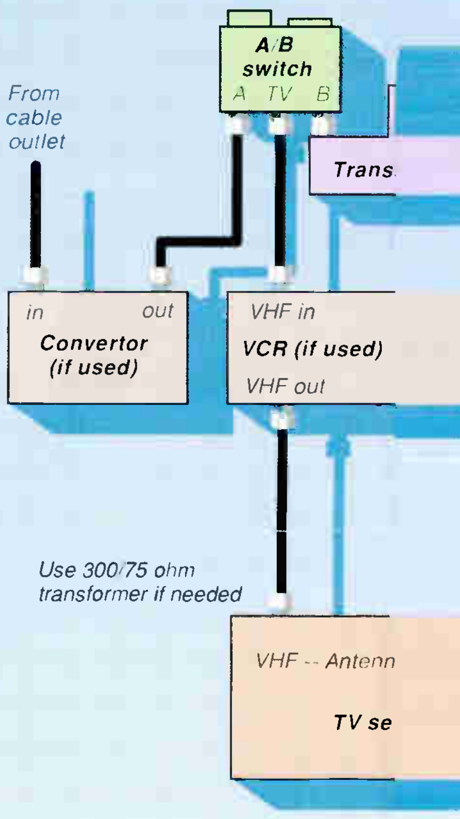
Use U/V signal splitter if necessary

in out
Convertor (if used)

Input
VCR (if used)
Output

Use U/V signal splitter if necessary

Antenna
TV set


From cable outlet

A/B switch
A TV B

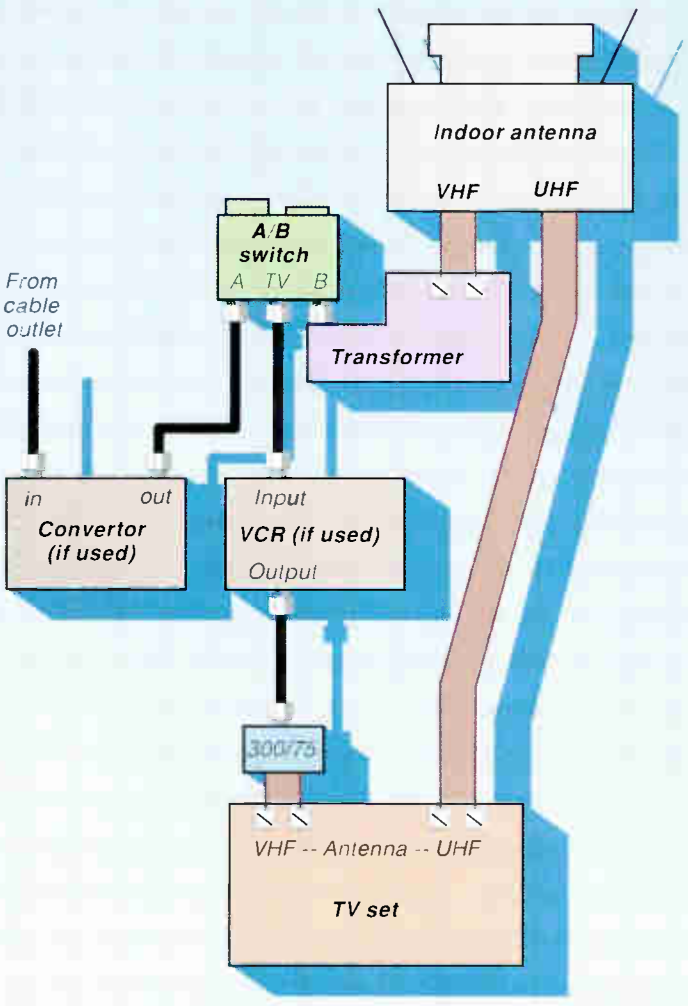
Trans

in out
Convertor (if used)

VHF in
VCR (if used)
VHF out

Use 300/75 ohm transformer if needed

VHF -- Antenn
TV se


Indoor antenna
VHF UHF

From cable outlet

A/B switch
A TV B

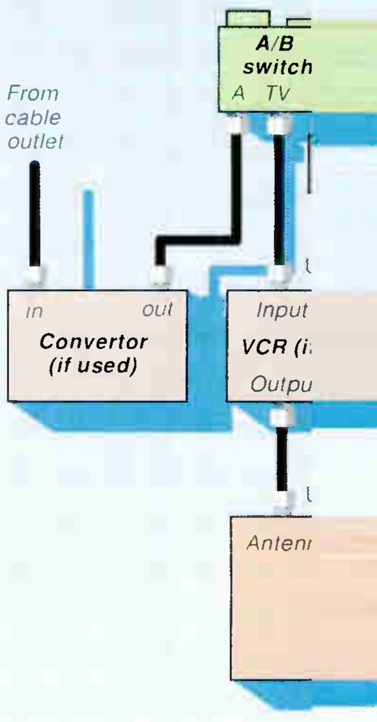
Transformer

in out
Convertor (if used)

Input
VCR (if used)
Output

300/75

VHF -- Antenna -- UHF
TV set


From cable outlet

A/B switch
A TV

in out
Convertor (if used)

Input
VCR (i
Outpu

Anten

- **Quality drop**
- **Up to 1 GHz**
- **Standardize programs.**
- **Reduced m& CLI leaka**

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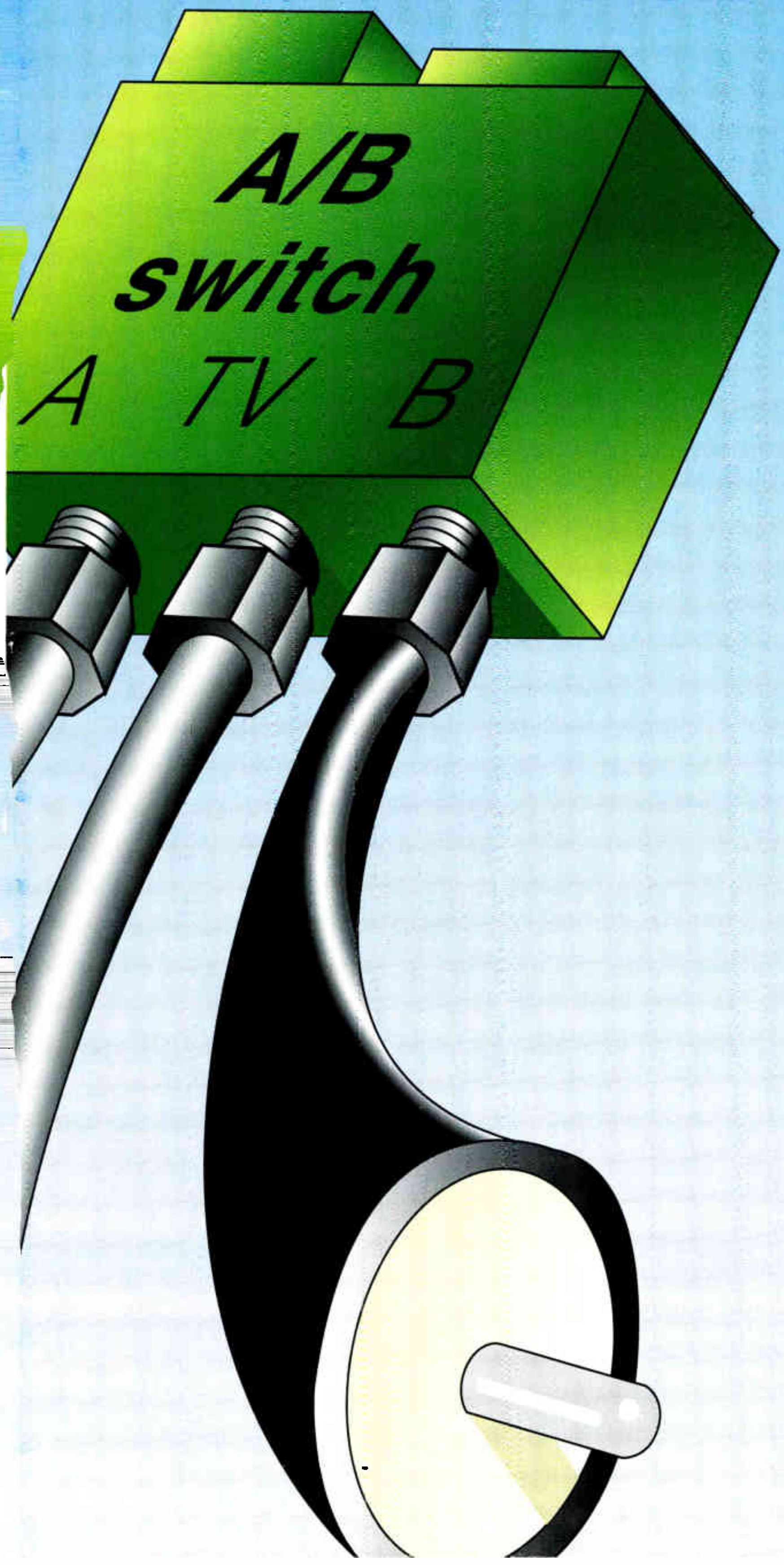
COMMON A/B SWITCH CONFIGURATIONS



With the implementation of the 1992 Cable Act, customer service representatives and installers will be addressing myriad installation options involving A/B switches,VCRs, splitters and set-top convertors. These sometimes confusing installations will be made more complicated with the recent implementation of the 1993 Cable TV law requiring retransmission consent from local TV stations.

Some TV stations (either UHF, VHF or both) will be dropped from the local cable TV system but will still be available to the consumer by coupling an indoor or outdoor antenna to the cable TV system via an inexpensive but high-quality A/B switch or Video Control Center.

This poster diagrams 16 different configurations that might be used to install an A/B switch properly.

Some variables include whether the customer needs to use UHF, VHF or both, whether the antennas utilize 75 ohm coax or 300 ohm twin lead and if the indoor or outdoor antenna combines UHF and VHF on one line or have separate outputs for UHF and VHF.

Other variations include TV sets that may have a variety of antenna terminals (one combined coaxial terminal, coaxial VHF and screw terminals for UHF, or separate screw terminals for VHF and UHF).

Customers may or may not have a VCR and/or a convertor. The VCR might have another whole variety of VHF and UHF terminals.

The customer might want to utilize the tuner in either the TV, VCR or set-top convertor for various features.

The following poster has been designed to be displayed in customer service phone rooms, cable TV lobbies, inside walls of installer trucks and other areas where *visualizing* the many different ways to hook up cable TV might be of benefit to the customer service rep, installer or customer.

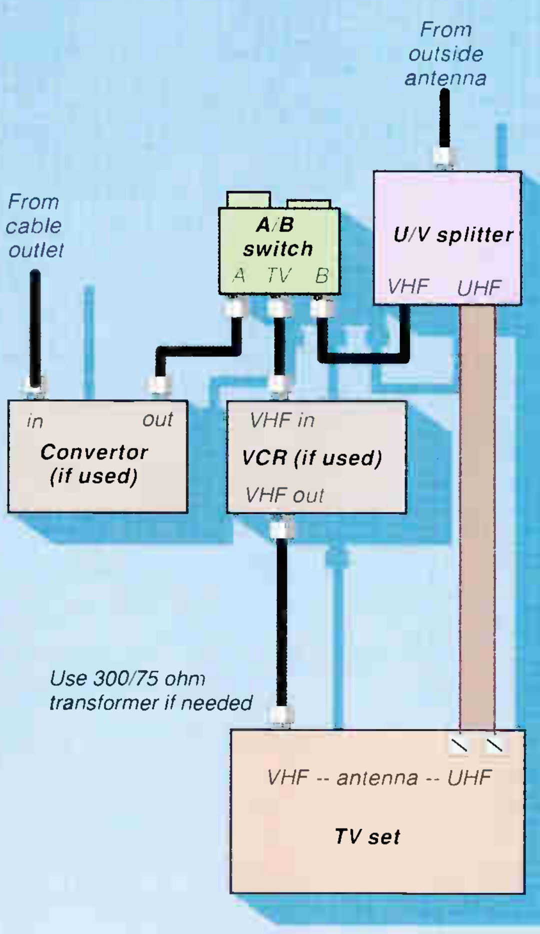
A/B SWITC

From outside antenna

/V splitter

F UHF

-- UHF



From outside antenna

From cable outlet

A/B switch

A TV B

U/V splitter

VHF UHF

in out

Convertor (if used)

VHF in

VCR (if used)

VHF out

Use 300/75 ohm transformer if needed

VHF -- antenna -- UHF

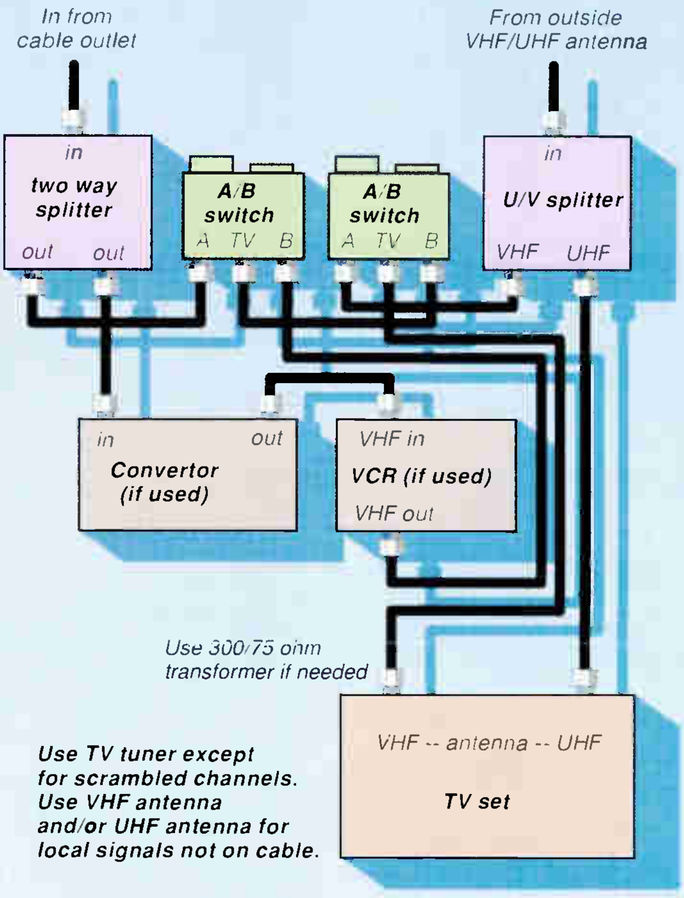
TV set

om outside antennas

VHF UHF

ormer

-- UHF



In from cable outlet

From outside VHF/UHF antenna

in

two way splitter

out out

A/B switch

A TV B

A/B switch

A TV B

in

U/V splitter

VHF UHF

in out

Convertor (if used)

VHF in

VCR (if used)

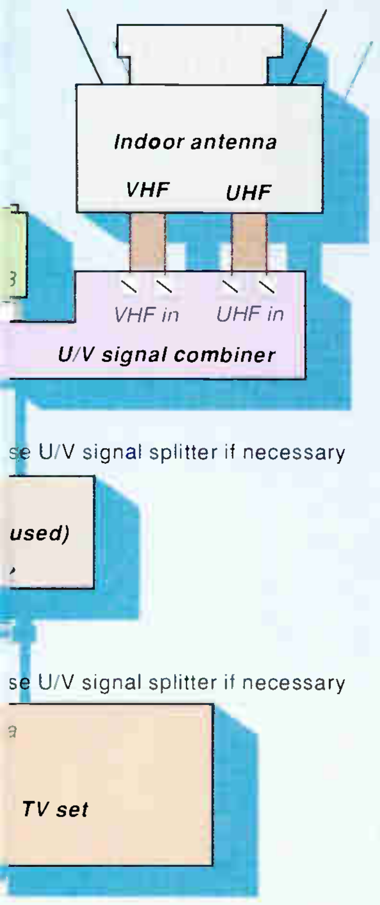
VHF out

Use 300/75 ohm transformer if needed

VHF -- antenna -- UHF

TV set

Use TV tuner except for scrambled channels. Use VHF antenna and/or UHF antenna for local signals not on cable.



