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Before the
Federal Communications Commission
Washington, D.C. 20554

ORIGINAL

In the Matter of	)	
Telephone Company-Cable Television Cross-Ownership Rules, Section 63.54-63-58	)	CC Docket No. 87-266
and	)	
Amendments of Parts 32, 36, 61, 64, and 69 of the Commission's Rules to Establish and Implement Regulatory Procedures for Video Dialtone Service	)	RM-8221

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Reply Comments of BroadBand Technologies, Inc., on
The Third Further Notice of Proposed Rulemaking

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SUMMARY

Comments on the Third Further Notice of Proposed Rulemaking make clear that the common carrier principles of equal access and expandability underlying Commission's video dialtone policy are at stake and that Commission action is needed to preserve these principles. BroadBand Technologies recommends that the Commission require that video dialtone systems be all-digital after an appropriate transition period.

Such Commission action is required even though most commenters agree that digital technologies are superior for delivering video dialtone services and that video distribution systems eventually will be all-digital. Requiring that video dialtone systems be digital by a date certain or upon achievement of certain specified milestones will send a strong signal about the Commission's expectations and will give added incentives to the LECs to deploy an infrastructure that will deliver multiple programmers' services on a nondiscriminatory basis.

BroadBand Technologies maintains that digital technologies are cost-effective for delivering video dialtone services, and points to the rapid adoption of direct broadcast satellite (DBS) services as proof that delivery of digital video is today technically and operationally feasible and economically justifiable. However, BroadBand Technologies agrees that there is a short-term need for some analog capacity, but maintains that "baseband" fiber-to-the-curb systems are capable of meeting this need without compromising the Commission's video dialtone objectives.

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Introduction

The Commission's video dialtone initiative has reached a critical juncture. At issue in this proceeding[1/] are the core common carrier principles underlying the Commission's

[1/] *In the Matter of Telephone Company Cable Television Cross-Ownership Rules, Sections 63.54-63-58,* Memorandum Opinion and Order on Reconsideration and Third Further Notice of Proposed Rulemaking, CC Docket No. 87-266, rel. Nov. 7, 1994, para. 3. In these reply comments, we refer (continued...)

video dialtone policy -- first, that video dialtone platforms provide sufficient capacity to serve multiple programmers on a nondiscriminatory basis and second, that such platforms be expandable where technically feasible and economically reasonable. The comments on the Third Further Notice of Proposed Rulemaking make clear that Commission action is needed to preserve these principles.

In the first place, the comments indicate that only digital video dialtone systems are fully consistent with the Commission's principles. Digital systems provide many times the capacity of analog platforms, and it is technically feasible and economically reasonable to expand the capacity of digital systems.[2/] In contrast, the analog capacity available on hybrid fiber/coax systems is limited and is both costly and inefficient to expand. Moreover, programmer demand for analog capacity already exceeds such systems' capacity, necessitating the imposition of analog channel rationing and channel sharing schemes that depart from the common carrier nature of video dialtone service.

However, while many of the commenters acknowledge the benefits of digital video systems, they argue in the name of "technology neutrality" and "market forces," that the Commission should not mandate the use of such technologies. As an initial matter,

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[1/](...continued)
to the Memorandum Opinion and Order as the "Reconsideration Order" and the Third Further Notice of Proposed Rulemaking as the "Notice."

[2/] Switched digital video dialtone platforms such as BroadBand Technologies' Fiber Loop Access (FLX) system provide virtually unlimited capacity and are essentially infinitely expandable. The FLX system is configured to deliver 384 digital "broadcast" channels and as much switched digital programming as the market will bear. See BroadBand Technologies Comments, pp. 10-12.

BroadBand Technologies urges the Commission to look skeptically on arguments that the technologies required to deploy digital video dialtone platforms are unavailable or too costly to deploy. Commenters quote such extreme variations in prices for digital components that one questions their reliability.

Moreover, BroadBand Technologies urges the Commission to stick to its principles. The Commission stated succinctly in the Notice that it is "not technology-neutral with respect to technologies that cannot meet" its "basic video dialtone requirements."[3] Given the current predominance of analog program production and reception, there are sound policy reasons to allow video dialtone systems with analog capacity, but only on an interim basis. In the long term, analog technologies cannot meet the basic tenets of the Commission's video dialtone policy. Video dialtone systems cannot be allowed to deviate permanently from the core video dialtone principles.

