- Rules to promote the commercial availability, from cable operators and retail vendors that are not affiliated with cable systems, of converter units and of remote control devices compatible with converter units;
- Requirements that cable operators who offer subscribers the option of renting a remote control unit--
  -- Notify subscribers that they may purchase a remote control from any source that sells such devices;
  -- Specify the types of remote control units that are compatible with the converter unit supplied by the cable operator; and,
- Prohibit a cable operator from taking any action that prevents or in any way disables converter units from operating with commercially available remote controls.

6. Finally, Section 624A(d) requires the Commission to review periodically and, if necessary, modify the regulations issued pursuant to this section in light of actions taken in response to the regulations and to changes in cable systems, television receivers, VCRs and related technology.

7. Under the Commission's current rules, cable systems are subject to technical standards that specify minimum performance with regard to the quality of NTSC (or similar format)[8] video signals provided at subscriber terminals; delivery of closed captioning information; and signal leakage limits.[9] Related rules specify requirements for monitoring and measuring technical performance and resolving any interference resulting from cable system operation.[10] The Commission's rules currently do not address compatibility between cable systems and extended features of subscribers' TV sets, VCRs and related equipment.[11]

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[8] Some cable systems disassemble the NTSC video signal for transmission through their plant. The disassembled signal is reassembled prior to its delivery to subscribers. The reassembled signal is not in the NTSC format in all respects. However, it can be received and displayed by current TV receivers and is subject to our cable technical standards.

[9] See 47 C.F.R. §76, Subpart K.

[10] Id.

[11] Our existing rules only require that the cable television channels delivered to a subscriber's terminal be capable of being received and displayed by receivers intended for reception of off-the-air reception of broadcast TV signals, as authorized under Part 73 of our rules.

DISCUSSION

8. Problems between cable systems and consumer television equipment generally tend to arise from conflicts between new features in consumer television equipment and the techniques used by cable systems to address security and other technical operating considerations. Many TV receivers, VCRs and related consumer television equipment on the market today include features intended to allow them to be connected directly to a cable service and to tune to channels across frequency ranges used by many cable systems. Manufacturers typically market equipment with these features as "cable compatible" or "cable ready." In addition to cable ready features, many higher-priced units of consumer television equipment also include a variety of other special features that allow users to make use of multiple program channels.[12]

9. Cable systems typically use a variety of techniques to address security and important technical considerations. As a result of cable systems' use of these techniques, the manner in which cable service is delivered to subscribers often frustrates the use of special features that make use of multiple program signals. This tends to occur most often where some or all of the cable signals are scrambled or otherwise encrypted and the cable system provides service through a cable terminal device, or "cable converter," that provides a single channel of programming to the consumer's equipment.[13] In such cases, tuning to the full range of channels is accomplished through the converter. Because there are no standards for the capabilities of cable ready equipment and because cable systems tend to vary in the frequencies they use for delivery of service, equipment designated as "cable ready" by manufacturers in many cases is not able to tune all of the channels of a given cable system. Similarly, the converters used by cable systems often preclude proper operation of the remote control features of consumer television equipment.

10. The new Section 624A of the Communications Act requires that the Commission study these compatibility issues and develop

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[12] For example, VCRs typically are equipped to allow a user to view one program channel while recording another channel at the same time. Many VCRs also can be programmed to record consecutive programs that appear on different channels. In addition, some television sets incorporate advanced "picture in picture" display features that allow simultaneous viewing of the video of two or more different program channels.

[13] Cable systems also use converter boxes to align channels, to cure direct pick-up interference problems from strong radio service signals and to control signal leakage.

appropriate regulations to assure compatibility between cable systems and consumer equipment, consistent with the need to prevent theft of cable service.[14] In this first phase of our implementation of Section 624A, we seek information on the nature and extent of the compatibility problem between cable systems and consumer electronics devices, including cable system operating technologies and practices and the extended features included in consumer equipment. In examining these issues, we request information regarding alternative approaches available to cable operators for protecting against unauthorized reception of their services. We also seek information and suggestions regarding possible alternative regulatory approaches for ensuring compatibility that will minimize costs for cable operators, consumer electronics manufacturers and consumers. The specific information we are requesting on each of these areas of inquiry is discussed in the sections which follow.