Indoor antenna

VHF UHF

VHF in UHF in

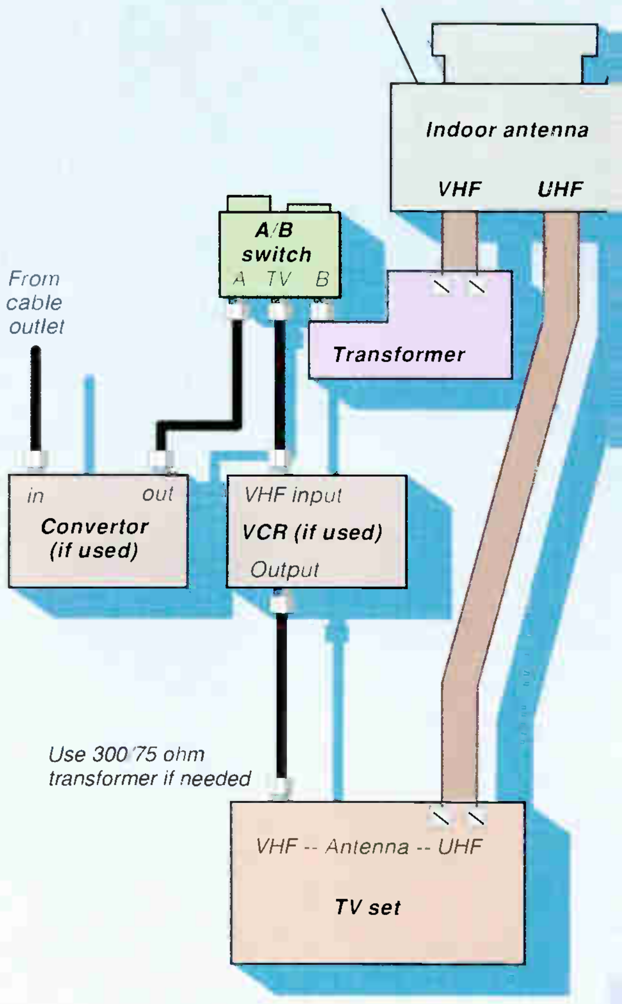
U/V signal combiner

se U/V signal splitter if necessary

used)

se U/V signal splitter if necessary

TV set



Indoor antenna

VHF UHF

A/B switch

A TV B

Transformer

From cable outlet

in out

Convertor (if used)

VHF input

VCR (if used)

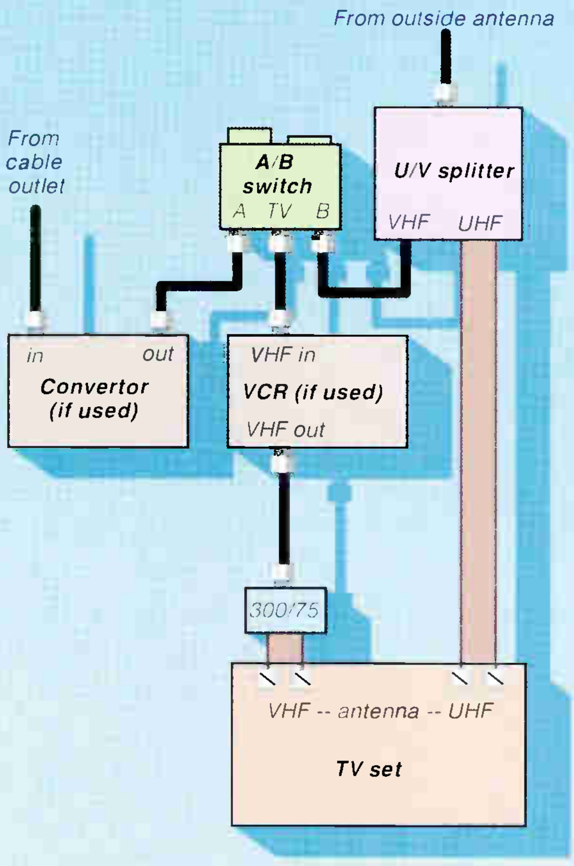
Output

Use 300/75 ohm transformer if needed

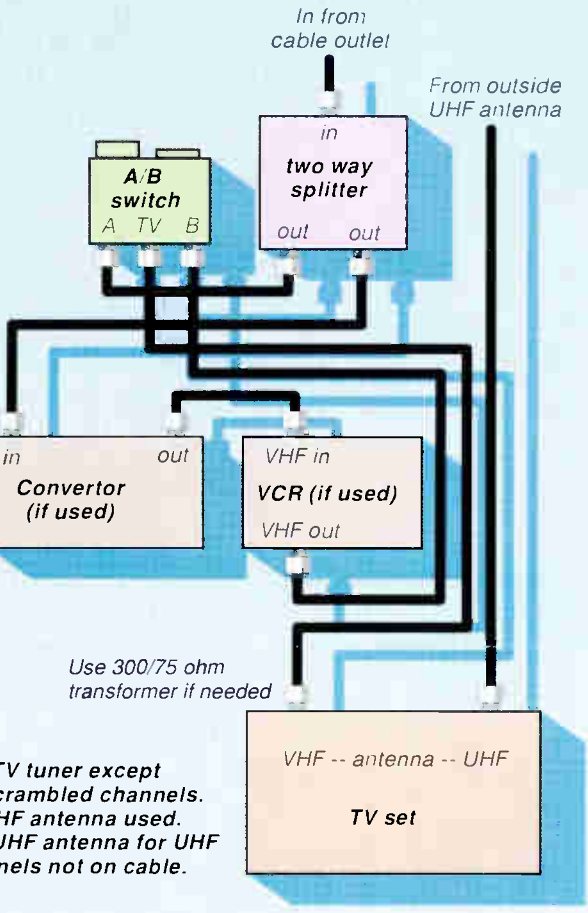
VHF -- Antenna -- UHF

TV set

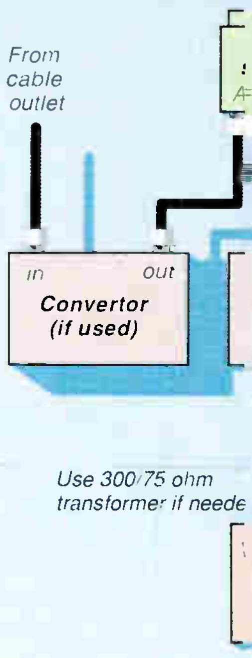
H CONFIG

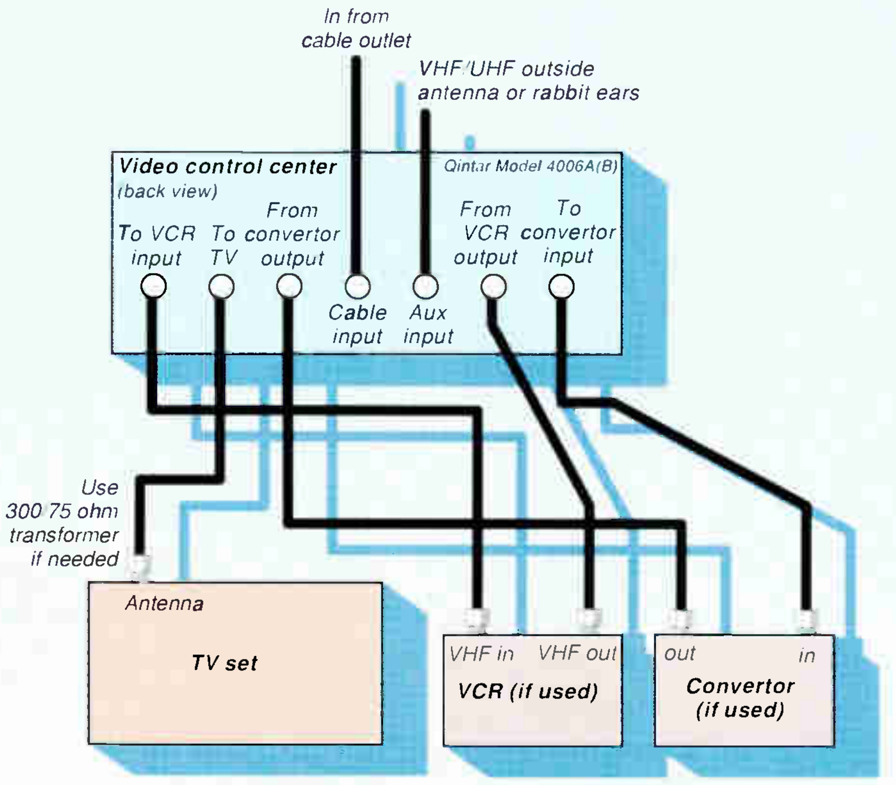


Use 300/75 ohm transformer if nee



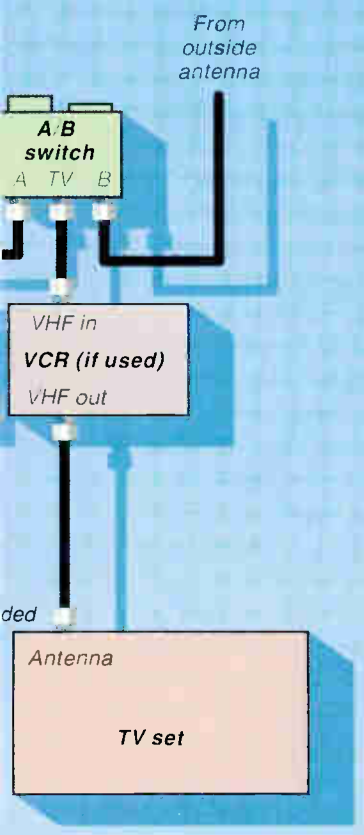
Use TV tuner except
for scrambled channels.
No VHF antenna used.
Use UHF antenna for UHF
channels not on cable.

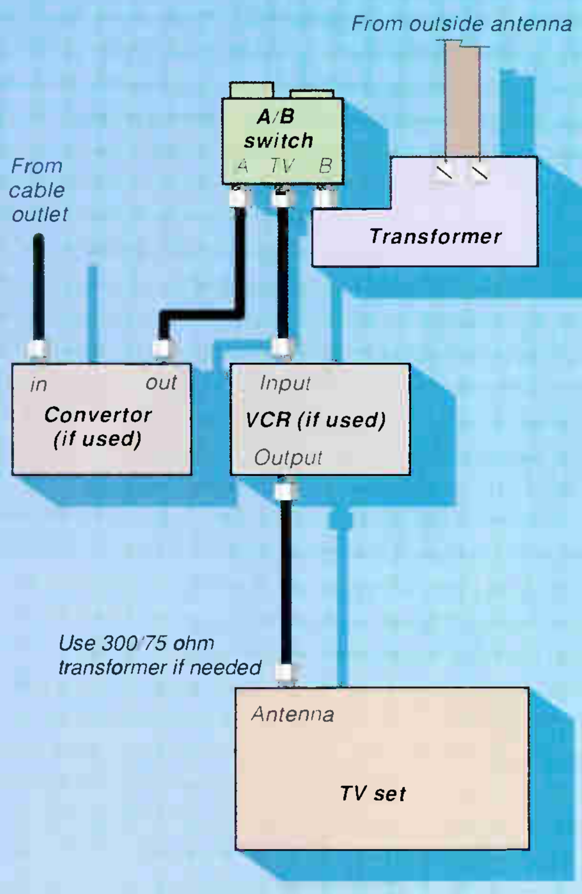


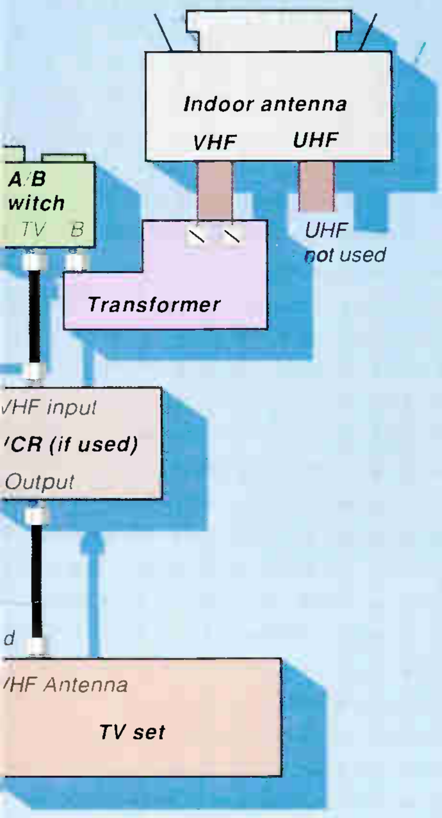


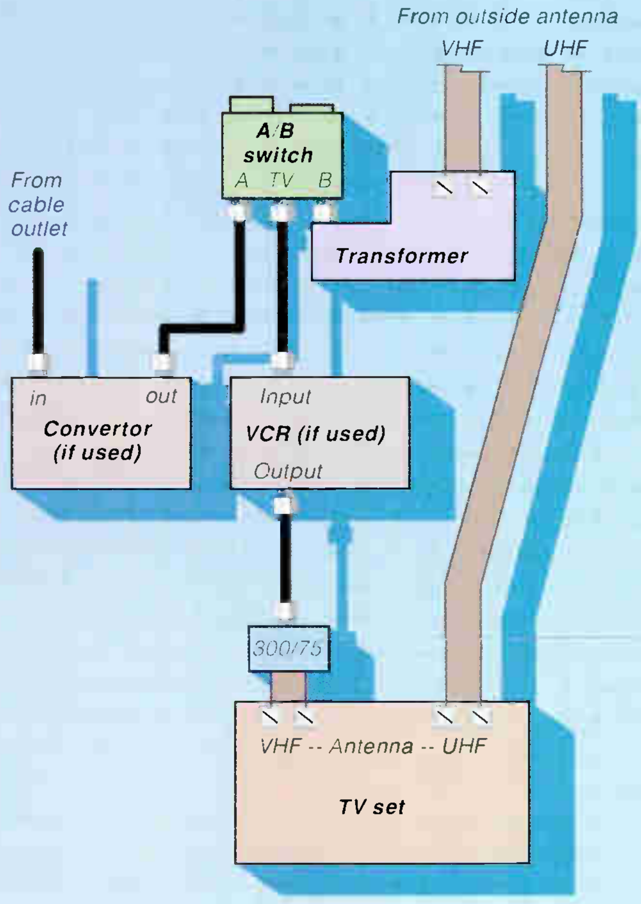
Use TV tuner for all cable or local stations except scrambled channels.
Record scrambled channel while viewing basic or off air channel.
Use antenna or rabbit ears for any local channel not on cable.

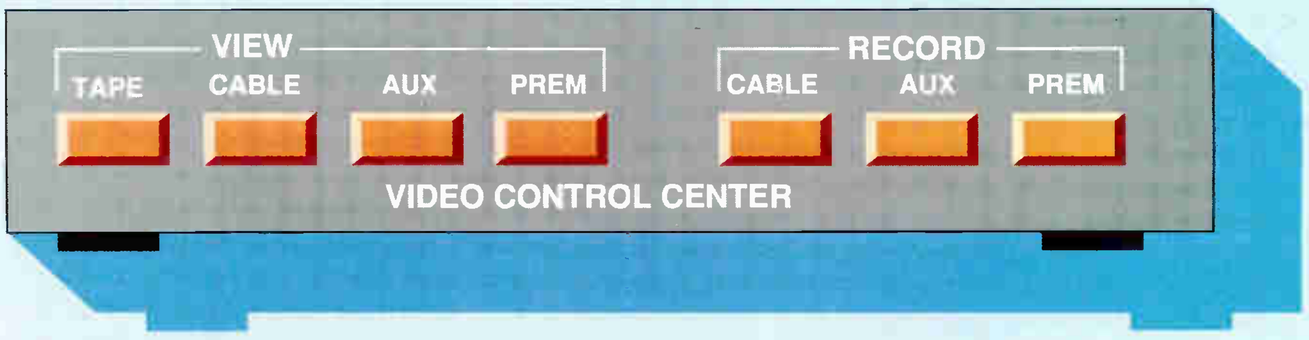
URATIONS











Diagrams supplied by David Large, Vice President of Intermedia Partners, and Randy Tishkoff, President of Qintar, Inc.

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TABLE 1

CATV performance prior to fiber

Forward pass band	54 to 450 MHz
Return pass band	5 to 30 MHz
Carrier-to-noise ratio (CNR)	43 to 45 dB
Composite triple beat (CTB)	-50 to -53 dB
Cross modulation (XMOD)	-50 to -53 dB

of signal traffic and load characteristics, this approach is particularly efficient for long-range planning.

Cell sizes will vary depending on the load and traffic requirements of the signals. A particular cell type can cover a range of subscribers to provide the required services, but performance should not degrade abruptly if the network experiences high demand.

The fiber node that feeds a cell within a system can be linked to the headend directly via fiber optic cable, or indirectly via a hub site. Several systems may also be connected via microwave or fiber (digital or FM), creating a cell that transcends the system level. At all levels, cell sizes must be large enough to be cost effective; a sufficient number of potential subscribers must be passed to share the cost of the plant. At the same time, cell sizes must be small enough for the network to handle the expected near-term services.

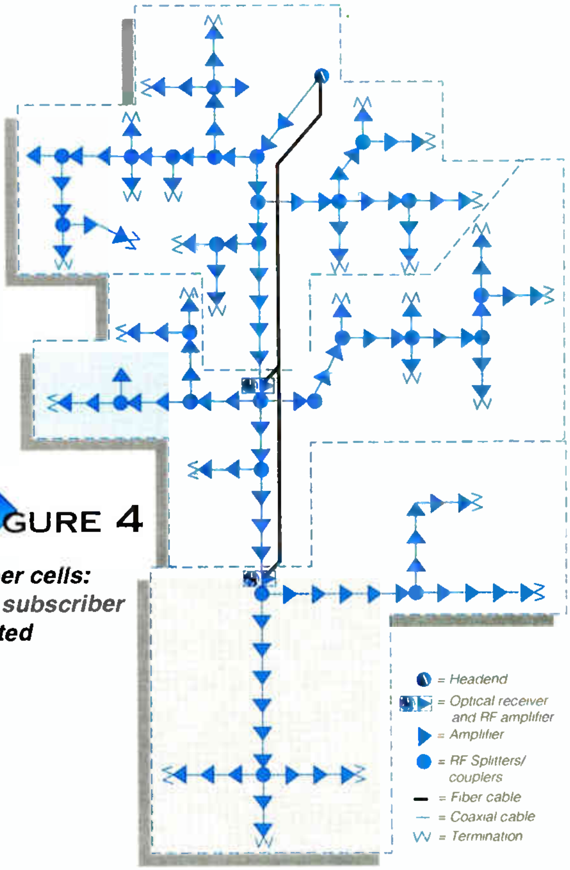
The following cell sizes provide a useful range of choices in designing or upgrading fiber architectures.