As BroadBand Technologies recommended in its comments filed December 16, the Commission should require that video dialtone platforms become all-digital by a date certain or upon the achievement of certain specified milestones. Such a mandate would send a strong signal about the Commission's expectations for video dialtone and would create incentives for the local exchange carriers (LECs) to accelerate the deployment of integrated broadband networks.

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[3] *Notice*, para. 34.

Digital Technologies Are Superior and Cost-Effective for Delivering Video Dialtone Services

Most commenters, including those that oppose an FCC requirement that video dialtone systems be all-digital, agree with BroadBand Technologies that digital technologies are superior for delivering video dialtone services. U S WEST, for instance, states that "an all digital network is desirable from a market, technological, and consumer perspective. The efficiencies of such a network and the availability of a broad array of both programming and programmers will be served by having and all digital solution."[4] Bell Atlantic summarizes succinctly the advantages of digital systems:

> (D)igital signals are capable of providing much better picture quality than analog signals, digital compression and switching techniques permit more efficient spectrum utilization, permitting dynamic allocation of bandwidth and providing substantially greater capacity from the same amount of bandwidth; and the more robust upstream signalling capability of digital systems is required to support the innovative interactive applications consumers seek, such as true video on demand, home shopping, banking and other transactions, distance learning, and other educational informational or health-related services.[5]

Most commenters also generally share BroadBand Technologies' conviction that the advantages of digital technologies will lead eventually to the use of all-digital video distribution systems.[6]

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[4] U S WEST Comments, p. 10.

[5] Bell Atlantic Comments, pp. 5-6.

[6] See U S WEST Comments, p. 16 ("In the future, U S WEST believes that an all digital solution is inevitable"); Bell Atlantic Comments, p. 4 ("The video industry is slowly but inexorably following the lead of the telecommunications industry in choosing digital over analog technologies").

Despite these clear benefits of digital video systems, several commenters question the near-term viability of deploying such systems, citing the cost of digital components and the prevalence of analog television sets and programming. They question whether, given these concerns, all-digital video dialtone systems would be profitable in the near term. In its comments, BroadBand Technologies demonstrated that its FLX fiber-to-the-curb (FTTC) system is a cost-effective switched digital video dialtone transmission platform available today.[7] Broadband Technologies also endeavored to demonstrate that the other components of a digital system, including digital video servers, encoders, and set-tops, also are now, or soon will be available.[8]

The digital component costs cited by parties opposed to requiring all-digital video system deployment vary widely from party to party. For instance, the current cost of digital set-tops is cited variously as $300, $700, and "between $1000 and $2000."[9] Similarly, real-time digital encoders are reported to cost $80,000 per channel, $100,000 per channel, or as much as $146,000 per channel.[10] While some price variation is to be expected when discussing telecommunications equipment, the digital component prices quoted by

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[7] BroadBand Technologies Comments, pp. 17-19. U S WEST has proposed to use a fiber-to-the-curb access architecture for its video dialtone systems, and it stated in its comments that this "solution is at parity with hybrid fiber/coax architectures (less than $1000 per house passed), and is actually less sensitive to cost increases as a function of increased video dialtone subscriber penetrations than are (hybrid fiber/coax) architectures." See U S WEST Comments, pp. 15-16.

[8] BroadBand Technologies Comments, pp. 19-25.

[9] AT&T Comments, p. 5; Southwestern Bell Comments, p. 3; and United and Central Telephone Comments, p.5.

[10] Southwestern Bell Comments, p. 4; U S WEST Comments, p. 15; United and Central Telephone Comments, p. 5.

commenters vary, in some cases, by more than 600 percent. These vast differences suggest either that the prices quoted are unreliable or that digital component prices are falling so fast that commenters can't keep up.

In fact, the components needed to deliver digital video signals are technically and operationally feasible and economically justifiable today.[11] Direct broadcast satellite (DBS) services deliver all of their programming in digital format and require the use of a digital set-top converter. Digital features have not hindered the rapid growth of DBS services, which now serve in excess of 600,000 subscribers after less than one year of operation. Indeed, the use of digital technology has proven to be a competitive advantage for DBS providers.