11. As indicated above, this information will be used in preparing our report to Congress on the means of ensuring compatibility between cable systems and consumer equipment and in formulating our proposals for regulations in this area. We also intend to consult with representatives of the cable television and consumer electronics industries and will also consult with other parties, as appropriate.[15]

12. Cable Technologies and Operating Practices. The first step in developing a regulatory plan for achieving compatibility between cable systems and consumer equipment is to identify the

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[14] The proper resolution of the issues in this proceeding requires a recognition and balancing of the very significant costs associated with both the redundant and incapacitated consumer electronics equipment involved and with the theft of cable service. With respect to the latter issue, we note that a recent survey by the National Cable Television Associations's Office of Cable Theft suggests that service theft results in over $4.7 billion in unrealized revenue annually. National Cable Television Association, "1992 Theft of Service Survey Results" (Dec. 1992). As the rates for cable service become subject to increased regulatory oversight under the provisions of the 1992 Cable Act, such losses become increasingly an issue of concern to cable operators as well as cable system investors. The costs associated with incompatible and unusable consumer electronics equipment may also be in the billions of dollars. We request comment on this assumption.

[15] We note, for example, that a joint cable/consumer equipment industry committee has been established by the National Cable Television Association and the Electronics Industry Association to investigate means for assuring compatibility between cable systems and consumer TV equipment.

current technologies and practices used by cable systems in delivering service to subscribers. We seek information about the technologies and practices that tend to preclude operation of the extended features of consumer equipment. We similarly seek information on technologies and practices that tend to support the operation of such features. We also request data regarding the extent to which the various types of technologies and equipment currently are used by cable systems nationwide. In particular, we ask commenting parties to address these questions:

- What technologies and technical systems do cable systems currently use to provide service to subscribers' premises?
  - -- How many channels of service are provided on a cable and what frequencies are used for delivery of those channels? In what circumstances and to what extent are dual cables used to deliver service?
  - -- What methods and technologies do cable systems use to prevent theft and unauthorized reception of service (the various scrambling and encryption systems, converter and/or descrambler units, interfering carrier systems, channel-blocking traps, addressable systems, interdiction systems, etc.)? What are the operating principles used in each of these approaches?
  - -- What proportion of cable systems (and the number and proportion of subscribers affected) use each of the available security methods and technologies? How many systems use converter units, for either security or other purposes, such as elimination of direct pick-up interference in receivers, and how many and what percentage of subscribers on those systems are using converters?
  - -- What are the costs of the existing alternative techniques for preventing theft, unauthorized reception and addressing technical performance considerations, both to cable systems and subscribers?
- What is the effect of channelization practices and security systems on the operation of extended features of television receivers, videocassette recorders and other related consumer television equipment? How does use of these techniques affect the technical performance and operations of cable systems?
- Which methods of scrambling and encryption systems do not interfere with the functions of subscribers' TV receivers, VCRs and other TV equipment?
- What types of cable converters are currently available to cable subscribers commercially from third parties?
  - -- To what extent do cable systems currently make converters and/or remote control units available for purchase by their subscribers?
- To what extent is it technically and economically feasible for cable systems to offer subscribers the

option of delivering directly to subscribers' receivers or VCRs all signals that do not need to pass through a converter?
- To what extent are cable converters or other devices used by cable systems to resolve technical problems such as signal leakage?

13. Consumer Equipment Features. We also need to develop a full understanding of the various features incorporated in consumer television receivers, videocassette recorders and other related equipment that can be affected by the manner in which cable service is delivered. In this regard, we request information and comment concerning the following:

- The features incorporated in consumer electronics equipment that can be affected by the manner of cable signal delivery.
  -- What types and portions of currently available consumer TV equipment include such features?
  -- How are these features affected by the various methods of cable signal delivery, particularly with respect to techniques and methods cable operators use to protect against theft of service?
  -- Generally, the number of cable channels that currently available "cable ready" TV receivers, VCRs and other equipment can accept tends to vary across different equipment. How many channels of cable service does currently available TV equipment accept, how does this vary across different equipment and what are the frequencies of these channels, including their associated video and aural carrier frequencies?
  -- Are any new consumer TV equipment features anticipated or expected in the foreseeable future that would pose compatibility issues different from those indicated in the 1992 Cable Act?
- What equipment other than TV receivers and VCRs are affected by the compatibility relationships addressed herein?
- The definition of a "cable compatible" or "cable ready" unit.
  -- What features should a device incorporate to be considered cable compatible or cable ready?
  -- How many channels should a device be able to receive, and in what frequency ranges should those channels be, in order to be considered cable ready or cable compatible? What other cable system operating characteristics should a device be able to accommodate to be considered cable compatible?

