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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

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In the Matter of	)	
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Deployment of Wireline Services Offering Advanced Telecommunications Capability	)	CC Docket No. 98-147
	)	

COMMENTS OF AT&T CORP.

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List A B C D E

TABLE OF CONTENTS

Page

SUMMARY ii

I. BACKGROUND AND INTRODUCTION 1

II. SPECTRUM COMPATIBILITY 4

A. The Commission Should Encourage A Competitively Neutral Standards Setting Process. 4

B. Generic Masks and A Calculation-Based Approach to Spectral Interference Should Be Adopted. 5

III. SPECTRUM MANAGEMENT 9

A. The Commission Should Require Competitively Neutral, Nondiscriminatory xDSL Binder Group Administration Practices. 11

B. Services Should Not Be Segregated Based on Technology Except In Known Cases of Significant Interference. 13

C. Outmoded and Interfering Technologies Should Be Phased Out through Grandfathering and Sunsetting. 14

D. The Commission Should Establish A Fast-Track Process for Resolution of Disputes Involving Advanced Services Deployment. 15

IV. SPECTRUM UNBUNDLING 16

A. Mandatory Spectrum Unbundling Raises Significant Operational Issues. 17

B. Mandatory Spectrum Unbundling Would Also Tend to Freeze Innovation at Current Levels. 19

CONCLUSION 21

SUMMARY

In order to provide advanced services over local loops, spectral interference standards and spectrum management processes must be in place to ensure that advanced services do not interfere with or degrade other services provided over cable pairs within the same binder group. However, incumbent LECs may use legitimate concerns regarding potential spectral interference as a pretext to thwart the deployment of competitive advanced services. Thus, in order to create the environment necessary for broad scale deployment of such services, the Commission needs to promote the establishment of competitively neutral, pro-innovation spectral interference standards and require competitively neutral, nondiscriminatory spectrum management processes and practices.

In Section II, AT&T addresses the need for competitively neutral, pro-innovation spectrum compatibility standards, including the development of technical standards for permissible interference through power spectral density (PSD) masks. AT&T has supported, and continues to support, the development of industry standards for loop spectrum by T1E1.4 to enable advanced services competition. However, Commission involvement in the standards setting process to ensure its openness to all advanced services participants and to encourage the development of competitively neutral, pro-innovation standards is critical. Adoption of generic, non-technology dependent PSD masks and development of spectrum compatibility standards that afford users a right to "limited spectral interference" would promote prompt deployment of innovative and competitive advanced services.

Section II addresses the need for nondiscriminatory and competitively neutral spectrum management practices and processes. There are a number of key areas in which the Commission can adopt rules regarding spectrum management that will maximize the deployment of advanced services. First, the Commission can ensure that information critical to the deployment of advanced services is available on a nondiscriminatory basis to new entrants, *e.g.*, loop information necessary to determine whether an end user may be provided advanced services over the existing loop, and information regarding the deployment of services in binder groups. Second, the Commission should mandate the development of competitively neutral, nondiscriminatory xDSL binder group administrative practices that ensure spectrum management decisions are based on the emissions or interference generated, instead of specification of permissible services or technologies. Incumbent LECs should also be required to provide comparative performance measurement results related to pre-ordering, ordering, provisioning, maintenance and repair, and billing support for xDSL to demonstrate nondiscriminatory performance. Third, outmoded technology should be identified and its deployment limited on a going forward basis through grandfathering and sunsetting to enable the growth of new, higher speed xDSL services. Finally, the Commission should provide for a fast-track dispute resolution process to handle disputes involving advanced services deployment.

For the reasons set forth in Section IV, AT&T opposes spectrum unbundling (or line sharing), *i.e.*, the mandatory sharing of spectrum by two different carriers on the same line. Although CLECs providing service over ILEC unbundled local loops should have the right to share spectrum with another carrier on a voluntary, commercial basis,

mandatory spectrum unbundling raises significant policy and operational issues. Moreover, a rule specifying that discrete portions of loop bandwidth must be allocated to particular services would create a substantial risk of freezing technological innovation at the current DSL level. Such an approach also conflicts with Commission's policies that: (1) UNEs are defined in terms of functionality rather than physical equipment or the types of services that are supported; and (2) a CLEC obtaining a UNE is entitled to all the features and functionality that the UNE is capable of delivering.

Technology is evolving at breakneck speed as data and telecommunications converge. The Commission should not rush to adopt requirements that may constrain or frustrate such innovation. The Commission therefore should not require mandatory allocation of frequencies within the same loop, because it would raise significant policy and operational issues, stifle innovative uses of loop bandwidth, and produce no clear offsetting consumer benefits.

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COMMENTS OF AT&T CORP.