Analog Video Dialtone Systems Suffer Multiple Shortcomings

The comments further highlight the difficulty of squaring video dialtone systems with limited analog channel capacity with the Commission's video dialtone requirements. The analog channel capacity of hybrid fiber/coax systems typically is between 60 and 80 channels. Demand for these channels is generally expected to exceed the supply. Indeed, where telephone companies have proposed to use such systems, even on a trial basis, programmer demand for channels has exceeded the systems' analog capacity. The only ways to expand the analog capacity of such systems are to reduce the number of digital channels

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[11] Even if accurate, the costs cited by commenters for certain digital components would not be unreasonable. For example, the per-home passed cost of adding real-time digital encoders to an all-digital video dialtone platform may be modest. If the platform serves 500,000 subscribers and real-time digital encoders are required to encode ten channels, the per-home passed cost would be only $2.

the platforms or add additional facilities at substantial cost. Given the drawbacks of either approach, the LECs' and the Commission's attention has shifted to so-called "channel-sharing" arrangements. These arrangements are highly controversial and raise complex regulatory issues. In particular, channel sharing will result in only a limited number of analog channels being available for exclusive use by individual programmers. The likely result will be that programmers will receive fewer analog channels than they request. This is a significant departure from the common carrier principles underlying the video dialtone rules, and should not be allowed on a permanent basis.[12] In addition, the sheer complexity of proposed analog channel allocation mechanisms could hamper the introduction of video dialtone services.

In their comments on the *Notice*, programmers indicated their concern about the limited analog capacity of most proposed video dialtone systems. While not opposed in principle to channel-sharing, they urged the Commission to maintain the requirement that telcos expand capacity "as required by programmers."[13] Programmers do not view analog

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[12] The only channel sharing arrangement the Commission has approved to date is the proposed analog channel allocation scheme for U S WEST's Omaha video dialtone market trial. In that case, 40 of the analog channels on the system will be shared channels, and the remaining 37 channels will be available to individual programmers. Two programmers will receive nine channels each, two will receive eight channels each, and three programmers will receive only one channel each. Any other programmers seeking to participate in the trial will be denied analog channel capacity. This arrangement may be acceptable in the limited context of a trial. However, if implemented on a long-term or permanent basis in the context of a commercial video dialtone service, such an arrangement would violate the requirement that video dialtone platforms provide sufficient capacity to serve multiple programmers on a nondiscriminatory basis. See *U S WEST Communications, Inc.*, Order and Authorization, File No. W-P-C-6868, released January 6, 1995.

[13] HBO Comments, p. 4.

and digital channels as equal substitutes. HBO recognized, however, that "digital technology is the only realistic means to significantly expand video dialtone channel capacity."[14]

BroadBand Technologies Agrees that There Is a Short-Term Need for Some Analog Capacity

As BroadBand Technologies recognized in its comments, there remains a short- to medium-term need to deliver some programming over video dialtone systems in analog format, notwithstanding the distinct advantages of digital video platforms. The reason is not, as other commenters assert, the high cost of digital system components. Rather, it is advantageous for video dialtone systems to include analog capacity, given the current prevalence of analog televisions and programming.[15] In response to this perceived need, BroadBand Technologies designed the next generation of its FLX platform to include an analog video transport capability. The platform remains a fully expandable switched digital system capable of delivering hundreds of digital channels of programming.[16]

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[14] Id., p. 6.

[15] The problem of incompatibility between digital signals and analog customer premises equipment is overcome through the use of analog/digital conversion. Given the rapidly declining cost of analog/digital conversion technology, the fact that television sets and programming are predominantly analog may not remain a barrier to the use of digital transmission systems. See R. Fike, *Analog or Digital: The Debate Continues*, Telephony, Oct. 17, 1994 (included as Appendix A in BroadBand Technologies' Comments in this proceeding).

[16] The FLX system, in contrast to hybrid fiber/coax systems, does not involve a "trade-off" between digital and analog capacity. To add the analog transport capability to the FLX system, it was not necessary to reduce the number of digital channels it can transmit. Likewise, expanding the system's digital capacity will not reduce the number of analog channels it can transmit. The analog transport capability was added to meet the near-term need to transmit programming to television sets that are not equipped with digital set-tops. As digital televisions, set-tops, and programming come to predominate, the analog transport capability of an installed FLX platform could be eliminated, leaving a fully switched digital system already in operation.