14. Regulatory Program for Assuring Compatibility. The above information will provide a base for understanding the nature and extent of compatibility between cable system

operations and consumer television equipment. As instructed by Congress, we intend to pay careful attention to the costs and benefits to consumers of imposing compatibility regulations on cable operators and television manufacturers. In this regard, we intend to balance the limiting effects of compatibility regulations on cable operators against the benefits those regulations provide in facilitating the operation of special features on consumer equipment. We seek to formulate our regulations so that they will accomplish the intent of the law with the least effect on opportunities for improvements in both cable system and consumer electronics equipment. In addition, we are aware of cable operators' need to protect effectively against theft or otherwise unauthorized use of their services. The compatibility rules we adopt should allow cable operators to employ cost-effective means for protecting their service from theft or other unauthorized interception and use. With these considerations in mind, we need additional information in the following areas relating to development of regulations for assuring compatibility between cable systems and consumer television equipment:

- To what extent could existing cable equipment be modified to be more compatible with TV receivers, VCRs and other consumer TV equipment (and how much would it cost and how long would it take to make the necessary changes), while still providing for adequate protection against theft of service?
- What new methods for providing cable system security are being developed, when will they be available and how much would they cost (to both consumers and cable subscribers)?
- How will new digital transmission techniques affect system security, including costs?
- What technical standards are necessary to assure that cable systems provide service in a manner that is technically compatible with the extended features of consumer TV equipment?
  - -- What elements of cable system operation should be regulated to assure compatibility?
  - -- What are the least costly approaches for a regulatory program that will achieve this goal while still permitting cable operators to prevent theft of service?
- To what extent, if any, should cable systems be restricted in the manner in which they encrypt or scramble their signals?
- What standards and/or operating requirements, if any, would be practical to accommodate the introduction of new technologies, such as compressed digital modulation, and still ensure that such technologies are compatible (insofar as possible) with TV receiver and VCR functions and features? In this regard, how should we reconcile

the requirements of the Act with the introduction of new technologies and what particular difficulties do we face in attempting such a reconciliation?

- What modifications could be made to existing consumer TV equipment designs to make it more compatible with the manner in which cable service is provided?
  -- Should shielding requirements be required for cable ready consumer equipment to protect against interference to cable signals from "direct pick-up" of broadcast signals and to limit unintentional radiation of cable signals by such equipment?
- What elements of consumer TV electronics equipment could be standardized to ensure compatibility with cable systems?
  -- Should consumer electronics equipment be required to be equipped with two cable input ports to accommodate dual cable systems? (Such capability would facilitate switching between cable within the consumer device, and through its remote control, and obviate the need for a separate and external input selector switch.)
- What standards should be specified as technical requirements with which TV receivers, VCRs and other consumer equipment must comply in order to be sold as cable compatible or cable ready?[16] For example, should we adopt rules regulating:
  -- The number of cable channels that can be received and the frequencies of those channels?
  -- A universal connection to enable the use of separate devices that can descramble signals encoded using alternative security techniques?
- To what extent could regulations intended to assure compatibility between cable systems and consumer television equipment also affect technical aspects of the "buy-through" provisions of Section 3 of the 1992 Cable Act?[17]

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[16] In this regard, we note that the Senate and House conferees, in drafting the 1992 Cable Act, encouraged the development of voluntary efforts by the cable industry and the manufacturers of television equipment to meet the technical requirements the Commission will adopt. See Conference Report on the Cable Television Consumer Protection and Competition Act of 1992, H.R. Report 102-862, p. 89.

[17] Section 3 of the 1992 Cable Act, which amends Section 623 of the Communications Act, generally prohibits cable operators from requiring subscribers to purchase any "tier" of service, other than the basic service tier, "as a condition of access to video programming offered on a per channel or per program basis." This is commonly referred to as the buy-through prohibition. 47 U.S.C. §543(b)(8)(A). Section 3 also provides

15. Remote Control Units. We also seek information to assist us in implementing regulations regarding remote control units. Many converter units used by cable systems provide for remote control of cable services. Cable systems typically charge a separate monthly fee for the remote control feature. The technologies used by some cable systems also permit the remote control features on their converter units to be remotely activated/deactivated by the cable operator. As indicated above, the 1992 Cable Act is much more specific about the nature of the rules to be applied to address remote control issue than it is for compatibility in other features. In this case, the legislation directs the Commission to adopt rules to: 1) promote the commercial availability of converter units and remote controls; 2) require cable systems to notify subscribers regarding commercial availability of remote controls; and, 3) prohibit actions that would prevent remote controls from operating with converter units. We therefore ask that parties submitting information and suggestions for rules regarding regulation of remote control units do so in the context of the regulatory requirements specified in Sections 624A(c)(2)(C) and (D).