AT&T Corp. ("AT&T") submits these comments on the Commission's Further Notice of Proposed Rulemaking ("FNPRM") regarding rules the Commission may adopt to encourage competition in, and timely deployment of, advanced telecommunications capabilities.

I. BACKGROUND AND INTRODUCTION

Because of the inherent, but generally manageable, spectral interference created when advanced services are provided over local loops, the provision of such services requires the establishment of competitively neutral, pro-innovation spectral interference standards and competitively neutral, nondiscriminatory spectrum management processes and practices so that advanced services do not interfere with or degrade other services provided over cable pairs within the same binder group.[1]

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[1] The spectrum available to each customer served by a loop is dependent on the gauge of the cable, the type of cable shielding, the cables length from the serving office, the presence of any intervening electronic devices or bridge taps, and the amount of signal interference it receives from other cable pairs. The interference or cross-coupling (cross-talk) between cable pairs is a function of power transmitted, frequency, cable geometry, cable type, and length over which the coupling acts. Because of the interference between cable pairs in a binder group, the total operational capacity of the loops within the binder group (the "Shannon Communication Volume") depends on the real-time interaction of every service in each cable pair within the binder. Thus, a cable pair producing excessive interference will reduce the effective spectrum available for other cable pairs within the binder.

Spectrum compatibility involves the technical assessment of the interference generated by different types of xDSL systems, as well as the development of technical standards for permissible interference through power spectral density (PSD) masks. See Section II, *infra*. AT&T has supported, and continues to support, the development of industry standards for loop spectrum by T1E1.4 to enable advanced services competition. However, Commission involvement in the standards setting process to ensure its openness to all advanced services participants and to encourage the development of competitively neutral, pro-innovation standards is critical. Adoption of generic, non-technology dependent PSD masks and development of spectrum compatibility standards that afford users a right to "limited spectral interference" would promote prompt deployment of innovative and competitive advanced services. Following adoption of such standards, the Commission must vigorously enforce its ruling that "any loop technology that complies with existing industry standards is presumed acceptable for deployment."[2]

Spectrum management relates to the methods and procedures for assignment of loops and maintenance of the facilities used to provide advanced services. There are a number of key areas in which the Commission can adopt rules regarding spectrum management that will maximize the deployment of advanced services. These areas are described in Section III, *infra*. First, the Commission can ensure that information critical

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[2] Deployment of Wireline Services Offering Advanced Telecommunications Capability, First Report and Order and Further Notice of Proposed Rulemaking, CC Docket No. 98-147, FCC 99-48 (rel. Mar. 31, 1999) ("Advanced Services First Report and Order"), ¶ 67.

to the deployment of advanced services is available on a nondiscriminatory basis to new entrants, *e.g.*, loop information necessary to determine whether an end user may be provided advanced services over the existing loop, and information regarding the deployment of services in binder groups. Second, the Commission should mandate the development of competitively neutral, nondiscriminatory xDSL binder group administrative practices that ensure spectrum management decisions are based on the emissions or interference generated, instead of specification of permissible services or technologies. Incumbent LECs should also be required to provide comparative performance measurement results related to pre-ordering, ordering, provisioning, maintenance and repair, and billing support for xDSL to demonstrate nondiscriminatory performance. Third, outmoded technology should be identified and its deployment limited on a going forward basis through grandfathering and sunsetting to enable the growth of new, higher speed xDSL services. Finally, the Commission should provide for a fast-track dispute resolution process to handle disputes involving advanced services deployment.

Spectrum unbundling (or line sharing) is the mandatory sharing of spectrum by two different carriers on the same line. See Section IV, *infra.* Although a CLEC providing service over an ILEC unbundled local loop should have the right to share spectrum with another carrier on a voluntary, commercial basis, mandatory spectrum unbundling raises significant policy and operational issues. Moreover, a rule specifying that discrete portions of loop bandwidth must be allocated to particular services would create a substantial risk of freezing technological innovation at the current DSL level. Such an approach also conflicts with Commission's policies that: (1) UNEs are defined in

terms of functionality rather than physical equipment or the types of services that are supported; and (2) a CLEC obtaining a UNE is entitled to all the features and functionality that the UNE is capable of delivering. The Commission therefore should not require mandatory allocation of frequencies within the same loop, because it would raise significant policy and operational issues, stifle innovative uses of loop bandwidth, and produce no clear offsetting consumer benefits.

II. SPECTRUM COMPATIBILITY

In the Order accompanying the FNPRM, the Commission properly found that clear spectrum management rules and practices "are necessary both to foster competitive deployment of innovative technologies and to ensure the quality and reliability of the public telephone network."[3] The Commission also found that incumbent LECs should not unilaterally determine what technologies LECs, including CLECs, may deploy. Incumbent LECs therefore should not have "unfettered control over spectrum management standards and practices."[4] Instead, "competitively neutral spectral compatibility standards and spectrum management rules and practices" should be established.[5] In this FNPRM, the Commission seeks comment on the interrelated issues of spectrum compatibility and spectrum management.