✔ Supra cell: multiple headends interconnected
✔ Super cell: 7,000 to 9,000 homes passed
✔ Standard cell: 2,000 to 2,500 homes passed
✔ Mini cell: 500 to 650 homes passed
✔ Micro cell: 100 to 150 homes passed
✔ Pico cell: Fewer than 50 homes passed

As cell sizes decrease, the optical fiber replaces more and more coaxial cable. While a super cell has both optical coaxial trunk, standard cells may have all optical trunk with coaxial feeder, and a pico

FIGURE 4

Super cells: Not subscriber limited



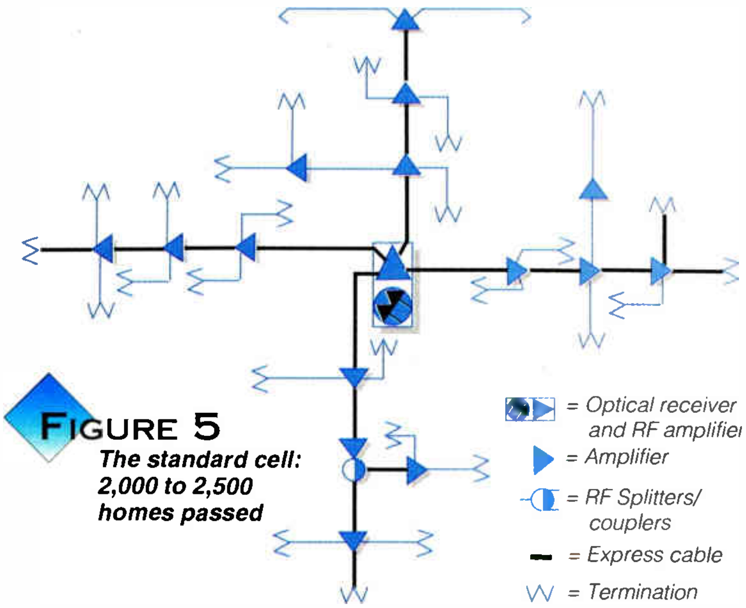


FIGURE 5
The standard cell: 2,000 to 2,500 homes passed

cell may have optical trunk with either coaxial or optical drops. Figure 1 indicates how the cell sizes relate to common CATV terms.

Before determining how to segment a CATV system, an operator should consider these factors:

✔ the number of subscribers opting for service, particularly two-way services
✔ the traffic and load characteristics of the delivered services, including the number of upstream and downstream channels which are available, and
✔ the geographic distribution of population, since a heavily populated urban system offers economies that are not available in a rural system.

System design is a difficult task. Fortunately, the cellular approach facilitates planning, making the design of a newbuild or rebuild flexible enough to be subdivided in the future. When designing an upgraded plant, it is more difficult to add this flexibility, since the justification for an upgrade is to use as much of the existing cable as possible. However, all designs should allow a sufficient number of fibers to the node to avoid additional wiring costs if and when the cell is subdivided.

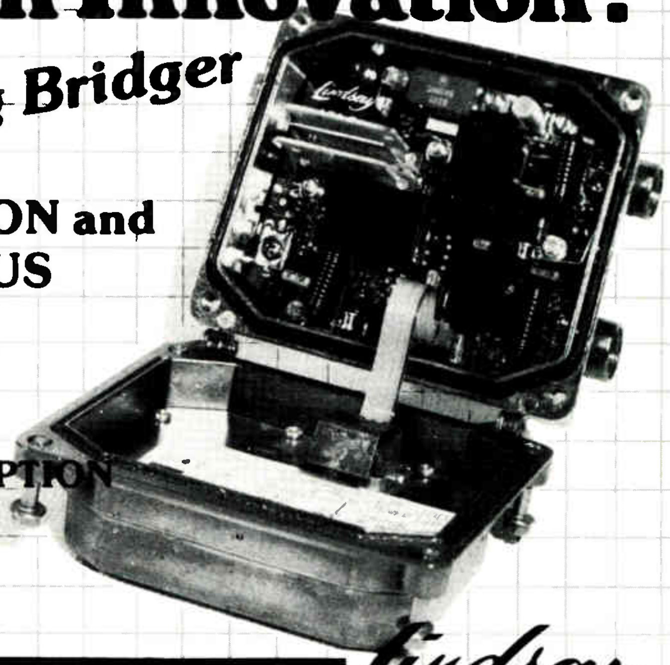
Smaller cell sizes increase system capacity because the spectrum is reused. Figure 2 shows how cells may evolve to smaller sizes. In general, cell size will decrease one level at a time. New or rebuilt plant may jump directly to the mini cell level with current technology. Further reductions to the micro or pico cell are presently undergoing field tests in a number of domestic and international locations.

The supra cell

Although this article focuses on subdividing a system served by a single headend, it is worth discussing the highest cellular level, the supra cell (see Figure 3). Supra cells allow for the creation of both regional and national information distribution networks.

The supra cell links headends using digital or FM fiber, microwaves, satellites or a combination of these technologies. A bidirectional ring provides redundancy in case one of the transmission legs fails. A sophisticated regional headend could be equipped for:

✔ network management
✔ satellite communications
✔ microwave communications
✔ local channel, off-air reception



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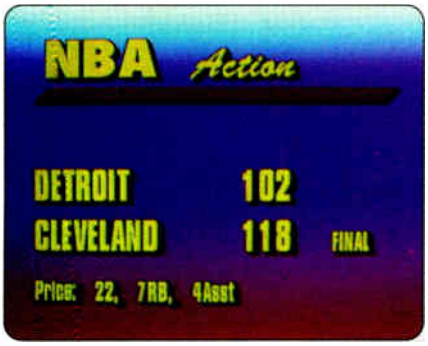

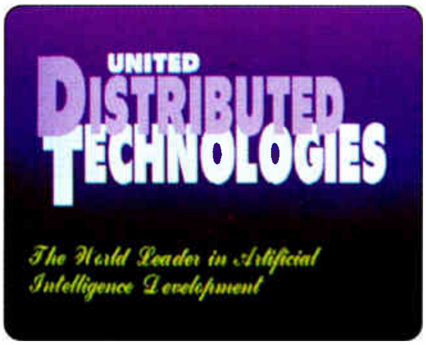

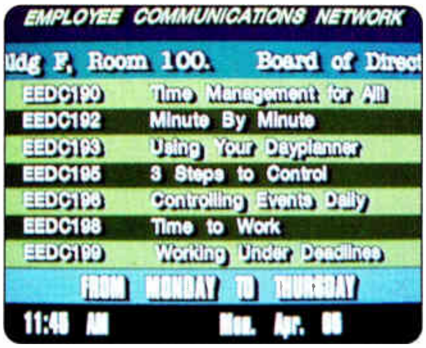

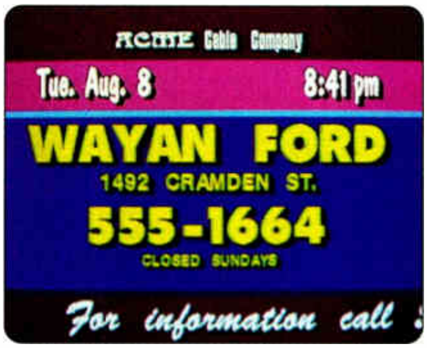

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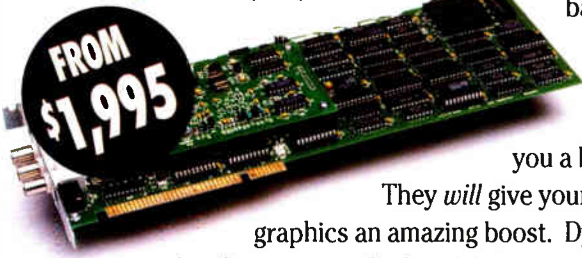

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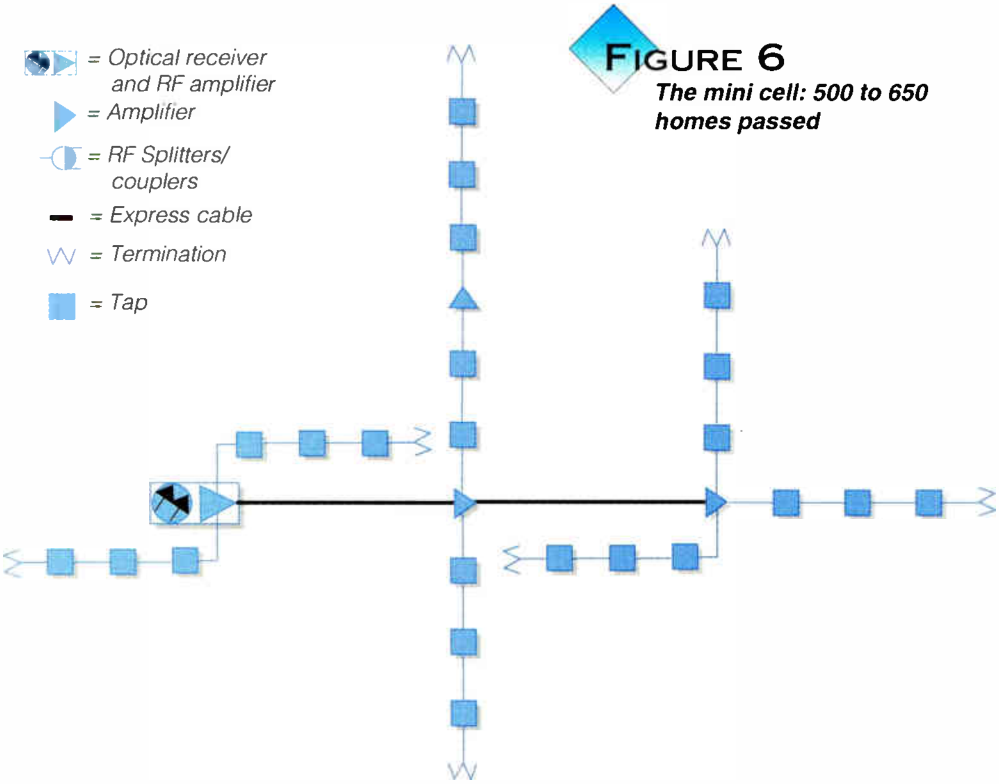


FIGURE 6

The mini cell: 500 to 650 homes passed

- ✔ bulk storage for pay-per-view (PPV) or near video on demand (NVOD)
- ✔ multimedia distribution
- ✔ compression/decompression of video signals
- ✔ advertisement insertion
- ✔ program guide
- ✔ telephony switching and cross-connection facilities.

Local headends will still retain many of their traditional functions. They will process signals for use in the local CATV plant, providing access for local origination (LO) and allowing local control of advertising, PPV, NVOD, program guides and other services. As part of a larger network, the local headend can be a concentration point for telephony or data services. It will be necessary for a local headend to contain equipment for repeating signals to the adjacent headends so that signal continuity is maintained.

Such networks represent a new degree of complexity in the CATV industry; however, systems incorporating some of the functions listed above already exist, or are in the planning stages. For example, Rogers Cablesystems has built such a ring network in the Toronto/Peel area,[1] and Continental Cablevision is planning

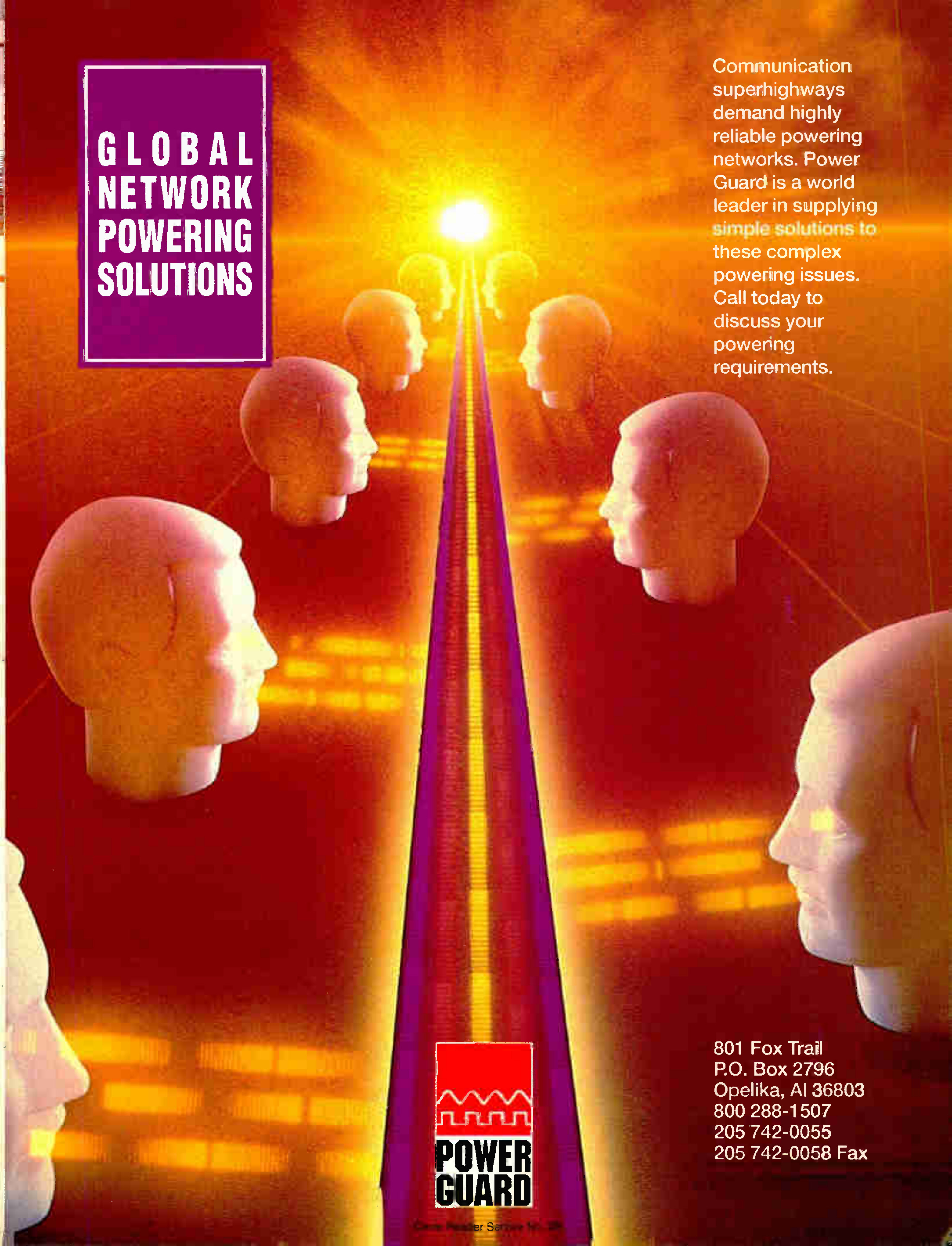
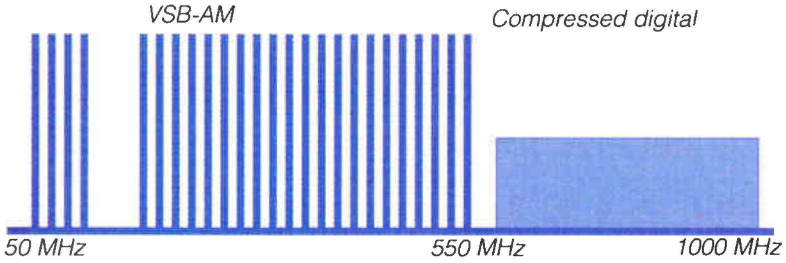


FIGURE 7

One GHz distribution plant: Spectrum configuration



such a network in southern New Hampshire[2]. Cable Television Laboratories[3] and the Deutsche Bundespost-Telekom have also studied such ring networks. The German version, called DIMOSAURUS, is intended to carry both video and telephone signals in a redundant ring. Signals from local headends will be sent to subscribers via passive optical networks (PONs.)

The super cell

In the late 1980s, fiber optics were used in supertrunking applications to upgrade the bandwidth of an existing plant. Because of the cost of optoelectronics at the time, it was thought necessary to spread the cost of hardware and construction over a large base of subscribers, roughly 7,000 to 9,000 homes. Current pricing makes building smaller cells practical, so super cells (see Figure 4) are not often built today.

Two fundamental styles of architecture emerged at this time, both of them still in use today: the fiber backbone (FBB) and the cable area network (CAN). Typically, an existing system is divided into a number of large cells with given cascade or performance limits. Ideally, all mainstation locations are maintained even if the system is upgraded to a larger bandwidth.

The CAN is essentially a fiber network overlaid on the RF network. In a CAN, existing mainstations remain in their original positions to provide a backup to the optical node in case of failure in the optical path. In the FBB, a fiber node is inserted in the middle of an existing span of RF mainstations, creating two shorter spans. One of these spans remains unchanged. In the other span, all mainstations are turned around, maximizing the geographic area covered by a node. Although the FBB offers no coaxial redundancy, it calls for nearly half as many node sites as a CAN.

AM fiber optics improves reliability by reducing the number of actives between the subscriber and the headend. Cascade reduction also means improvements in CNR and distortion. In a bandwidth expansion, high distribution levels overcome the increased cable attenuation and passive insertion losses; however, higher outputs increase the distortion products. Reducing the cascade makes it possible to have high distribution levels with acceptable system performance. Table 2 shows the performance of a typical super cell.