That said, analog video dialtone capacity, while warranted in the short term, is neither needed nor justified in the long term. Digital programming and customer premises equipment eventually will become predominant, and the Commission can take concrete steps to accelerate that process. For instance, Chairman Reed E. Hundt suggested in a recent speech that it might be advisable for the Commission to accelerate the proposed schedule for converting television broadcasting to digital format.[17] Moreover, to the extent the Commission gives LECs incentives in this proceeding to deploy robust integrated broadband platforms capable of delivering compelling packages of digital services, including two-way interactive offerings, it will speed the diffusion of digital customer premises equipment.

Several commenters oppose requiring LECs to deploy digital video dialtone systems on the ground that such systems would be too costly to deploy today. Even if they were right -- which they are not -- these parties expect the cost of digital components to continue falling, to the point where it will be economically advantageous to build all-digital systems.

Thus, the main arguments against requiring LECs to deploy digital video dialtone systems -- the prevalence of analog programming and receivers and cost considerations -- apply only in the short- to medium-term. Choices among alternate network architectures, in contrast, should be based on long-term considerations. Moreover, the Commission's policies should promote the deployment of the optimal network for the long term. At most, the arguments against digital systems may justify deferring the effectiveness of such a

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[17] Reed E. Hundt, *Comments at the Consumer Electronics Show*, Las Vegas, Nevada, January 6, 1995, p. 7.

requirement until a future date or until certain specific conditions have changed. They are not a rational basis for allowing deployment of video dialtone systems which, on a permanent basis, provide limited analog capacity, and which therefore are incompatible with the video dialtone rules.

Digital Systems Are Not All Created Equal

BroadBand Technologies also would like to stress that all video dialtone platforms do not offer the same capabilities. While the Commission should not involve itself in choosing among alternate platforms, it should be aware of certain key differences. There are two primary video platform architectures: "baseband" fiber-to-the-curb (FTTC) systems, such as the FLX platform, and "passband" hybrid fiber/coax systems. BroadBand Technologies provided a detailed discussion of the advantages of the baseband FTTC approach relative to passband systems in its comments. Another party, Ortel Corporation, argued for the superiority of the passband approach.[18] BroadBand Technologies would like to set the record straight by addressing Ortel's main claims:

Ortel asserts that FTTC is an all-digital approach that requires a decoder on every television set in order to receive analog signals. In fact, as described above, BroadBand Technologies has designed its FTTC architecture to include an analog transport capability, eliminating the need for a digital set-top on every television. This vitiates Ortel's contention

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[18] Comments of Ortel Corporation, filed December 16, 1994.

that the FTTC approach would add $90 Billion in consumer costs in order to receive services on an FTTC network.

Ortel contends that passband hybrid fiber/coax systems are more "bandwidth-efficient" than FTTC systems for delivering digital signals. However, Ortel neglects to explain the trade-offs involved in the use of bandwidth. FTTC systems have much greater bandwidth than HFC systems because they make far more extensive use of fiber optics (in FTTC systems, fiber optics are used all the way to a curbside pedestal; in HFC systems, fiber optic lines extend only to a neighborhood "node"). The vast bandwidth of FTTC systems makes it possible to transport digital signals directly, without the need for expensive modulators. HFC systems provide limited bandwidth. Hence the need for bandwidth efficiency, which is achieved by processing digital signals through a modulation step. Such modems are complex and expensive, adding to the cost of delivering digital channels to subscribers. Bandwidth efficiency comes at a high cost in HFC systems.

Furthermore, the wide bandwidth of FTTC systems eliminates concerns about modulation efficiency, allowing the system designer to use bandwidth to reduce the cost of transport electronics. HFC systems must use bandwidth efficiently in order to overcome the limited bandwidth of the coax medium, which raises the cost of the terminal electronics. To deliver digital signals, an HFC system requires a modulator and a set-top, while FTTC systems require only a set-top. Moreover, the set-top on an FTTC system is less complex

than the HFC set-top.[19] In sum, FTTC was designed to carry, and thus is the better medium for, digital signals.

Ortel cites the installed base of analog TV sets as the reason why analog transport systems should be deployed. This recalls the arguments against the deployment of digital switching systems in an analog telephony environment.[20] There are many reasons why digital transport is preferred even though terminal equipment may be analog. Switching, storage and transport functions are considerably less costly to implement digitally, especially when the cost of analog to digital conversion is relatively inexpensive. Digital video codecs are declining rapidly in cost or can be shared over a large population base. In fact, implementation of analog switches and analog mass storage systems for video on demand is not cost effective given the recent advances in implementing those functions digitally.[21]

Ortel discusses channel allocation schemes for HFC systems. FTTC systems do not require the allocation of channels between digital and analog applications. The digital capacity is separate from the analog capacity, thereby eliminating the channel allocation concern. Furthermore, since the analog capacity in the FTTC system is left intact, more analog channels are available for multiple analog service providers.