A. The Commission Should Encourage A Competitively Neutral Standards Setting Process.

AT&T agrees that a competitively neutral standards setting process should be established that includes the active participation of incumbent LECs, CLECs, equipment

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[3] Advanced Services First Report and Order, ¶ 63.

[4] Id.

[5] Id.

suppliers, and the Commission. All participants in this process should have an equal say, *i.e.*, no parties or groups should have greater weight or veto power. The Commission should work as an active participant in the standard setting process to provide direction to the standards setting body. In this role, the Commission should encourage the development of standards that are supportive of new technology, and that do not reflect any bias toward currently deployed technology.[6] The Commission should also urge the standards body to address and develop standards for new technologies in reasonable time frames.

AT&T believes that T1E1.4 is the best forum for developing future power spectral density (PSD) masks. AT&T has participated in the T1E1.4 standard setting process and supports its efforts. However, in order to allay concerns that incumbent carriers and large manufacturers are overly represented on T1E1.4, the Commission should encourage broader representation of CLECs and smaller manufacturers. Such representation would help ensure against a potential bias for existing, rather than developing technology.

B. Generic Masks and A Calculation-Based Approach to Spectral Interference Should Be Adopted.

The development of generic masks, *i.e.*, PSD masks that are independent of a specific equipment manufacturer and technology,[7] coupled with implementation of

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[6] An example of such bias in favor of existing technology is the present proposal by T1E1.4 to require all new technologies to be spectrally compatible with certain "guarded" legacy technology and certain technologies which are perceived will be widely deployed.

[7] A generic mask should not be mapped to a particular technology or manufacturer's equipment. For example, adopting masks with nulls in the frequency spectrum that are related to a particular technology or a manufacturer's brand of equipment should not be permitted.

processes that allow for rapid qualification of new equipment that complies with such generic masks, would help ensure that consumers receive the benefits of technological innovation in a timely fashion. The T1E1.4 is in the best position (subject to FCC guidance and full industry participation) to address this undertaking. However, the Commission should specifically encourage the T1E1.4 to allow for the addition of new technologies, and promptly develop the associated new generic PSD masks, unless there is consensus by the standard body members that a particular technology would create excessive interference or otherwise harm the network. In this regard, each PSD mask should be as minimally restrictive as possible.[8]

In addition to generic masks, industry standards should include a calculation-based approach toward management of spectral interference. Such an approach would take into account the potential noise that could reasonably be generated by the service provided over a loop in a binder group. One possible calculation-based approach would be to provide each user of a particular technology (that is compliant with a specific PSD) with an "allocation" of permissible interference. The characteristics of the PSD that encompasses a particular implementation of a technology could be characterized by a number (or an index, just as had been done with the Ringer Equivalency Number[9]) based

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[8] It is possible that generic masks could be specified so as to restrict deployment of particular equipment that would not harm the network. The goal of the generic PSD should be to avoid the potential for tangible harm to the network and to minimize the potential for interference within a binder. To that end, the PSD should not reflect any preference for a particular transmission strategy (*e.g.*; single carrier vs. multi-carrier, frequency division duplexing (FDD) vs. echo-cancelled overlapped spectrum).

[9] The Ringer Equivalency Number (REN) was used to characterize the amount of power used in a particular telephone design to operate the ringer device. The REN was used to estimate how many telephones could be operated on a single loop connection while preserving normal ringing operation.

on a maximized bandwidth and power integral to produce a "Communications Efficiency Rating" for the implementation of the technology.

For example, the interference potential of a DSL class may be expressed in detail by its PSD, which is a representation of the spectral distribution of its transmitted power, and which has been characterized as the maximum power (as a function of frequency) which can be transmitted by a DSL system without causing excessive interference.[10] The total power transmitted by a technology may thus be found by integrating a class mask-compliant PSD over the relevant frequency range. By dividing the power by the maximum loop length,[11] a representation of power-per-distance is produced. To account for throughput, the power-per-distance would be divided by the transmission rate at which the system will operate, producing a representation of power-per-distance-per megabit.[12] Using this approach, the spectral interference potential for each loop could be approximated by multiplying such a technology-specific "Communication Efficiency Rating" by the loop length (based on a resistance measurement) and throughput.