Return still limited

The use of the return system is still limited in a super cell. The return bandwidth can be reused in several locations in the

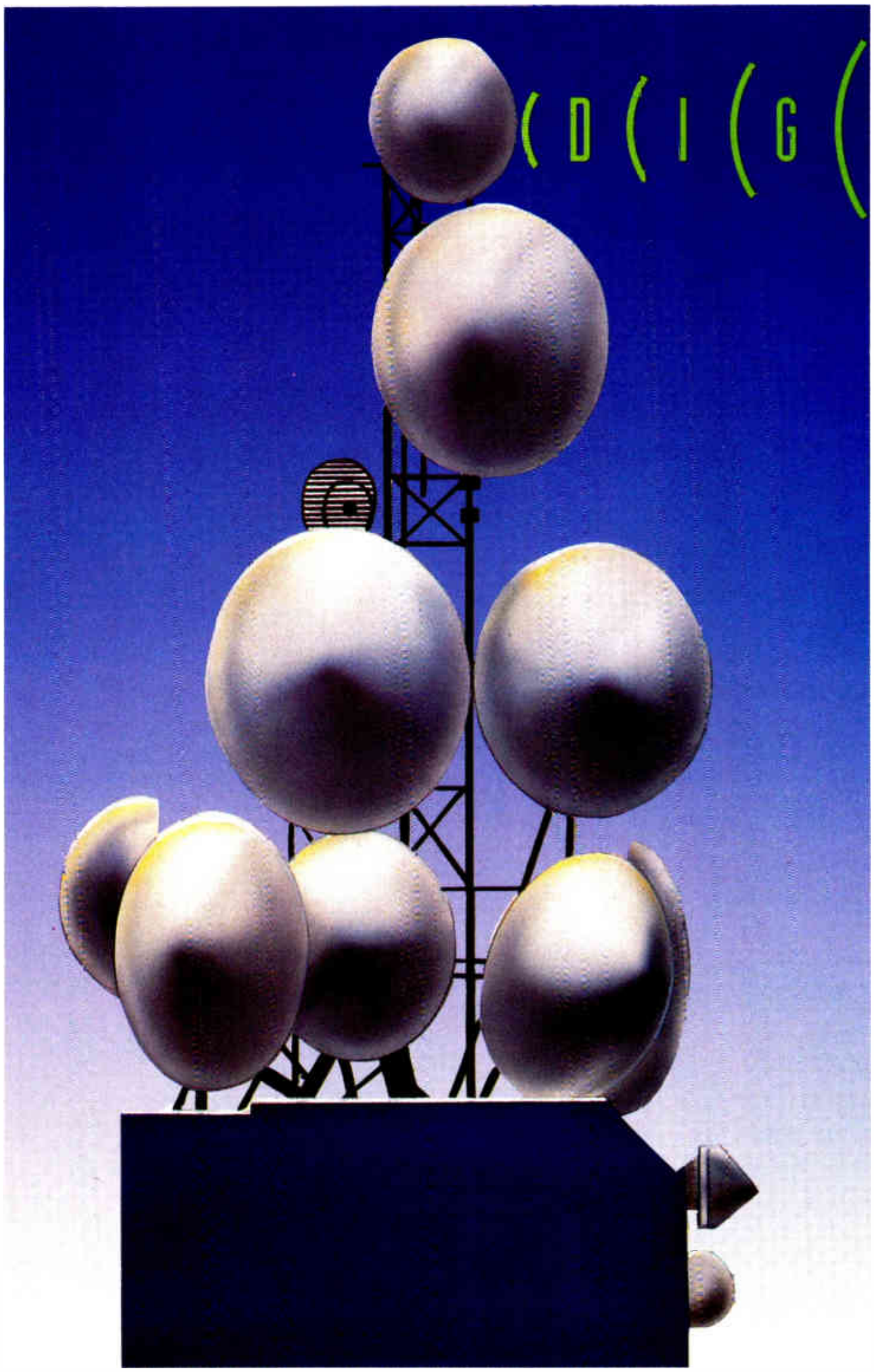

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TABLE 2

CATV performance in the super cell

Forward pass band	54 to 550 MHz
Return pass band	5 to 30 MHz
Typical trunk cascade	10 to 15
Carrier-to-noise ratio (CNR)	45 to 47 dB
Composite triple beat (CTB)	-51 to -53 dB
Cross modulation (XMOD)	-52 to -53 dB

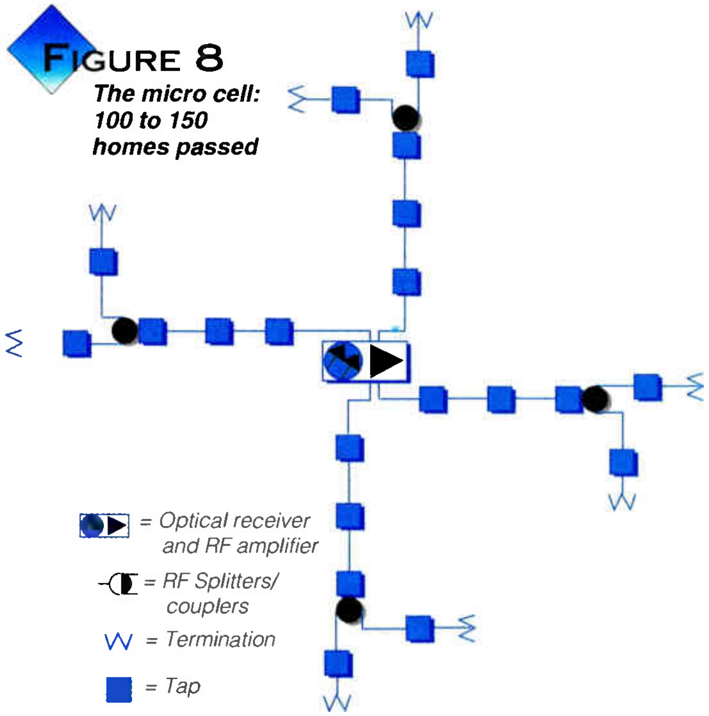
TABLE 3

CATV performance in the standard cell

Forward pass band	54 to 700 MHz
Return pass band	5 to 30 MHz
Typical amplifier cascade	4 to 8
Carrier-to-noise ratio (CNR)	48 to 50 dB
Composite triple beat (CTB)	-53 to -55 dB
Cross modulation (XMOD)	<-53 dB

FIGURE 8

The micro cell: 100 to 150 homes passed



plant, and relatively few upstream sources mean simpler switches are needed at the headend. Noise accumulation in the return plant is still a problem, because the effective cascade of an amplifier type is the square root of the actual cascade times the number of active amplifiers. Shutting down unused return paths helps control the noise.

Typical network

The typical fiber network in the super cell uses AM signals to avoid processing at the node. The optical transmitters typically use the 1310 nm window, although the 1550 nm window may be used. In the forward path, the optical transmitters may use distributed feedback (DFB) or externally-modulated lasers; the return transmitter at the node can be a DFB or Fabry-Perot (FP) laser, depending on the performance required.

With careful planning, the cascade of an existing FBB or CAN can be decreased and the network segmented to the next cell level, the standard cell, as illustrated in Figure 5. Such smaller cascades are often called "mini-CANs" or "mini-FBBs."

The standard cell

By adding more nodes, transmitters and fiber optic cable, a system can be divided into standard cells, which cover 2,000 to 2,500 homes, roughly equivalent to the telephone carrier service area (CSA) serving about 3,000 homes (see Figure 5). The standard cell is probably the cell size of choice today, but given the rapid technological advances and cost reductions in optoelectronics, this is likely to change.

The standard cell is an ideal size for providing bi-directional voice, data or other switched services. Earl Langenberg of US West[4] has assumed that for 56 bi-directional circuits in two RF (5.5 MHz) channels with 2.5 century call seconds (CCS) loading typical of residential and light commercial areas, 625 users can coexist on the 56 available circuits with only one call blocked out of 100.

(One century call second, or CCS, equals 100 seconds per hour of telephone use. Blocking is the inability of the calling party to be connected with the called party because of busy voice or switching paths. For more information about telephone traffic analysis, as developed by A.K. Erlang, refer to the second edition of


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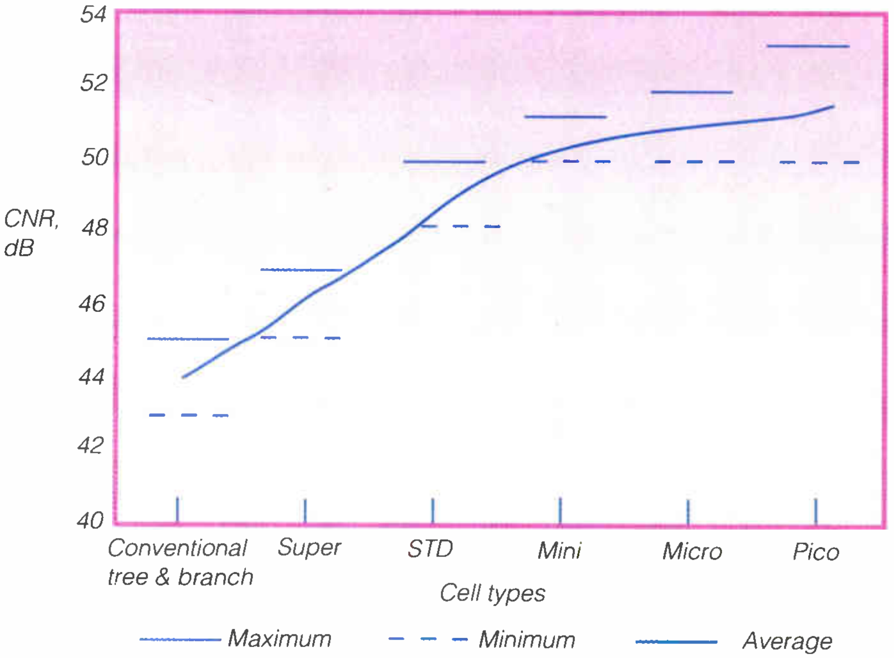
FIGURE 9

Carrier-to-noise ratio (CNR) performance



Digital Telephone, written by John Bellamy and published by John Wiley and Sons Inc., New York, N.Y. 1991.)

Assuming that the bi-directional services will show an initial penetration of 25 percent, the standard cell should cover a maximum of 2,500 homes.

Several CATV terms are associated with the standard cell, reflecting the current importance of this cell size. Some of the more common terms are listed here, with a brief explanation of their characteristics.

Fiber to the feeder (FTF) is the most commonly used name. In this case, fiber is used as the trunk line to the coaxial distribution portion of the plant. Typically, no mainstations are used after the node. Instead, short cascades of four to eight line extenders or network (distribution) amplifiers are used to provide signal to the feeder plant. Some or all of the amplifiers will use some form of automatic gain or level control, typically with a single pilot.

Usually, the plant will be designed in a star pattern, using untapped express cable between the node and the first amplifier. Untapped cable can also be used after the first amplifier to allow for further system segmentation. With the latter option, the feeder plant resembles a miniature tree-and-branch network.

Fiber to the line extender (FTLE) is another term roughly equivalent to FTF, specifying that no mainstations are used in the distribution.

This architecture can be used in new or rebuilt plant. Existing plant can be upgraded to FTF as well, using the existing trunk cable as the express cable, but because upgrades require using as much of the existing cable as is practical, design compromises inevitably result.

The standard cell can be limited by population or performance. In the former case, the population range corresponds to the limits of the standard cell: 2,000 to 2,500 homes passed.

The performance constraints will limit the physical size of the plant. Except for in rural areas, a node will usually cover a larger geographic area when limited by performance alone.

Fiber to the service area (FSA) does not define a particular architecture. The idea of the FSA is to serve a defined population–2,000 to 2,500 homes–with cascades limited to four to eight amplifiers.

Existing plant can be upgraded to a standard cell using FBBs or CANs with shorter cascades of amplifiers: mini-FBBs or mini-CANs. Once again, the object is to feed 2,000 to 2,500 homes.

Forward intermediate/terminating trunk (FITT) is a variation of the FBB or CAN architectures, with the same population limits as the mini-FBB or mini-CAN. FITT is used when the gain of the trunk amplifier is not able to compensate for the increased cable attenuation and increased passive insertion losses between existing mainstation locations when the bandwidth is enlarged. It allows the designer to maintain the locations of bridger ports without overlashing new trunk cable.

With FITT, an amplifier is placed in the trunk between existing mainstation loca-

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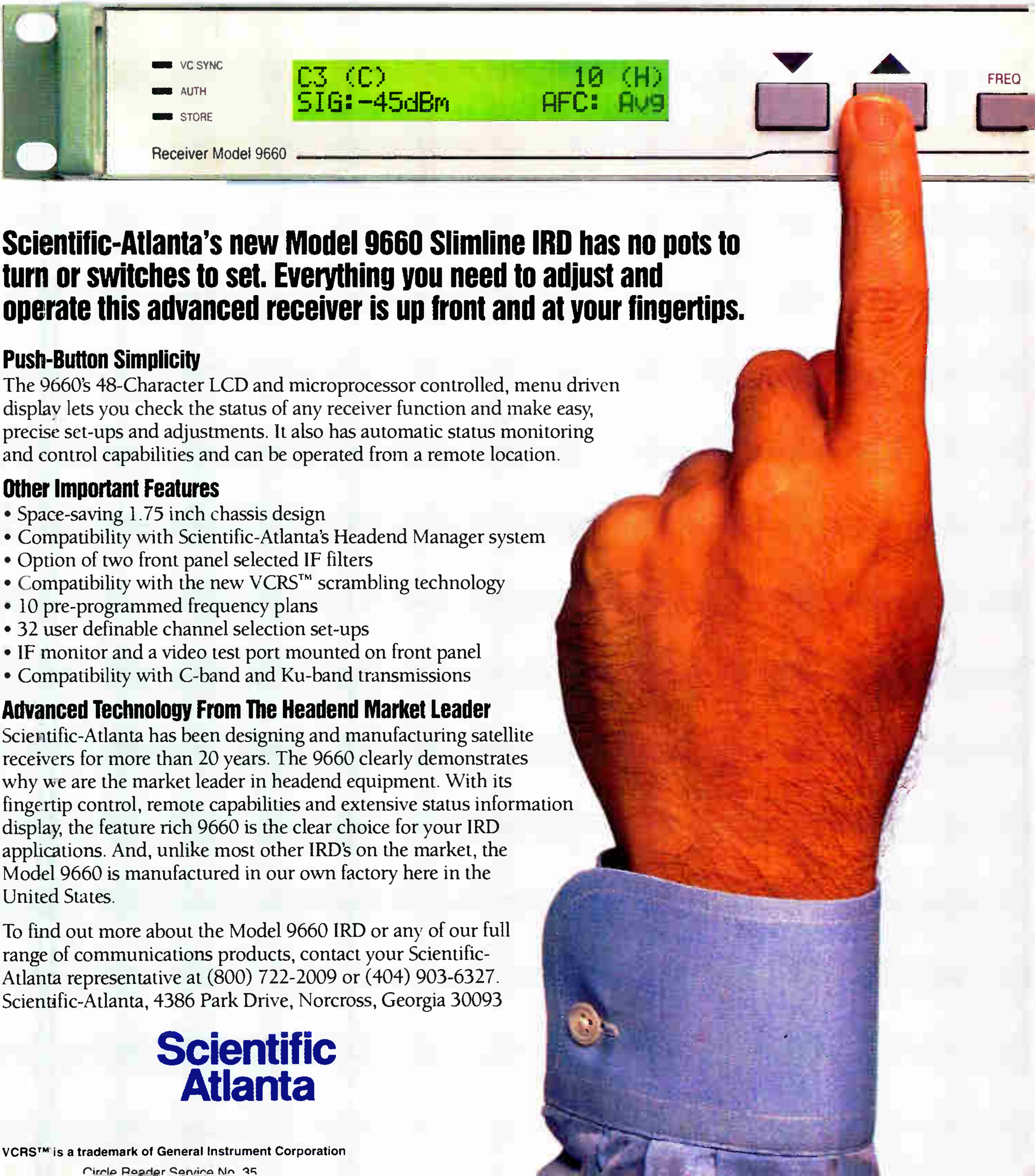

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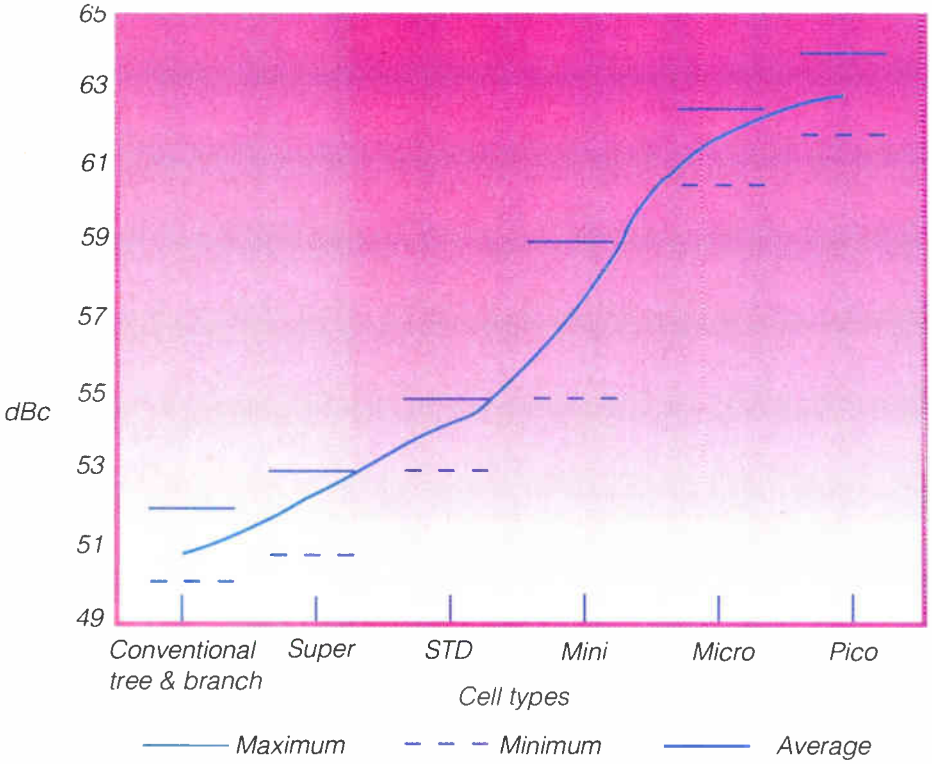
FIGURE 10

Composite triple beat performance



tions to overcome the intervening losses. This booster amplifier will feed mainstations via internal or external RF splitters; the mainstations are then terminated at their existing locations.