16. In order to assist us in developing proposals for rules to implement the remote control provisions of Section 324A, we request information on the following topics:

- What types of remote control equipment currently are used by cable systems?
  -- To what extent is the same model of converter units provided to subscribers for both manual and remote control use?
  -- To what extent do cable operators use technical systems that allow them to disable a converter's remote control function, either through a manually invoked control on the device itself, or through an electronic signal that can be transmitted to the device from the cable headend?

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that for a period of 10 years, or until a cable system is modified to eliminate technological impediments to unbundling of pay from other tiers of service, the prohibition shall not apply to a cable system "that by reason of the lack of addressable converter boxes or other technical limitations, do not permit the operator to offer programming on a per channel or per program basis." 47 U.S.C. §543(b)(8)(A). The Commission has issued a separate Notice of Proposed Rule Making addressing regulations pertaining to the buy-through prohibition in a separate proceeding. See Notice of Proposed Rule Making in MM Docket No. 92-262, adopted December 10, 1992, FCC 92-540, released December 11, 1992.

-- What portion of the market currently rents each type of cable remote control unit?

- To what extent are remote control units that are compatible with the converter units used by cable systems available to consumers now?
  -- To what extent are the remote control features of cable converters compatible with existing commercially available remote control units, including the "universal" remote control design?
  -- What types of such units are available and how much do they cost?
  -- What portion of the market currently owns such units?
- How can the Commission best encourage the commercial availability of remote control units that are compatible with existing converter units?

17. Future Cable Television and Consumer Electronics Developments. The foregoing discussion focuses primarily on the current status of cable television and consumer electronics technology in the consumer marketplace. Information on the current situation is critical in determining how to respond to the problems identified in the 1992 Cable Act. We also seek information on likely future developments in cable television distribution techniques and consumer electronics that may be used in association of cable television reception:

- How will projected increases in cable television channel capacity affect the interface?[18] What is the likelihood that any interface would either become obsolete in a short time or inadvertently stifle technological advances?
- Will digital transmissions, including advanced television and video compression change the nature of the interface in ways that should be addressed in this proceeding?
  -- How would the use of such methods affect the operation of special features of cable subscribers' TV equipment?
- What are the implications for a standard interface arising from the digital transmission of video over common carrier networks?

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[18] See e.g., Broadcasting, December 14, 1992, p. 66 ("[fiber architecture] ... Coupled with compression, which the company anticipates will directly reach subscriber homes by the first quarter of 1994, Time Warner is preparing for systems with 500 to 600 channels."); New York Times, December 3, 1992, p. 1 ("The nation's biggest cable television company announced yesterday that as early as 1994, it would install technology that would ultimately let its customers receive as many as 500 channels.")

- How might prospects for new remote control devices providing access to program types rather than channel numbers, affect, or be affected by, this proceeding?[19]
- How will expanded receiver features, such as increased "picture-in-picture" features, be accommodated?[20] In this regard, we seek assistance in developing rules that provide the least possible obstacle to technical improvements in both cable television and consumer electronics consistent with accomplishing the stated objectives of the law.

18. Implementation Considerations/Schedule. One of the most important elements in implementing the new equipment compatibility regulations will be the schedule by which they become effective. The extent to which the implementation of our equipment compatibility rules are spread over time will significantly affect the impact of these rules on cable operators and equipment manufacturers. At the same time, we must balance the interests in minimizing the impact of this regulation on industry with the need to promote compatibility in a prompt manner. It would appear that the scheduling of some requirements, such as notification requirements, would have little impact on industry, so that those requirements could be implemented quickly. We request comment and information on the scheduling of the dates when cable systems and consumer equipment manufacturers should be required to comply with the new rules we will adopt. We note that Section 624A and the legislative history do not address the issue of the schedule for compliance with the new rules. We seek comment on the schedule for implementing all aspects of new rules in this area.

PROCEDURAL MATTERS

19. Pursuant to applicable procedures set forth in Sections 1.415 and 1.419 of the Commission's rules, 47 CFR Sections 1.415 and 1.419, interested parties may file comments on or before March 22, 1993, and reply comments on or before April 21, 1993. All relevant and timely comments will be considered by the Commission before taking further action in this proceeding. To file formally in this proceeding, participants must file an

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[19] See, e.g., "Discovery plans compression control," Variety, December 14, 1992, p. 22.

[20] See e.g., Communications Daily, December 17, 1992, p. 3 (Thompson Consumer Electronics receiver "has all picture tricks we've ever seen displayed on widescreen sets -- and more: 2-tuner picture-outside-picture (POP); PIP with swap, freeze, expand; channel guide, with as many as 15 pictures on screen; ....").

original and four copies of all comments, reply comment and supporting comments. If participants want each Commissioner to receive a personal copy of their comments, an original and nine copies must be filed. Comments and reply comments should be sent to Office of the Secretary, Federal Communications Commission, Washington, D.C. 20554. Comments and reply comments will be available for public inspection during regular business hours in the FCC Reference Center (Room 239) of the Federal Communications Commission, 1919 M Street, N.W., Washington, D.C. 20554.