Each binder would be assigned an interference limit based on the weighted average of its electrical loop lengths (using resistance measurements) to determine its total spectral interference potential. Services, corresponding to the individual loop contribution discussed above, could be added to the binder provided the sum of the

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[10] The PSD mask is not flat (or square) over a defined frequency band because guarded systems which may be victims of the interference generated by a particular interferer may be more sensitive over certain frequency intervals.

[11] In its draft standard, T1E1.4 has attached loop length restrictions to certain classes which represent the maximum length of loop over which the maximum transmit power can be exercised.

[12] Some systems can reduce rate in order to fit within a maximum PSD mask, allowing them to operate at longer loop lengths; use of a representation which takes into account throughput allows these systems to trade throughput for more loop reach.

spectral interference values for all active loops in the binder did not exceed the maximum spectral interference limit for the binder group. If the binder limit would be exceeded, additions to the binder could be accommodated by moving an excessively interfering "guarded" implementation,[13] replacing such an implementation with a less interfering one, or by placing the new loop in a different binder that has not reached its spectral interference limit.[14] AT&T believes that such an approach could prove effective without requiring extensive individual loop data.

Adoption of both generic PSDs and an approach that affords users a right to "limited spectral interference" would promote prompt deployment of competitive advanced services, provided the Commission vigorously enforces its determination in the Advanced Services First Report and Order that "any loop technology that complies with existing industry standards is presumed acceptable for deployment."[15]

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[13] T1E1.4 has defined certain "guarded" systems to which spectrum compatibility is to be demonstrated. These systems are those legacy systems which have been deployed in high numbers (such as T1s) or certain standards-based DSL systems which are expected to be deployed in high numbers.

[14] Because such guarded implementations would largely be for retail customers of the incumbent LECs, the incumbent should have the discretion to use any of the proposed options to accommodate a CLEC's requested addition. However, in the rare instance that the CLEC's end user must be moved to a new binder, the ILEC should not be permitted to charge for the move (or any additional binder installation required) nor should the incumbent be permitted to execute the move without the involvement of the affected CLEC. In addition, where the incumbent increases the free space in a binder, such information should be made available to all potential users of the binder as part of the ILEC's nondiscriminatory spectrum management practices.

[15] Advanced Services First Report and Order, ¶ 67.

III. SPECTRUM MANAGEMENT

Spectrum management includes binder/cable administration as well as deployment practices, *e.g.*, the rules for testing and implementing xDSL-based and other advanced services.[16] T1E1.4, or any standards body, should have the goal of fostering open competition and allowing new technologies to enter the marketplace.[17] However, the Commission must take a leading role in ensuring that new entrants have nondiscriminatory access to the incumbents' loops in order to deploy new technology.

There are a number of key areas in which the Commission can adopt rules regarding spectrum management that will maximize the deployment of advanced services. First, the Commission can ensure that information critical to the deployment of advanced services is available to new entrants. Thus, the Commission should require ILECs to provide nondiscriminatory access to the loop information necessary to determine whether an end user may be provided advanced services over the existing loop.[18] The Commission also can ensure that critical information regarding the

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[16] Id., ¶ 71

[17] For example, the Network Interconnection Interoperability Forum ("NIIF"), sponsored by the Alliance for Telecommunications Industry Solutions ("ATIS"), is heading up an effort (Issue 0141) to develop a central repository for information regarding local loops that service providers require in order to determine whether the loop can be used to provide xDSL service. NIIF has asked service providers whether: (A) they have the following loop information: (1) cable length; (2) cable gauge; (3) bridge tap information; (4) load coil information; (5) serving technology (*e.g.*, via DLC); (B) they would be willing to share this information on a mechanized basis; and (C) they would be willing to disclose their criteria for determining xDSL capability. The Commission should support this effort.

[18] See Implementation of the Local Competition Provisions of the Telecommunications Act of 1996, CC Docket No. 96-98, Second Further Notice of Proposed Rulemaking, Reply Comments of AT&T Corp. (filed Jun. 10, 1999) at 148-49; Deployment of Wireline Services Offering Advanced Telecommunications Capability, CC Docket No. 98-147, Notice of Proposed Rulemaking, Reply Comments of AT&T Corp.

deployment of services in binder groups is maintained and made available in order to optimize binder spectrum management. Second, the Commission should mandate the development of competitively neutral, nondiscriminatory xDSL binder group administrative practices. In this way, spectrum management decisions will be based on the emissions or interference generated, instead of specification of permissible services or technologies. As part of such practices, where various technologies or applications share a binder group, less efficient technologies that generate disproportionately greater sources of interference must be limited to the minimum levels of transmitted power necessary to provide acceptable performance. Newer technologies must be required to perform within Multiple Access Interference (MAI)[19] levels and, as technology improves and the PSDs are revised, the MAI should be reduced accordingly. Incumbent LECs should also be required to provide comparative performance measurement results related to pre-ordering, ordering, provisioning, maintenance and repair, and billing support for xDSL to demonstrate nondiscriminatory performance. Third, outmoded technology should be identified and its deployment limited on a going forward basis through grandfathering and sunsetting to enable the growth of new, higher speed xDSL services that generate less interference at the same levels of throughput. Finally, the Commission should provide for a fast-track dispute resolution process to handle disputes involving claims of spectral interference.