The desired performance of a standard cell is shown in Table 3. These are typical of current design criteria. Because of the short cascades, the performance will be more uniform throughout the plant; thus, those subscribers far from the headend will have performance comparable to subscribers near the headend.

Heavy fiber infusion

Implementing these designs requires a heavy infusion of fiber. Bundle size will be twice or three times that of a system designed for super cells, making restoration of damaged fiber and important concern for the operator. The fiber network is typically fed with AM signals using DFB or externally modulated lasers in the 1310 nm window, although some operators are using the 1550 nm window. Return signals may be transmitted by DFB or FP lasers, depending on the system requirements.

The short cascades will improve the reliability of the RF plant; a failure anywhere in the cell cannot affect those homes which are outside the cell. The effect of power outages can be minimized by using standby line power supplies (LPSs) at node locations. Other LPSs may not need standby powering, because it is likely that the homes covered by these LPSs will be in the same area where the local power grid has failed.

Fiber systems offer reliable transmission, but a failure in the fiber plant can have long-range results. Because large bundle counts of 80 to 100 fibers are not uncommon near the headend area, restoring the system will take a substantial amount of time, even if active fibers are spliced first. To ensure that active fibers have the highest priority during restoration, it will be necessary to maintain accurate records of fiber use for all fiber cable segments.

The reduction in the number of amplifiers for a given node means that the noise accumulation in the return system, which was a significant limitation for larger cell sizes, is typically not a problem.

The small return bandwidth is reused at each cell, so the effective return bandwidth can be very large. Taking full advantage of the return system will require sophisticated switching or patching at the headend.

The standard cell allows narrowcasting, the selective transmission of specialized signals.

The market segmentation resulting from the cellular structure of the plant offers the potential for a wide variety of services, such as:

✔ NVOD

- ✔ impulse pay-per-view (IPPV)
- ✔ PCN
- ✔ direct market advertising
- ✔ alternate access to long-distance telephone carriers
- ✔ data transmission
- ✔ culturally diverse programming
- ✔local origination.

The mini cell

The mini-cell shown in Figure 6 is the smallest level of system segmentation that is cost-competitive within today's technology. It will probably be implemented in urban or suburban areas at first. A mini cell has a small cascade; two to four amplifiers (line extenders or network amplifiers) are typical, because the cascade needs to feed an area with only 500 to 650 homes.

Small cascades make it practical to build a plant with a bandwidth to 1 GHz in an urban area. In a rural area, 750 MHz may be a more realistic goal because amplifier cascades will increase to cover greater geographical areas.

The mini cell can be upgraded from a standard cell; this will be easiest if the cell had been designed with system segmentation in mind. Ideally constructed as part of a newly built or rebuilt plant, the mini cell can also be part of an upgrade from an existing system or super cell, although upgrades may not permit optimum node or amplifier placement.

The upper limit of the mini cell's size was selected to provide for 100 percent penetration of the bi-directional services cited in the discussion of standard cells: 625 potential users (rounded up to 650), or approximately one-fourth of a standard cell.

Video on demand (VOD) channel capacity determines the lower limit of the mini cell's size. For the 1-GHz spectrum shown in Figure 7, the first 500 MHz will carry VSB-AM signals, while the upper 450 MHz band may carry unmodulated digital traffic.[5]

Assuming that the 600 MHz to 1,000 MHz band (66 NTSC channels) carries VOD signals compressed at a 4:1 ratio, 264 separate selections are available at any one time. A 50 percent penetration of VOD subscribers means 528 homes passed; this figure is rounded down to 500 homes.

There is little field or design experience for cells of this size, so forecasting levels of performance is difficult. The performance specifications shown in Table 4 are based on the expected performance for the spectrum use illustrated in Figure 7.

TABLE 4

Expected performance in the mini cell

Forward pass band	*50 to 1000 MHz*
Return pass band	*5 to 30 MHz*
Carrier-to-noise ratio (CNR)	*50 to 51 dB*
Composite triple beat (CTB)	*-55 to -59 dB*
Cross modulation (XMOD)	*-50 to -53 dB*

To meet the expected performance, split band optical transmission may be necessary. For example, one transmitter may carry the lower 40 VSB-AM channels, another the upper 40, while a third may carry all the modulated digital signals. The transmitters could use either the 1310 nm window, the 1550 nm window or, with wavelength division multiplexing (WDM), both windows can be used on a single fiber.

The latter option will reduce the number of fiber bundles which must be dedicated to each node site. A more sophisticated version of WDM, known as "coherent" transmission, has the potential to use some of the tremendous bandwidth of optical fiber.

Coherent transmission will combine the output of a number of optical transmitters whose wavelengths differ slightly and feed the combined signal over the optical network to the receiver. The receiver will use a tunable laser to recover the signal in much the same fashion as a heterodyned radio receiver works on conventional radio signal.

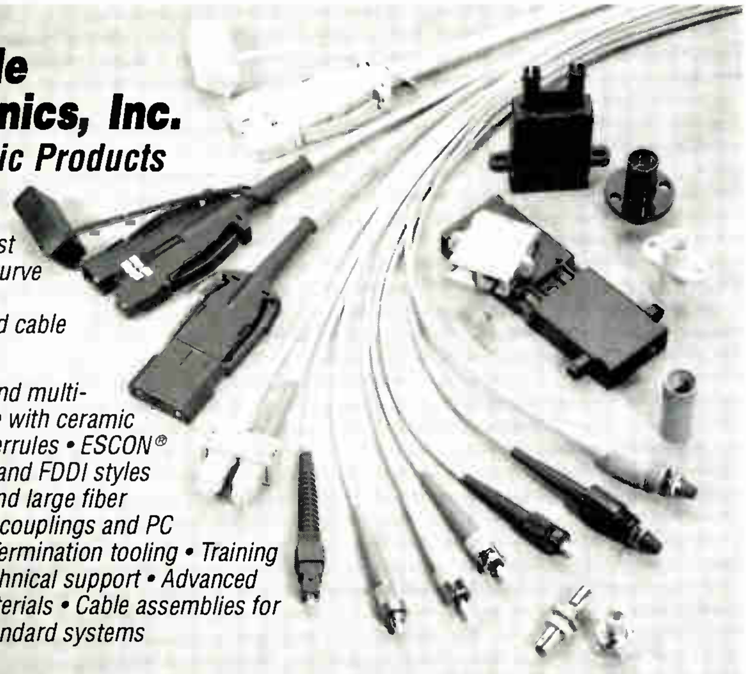
Each optical source can be considered to be an optical channel, capable of carrying a few hundred megahertz of bandwidth. Thus, by placing a number of optical channels in the 1310 nm and 1550 nm windows, a transmission network with a bandwidth of tens of gigahertz is possible.

The micro cell

The micro cell shown in Figure 8 is about one-fourth the size of a mini cell. Although cells this small are expensive to build, many field trials have been conducted at this level to determine the optimum configurations of fiber and actives. Signals may be a combination of analog and digital transmission.

In an urban area, micro cells include no actives past the node; rural areas may require one or two line extenders or network amplifiers to cover the projected 100 to 150 homes passed. With very few amplifiers in the RF plant and a standby LPS at the node, the entire cell is virtually immune to power outages.

The term "fiber to the bridger" (FTB) corresponds approximately to the micro cell. This is a network similar to FTF, with



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the distribution plant fed by bridger. The equivalent terms "fiber to the node (FTN)" and "fiber to the last amplifier (FTLA)" also apply to this cell size.

A cell with this size and channel capacity is capable of delivering a wide variety of services encompassing emerging technologies and services traditionally associated with telephony or CATV.

Telephony services might include plain old telephone service (POTS), broadband integrated services digital network (BISDN), packet switching and alarm/load control.

CATV services might include video delivery (including IPPV and VOD), FM/digital audio, emergency broadcasting and one-way data services. New technologies may provide picture phones, video conferences, facsimile services, electronic publishing, and interactive services such as home shopping, games and computer links.

Each subscriber should see broadcast-quality signals, with excellent noise and distortion characteristics, because there will be few active devices between the headend (or hub) and the home terminal unit. Table 5 indicates values that are possible with current technology.

Meeting these requirements for a large number of small cells without excessively large bundles of fiber optic cable will require some form of WDM. Coherent optical transmission holds great promise for a cost-effective optical system in this type of network.

TABLE 5

Expected performance in the micro cell

Forward pass band	*50 to 1000 MHz*
Return pass band	*5 to 30 MHz*
(Spectrum use may be realigned to meet future needs.)	
Carrier-to-noise ratio (CNR)	*50 to 52 dB*
Composite triple beat (CTB)	*-55 to -59 dB*

The pico cell

A system divided into pico cells, with fewer than 50 homes per cell, is the long-term goal of CATV and telephone companies. Building a pico cell plant requires state-of-the-art technology, making it quite expensive today, especially if existing copper drops must be replaced with glass. There are no set standards for construction, architecture, electronics, signaling protocol and so forth. However, telephone companies, sometimes in cooperation with CATV companies, are

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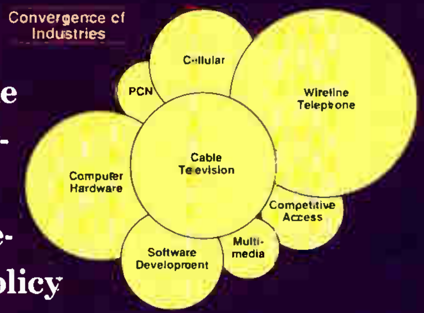

Between the administration's impetus and private industry's competitive agenda, the drive to install, upgrade and interconnect the network of networks that will form the information superhighway is shifting into high gear. What is cable's role? Where will the telephone networks take us? What will public policy dictate? What role will the consumers play? Convergence '93™ the Information Superhighway conference will provide you with the answers you need to set your company's strategic and technological blueprint for the information network of the future.

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conducting limited field trials.

The pico cell has been described as fiber to the home (FTTH), fiber to the curb (FTTC) and fiber to the tap (FTT). The latter is primarily a CATV term; the other terms are used in the telephone industry as well. The terms are similar in nature, differing primarily in the location of equipment and the number of subscribers served. New technologies should define these terms more precisely in the future.

TABLE 7

How the cells compare

	Super cell	Standard cell	Mini cell	Micro cell	Pico cell	
Forward pass band	*54 to 550*	*54 to 700*	*54 to 1000*	*54 to 1000*	*54 to 1000*	*MHz*
Return pass band	*5 to 30*	*5 to 30*	*5 to 30*	*5 to 30*	*5 to 30*	*MHz*
Carrier-to-noise ratio (CNR)	*45 to 47*	*48 to 50*	*50 to 51*	*50 to 52*	*49-53*	*dB*
Composite triple beat (CTB)	*-51 to -53*	*-53 to -55*	*-55 to -59*	*-60 to -62*	*-61 to -63*	*dB*
Cross modulation (XMOD)	*-52 to -53*	*<-53*	*?*	*?*	*?*	*dB*

For an FTTH system, light signals are fed to an optical interface unit at the home to serve a single user. However, the acronym may be used to indicate an interface to a multiple dwelling unit (MDU), which requires service to more than one subscriber.

TABLE 6

Expected performance in the pico cell

Forward pass band	*50 to 1000 MHz*
Return pass band	*5 to 30 MHz*
(Spectrum use may be realigned to meet future needs.)	
Carrier-to-noise ratio (CNR)	*49 to 53 dB*
Composite triple beat (CTB)	*-61 to -63 dB*

In FTTC, the optical interface may be located at the curb, or in the case of MDUs or businesses, near a building. The interface may feed from four to 50 subscribers, depending on system density.

FTT is similar in concept: the optical interface is at the tap and will serve about the same number of subscribers. For most purposes, the terms are equivalent. Expected pico cell performance is listed in Table 6.

Ideally, the pico cell will be able to support integrated services. Network switching will be transparent to the end user, regardless of whether there is a single network operator or multiple network operators. Some of the signal will probably be routed to all subscribers in a cell, while some will be switched to individual subscribers.

The cellular approach to defining broadband communications systems avoids the confusion that results from the alphabet soup of confusing terms used to define specified fiber architectures. Instead of focusing on these architectures, the cellular approach focuses on what the architectures need to accomplish: offering an appropriate level of service and quality to a certain number of subscribers. Using the cellular approach makes planning easy, because it begins with the end, not the means, in mind. The cellular approach is flexible, too, anticipating the subdivision of cells that occurs as systems evolve and new technologies emerge.

The natural progression seems to be a steady move toward smaller cells, or service areas fed by a single fiber node linked to a central distribution point. As cell size decreases, performance and the number of services that can be offered increases. Table 7 and Figure 10 compare the performance of the five cells discussed in this article.

Acknowledgments

The authors wish to thank the following individuals for their help in developing the cellular approach and creating this article: Marcia Riefer Poulsen, Gary Kim, Amy Spring, Debbie Hoffmeister and Tim Voorheis. CED

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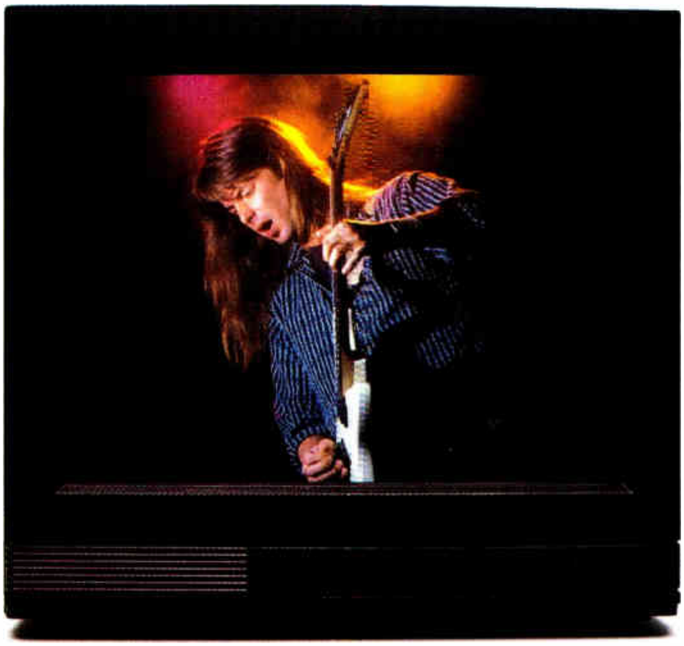

In 1981 We Helped Change The Face Of Rock & Roll. Now We're Part Of A New Revolution.

When MTV rocked the world with their first stereo broadcast, they made television history using Wegener audio technology. A short time later a second music network, VH-1, went on the air in stereo with Wegener digital audio equipment.

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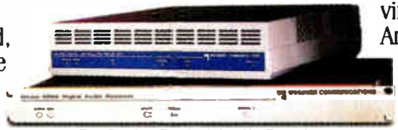

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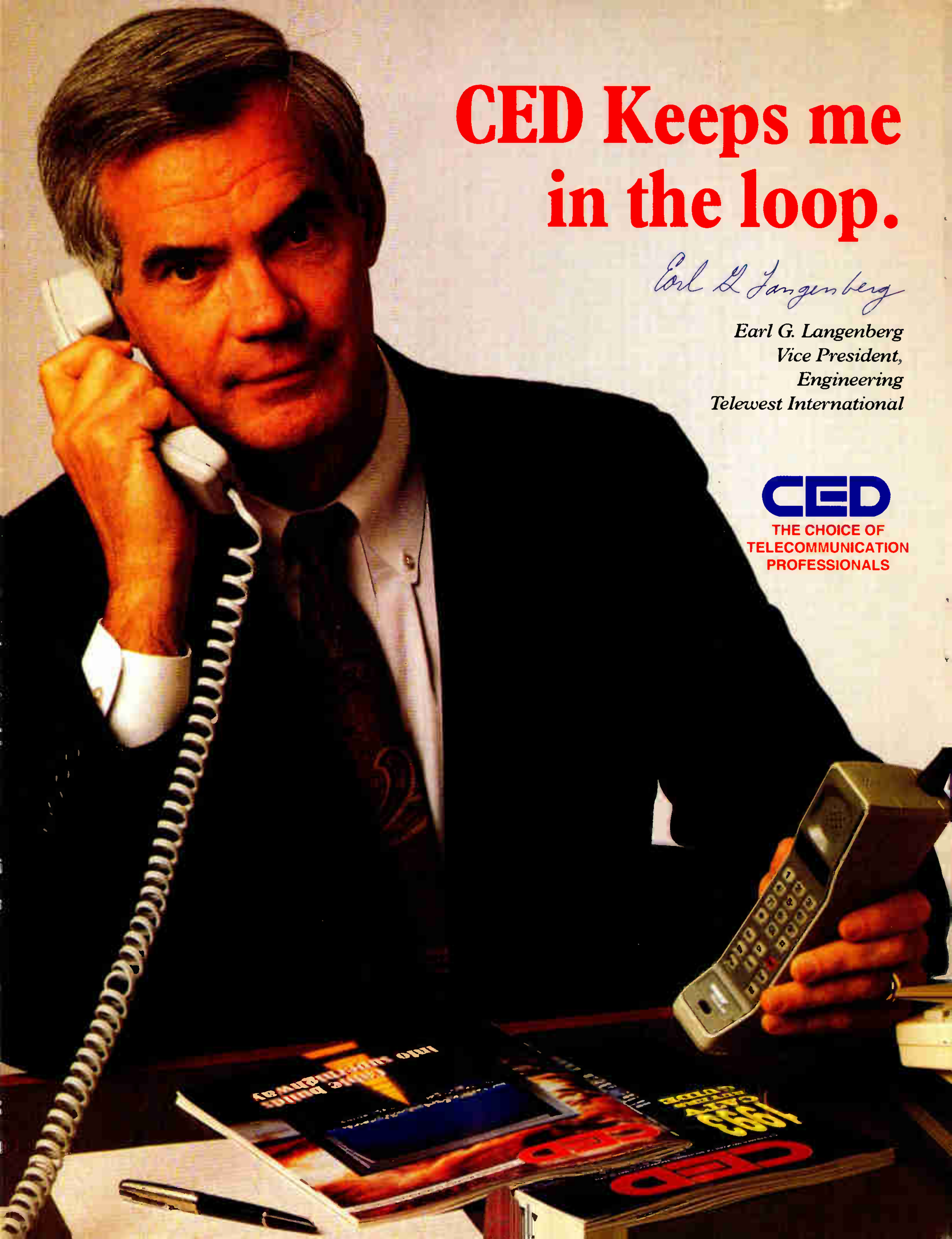

The issue: Interconnects

During the Atlantic Cable Show last month, an enlightening panel session focused on interconnects both within a cable system and between neighboring cable systems. Interconnects will likely become an important issue if cable operators want to be the conduit through which data and voice services flow across the country. But are cable operators ready to approach business opportunities cooperatively?