20. For further information concerning this Notice of Inquiry, contact Bruce Franca or Alan Stillwell (202-632-7060), Office of Engineering and Technology, Federal Communications Commission, Washington, D.C. 20554.

FEDERAL COMMUNICATIONS COMMISSION

Donna R. Searcy
Secretary

APPENDIX B: PARTIES FILING COMMENTS AND REPLIES

Parties Filing Comments

1. Ameritech Operating Companies
2. Mr. Cleatus E. Barnett
3. Stephen G. Baumgartner
4. BellSouth Telecommunications, Inc.
5. Booth American Company
6. Cable-Consumer Electronics Compatibility Group
7. CableVision Industries Corporation
8. The Community Antenna Television Association, Inc.
9. Continental Cablevision, Inc.
10. Discovery Communications, Inc.
11. The Electronics Industries Association/Consumer Electronics Group
12. Electronics Technicians Association, International, Inc.
13. General Instrument Corporation
14. Greater Media, Inc., Monmouth Cablevision Associates and Riverview Cablevision Associates
15. InterMedia Partners
16. Matsushita Electric Corporation of America
17. Media General cable of Fairfax, VA
18. City of Mesa, AZ
19. Mitsubshi Electronics America, Inc.
20. Multichannel Communications Sciences, Inc.
21. Multiplex Technologies, Inc.
22. The National Association of Telecommunications Officers and Advisors, the National League of Cities, the United States Conference of Mayors and the National Association of Counties (Joint Local Governments)
23. National Cable Television Association
24. National Electronics Dealers Association
25. New York City Department of Telecommunications and Energy (City of New York)
26. Oregon Consumer League
27. Scientific-Atlanta
28. Village of Schaumberg, IL
29. Robert M. Soloway
30. Sony Corporation of America
31. Starsight Telecast, Inc.
32. TeleCable Corporation
33. Tele-Communications, Inc.
34. Thomson Consumer Electronics, Inc.
35. Time-Warner Entertainment Company, L.P.
36. United States Telephone Association
37. Zenith Electronics Corporation

Parties Filing Reply Comments

1. American Telephone and Telegraph Company
2. Bang & Olufsen
3. Bell Atlantic
4. Cable-Consumer Electronics Compatibility Group
5. Cable Systems Corporation
6. The Community Antenna Television Association, Inc.
7. Consumer Federation of America
8. Continental Cablevision, Inc.
9. Discovery Communications, Inc.
10. The Electronics Industries Association/Consumer Electronics Group
11. General Instrument Corporation
12. Greater Media, Inc., Monmouth Cablevision Associates and Riverview Cablevision Associates
13. GTE Service Corporation
14. Home Recording Rights Coalition
15. InterMedia Partners
16. Matsushita Electric Corporation of America
17. Multichannel Communications Sciences, Inc.
18. The National Association of Telecommunications Officers and Advisors, the National League of Cities, the United States Conference of Mayors and the National Association of Counties (Joint Local Governments)
19. National Cable Television Association
20. Newhouse Broadcasting Corporation
21. New Jersey Office of Cable Television
22. Prime Cable
23. Rogers Cablesystems of Alaska, Inc.
24. Sanyo Fisher (USA) Corporation
25. Sanyo Manufacturing Corporation
26. Scientific-Atlanta
27. Sony Corporation of America
28. TeleCable Corporation
29. Tele-Communications, Inc.
30. Thomson Consumer Electronics, Inc.
31. Time-Warner Entertainment Company, L.P.
32. Zenith Electronics Corporation

Parties Responding to the Supplemental Comments of the Cable-Consumer Electronics Compatibility Advisory Group

1. Ameritech Operating Companies
2. BellSouth Telecommunications Inc.
3. Consumer Federation of America
4. General Instrument Corporation
5. Multichannel Communication Sciences, Inc.
6. National Association of Telecommunications Officers and Advisors, The National League of Cities, The United States Conference of Mayors, and the National Association of Counties (Joint Local Governments)
7. National Consumer Cable Association
8. New Jersey, Office of Cable Television
9. Pacific Telesis Group, Pacific Bell and Nevada Bell
10. Prodigy Services Company
11. Tandy Corporation
12. Titan Corporation
13. United States Telephone Association
14. Videomaker Magazine, Inc.