(filed Oct. 16, 1998) at 59-66; id., Comments of AT&T Corp.(filed Sep. 25, 1998) at 54-56.

[19] Multiple Access Interference is the term used in radio system design to describe noise-floor elevation, which results when many users simultaneously utilize the spectrum for communications.

A. The Commission Should Require Competitively Neutral, Nondiscriminatory xDSL Binder Group Administration Practices.

The Commission should develop rules that ensure competitively neutral nondiscriminatory access to incumbent LEC bottleneck loop facilities. Thus, the Commission should require incumbent LECs provide new entrants nondiscriminatory access to information critical to the deployment of advanced services. Incumbent LECs should also be required to capture and disclose comparative performance measurement results related to pre-ordering, ordering, provisioning, maintenance and repair, and billing support for xDSL. Such information will, inter alia, aid detection of discriminatory service activation intervals for advanced data services.[20] With respect to spectrum management, the Commission should develop rules to ensure that incumbents do not use spectral interference concerns as a barrier to deployment of competitive advanced services. Specifically, such rules should:

- Provide for spectrum management classes that are technology independent in order to allow new technologies to operate under class-level provisions to displace older, poorer-performing ones.
- Limit maximum transmitted power vs. frequency through PSD masks. The PSD mask should reflect maximum interference potential to the most susceptible "guarded" system within the bundle (not including AMI T1) based on a reasonable assumption of the maximum number of disturbers of the same type.[21]

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[20] See Deployment of Wireline Services Offering Advanced Telecommunications Capability, CC Docket No. 98-147, Notice of Proposed Rulemaking, Reply Comments of AT&T Corp. (filed Oct. 16, 1998) at 65-67; id., Comments of AT&T Corp.(filed Sep. 25, 1998) at 56-57.

[21] For example, in Contribution 99-350 delivered to T1E1.4 at its working group meeting on June 7-10, 1999, various CLECs, including AT&T, pointed out that T1E1.4's current analytical framework for develop spectrum management standards was overly restrictive and unrealistic. Thus, T1E1.4 assumes that there will be 20 overlapped DSL "disturbers" in a binder, which typically contains 25-50 cable pairs, and that all 20 overlapped DSL CPE are operating at the same rate and PSD, and located at exactly the same point in the plant. Such an occurrence is highly unlikely.

- Allow any amount of receive-transmit spectral overlap for duplexing in these masks.

- Encourage use of power control, so that power transmitted is just sufficient to maintain adequate communications quality (*e.g.*, specified maximum rate and bit error rate). Power control may be reciprocal (open loop), adaptive (closed loop), or a combination of both, to compensate for attenuation due to loop length.[22]

- Allow transmitted spectrum to be filled to mask limits using any combination of fixed filtering, adaptive filtering or assignment of tones (*e.g.*, DMT).[23]

- Adopt a generalized throughput rule so that bit rate and mask power are adjusted depending on loop length. For example, to provide services at longer loop lengths, customer bit rate would have to be lowered, and the power would have to be managed so as to minimally interfere at these longer loop lengths. With SDSL, for example, the bit rate offered varies depending on loop length. Rather than

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Copies of Contribution T1E1.4/99-350, and supporting Contributions T1E1.4/99-349 and T1E1.4/99-351, are attached as Attachment A.

22 Reciprocal (open-loop) power control means that a subscriber terminal determines how much transmit power it must use to achieve acceptable communication quality by measuring the level of received signal from the network termination and inferring line loss from the measurement. This type of power control is frequently used to estimate the appropriate level of power needed on first access to the network termination by a subscriber termination (*e.g.*, initialization). The technique ensures that modems that have just been turned on do not produce more interference than is necessary. Closed-loop control means that once communication is established the network termination sends power control messages to the subscriber termination to adjust transmit power levels up or down as needed. These techniques are frequently used in radio systems (*e.g.*, TIA/EIA-IS-95).