The questions:

1. Does your system geographically cover more than one community?

☐ Yes ☐ No ☐ Don't know

2. Does your system have multiple headends serving the local franchise area?

☐ Yes ☐ No ☐ Don't know

3. Does your system use microwave to deliver television signals throughout a wide area?

☐ Yes ☐ No ☐ Don't know

4. Has your system considered interconnecting adjacent cable plants with fiber optics (or already completed an interconnect project)?

☐ Yes ☐ No ☐ Don't know

5. Do you think an interconnect could save your system money over the long term?

☐ Yes ☐ No ☐ Don't know

6. Has your system considered interconnecting with neighboring system(s) owned by another MSO?

☐ Yes ☐ No ☐ Don't know

7. Is your system already interconnected with a neighboring MSO?

☐ Yes ☐ No ☐ Don't know

8. Do you think your neighboring MSO would welcome the opportunity to interconnect with your system?

☐ Yes ☐ No ☐ Don't know

9. Do you think it's important to interconnect with a neighboring MSO for business reasons (data transfer or advertising interconnect)? In other words, would an interconnect bring you more revenue?

☐ Yes ☐ No ☐ Don't know

10. Why or why not? ______________________

____

____

11. In your opinion, how important will interconnects be in the future?

☐ Important ☐ Not important ☐ Don't know

12. Do you think cable operators can overcome individual approaches (i.e. signal security) and interconnect their systems effectively?

☐ Yes ☐ No ☐ Don't know

13. Do you think the technology exists to effectively integrate two neighboring cable systems?

☐ Yes ☐ No ☐ Don't know

Your comments:

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303-393-6654

Make a copy of this page and fax it back to us at the number above or mail it to CED, 600 South Cherry Street, Suite 400, Denver, Colo. 80222.

We will tally the results and print it in a future issue. Your suggestions for future questions are always welcome.

We also want some written comments from you on this subject. Names won't be published if you request your name to be withheld, but please fill out the name and job information to ensure that only one response per person is tabulated.

Your name and title

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System name:

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Your MSO:

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Location:

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Your job function:

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RESULTS

Despite the industry's past reticence to embrace national and global standards, most survey respondents believe interface standards wil be a key to becoming national transporters of video, data and voice communications. While there appears to be widespread support for standards (and although many believe organizations like the Society of Cable Television Engieers should be more active in standard-setting), several who responded said the best standards are de facto standards. The attraction to de facto standards relates to timing (the development and acceptance of global standards often takes years and in a fast-moving industry like telecommunications, no one wants to wait that long) and the ability of an industry to reach consensus while allowing manufacturers more flexibility.

Respondents unanimously said standards are helpful to industry and manufacturers alike. A big majority said standards will be important in the coming digital, interactive world of multimedia delivery and a similar number said the cable industry should be open to developing standards in conjunction with computer and telephone companies.

The issue: Standards

As the cable industry looks to increase revenue through new services, it is being drawn further into a convergence with the computer and telephone industries. While the cable industry has typically eschewed standards, can it continue to do that and be a major national communications player?

The results:

1. In general, do you think standards are helpful to industries?

100	**0**	**0**
Yes	No	Don't know

2. Do you think new standards would aid manufacturers in developing new products for the cable industry?

100	**0**	**0**
Yes	No	Don't know

3. Do you favor a standard for the interface between cable and consumer equipment like TVs and VCRs?

100	**0**	**0**
Yes	No	Don't know

4. Do you think standards will be necessary to bring about a two-way interactive and multimedia environment over cable systems?

82	**18**	**0**
Yes	No	Don't know

5. Do you think standards are easier to develop in a digital environment than an analog one?

23	**53**	**23**
Yes	No	Don't know

6. Do you think the cable industry should team with the computer and telco industries to develop more standards?

82	**6**	**12**
Yes	No	Don't know

7. Historically, do you think the cable industry has been able to thrive because it has avoided standardization?

18	**71**	**6**
Yes	No	Don't know

8. Going forward, do you think the industry should embrace more standards?

94	**0**	**6**
Yes	No	Don't know

9. Do you think cable should embrace the MPEG-2 video standard?

35	**12**	**53**
Yes	No	Don't know

10. Should the SCTE get more involved in monitoring and developing national and global standards as they relate to video transmission?

88	**6**	**6**
Yes	No	Don't know

11. Do you think additional standards will result in better connectivity between operators and with a national communications infrastructure?

94	**0**	**6**
Yes	No	Don't know

12. Do you think it's important that cable attaches to a national communications and information "highway"?

82	**0**	**18**
Yes	No	Don't know

13. Do you think that if cable embraces more standards it will allow manufacturers to develop less costly products?

82	**6**	**12**
Yes	No	Don't know

Selected comments:

The cable industry (has) had many de facto standards which weren't documented in a formal way but were used with great success.

–Nick Hamilton-Piercy, Rogers Cablesystems, Toronto, Canada

Cable has the capacity to outdeliver the telcos with digital information to the consumers.

–Stephen Whitlock, Sammons Comm., Petersburg, Va.

NOVEMBER

4 OSHA/Safety SCTE Seminar. Training seminar for system managers and safety coordinators on maintaining records and developing safety training programs. Location: Savannah, Ga. Call SCTE Headquarters, (215)363-6888.

4 Chesapeake SCTE Chapter Technical Seminar. "Fiber Optics." Location: Arlington, Va. Call Scott Shelley, (703) 358-2766.

4 Ohio Valley SCTE Chapter Technical Seminar. OCTA/SCTE meeting. Location: Columbus, Ohio. Call Weldon Feightner, (513) 941-7000.

8 ATM TecForum. Hosted by the National Engineering Consortium. Location: Stouffer Orlando Resort. Call (312) 938-3500.

9-10 Broadband ComForum. Hosted by the National Engineering Consortium. Location: Stouffer Orlando Resort. Call (312) 938-3500.

9 Cascade Range SCTE Chapter Technical Seminar. Location: Holiday Inn, Wilsonville, Ore. Call Cynthia Stokes, (503) 230-2099.

9 Magnolia SCTE Chapter Technical Seminar. Location: Ramada Coliseum. Call Steve Christopher, (601) 824-6010.

9 New England SCTE Chapter Technical Seminar and Testing. "BCT/E and Installer Certification Training," with Odule Breau, Greater Media Cable. Location: Greater Media Cable, Worcester, Mass. Call Brian Bedard, (508) 853-1515.

9 New York City SCTE Chapter Technical Seminar. "Emerging Technologies." Call Rich Fevola, (516) 678-7200.

9 Wheat State Chapter Technical Seminar. Call Lisa Hewitt, (316) 262-4270, ext. 191.

10 Badger State SCTE Chapter Technical Seminar. "Power Design and System Reliability." Location: Fon du Lac, Wisc. Call Brian Revak, (608) 372-2999.

10 Heart of America SCTE Chapter Technical Seminar. Location: Kansas City, Mo. Call Don Gall, (816) 358-5360.

10 Mid-South SCTE Chapter Technical Seminar. Call Bob Allen, (901) 365-1770, ext. 4110.

10 Palmetto SCTE Chapter Technical Seminar. Vendor show and hands-on training. Location: Columbia, S.C. Call John Frierson, (803) 777-5846.

10 South Jersey SCTE Chapter Technical Seminar and Testing. "CATV Olympics." BCT/E and installer exams to be administered in all categories at both levels. Location: Ramada Inn, Vineland, N.J. Call Mike Pieson, (609) 967-3011.

11-12 Multimedia ComForum. Hosted by the National Engineering Consortium. Location: Stouffer Orlando Resort, Fla. Call (312) 938-3500.

11 SCTE Satellite Tele-Seminar Program. "Digital Compression–Part 2," featuring Bob Luff of Scientific-Atlanta. Location: Galaxy I, Transponder 14. Call SCTE headquarters, (215) 363-6888.

11 Gateway SCTE Chapter Technical Seminar. Call Chris Karmer, (314) 949-9223.

11 Penn-Ohio SCTE Chapter Technical Seminar and Testing. Second annual broadcasters forum. Installer and BCT/E exams to be administered in all categories at both levels. Location: Sheraton Hotel, Warrendale, Pa. Call Marianne McClain, (412) 531-5710.

13 Cascade Range SCTE Chapter Testing Session. BCT/E exams to be administered. Location: Paragon Cable, Portland, Ore. Call Cynthia Stokes, (503) 230-2099.

13 Upstate New York SCTE Chapter Testing Session. BCT/E exams to be administered in all categories at both levels. Call William Grant, (716) 827-3880.

15-19 Fiber optics training. Hosted by Antec. Location: Denver, Colo. Call (800) FIBER-ME.

17 Appalachian Mid-Atlantic SCTE Chapter Technical Seminar and Testing. BCT/E exams to be administered in all categories at both levels. Location: Holiday Inn, Chambersburg, Pa. Call Richard Ginter, (814) 672-5393.

17 Bluegrass SCTE Chapter Technical Seminar. "Safety." Location: Elizabethtown, Ky. Call Alan Reed, (502) 389-1818.

17 Golden Gate SCTE Chapter Technical Seminar. "CableLabs Outage Reduction" with Ron Hranac, Coaxial International. Call Mark Harrigan, (415) 358-6950.

17 Piedmont SCTE Chapter Technical Seminar and Testing. Vendor Show with technical sessions. Location: Winston-Salem, N.C. Installer and BCT/E exams to be administered. Call Mark Eagle, (919) 477-3599.

Conferences

October 31–November 2 Quebec Cable Exposition. Location: Quebec City Loews Concorde. Call (514) 525-1083.

10-12 Cable Television '93, Tokyo, Japan. Call Ministry of Posts and Telecommunications, 011-81-3-3504-4087.

15-16 Convergence III: The Information Superhighway. The strategic, financial and technical implementation of the information superhighway–and cable's role in it. Hosted by CommPerspectives. Location: Capitol Hill Hyatt, Washington, D.C. Call Jayne Conant, (303) 393-7449.

22-26 Jornadas de Television por Cable '93/CAPER '93, Buenos Aires, Argentina. Call Inforexco S.A., 011-54-1-383-5399.

Handheld frequency counter

FORT LAUDERDALE, Fla.–Optoelectronics Inc. has introduced a new high performance, pocket-sized frequency counter in its Model M1. The counter was devised for the test. communications, two-way, amateur radio and communications monitoring markets, company officials say.

Features include 10 user-selectable sample measurement periods, ranging from 13 milliseconds to 10 seconds, with corresponding measurement resolution from 10 kHz to 0.1 Hz–so that the M1 is capable of both high-speed measurements as well as high resolution, 10 digit measure-

Tool for Amphenol connectors

CROMWELL, Conn.–New from the Cablematic Division of the Ripley Co. is a round crimp tool which uses intermeshing jaws to crimp within four progressive segments. The tool is designed specifically for Amphenol brand environmental connectors with crimp diameters of .276-inches and .322-inches.

Round crimp tool

A tapered opening progressively forms the crimp ring to its final diameter. Precision, hardened jaws are self-bottoming and are designed to not over-crimp, officials say.

Circle Reader Service No. 51

Optical power meter

BOSTON–New from Fotec Inc. is a $249 ($299 with carrying case and connector adapter) optical power meter, the M715, aimed at a broad market of installers and technicians in fiber to the curb, fiber to the home and cable television applications. The meter is designed to test singlemode fiber optic cable plant and networks. "Low cost test equipment is mandatory," said Fotec President Jim Hayes in a press release. "We've been working on lowering costs while increasing performance at the same time."

M715 fiber optic minimeter

The M715 measures input power in the range of +10 dBm to -60 dBm with a resolution of .1 dB and an accuracy of ±.2 dB. It is calibrated at both the 1300 nm and 1550 nm wavelengths, and will run over 100 hours on a standard, 9V alkaline transistor battery.

Circle Reader Service No. 52

Training video

KENT, Wash.–The Light Brigade has unveiled the latest in its ongoing series of fiber optic training tapes. This one, titled "Fiber Optic Applications," features the current state of fiber optic technology and how it is being used. Topics covered in the tape include SONET, FDDI, ATM, HDTV, fiber to the curb, metropolitan area networks, sensing and sensors, smart house, videoconferencing, virtual reality, imaging, audio, security, and more.

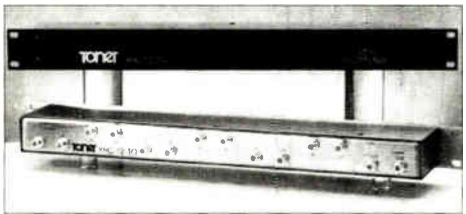
Actual applications footage and graphics are used liberally throughout the film to provide a visual understanding of emerging applications in the world of fiber optics.

Circle Reader Service No. 53

1-GHz headend combiner

HORSHAM, Pa.–New from Toner Cable Equipment is its XHC 12-1G headend combiner, which offers full bandwidth from 5 MHz to 1 GHz and a 12-way combiner/splitter. The device is used to combine 12 separate signal sources or to distribute a phase-lock generator reference signal.

The unit features 12 half-inch long silver-plated F-type inputs, one half-inch long silver-plated F-type output and a half-inch silver-plated test point at 20 dB down. Insertion loss on the unit measures 19 dB ± .5 dB; flatness is 1 dB across the bandwidth; port-to-port isolation from 5 MHz to 800 MHz is 10 dB typical. Across the entire bandwidth (5 MHz to 1000 MHz), port-to-port isolation measures 37 dB typical.



XHC 12-1G headend combiner

Circle Reader Service No. 54

VTR controller

WEST HOLLYWOOD, Calif.–DNF Industries has introduced its ST100 VTR controller. designed with an integral timecode display, keypad and jogwheel. Use of the unit enables the operator to control D1, D2, D3, Betacam, MII, 3/4-inch, 1-inch, S-VHS and HI-8 formats via a serial RS422 connection using only one controller, company officials say. Functions can also be customized, if necessary.

Also, the ST100 can be used through a facility's existing RS422 control router to control VTRs at any number of remote locations. The advantage, company officials say, is the elimination of the need for multiple remote controllers and the associated clutter of several pieces of control hardware.

The ST-100 controls up to 15 VTR func-

Model M1

ments.

At the heart of the M1 is the OE10, a high-speed ASIC capable of 250 MHz direct counting. An embedded microcontroller provides digital filtering, which reduces the display of random noise and oscillation without any loss of sensitivity, company officials submit. A digital auto capture feature locks the counter display n the first reading to pass the filter, and an arm/store button sends captured data into a three-register stack that can later be recalled by the user.

Also included is an asynchronous serial data port, so that TTL data can be shifted to RS-232C using an optional accessory (the Model CX-12 interface). With the interface, which includes data logging software, users can link with any personal computer to log and time-stamp frequency data.

The M1 is priced at $229 and comes with NiCad batteries, a wall-plug power supply and charger, and an owner's manual.

Circle Reader Service No. 50

tions.

Circle Reader Service No. 55

Safety analyzer

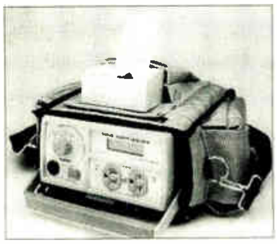
VIBORG, S.D.–New from Bapco (an affiliate of Sencore) is its SA115 safety analyzer, designed to test both power and products to NED, NFPA, ANSI, AAMI, CSA and UL specifications. The tests are automatically sequenced along three categories:

4 receptacle testing

4 grounding capability testing

4 AC leakage testing (to 10 microamps)

A "hot chassis" test checks a product before the power is turned on, to prevent a shock hazard to the repairperson, the test equipment or to the product being tested.