APPENDIX C: SUPPLEMENTARY INFORMATION RELATED TO CABLE SYSTEM OPERATION AND COMPATIBILITY ISSUES

Technologies Used to Provide Cable Service. Cable systems typically are constructed using a topology known as "tree and branch." This type of system is made up of a "headend" (the place where the signals that will be delivered are gathered together) plus a distribution system made up of either coaxial cable or fiber optic cable. The distribution system consists of the "trunk" cable, "feeder" cable and "drops." The trunk portion of the system is meant to bring signals from the headend to neighborhoods with as little noise as possible. It uses larger diameter cable with active amplifiers about every two thousand feet. Trunk cable is usually less than 10 miles in length. The feeder cables bring service into the neighborhoods, where it is tapped to deliver service to homes and other institutions. The splitting of signals results in the need to restrict feeder cables to short runs, typically about 1.5 miles, and to use amplification. Generally, signal levels are higher on feeder cables, as tapping to serve homes splits off energy. Drops are 100 to 200 foot coaxial cables that connect customers to the cable system. In most systems, almost 50 percent of the footage of cable is in the drops. About 36 percent is in the feeders and the remaining 14 percent is in the trunk. When cable systems geography extends beyond the range practical for trunk lines, two options are typically used. These are microwave links and frequency modulated signals on "super trunks."

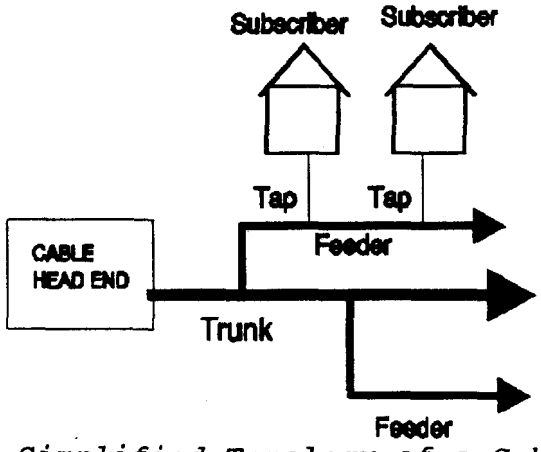

Figure 6: *Simplified Topology of a Cable System*

In almost all cases, cable programming now is provided to subscribers in analog form. The channels delivered to subscribers on cable are carried as vestigial side-band,

About 5 or 6 years ago, it was determined that most of the cable in a system's plant could carry much higher bandwidths, up to 1 GHz, for example. The limiting factor is the cascade of amplifiers in the trunk portion of the plant. Analog fiber optics can also be used to replace the trunk and more fully realize the capacity of the remainder of the system. Since the trunk constitutes the smallest fraction of a system, upgrading to fiber is very cost effective. It also provides substantial quality benefits that derive from the removal of active electronics from the cable plant and the substitution of passive optical cable. In order to take advantage of these benefits, cable systems are increasingly using a hybrid system made up of portions of both coaxial cable and fiber. Some newer installations and upgrades are also bringing signals into neighborhoods using fiber optic cables. Even in these cases, however, service is brought to the home using coaxial cable.

Set-top Devices. In a subscriber's premises, the drop cable is connected either directly to the customer's receiving equipment or to the input of a set top device, which is then connected to the TV receiver or VCR. Set top devices may be either a basic converter or, in the case of a cable system that uses scrambling, a combined converter/descrambler unit. Converters change the channel of a desired cable signal to a channel in the broadcast TV band, usually channel 3 or 4, that is unused in the subscriber's local area.

The original purpose of set-top devices was to compensate for inadequate shielding in TV receivers and VCRs that can result in direct pick-up interference (DPU) on the host unit or leakage of input cable signals. DPU occurs when radio signals are received directly by the internal circuitry of a TV receiver or VCR and mix with cable signals to either impair or render unwatchable the desired video or audio.[73] As the bandwidth used by cable systems increases, it becomes more important to have adequate shielding since higher frequencies tend to be more likely to penetrate inadequately shielded circuits. NCTA states that converters now are used to compensate for poor performance by consumer equipment in the areas of image response, overload, adjacent channel rejection, and noise and oscillator feedback interference.

The earliest cable converters only tuned the 12 channels in the VHF TV band. As cable systems increased the number of

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[73] If a broadcast signal is carried "on channel," leakage of its over-the-air signal into the receiver produces a leading ghost. If the over-the-air TV and cable signals are off-set, diagonal bars appear on the screen. Signals from other over-the-air services such as paging will cause background patterns to roll through the picture or block the picture entirely.

channels they carry, the function of converters was expanded to include providing subscribers access to signals carried on channels beyond the tuning range of the subscribers' own receiving equipment.