23 DSL systems use modulation schemes which fill the band of interest with energy. Like radio systems, filters are sometimes necessary to confine emissions to stricter limits than can be obtained by constraining the modulation process. Systems may utilize fixed filters (filters with non-adjustable characteristics) to confine emissions to a PSD mask. An example of this type would be ISDN implementations. Newer systems may utilize a combination of fixed filters and parametrically-adjustable (signal processed) filters to achieve a PSD which can be adjusted more precisely, enabling a better PSD mask-fill and consequently more throughput. Modulation schemes such as Discrete Multi-Tone (DMT) may use a combination of fixed filters, adjustable filters and tone assignment to improve mask-fill. The newer systems represent adaptive filtering means, which can be used to avoid interfering with a particular guarded service (*e.g.*, measurement of pre-existing interference and detection of a perceived guarded system operating in the binder) or which may be used to maximize the "communications efficiency rating" of a particular DSL implementation (increasing its throughput or loop range).

fixed constant deployment rules (*e.g.*, no deployment beyond a certain distance), the deployment rules should be a function of power, bit rate, and loop length.

- Permit (within the limitations of the spectral mask and de-rating rule) systems to adapt to deliver optimum performance based on sensed conditions, based on local measurements, cooperative measurements at both ends of the loop, or both, using either line-by-line, distributed, or centralized control methods.

B. Services Should Not Be Segregated Based on Technology Except In Known Cases of Significant Interference.

As a general rule, services should not be segregated into separate binder groups, except for technologies, like AMI T1, that are known to cause significant interference with other services within the same binder group, and thereby significantly degrade such other services. Permitting incumbent LECs to segregate competing advanced services into their own binder groups will only serve to restrict the available spectrum for such services unnecessarily. All high frequency DSL-type services cause some interference. Placing such services in binder groups with cable pairs carrying analog voice traffic (which does not make use of the higher frequency bands) allows more xDSL services to be deployed than would be possible if all xDSL services were placed next to each other in their own binder group. Such intermixing of different services results in better utilization of the potential Shannon communications volume of the binder group.

Where a particular technology is known to cause significant degradation of other services carried over cable pairs in the same binder group, such service should be segregated into its own binder groups. As the Commission has recognized, AMI T1 service can cause significant interference with adjacent services, and incumbent LECs have currently assigned AMI T1 to separate binder groups. Although this segregation is appropriate for AMI T1, it is not appropriate for xDSL services.

C. Outmoded and Interfering Technologies Should Be Phased Out through Grandfathering and Sunsetting.

As newer technology is introduced that provides greater capability with less potential interference, older technology should be replaced to increase efficient spectrum utilization. The best way of accomplishing this result is through the development of industry standards that do not protect older "guarded" technologies at the expense of newer, more efficient ones. The development of such pro-innovation standards, such as PSD masks, coupled with vigorous enforcement of the spectrum management rules adopted by the Commission in the Advanced Services First Report and Order should encourage the deployment of more efficient technologies.

At the same time, however, for the foreseeable future, the deployment of advanced services will be controlled by incumbent LECs who own and manage the copper distribution plant critical to the deployment of such services. ILECs naturally will be inclined to protect their existing services and discourage the deployment of newer, more efficient, competitive technologies. For this reason, AT&T recommends that the Commission review existing technology on a periodic basis to determine whether replacement technology should be utilized and outmoded technology replaced. Such review is especially appropriate where a deployed service, such as repeater-based T1s, causes significant degradation of other services within the same binder group. Once the Commission determines that a service has become outmoded or that it is a significant "disrupter," the Commission should encourage the replacement of such older technology with newer, more efficient technology.

AT&T recommends a three-step approach for eliminating outmoded and disrupting technology. First, existing installations of outmoded/disrupting technology

should be grandfathered. Second, existing installations of the outmoded/disrupting technology should be segregated into their own binder groups. Third, incentives should be used to encourage the retirement of the outmoded/disrupting technology over a specified time frame, *e.g.*, over three years.

AMI T1 service provides an example of how grandfathering and sunsetting of outmoded services should operate. In T1E1.4/97-294, repeater-based T1s (*i.e.*, AMI T1s) were identified as the major source of interference for ADSL services. Because of the ongoing widespread deployment of ADSL modems, T1 deployment must be managed to promote more efficient utilization of copper cable plant without causing undue burden to carriers or significant service disruption to customers. AT&T therefore recommends that existing repeater-based T1s be:

- grandfathered, allowing for no further deployment within the loop plant.
- moved to separate binder groups. The Commission has noted that incumbent LECs currently assign T1s to segregated binder groups. To the extent a T1 is not in a separate binder group, it should be moved to one during any repair, maintenance or grooming activity to the T1.
- migrated to newer technology (*e.g.*, replaced with HDSL or other similar technology) over a specified time frame (*e.g.* three years) if the preceding steps prove inadequate to accommodate the growing demand for advanced services.

D. The Commission Should Establish A Fast-Track Process for Resolution of Disputes Involving Advanced Services Deployment.

