

In-Home Wiring, Problems and Potentials

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ABSTRACT

The two other wire based service companies, the power company and the telephone company, have a very different policy regarding the wires that run thru the home. As with every thing, there are advantages and disadvantages to their approach. It is time to review the situation and come to some conclusions.

The Power Company

Today, no one would think of calling the power company to install wiring in their home or to fix the problem when a fuse blows or a circuit breaker trips. The phone book has pages of electrical contractors who will help the unskilled or the intimidated with repairs and installations. Do-it-yourself stores have well stocked aisles of hardware for those who are (or think they are) handy with tools. Books, video tapes, and Saturday home owner seminars provide a degree of education. Procedures and methods are standardized and well accepted. Supplies bear approval stickers. Local building codes cover the legal and accepted ways of doing things. A system of permits and inspectors to enforce the laws is in place.

Another significant difference in policy is that the power company does not attempt to charge for each separate power outlet. You can have as many plugs and lights in your home as you like, but you only pay for the power you use and for having it available at your house.

It may be that the power company is in the most enviable position regarding in-home wiring. If this becomes our conclusion, then the power company model should be our ultimate goal.

The Phone Company

The phone company is a relative new comer to the concept of subscriber ownership of wiring. In fact they were

forced into accepting the idea. For decades they resisted. Part of the resistance was a genuine fear that unskilled or even malicious subscribers would damage the telephone network. This would be expensive, cause other customers to complain, and impair public safety. The other part of the telephone company's resistance was the loss of an attractive revenue stream for the rental of in-home hardware. The charges collected for extension phones was no small issue. If subscribers became comfortable with doing their own wiring, they'd probably add their own extension phones. The phone company even had a mechanism for checking from its office to determine how many extension phones you had. Since the bell in rung by capacitively coupled alternating current, the phone company measured the capacitance of your circuit to determine how many ringers you had. This was done automatically at night when you probably wouldn't be using the phone. It took just a few seconds. More knowledgeable subscribers realized that if they disconnected the bell in their self installed extension phones, they could avoid detection. If the telephone repair man had to make a visit, you disconnected and hid your extension phones.

Subscribers had a bit more reverence for the telephone. They recognized it as their link to a doctor, the fire department, or the police. They felt that even if they didn't need to make an emergency call at the moment, their neighbor might. Years of being told to relinquish the party line in an emergency taught subscribers to view the phone line as almost sacred. For some folks, there was the suspicion that since the telephone was such a wonderful communications device, just maybe the phone company could tell what you were doing by listening in on the other end. This has all changed now.

As labor rates continued to increase and as subscribers added extension phones anyway, the phone companies realized that continued control of in-home wiring was no longer attractive or enforceable. The

grand old revenue streams from in the home no longer even covered the costs. The phone companies have now turned over the responsibility to the subscriber and made a virtue of having done so. Significant charges accrue to the subscriber who needs his in-home wiring serviced by the phone company. Service has become a profit center in many telephone companies rather than just a cost center. After just one of these expensive service calls, most subscribers will view the monthly option of an in-home wiring service contract as an attractive alternative. In most cases, the contract is more attractive to the phone company since the next service call is likely to not come for years.

The telephone companies worked with the FCC to institute a series of standards. Manufacturers of telephone customer premise equipment must comply with these standards. The products must be registered with the FCC and the designs "type approved". The manufacturer himself certifies that the product is in compliance. The FCC does not verify every design. In addition, there is a "ringer equivalence number" which the subscriber is expected to supply the phone company. Almost certainly the vast majority of subscribers are not even aware of this obligation. Those who are aware, don't treat it seriously. Have you reported all your ringer equivalence numbers? Do you know anyone who has? There does not appear to be an effective means of monitoring subscriber compliance with these standards.

Cable's Differences

The primary difference between the power company, the phone company, and the cable company's wiring is cable's potentially dangerous signal leakage. The rules on Cumulative Leakage Index, CLI, which we all must observe, have serious consequences for an in-home wiring policy. Since cable is an enclosed, self contained spectrum, it is allowed to re-use spectrum normally occupied by other services in the external environment. Two problems occur when the cable system is not completely sealed. Cable signals leak out into the environment and cause interference and environment signals leak into the cable and also cause interference. The interference with other signals in the environment is more serious because some of these frequencies are used for emergency communications and others are used for aircraft navigation and communications.

The Signal Leakage Issue

There appears to be substantial disagreement over the likely contribution of leakage from subscriber installed in-home wiring to the Cumulative Leakage

Index, CLI. On the one hand, a vocal group of engineers feels that CLI is almost entirely dominated by leaks in the large signal portion of the plant. This group feel that contributions from drops and in-home wiring won't add up to much and can be ignored. On the other hand, an equally vocal group feels we haven't yet begun to see the full scope of trouble that can come from subscriber in-home wiring. While it is true that many subscribers now do their own wiring, they usually do it knowing their cable company doesn't approve. Therefore they limit their extra outlets to just a few. If subscribers were told that the in-home wiring was their responsibility, more would do it and likely more rooms would be wired. If the hardware used was of low quality, and / or the workmanship was inadequate, leakage would certainly result. Anecdotal evidence from fly-overs indicates that apartment buildings and especially college dorms yield leakages that are not insignificant. While it is not known how many of these incidents are necessary to cause a cable system to fail the CLI, it is certainly true that a "background level" of leakage is created which reduces the tolerance for leaks in the rest of the system.