Cable converters currently are useful to customers under one or more of the following circumstances:

1. The customer's TV or VCR does not tune the same number of channels (i.e., the cable system provides more channels than the TV set can tune).
2. The customer has a TV or VCR that is capable of tuning the cable channels but experiences direct pick-up interference. A set top converter will frequently help this problem, since the output channel of the converter is chosen so as not to duplicate an off-the-air signal.
3. The customer's TV set does not have remote control capability. In this case, a converter equipped with a remote control feature can act as an add-on remote feature for an older TV.
4. The customer's TV or VCR has inadequate selectivity, allowing adjacent channel signals to mix with the desired signal and degrade it.
5. The customer's TV or VCR has poor image response, so that a channel at the image frequency (+/- 7, 8, 14 and 15 channels removed from the desired channel) interferes with the desired channel.
6. The customer's equipment leaks broadband cable signals that could cause interference to other licensed communications services, particularly aircraft navigation and communications services or emergency services such as police, fire and rescue communications.
7. Feedback of signals from one of the customer's TV receivers or VCRs to another TV or VCR.
8. The customer has chosen to pay for a "premium" channel that has been secured through the use of scrambling. In this case, the set top device performs the descrambling function needed to view the premium service.

About 15 to 20 years ago, cable systems began offering their subscribers converters with remote control capability. At that time, only a few models of TV receivers were equipped with remote control capability. The first remote controlled converters used a long wire that connected the tuning control to the set-top unit. The wired connection limited the use of remote tuning and was easily damaged. CVI indicates that even with these limitations, 25 to 40 percent of cable subscribers paid the rental fee to get remote tuning capability that was not on their TV sets. About 12 to 15 years ago, cable systems began to offer wireless remote controls that use IR signaling. The portion of subscribers with converters who pay a fee for remote controls has now increased to 40 to 50 percent.

The EIA/ANSI 563 Decoder Interface Connector (DIC). The DIC is a special plug connection used with TV receivers and VCRs that allows access to the internal circuitry of the device to facilitate the operation of descrambler circuits and other functions. The plug connection is generally located in the back of TV receivers and VCRs so equipped. The DIC plug has 20 pins and resembles the plugs on the backs of computers. This same 20 pin plug is now mandated on TV receivers in France and much of the rest of Europe, and is also included in many sets sold in Japan. With cable service, unprocessed video and audio signals are received by the TV receiver or VCR, and then passed into a set-back descrambler through the DIC. After descrambling, the processed signal is passed back into the host device for display or other use.

Use of a DIC descrambler allows the descrambling function to be located "downstream" of the TV's or VCR's tuner and remote control circuitry, thereby making descrambling transparent. No set-top device is needed and all of the functions of the consumer equipment are maintained. The DIC descrambler avoids the need for duplication of the consumer device's tuner, remote control and channel indicator. In addition, it does not necessitate converting or remodulating the signal so that it is compatible with the host units tuner. The DIC descrambler also reduces "bruising" of the signal, that is adding distortion and noise to the signal, is cheaper and consumes less power.

The DIC also offers a means for achieving cable compatibility with VCRs. Use of a DIC and plug-in descrambler permits the VCR's timer to regain control of the tuning function, so that sequential recording of different channels becomes possible again. If the DIC feature were only used on TV receivers, the TV receiver would have to be left powered in order to provide descrambled signals to the VCR. Thus, if the VCR is DIC equipped, sequential programs on different channels can be recorded from cable much the same as using the VCR with an antenna.

An optional enhancement feature for the DIC would allow the TV's or VCR's remote control to communicate with the descrambler and the descrambler to communicate with the tuner in the TV or VCR. This would facilitate ordering IPPV services with the TV set or VCR's remote control and could also support on-screen-displays for assisting subscribers in ordering IPPV programming and presenting program guides.

There are two additional important applications of the DIC. The first is that the DIC can be used for connecting TV receivers and VCRs, thereby eliminating the need for multiple cables for video and audio in and out, left and right. Second, if the consumer's cable systems were to expand its channel capacity so as to exceed the tuning range to the DIC equipped device, the DIC

allows an external tuner to be attached that matches with the increased cable channel capacity. Time-Warner notes that while no products are currently available that perform this last function, there is no technical reason they cannot be developed and marketed.