Through the standards setting process, some measures of allowable interference should be developed, which will then need to be adjusted over time to reflect real-world experience. In the event that a dispute arises regarding advanced services deployment, such as claimed interference in shared facilities, or a refusal by an incumbent LEC to

deploy a technology because of claimed spectral interference, such dispute should be resolved through the application of Commission rules in an expedited complaint proceeding. Because of the value of national rules and standards,[24] and because a finding that a particular technology has caused significant degradation may have nationwide effect, the Commission – rather than state commissions or arbitrators – should be charged with resolving such disputes. In this regard, the use of an expert third party to provide assistance to the Commission could be helpful. However, the role of such a third party should be to provide expertise to the Commission, rather than to decide disputes.

IV. SPECTRUM UNBUNDLING

In the FNPRM, the Commission tentatively concluded (at ¶ 99) that "incumbent LECs must provide requesting carriers with access to the transmission frequencies above that used for analog voice service on any line that LECs use to provide exchange service when the LEC itself provides both exchange and advanced services over a single line." Although a CLEC providing service over an ILEC unbundled local loop should have the right to share spectrum with another carrier on a voluntary, commercial basis, mandatory spectrum unbundling within the same loop (or "line sharing") raises significant policy and operational issues. For example, when two carriers share spectrum on a single line, it is not clear which carrier would be responsible for maintenance and repair (both trouble receipt and the cost of trouble resolution). Further, mandatory spectrum unbundling

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[24] In order to facilitate the rapid deployment of advanced services, the Commission should vigorously enforce the rules adopted in the Advanced Services First Report and Order (¶ 67), *e.g.*, that any loop technology that complies with existing industry standards, has been successfully deployed by any carrier without significantly degrading the performance of other services, or has been approved by the Commission, any state commission, or an industry standards body, "is presumed acceptable for deployment."

appears to deny the LEC providing voice service the opportunity to provide innovative other services to its customer because of its restriction to a narrow slice of loop bandwidth. Moreover, a rule specifying that discrete portions of loop bandwidth must be allocated to particular services would create a substantial risk of freezing technological innovation at the current DSL level. Such an approach would also overturn the Commission's prior policies that: (1) UNEs are defined in terms of functionality[25] rather than physical equipment or the types of services that are supported; and (2) a CLEC obtaining a UNE is entitled to all the features and functionality that the UNE is capable of delivering. For these reasons, the mandatory allocation of frequencies within the same loop could raise significant policy and operational issues, stifle innovative uses of loop bandwidth, and produce no clear offsetting consumer benefits.

A. Mandatory Spectrum Unbundling Raises Significant Operational Issues.

As described below, mandatory spectrum unbundling on individual loops would create technical, quality, maintenance, and customer service problems. This does not mean that spectrum cannot be unbundled, but any unbundling should be at the discretion of the loop owner.[26] The Commission should find that the features, functions, and capabilities that pass with "ownership" of the loop can be leased to other service providers. There is no reason to believe that a loop supporting analog voice and data

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[25] For example, the loop UNE provides the following functionality: the transmission capability between the network interface device at the customer's premises and the physical termination and cross-connection to either another ILEC UNE or any other technically feasible point of interconnection with the CLEC network where the CLEC gains access to communications that its customer places on that loop.

[26] The CLEC controls the loop if its leases that unbundled network element from the incumbent LEC.

traffic simultaneously cannot support multiple carriers and, in fact, incumbents themselves intend to separate their loops' advanced data service capability from their analog voice functions. Thus, the Commission should not permit an incumbent LEC to prohibit a CLEC from unbundling spectrum to other service providers so long as the services that will be carried over the loop by the other service providers could have been carried over the loop by the CLEC.

Mandatory spectrum unbundling, however, raises operational issues because it involves two carriers in the operation of the same loop. In order to accomplish spectrum unbundling, for example, at least a filter must be placed on the line in order to separate the voice from the data frequencies. It is not clear which carrier would be responsible for the deployment and cost recovery of that equipment. Further, maintenance troubles on a line are frequently associated with the failure or degradation of a physical element. If two carriers are utilizing some, but not all, of the elements in a physical configuration, which one will be responsible for repair management, including customer contact, trouble isolation, and follow-up with the incumbent LEC? If a technician must be dispatched, it is not clear which carrier would be responsible for the costs of the dispatch.

Moreover, although it is technically possible to allocate the loop's spectrum to voice and data frequencies, interference caused by the provision of data service on the same loop may interfere with the voice service. As discussed above, competitively neutral and nondiscriminatory spectrum management procedures still need to be developed when advanced services are provided over <u>different</u> loops within the same binder group. These issues have not even been addressed with respect to the more complicated shared line environment.