Safety analyzer

The unit includes a four-digit LCD, the readouts of which can be printed on adhesive-backed certification tape by pushing a button. Further, a preprogrammed and built-in RS232 port interface enables further print capabilities.

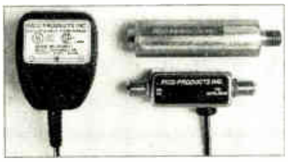
The unit is priced at $1,295; the PR116 printer at $395 and the CC119 carrying case at $125.

Circle Reader Service No. 56

Drop amplifiers

LAKEVIEW TERRACE, Calif.–Pico Products Inc. has announced a new line of low noise drop amps (the LNDA-10 and LNDA-20), available in either 10 dB or 20 dB gain. The broadband amps are designed to provide continuous amplification from 50 MHz to 1000 MHz and beyond, company officials say.

Low noise and high output capability make the amplifiers ideal for improving the signal level and quality of long cable drops, Pico officials say. Surface-mounted circuitry packaged in a sealed trap enclosure with -130 dB of RF shielding and protection from environmental elements also assists in long-term performance. Over the entire 1 GHz of bandwidth, the amplifiers offer a flatness specification of ± .5 dB and a noise specification of 4 dB.



Low noise drop amps

Both version of the amplifier contain and internal DC block, which allows direct connection ton antenna or CATV drop tap port. Also included is a power inserter to provide in-line voltage to a remotely-located amplifier, while allowing only the RF signals to pass to the subscriber's television.

Circle Reader Service No. 57

Portable locator

New from Rycom is its 8870 portable locator, which company officials say is capable of long or short range, inductive or conductive and active or passive locating. The unit provides these features within a low-cost and lightweight instrument.

Users of the 8870 locator can choose from multiple frequencies to optimize the performance for specific locating situations.

A HI power setting on the transmitter allows AF or RF signals to transmit simultaneously, which in turn allows the user to switch between signals without have to return to the transmitter to select a new frequency.

The unit also features current amount reading, 60 Hz passive power, peak and null antenna, LCD display and 45-degree depth measurement.

Circle Reader Service No. 58

International satellite receiver

LOS ANGELES–New from Standard Communications is its Intercontinental satellite receiver, designed for use in broadcast, special network and CATV systems. The receiver features a fully synthesized PLL tuning circuit with digitally locked, continuous tuning AFC and microprocessor control. A C/Ku-band 950 MHz to 2020 MHz RF input can be dual converted to a commercial, industry standard 70 MHz IF; because of that, the receiver can be used for rebroadcast in any area of the world from almost any satellite format, Standard officials say.

With the new satellite, users can select a microprocessor-controlled 24-channel frequency plan, or dial the desired satellite frequency directly. The microprocessor will automatically track down all the known LNBs without conversion charts.

Also, the receiver's digital AFC utilizes a new frequency counter circuit for signal tracking control, which Standard officials say outperforms older designs in low threshold, severe interference, or half transponder situations and band-edge SCPC systems.

The device can be ordered without audio to minimize cost in dedicated scrambling systems. Other options on the Intercontinental receiver include a PLL frequency agile mono audio demodulator with three adjustable IF tuners, a PLL frequency agile dual channel stereo demodulator with five adjustable IF filters, a front panel adjustable, multiple SAW-filtered module with six, 70 MHz IF bandpass filters and a wideband RF tuner module for use in ASTRA or other 950 MHz to 2050 MHz systems.

Circle Reader Service No. 59

Bench-top coax stripper

LIVERPOOL, N.Y.–New from Coastel Cable Tools Inc. is an A/C powered bench top coaxial cable stripper, the CTEL 1066, designed to produce high-quality and repeatable strips in volume applications.

The unit is opereated by a foot pedal linked to a selectable timer switch, and has built-in safety features which include an automatic brake stop. Each cutter head is manufactured to the cutting dimensions specified by connector and cable type; the heads take 10 second to install, Coastel officials say.

The unit has a maximum overall strip lengh of two inches, and a maximum strip diameter of .425 inches. Minimum strip diameter is .070 inches. The CTEL 1066 weighs 26 pounds and is priced at $2,200.

Circle Reader Service No. 60

Plan early for this year's Western Show

Schedule of technical events

Wednesday, December 1

8:30–5:30 p.m. Registration open, Anaheim Convention Center

10–11:00 a.m. Opening general session: "Programming as Usual: NOT!" moderated by Paul Kagan, Paul Kagan Associates Inc. Panelists: Trip Hawkins, 3D0; John Malone,TCI; Rupert Murdoch, Fox; Ted Turner, Turner Enterprises

11:30–1 p.m. Exclusive exhibit hours

11:30–5:30 p.m. Exhibits open

1–2:15 "FCC/Washington Update" moderated by William Riker, Society of Cable Television Engineers. Panelists: Wendell Bailey, National Cable Television Association; Tom Mock, Electronic Industries Association; Ron Parver, Federal Communications Commission; John Wong, Federal Communications Commission

2:30–3:45 p.m. "Platforms for Profit: An Update on CAPs and Alternate Access" Moderated by David Woodrow, Cox Cable.

"Proof of Performance: A Report Card, One Year Later" moderated by Steve Allen, Jones Intercable. Panelists: Saconna Blair, Jones Intercable; Jonathon Kramer, Communications Support Corp.; John Wong, Federal Communications Commission

4–5:30 Exclusive exhibit hours

Thursday, December 2

8:30–5 Registration open

8:30–10 a.m. Opening general session: "Technology–Television as Usual: NOT!" moderated by Judy Wodruff, CNN.

10–5:30 p.m. Exhibits open

10:15–11:30 a.m. "Multimedia/Interactive Services and Applications" moderated by Doug Semon, Viacom Cablevision. Panelists: Peter Miller, Viacom International, Rick Tompane, Prodigy Services Co.; Dave Waks, Prodigy Services Co.

"Making Compression Pay: Adventures in the 500 Channel Universe," moderated by Michael Schwartz, CableLabs

Noon–1:30 p.m. Luncheon

1:45–3:00 p.m. "A Small System Operator's Guide to the Future" moderated by David Kinley, Sun Country Cable

"Intelligent Convertors vs. Intelligent Networks" moderated by David Bourne, Pioneer New Media Technologies. Panelists: Leo Hoarty, ICTV; Jeff Huppertz, Scientific-Atlanta; Richard Annibaldi, Pioneer New Media Technologies

3:15–4:30 p.m. "How to Digitize: An Operator's Handbook." Moderator TBA.

"Fiber Architectures in an Interactive World" moderated by Al Kuolas, Continental Cablevision. Panelists: Andy Paff, Optical Networks International; Carl McGrath, AT&T; Stephen Felming, Northern Telecom

4:30–5:30 Exclusive Exhibit hour

Friday, December 3

8–2:00 p.m. Registration open

9–11:00 a.m. BCT/E and Installer Certification Testing

9–10:15 "Not Business as Usual: Cable in a Multimedia Environment" moderated by David Fellows, Continental Cablevision

10–2:00 p.m. Exhibits open

CableLabs, CCTA to bring multimedia to Western

This year's theme for the annual Western Show–"definitely not business as usual"–certainly rings true (particularly considering the fact that this article is being written just hours after Bell Atlantic's groundbreaking announcement to merge with TCI).

Indeed, this year's show will be jammed with technology-related exhibits, sessions and discussions including compression, multimedia and re-regulation.

A case in point is CableLabs announcement to join forces with the California Cable TV Association to produce an on-line and working multimedia exhibit to illustrate "the building blocks a cable oprator may use to implement an operable, end-to-end information network capable of delivering a variety of educational, entertainment and workplace services to the home, office or school simultaneously," according to a press release relating to the announcement.

Called "CableNET '93," the 2,700 square-foot multimedia display will combine computer, cable TV and ATM switching technologies as well as working concepts being used in Time Warner's Orlando, Fla.-based full service network project and Viacom's similar Castro Valley, Calif. effort.

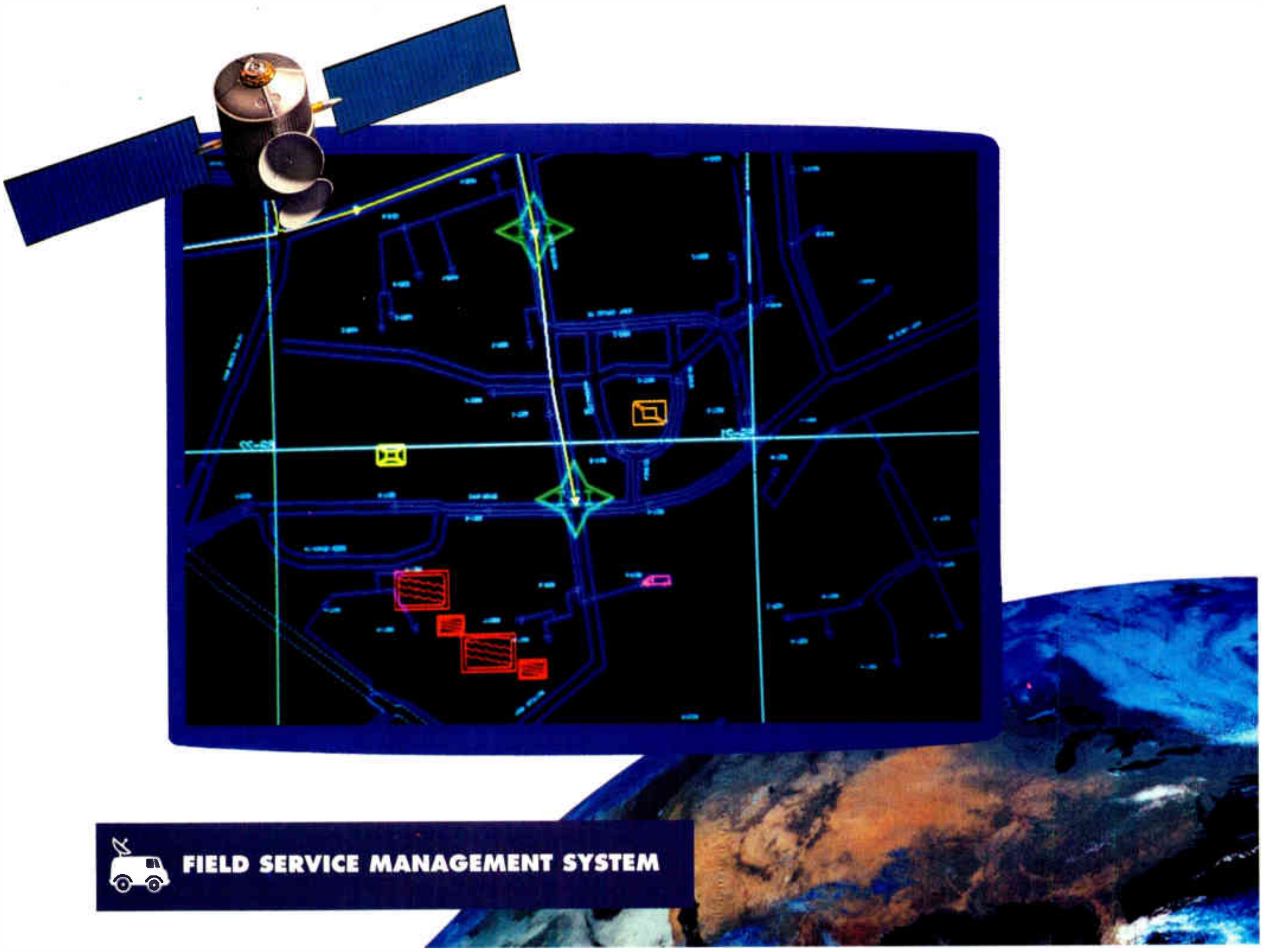
"CableLabs and CCTA will use CableNET '93 to exhibit network elements needed to build a prototype infrastructure that can be easily adapted as new technologies emerge," says Spencer Kaitz, CCTA president, in a press release.

CableNET '93 participants

Participants in the multimedia display include Antec, C-Cube Comstream, the Consortium for School Networking, Digital Equipment Corp., DSC-Optlink, EDS, Grass Valley, General Instrument Corp., IBM, Jones Intercable/Mind Extension University, Multivision Cable TV, NEC America, Northern Telecom, Scientific-Atlanta, Sun Microsystems Inc., SynOptics, Teleport Communications Group, Tellabs, 3DO, TRW, Unisys and Zenith Electronics.

In keeping with the show's theme, it's notable that many of those participants are not traditional cable TV vendors.

"The overwhelming success of our efforts to bring this industry cross-section together demonstrates the high level of interest these companies have in participating with cable delivery of interactive, multimedia and high-bandwidth services to the home," said Dr. Richard Green, president and CEO of CableLabs.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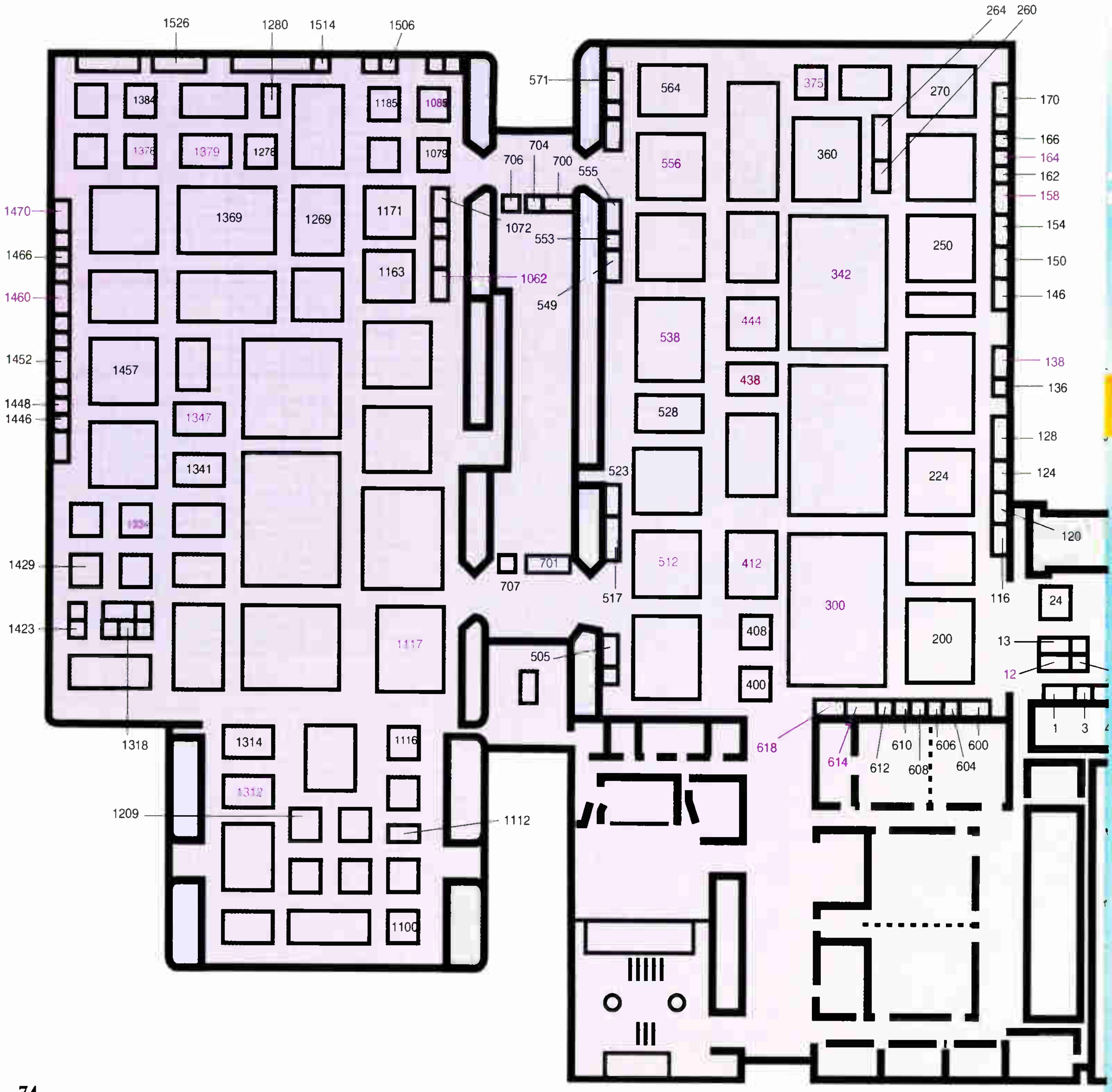

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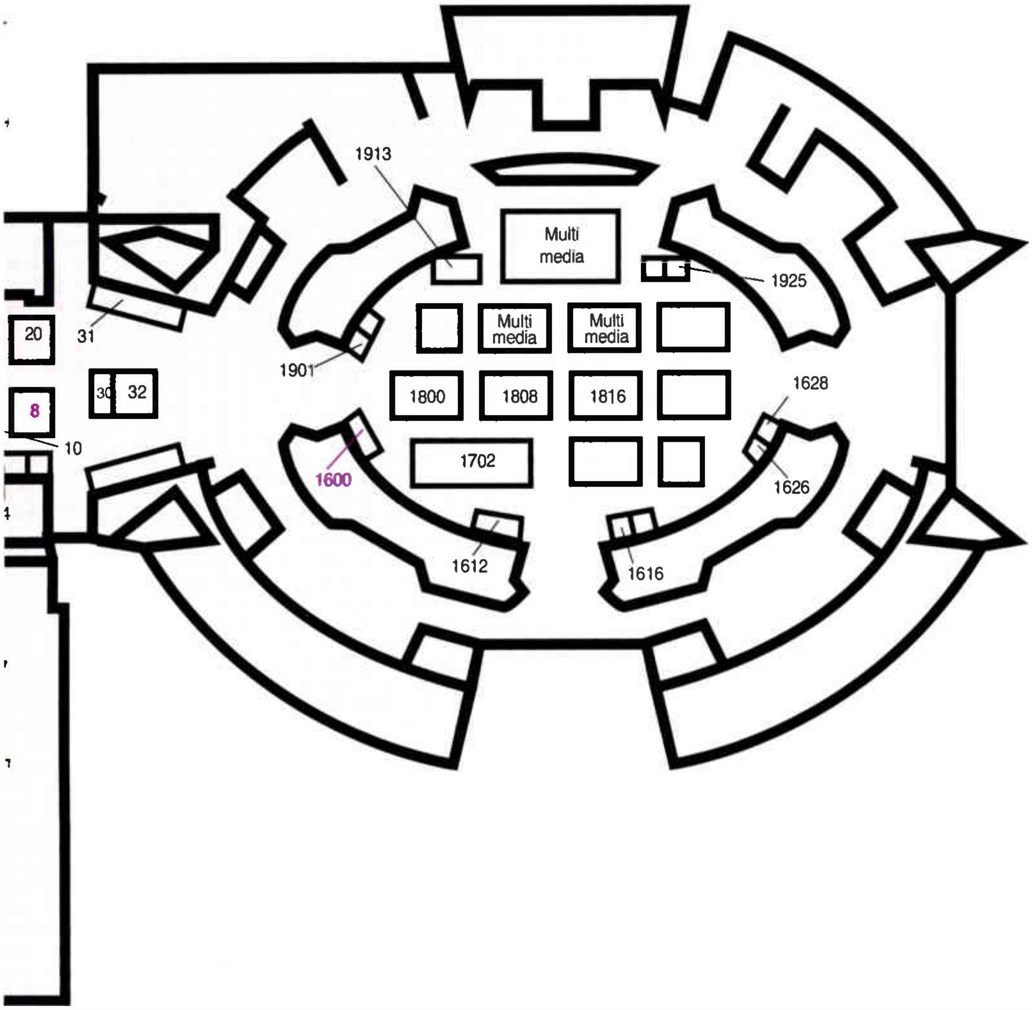

'93 WESTERN SHOW TECHNICAL BOOTH PREVIEW GUIDE

The following technical companies will be exhibiting at the 1993 Western Show, Anaheim:

Advanced Telecomm. Solutions.........1100

Alpha Technologies..............................701

AM Communications 30

ALS
AMERICAN LIGHTWAVE SYSTEMS, INC.