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[19] BroadBand Technologies Comments, p. 21.

[20] See Fike, *supra* note 15.

[21] For example, a movie stored in digital form can be viewed simultaneously or at staggered intervals and controlled independently by many subscribers. A movie stored in analog form must be viewed simultaneously and can be controlled by only one subscriber. Also, the lifespan of a movie stored in a digital medium far exceeds that of a movie stored in analog form.

Ortel contends that if subscriber demand for interactive services, on-demand programming, and other high-bandwidth services goes up (i.e., if "take-rates" increase), the optical node of an HFC system can simply be moved closer to the subscribers. However, moving the optical node in response to increased bandwidth demand will mean the network is constantly being modified, thereby raising the operating cost and causing delays in meeting service requests. FTTC systems are cost-effective compared to HFC, making Ortel's incremental approach unnecessary and expensive.

Finally, Ortel proposes an analog video dialtone approach that uses analog channels for interactive services and a "plain old telephone service" channel for the return path. Such an approach is no different from what we have today and certainly falls far short of the Commission's vision of an information superhighway capable of delivering two-way voice, video, and high-speed data services. It is self-evident that such a jerry-built interactive network would offer severely limited capabilities. Implementing even essential functions of a video dialtone network would require expensive network upgrades, adding significantly to the cost of what appears to be a low-cost approach. In fact, BroadBand Technologies believes, upon analysis, that Ortel's video dialtone approach would be more costly to implement than a digital FTTC system if even relatively low subscriber penetration levels were achieved for interactive capabilities.[22]

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[22] See J.R. Jones, *Baseband and Passband Transport Systems for Interactive Video Services*, IEEE Communications Magazine, May 1994 (included as Appendix B in BroadBand Technologies' Comments in this proceeding).

Given the Superiority of Digital and the Drawbacks of Analog Systems, the FCC Should Allow Analog Video Dialtone Systems on a Short-Term Basis Only

In its comments and in this reply, BroadBand Technologies has endeavored to demonstrate the advantages of digital video platforms, while recognizing the short-term need to deliver analog programming. We also have discussed the drawbacks of analog video systems and the extent to which they depart from the Commission's original definition of video dialtone service, the core common carrier principles underlying the video dialtone concept, and the Commission's vision of the information superhighway. Other commenters predict that LECs "inexorably" will convert their analog video platforms to all-digital systems as the technology matures, costs fall, and the market develops.

Despite these assertions, BroadBand Technologies reiterates its recommendation that the Commission require a transition to all-digital systems at a date certain or upon achievement of certain specified milestones in the diffusion of digital televisions, set-tops, and programming.[23/] This diffusion has already begun with the advent of digital DBS services. BroadBand Technologies shares the Commission's vision of a truly robust access network capable of delivering, on an integrated basis, not only video dialtone service, but voice, data, and two-way interactive services as well. By stating its expectation that video dialtone systems will be all-digital after an appropriate transition period, the Commission will send a strong and much-needed signal to the telecommunications industry. Such a

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[23/] Several commenters argue, without foundation, that the Commission lacks the statutory authority to mandate digital systems. As BroadBand Technologies discussed in its Comments, the Commission has full authority to impose such a requirement and has exercised this authority in similar circumstances in the past. See BroadBand Technologies Comments, pp. 28-31.

requirement will give added incentives to the LECs to deploy an infrastructure that is fully capable of delivering multiple programmers' services on an nondiscriminatory basis.

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January 17, 1995

CERTIFICATE OF FILING AND SERVICE

I, Kay Hawkins, hereby certify that an original and ten copies of the foregoing Reply Comments of BroadBand Technologies in file number CC Docket No. 87-266 were deposited for filing with the Office of the Secretary, Federal Communications Commission, Washington, D.C. 20554, this 17th day of January, 1995.

I further certify that a true copy of the Reply Comments of BroadBand Technologies in CC Docket No. 87-266 was served by first-class U.S. mail, postage pre-paid, on each of the parties listed below this 17th day of January, 1995.

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