The Signal Quality Issue

Picture quality is becoming more and more important as consumer electronics hardware evolves. The interest in High Definition Television will only emphasize quality. When we allow the subscriber to do his own wiring, video quality is likely to suffer. Wiring installations that may leak will also suffer ingress. Excessive splitting of the signal will cause noisy pictures. Subscriber installed amplifiers will degrade noise figure, contribute to composite triple beat, cross modulation, and second order effects. Cheap amplifiers may oscillate. The headaches are almost limitless.

CeBus and Smart House

The EIA has been working diligently on a standard for home appliances to communicate with each other. This standard is called the Consumer Electronics interface Bus, CeBus. Communication occurs over four possible media: via radio, over twisted pairs, over coaxial cable, or by infra red links. Fiber may be in the future. Two important issues are raised by this EIA project. Consumers are led to expect that their TV's should be interconnected. Subscriber responsibility for in-home wiring will be expected. Service companies will be calling to sell installation of wires and connectors for CeBus. This must not lead to a CLI hazard or to degraded video quality. Secondly, the CeBus standard intends to distribute

in-home video to the television sets connected to the bus. In-home video comes from VCR's, satellite receivers, front door and baby sitting cameras, and graphics generators associated with security systems and home automation systems. Some of the early work involved trapping out a piece of the spectrum for use by the in-home video equipment. Cable involvement in these efforts is mandatory if we are to protect our interests. Specifically, we need to prevent the trapping of our channels to make room for in-home generated video.

A similar but incompatible effort is underway by the National Association of Home Builders. Their project is called "Smart House". The goal is to have new homes pre-wired with an interconnection scheme that would include in-home coaxial cable. Again cable involvement is necessary to insure that cable's interest's are protected. The NCTA Science and Technology Department has representation on the Smart House board. This may not be enough. More cable industry participation would be helpful.

Standards

One possible approach to minimizing problems from subscriber in-home wiring is to establish a set of hardware standards and an approval labeling system. These would be supported by training booklets, video tapes, and seminars. Subscribers who use these resources would likely do a job that minimizes the CLI hazards and protects their image quality. The cable company could reserve the right to disconnect installations which do not measure up.

The Multiple Outlet Issue

Nearly all cable operators charge for multiple outlets. Depending on the amount and the degree of enforcement, this can be a significant bottom line contributor. The financial positives of subscriber responsibility for the in-home wiring will have to out-weigh the loss of multiple outlet income.

There is also a strategic issue. The single most important trend in consumer electronics is the proliferation of TV's and VCR's in the home. These products have become impulse purchases. Multiple receivers in the home are very common and will become more so. If the subscriber only has cable on the set in the principal viewing room, he remains tied to over the air broadcast in the rest of the home. Strategically, it would be best if cable is available on nearly all of the TV receivers and VCR's in his home. This becomes more important as we face competition from telco and possibly Direct Broadcast Satellite, DBS.

Initiatives

The NCTA Engineering Committee has a new subcommittee on In-Home wiring chaired by Larry Nelson, Executive Vice President of Comm/Scope, Inc.. Its purpose is to explore these and other issues and to reach an industry position on them. In addition, Cable Labs is considering what might be appropriate for it to undertake. Broadly speaking, the differences between these two groups are that the NCTA is generally responsible for regulations and congressional matters while Cable Labs has the funding and full time staff to undertake technological projects which require the expenditure of resources for their accomplishment.

A third group which has the potential to contribute is the Electronic Industries Association, EIA. Cable has had joint efforts with the EIA for at least seven years. The relationships developed with the EIA can be used to reach common goals.

You are encouraged to contact Larry Nelson (704/324-2200) and become actively involved in this important issue.

THE AUTHOR

Dr. Ciciora is Vice President of Technology at American Television & Communications, ATC, in Stamford Connecticut. Walt joined ATC in December of 1982 as Vice President of Research and Development. Prior to that he was with Zenith Electronics Corporation since 1965. He was Director of Sales and Marketing, Cable Products, from 1981 to 1982.

Earlier at Zenith he was Manager, Electronic System Research and Development specializing in Teletext, Videotext and Video Signal Processing with emphasis on digital television technology and ghost canceling for television systems.

He has nine patents issued. He has presented over seventy papers and published about thirty, two of which have received awards from the IEEE. Walt writes a monthly column titled "Ciciora's Page" for Communications Engineering and Design magazine.

He is currently chairman of the National Cable Television Association, NCTA Engineering Committee, Chairman of the Technical Advisory Committee of Cable Labs, and President of the IEEE Consumer Electronics Society. He is a past chairman of the IEEE International Conference on Consumer Electronics. Walt is a Fellow of the IEEE, a Fellow of the Society of Motion Picture and Television Engineers, and a senior member of the Society of Cable Television Engineers. Other memberships

include Tau Beta Pi, Eta Kappa Nu, and Beta Gamma Sigma. He served on several industry standard-setting committees. Current interests center on competitive technology, the consumer electronic interface with cable, and HDTV.

Walt received the 1987 NCTA Vanguard Award for Science and Technology .

Walt has a Ph.D. in Electrical Engineering from Illinois Institute of Technology dated 1969. The BSEE and MSEE are also from IIT. He received an MBA from the University of Chicago in 1979. He has taught Electrical Engineering in the evening division of IIT for seven years.

Hobbies include reading, wood working, photography, skiing, and a hope to someday become more active in amateur radio (WB9FPW).