American Lightwave Systems Inc. ....Booth 1334
Phone 203/630-5792
Complete network solutions from master headend to subscribers. Our solutions include: homeworx VSB/AM/QAM transmission system; DV6000 digital transport system; LiteAMp VSB/AM/QAM transport system; soneplex digital DS1-DS3 transport system; CityCell PCN, microcell transport system; fiber management systems, and more.

ANTEC℠

ANTEC....................................Booth 512
ANTEC Network Systems.......Booth 412
ANTEC Communication Services ....Booth 412
Phone 708/439-4444
ANTEC, a technology integration company, will feature the Cable Integrated Services Network (CISN)–its vision for emerging cable networks. ANTEC will present network architectures including the Cable Loop Carrier (CLC 500), which integrates cable and telephone networks. And, innovative products systems including the Integrated Drop System (IDS), utilizing products by Raychem, and the Underground Plant System (UPS) will also be shown. Interactive services delivered over a SONET network, such as Distance Learning and Medical Consultations, will be demonstrated by ABL. In its booth, ANTEC will also showcase popular industry products including MONARCH Permalash and Strand, the Regal RR-92 converter, the Digicipher, and network powering products from Power Guard and Alpha Technologies.

Antenna Technology..................Booth 707

Arcom Labs...............................Booth 523

Arnco Corporation....................Booth 1452

AT&T ....Booth 1800, 1808

Augat Communications Division....................................Booth 1116

Belden

Belden, Inc. ....Booth 12
Phone 800/235-3362
Belden is a quality provider of coaxial drop cable and fiber optic trunk cable including Duobond Plus™ drop cable and loose tube fiber optic cable in armored and all dielectric versions from 4 to 240 fibers. Belden also offers headend cables, plenum rated products, and a variety of cables for networking applications.

Blonder Tongue ....Booth 610

Budco...Booth 1

C-COR®
ELECTRONICS INC

C-COR Electronics Inc. ....Booth 444
Phone 814/231-4438
C-COR's display includes the new series of 750 MHz FLEXNET amplifiers for increased channel and service capability from basic to multimedia; digital and AM fiber optics; Cable Network Manager, modems; passives and power supplies.

Cabelcon Connectors ....Booth 124

Cable AML Inc. ....Booth 1612

Cable Innovations, Inc. ....Booth 1616

Cable Link, Inc. ....Booth 608

Cable Security............................Booth 600

FDC
FIRST DATA CORP.
CABLE SERVICES GROUP

Cable Services Group...........Booth 1117
Phone 402/222-5365
Stop by FDC Cable Services Group's booth #1117 for a demonstration in the latest in subscriber management systems. We've made CCS even more user-friendly with an easy-to-use GUI front-end. Plus, CSG's relational database VIP will help you turn data into information.

cable data

CableData................................Booth 538
Phone 916/636-5800
CableData will feature its two market leading products, DDP/SQL, its powerful relational database subscriber management software for the North American market, and its international product, Intelecable™, the world's first and only integrated telephony and cable transaction management system. CableData is the largest supplier of cable subscriber management information and telephony systems in the world, serving more than 33 million subscribers worldwide.

Cadix International Inc. ....Booth 32

CALAN Inc. ....Booth 128

Channell Commercial Corp......Booth 1278

Channelmatic, Inc. ....Booth 1163

Coast CATV Supply ....Booth 170

CommScope
GI General Instrument

CommScope/ General Instrument ....Booth 438
Phone...............................(704) 323-4889
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Parameter III® trunk and distribution cables and Optical Reach® fiber optic cables, as well as hundreds of versions of drop cables for all applications including headend cables, all with 1 GHz bandwidth.

Compression Labs, Inc. (CLI)..Booth 1913

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ComSonics, Inc. ....Booth 1347
Phone 800/336-9681
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Contec International..................Booth 264

DH Satellite ....Booth 1446

Digital Equipment Corp...........Booth 1526

Display Systems International....Booth 704

DX
ANTENNA

DX Communications, Inc........Booth 375
Phone 914/347-4040
Manufacturer of commercial headend equipment for the CATV, SMATV, private network and broadcast industries. Products include: integrated receiver descramblers, satellite receivers, agile modulators, combiners, LNBs and accessories.

Eagle Comtronics, Inc...............Booth 505

EDS

EDS.......................................Booth 1312
Phone ....(214) 605-6181
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ELECTROLINE

Electroline Equipment Inc. ...Booth 1085
Phone 514/374-6335
Electroline will be featuring its 1-GHz "Super-Tap" that can be used as a standard multi-tap or, with a simple change of faceplate, as an addressable tap. It will be showing its state-of-the-art 1-GHz "DROPAmp" offering a noise figure of 3dB while providing 15 dB gain and 23 dBmV output per-channel for 155 channels. On exhibit will be its multi-tier security unit aimed at MDU and resort applications.

EON Corporation.........................Booth 20

EXECUTONE Information
Systems..................................Booth 1466

FPN
FIRST PACIFIC NETWORKS
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Phone 800/544-4959
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FM Systems, Inc........................Booth 553

GCTechnologies

GC Technologies, Inc. ....Booth 1600
Phone 404/991-9200
GCT offers a complete line of fiber optic interconnect products for CATV including SuperSmooth™ PC singlemode pigtail and jumper cables, fiber splice and termination headend cabinets, aerial and buried plastic and metal splice closures, couplers (splitters), attenuators, wavelength division multiplexers (WDM) and a complete line of hand-held optical test equipment.

GE American
Communications Inc. ....Booth 1269

General Cable Company ....Booth 571

Gilbert Engineering...................Booth 400

Great Lakes Data
Systems, Inc............................Booth 1318

Group W Satellite Comm...........Booth 360

Harmonic Lightwaves, Inc. ......Booth 1429

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Hewlett-Packard Co. ....Booth 1378
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Hughes Aircraft Co. ....Booth 1341

Hughes Communications, Inc....Booth 528

IBM Corp.................................Booth 1702

ICTV Inc. ....Booth 1702

Information Sys. Development...Booth 120

IPITEK ....Booth 4

Jerrold
GI General
Instrument

Jerrold/Generald Instrument..Booth 300
Phone 800/523-6678

Booth highlights the convergence of technologies into cable television's broadband platform. Included will be exhibits and demonstrations highlighting telephony, interactive television, computer-controlled converters and digital compression. Also demonstrated will be state-of-the-art cable television technologies such as Cableoptics® fiber optoelectronics, addressability and products for the emerging international marketplace.

Leaming Industries	Booth 555
Lectro Products, Inc.	Booth 260
Lemco Tool Corp.	Booth 1514
LSI Logic Corp.	Booth 1628
Macrovision Corp.	Booth 154
Main Line Equipment, Inc.	Booth 146
Midwest CATA	Booth 1925
Mind Extension Institute	Booth 1457
Multilink	Booth 1112
NACOM	Booth 606
New Century Communications	Booth 1702

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Ortel Corporation ....Booth 1460
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Panasonic

Panasonic Broadcast &
TV Syst. ....Booth 138
Phone 201/392-4709

Supplies a full line of professional and broadcast video equipment for production, editing, playback and pay-per-view. Supplies non-addressable converters.

Philips Broadband Networks Inc.	Booth 200
Pico Products, Inc.	Booth 116
Pioneer Comm. of America, Inc.	Booth 564
Plex Communications Group Inc.	1280

Power & Telephone Supply Company

Power & Telephone
Supply Co. ....Booth 164
Phone 800/238-7514

Power & Telephone Supply is an independent wholesale distributor of network communications and cable television equipment. We stock and sell the equipment of over 500 manufacturers, including fiber optics, electronics, drop material, tools and test equipment, CATV distribution and electronics gear, and all associated tools and hardware.

Power Guard	Booth 600
Production Products Co.	Booth 549
Qualcomm Inc.	Booth 31

QRF

Quality RF Services, Inc. ......Booth 1316
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Raychem	Booth 512
Ripley Co.	Booth 162
Riser-Bond Instruments	Booth 10
Sachs	Booth 1423
Sadelco, Inc.	Booth 1506

Scientific
Atlanta

Scientific-Atlanta ....Booth 342
Phone 800/722-2009

Scientific-Atlanta, world leader in broadband communications systems and cable TV equipment, will demonstrate multimedia interactive applications over its 8600^X home communications terminal with digital docking station. Also featured will be Scientific-Atlanta's MPEG-based digital video compression system, 750 MHz advanced distribution and fiber electronics, headend equipment and a range of other products from this full line end-to-end supplier.

Siecor Corporation	Booth 150
Signal Vision, Inc.	Booth 1072
Simon West Coast, Inc.	Booth 1209
Society of Cable TV Engineers	Booth 604
Standard Communications Corp.	Booth 24
Starnet	Booth 270
Sumitomo Electric Fiber Optics	Booth 1384
Superior Electronics Group Inc.	Booth 1185
Synchronous Communications Inc.	Booth 1314
Tektronix, Inc.	Booth 13
Telecorp Systems, Inc.	Booth 700
Telecrafter Products	Booth 136

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Teledirect International, Inc. ......Booth 706

Teleport Communications Group.......................................Booth 1816

Texscan Corporation..................Booth 224

TFC Times Fiber Communications, Inc.
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Times Fiber Communications Inc...............Booth 618
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Toner Cable Computer Systems...................................Booth 1079
Toner Cable Equipment, Inc. ...Booth 1079

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Trilogy Communications, Inc............Booth 1379
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TV/Com International..................Booth 250

TVC Inc. ....Booth 408

Underground Service Alert ......Booth 1448

United Video Satellite Group....Booth 1369

UNiWAND
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Universal Electronics, Inc. ...Booth 1470
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US Electronics..........................Booth 1171

Viewsonics, Inc. ....Booth 612

Vikimatic Sales, Inc. ....Booth 1626

VTR Service Co. ....Booth 166

WAVETEK

Wavetek Communications Division ....Booth 614
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Westec Communications, Inc.............Booth 158
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Western CATV Distributor, Inc. ..Booth 517

ZENITH

Zenith Electronics Corporation..............................Booth 556
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SA Slimline 450 Trnk	- $435	Jerrold CIV Mod	- $550
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Barcode Adressable Units	YES!	Maybe.
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Sells Rebuilt Converters	YES!	Sometimes.
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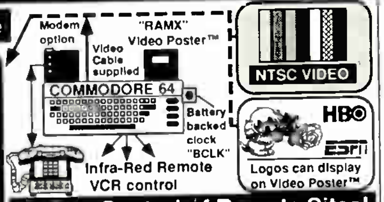

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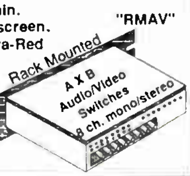

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Cutting the Gordian Knot

By Archer S. Taylor, Director and Senior Engineering Consultant, Malarkey-Taylor Associates

The issue of security for premium programming has snarled negotiations for compatible interface technology, frustrated the negotiators, and infuriated the public. Vigorous opposition by Consumer Electronics to the set-top interface on the one hand, and by cable TV to standardized scrambling on the other, have effectively thwarted all efforts to untangle this Gordian Knot.

The telco concept, loosely called video dial-tone (VDT), would eliminate the need for picture scrambling or encryption. In its most primitive form, every subscriber would be assigned a dedicated, asymmetric two-way digital video line to a central office (headend) switching facility. Multiple TV outlets would be served by multiplexing several VDT channels on each service drop, although each separate TV outlet would normally have access to only one program at a time. Since the VDT distribution network would carry only the constantly changing mix of programs ordered by various subscribers, piracy would most likely concentrate on gaining access to the programs assembled at the headend switching center.

Defensive strategy, therefore, would include not only securing the switching facility premises against authorized entry and dealing with disloyal employees, but most importantly, blocking penetration of the digital access control system by unscrupulous hackers. Descrambling pictures, either in the TV set or its video interface, would be quite unnecessary.

Convenience features such as parental control or favorite and last channel recall, as well as dual program selection for PIP (picture-in-picture) could be provided by software at the headend, remotely activated by the user's VDT key pad. However, neither VDT nor cable TV set-tops can provide full range remote volume control, or truly user-friendly remote on/off control, except by individually cloning the various non-standard IR codes in each TV set. Remote volume control is necessarily limited to reducing sound level below that established at the TV set manually or by its associated remote control. A remote power on/off control that merely kills the main power to the TV set cannot turn some sets back on again. Moreover, some TV sets return to channel 2 instead of channel 3 when power is restored, and have to be reset. While VDT could avoid the necessity of scrambling, it could not overcome the exasperating inconveniences created by the cable TV converter which led to the Congressionally mandated compatibility order.

Cut and run

Perhaps, like Alexander the Great, we should simply cut the Gordian Knot and get on with it. Consider a hybrid system in which all VSB/AM analog non-premium programs would be carried in the clear, with the customary FDM (frequency division multiplex) format, in the conventional 450 MHz network. Premium programs (including HDTV and other compressed digital programs) selected by the user would be dynamically switched at the headend for distribution to the designated TV outlets on separate, but not necessarily dedicated transmission paths in the 450-750 MHz region, converted at the outlet interface to channel 3 VSB/AM analog. Non-premium programs would by-pass the interface box, allowing the TV set to function normally, just as if connected to an antenna.

For premium programs, the TV set would be tuned to channel 3, manually or with its own remote control. A separate VDT keypad would be used only to select the particular premium programs to be displayed on channel 3. All other functions of the TV set would operate normally, including sound volume/mute, channel recall, power on/off, closed captioning, text, and any others devised by set manufacturers. A VCR connected to a separate TV outlet would also function just as if connected to an antenna, using the VDT keypad only to select the program to be provided when tuned to channel 3.

Architecture similar to FSN

The architecture to accomplish this bears a striking resemblance to Time-Warner's Full Service Network (FSN). Not all of the hardware and operational software is yet in place "on the shelf". Considering the explosive pace of new technology and the dynamic thrust with which Time Warner is pursuing the FSN, the hardware will surely soon be available, and probably at rapidly declining cost.

Optical fiber star networks are now being widely installed, and digital fiber rings, possibly SONET (synchronous optical network), are under consideration. They could provide whatever transmission paths are needed to carry premium program traffic to the fiber nodes. ATM (asynchronous transfer mode) packet switches would assign the particular premium program selected by the subscriber to an available transmission path for delivery to the subscriber's TV outlet, via the fiber optic node. It is claimed that the FSN model would provide enough transmission paths, using frequency, time, and space division multiplexing, for simultaneous delivery of different program material to subscribers up to about 38 percent peak traffic loading, triple the average telco peak loading. Distribution from the node to the home would most likely be coaxial.

The drivers

Two critically important characteristics drive the adoption of such a hybrid architecture.

1. Completely normal operation of TV sets, using the VDT keypad only for selecting premium programs for display on channel 3.
2. Eliminating the need for scrambling premium channels.

Next month I plan to discuss the logistics and economics of various scenarios for migrating to the hybrid architecture, depending on a variety of existing coniguations.

Nevertheless, hybrid architecture could be the sword with which to cut the unyielding Gordian Knot. CED

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