The EIA/ANSI 563 standard was developed and tested over a period of several years by engineers from the cable and consumer electronics industry. The Joint Engineering Committee that performed this work is sponsored by the Electronics Industry Association (EIA) and the Engineering Committee of the National Cable Television Association (NCTA). The DIC standard has been adopted by the American National Standards Committee as a national standard.[74]

EIA/ANSI 563 has been a standard for about four years now. When it was first introduced in 1989, about 1 million receivers were manufactured and marketed. Receivers from RCA, General Electric, Panasonic, Quasar, Curtis-Mathes and JC Penny were matched with component descramblers made by Jerrold and Zenith. Oak, Pioneer and Scientific Atlanta also developed prototype component descramblers. While its practicability and acceptability to consumers were demonstrated, this technology did not achieve widespread deployment in cable systems, and receiver production subsequently declined.

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[74] The term "multiport" has also been commonly used for the DIC. This nickname developed from the original intention of the Joint Engineering Committee to develop a standard that would have multiple applications in the consumer, cable, computer and related fields. Time-Warner indicates that it is not an official name and that continued use of this name for the DIC is being discouraged.

APPENDIX D: THE NATIONAL CABLE TELEVISION ASSOCIATION OFFICE OF CABLE SIGNAL THEFT 1992 SURVEY

Cable Industry Lost Revenue Due to Cable Signal Theft 1992

System Size	Basic	Premium	Total
50,000 or More			
Potential for Theft (households)2	30,531,809	19,065,843	—
Theft Percentage3	14.07%	13.21%	—
Estimated Thefts (households)	4,295,826	2,518,598	6,814,424
20,000-49,999			
Potential for Theft (households)	20,221,763	13,665,868	—
Theft Percentage	14.61%	14.33%	—
Estimated Thefts (households)	2,954,400	1,958,319	4,912,719
10,000-19,999			
Potential for Theft (households)	10,957,836	7,858,176	—
Theft Percentage	10.37%	14.76%	—
Estimated Thefts (households)	1,136,328	1,159,867	2,296,195
9,999 or Less			
Potential for Theft (households)	18,044,331	12,848,893	—
Theft Percentage	5.81%	6.33%	—
Estimated Thefts (households)	1,048,376	813,335	1,861,711
Total Estimated Thefts	9,434,930	6,450,119	15,885,049
Rates4	$17.95	$10.28	—
Average Number of Pay Services5	—	3.4	—
Lost Revenue Per Month	$169,356,994	$225,444,559	$394,801,553
Lost Revenue Per Year	$2,032,283,928	$2,705,334,708	$4,737,618,636

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2 A.C. Nielsen Co., (Cable On-Line Data Exchange) Database. Data as of October 31, 1992

3 Derived from NCTA Office of Cable Signal Theft 1992 Theft of Service Survey.

4 Paul Kagan Associates, Inc., *Cable TV Financial Databook*, June 1992. Data as of December 31, 1991.

5 Derived from Paul Kagan Associates, Inc., *Census of Cable and Pay TV*. Data as of December 31, 1990.

1992 Theft of Service Survey Results

The cable industry loses $4.7 billion a year from cable theft according to the National Cable Television Association's Office of Cable Signal Theft 1992 survey. The survey was distributed in January 1992 to 2,685 systems. A total of 771 systems reported statistical data (29% response rate) based on 1991 year-end data.

The systems responding represent 27 million homes passed and 16 million subscribers. For analytical purposes, systems were categorized into four groups: under 10,000 subscribers; 10,000-19,999; 20,000-49,999; and 50,000 or more subscribers.[1]

Based on the data provided, the percentage of theft of basic service ranged from 5.81%-14.61% and the percentage of theft of premium service ranged from 6.33%-14.76%. Projecting the larger percentages into the cable universe as a whole in each system-size category produces estimates of over 9.4 million illegal basic and 6.4 million illegal premium users.

Using conservative monthly average rates ($17.95 basic and $10.28 premium), the piracy loss translates into over $4.7 billion in unrealized revenue annually, or almost 24% of gross industry revenue in 1991.

Overall, average percentages of theft are 11.21% of basic service and 11.52% of premium service. This is the first time that estimated premium theft percentages have been greater than basic theft percentages.

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[1] It should be noted that responses to the theft of service survey from large systems (50,000 or more subscribers) represented a larger portion of total responses than large systems represent in the total industry. However, the potential overrepresentation by large systems in the survey results was mitigated by grouping the results into four categories according to system size. The number of households where theft could potentially occur is a conservative figure: in the Nielsen database not all headends report the number of homes passed.

APPENDIX E: NCTA PUBLICATION ON METHODS FOR CONNECTING CONSUMER EQUIPMENT TO CABLE SERVICE

Connecting Cable Systems to Subscribers' TVs and VCRs — Guidelines For The Cable Television Industry

by the NCTA Engineering Committee's Subcommittee on Consumer Interconnection

Chairman: David Large

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