Mandatory spectrum unbundling also raises the issue of what price should be paid to the incumbent LEC for the underlying network element. For example, if a carrier uses bandwidth corresponding to 64 Kbps of throughput to its customer for analog voice service, and a data carrier uses bandwidth corresponding to 6.0 Mbps of throughput to its customer for data service (*e.g.*, through ADSL) on the same loop, should the voice carrier pay 1% of the incumbent LEC's price for the unbundled loop (.064 Mbps/(6.0 MBPS + .064Mbps) = 0.01055)? Would every carrier using a UNE loop solely for voice service be entitled to such a reduction in its recurring UNE loop price? Would the price of the loop be a function of the length and the type of equipment placed on the loop (*e.g.*, shorter loops can support higher bandwidth than longer loops; ADSL supports different data rates than HDSL)? And, would new UNE cost proceedings need to be held in every state to determine the appropriate UNE price for the allocated loop and data portions of the shared line?

B. Mandatory Spectrum Unbundling Would Also Tend to Freeze Innovation at Current Levels.

Although advanced telecommunications services supported over incumbent LEC loops today generally have discrete spectrums for data and voice services, mandating spectrum unbundling would inhibit the development of new technologies that might more efficiently rely on overlapping spectrums for voice and data traffic. The loop is a transmission resource that must be managed on an integrated basis for optimum performance. As technology advances, the utilization of the loop will improve, but will only reach its maximum potential if the full spectrum is available. For example, ADSL currently is not a fully overlapped spectrum technology. Thus, upstream and downstream data are assigned to different frequency bands with the capacity of each band being

unequal (*i.e.*, asymmetric). As multimedia applications proliferate, symmetrical data capabilities will be required, and next generation xDSL technologies will likely employ fully overlapped upstream and downstream spectrum. Such development could be impeded if the prospect of subdivided loop spectrum ownership exists. For example, the adoption of G-lite or splitterless ADSL may have been delayed or forestalled entirely if the prospect of spectrum unbundling had existed at the time each was being initially considered.

In a similar vein, the provision of voice services over the data portion of the loop would result in situations where a customer is obtaining its voice and data services from the same carrier, but the entire spectrum of the loop is not being utilized. Such inefficient use of loop spectrum should not be endorsed as national telecommunications policy. Likewise, a CLEC consigned to the allocated voice frequencies of the loop may devise innovative features associated with its voice offering that would require additional spectrum beyond that achievable with the 4Khz assigned to voice.[27] Customers would not receive the benefit of such innovations, unless the CLEC also offered xDSL service and convinced the customer to choose it as the customer's xDSL provider so that the CLEC could acquire the data portion of the loop.

Technology is evolving at breakneck speed as data and telecommunications converge. The Commission should not rush to adopt requirements that may constrain or frustrate such innovation. By all accounts, incumbent LECs and CLECs are aggressively deploying advanced services to every corner of the country. Instead of arbitrarily

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[27] Although 4Khz is used for illustrative purposes, it is not clear what portion of the loop spectrum would be restricted to voice and what would be restricted to DSL.

allocating loop spectrum to industry participants to correct a perceived problem, the Commission should focus its resources on ensuring that competitively neutral, pro-innovation spectrum compatibility standards are developed and that incumbent LECs: (1) make xDSL loops available in a nondiscriminatory manner; (2) implement competitively neutral, nondiscriminatory spectrum management procedures; and (3) price their xDSL loops based on TELRIC costs, rather than upon theoretical bandwidth calculations or the proposed use of the loop. By doing so, the Commission would help remove any remaining impediments to the broadscale deployment of DSL services.

CONCLUSION

For all of the reasons set forth above, the Commission should encourage the development of competitively neutral, pro-innovation spectrum compatibility standards, should require competitively neutral and nondiscriminatory spectrum management practices, and should not require mandatory spectrum unbundling.

Respectfully submitted,

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ATTACHMENT A

COMMITTEE T1 – TELECOMMUNICATIONS
Working Group T1E1.4
Ottawa, Ontario, Canada, June 7-10, 1999

CONTRIBUTION

TITLE: **Deployability and Spectrum Compatibility**
SOURCE: **AT&T, Conexant, Covad, Copper Mountain[1], Metalink, Nokia, Northpoint, Rhythms**
PROJECT: **Spectrum Management**

ABSTRACT

The FCC rule making in March created the doctrine of "significant Degradation" to be applied in the evaluation of spectral compatibility for wireline services. This doctrine requires that a new technology would not *significantly degrade* an existing technology. The real world limits of significant degradation permit a more robust deployment of all DSL services without hampering deployment by assuming unreasonable cases. The current approach to codifying spectrum management by T1E1.4 fails to recognize the doctrine of significant degradation and instead has focused on worst case analyses which would artificially hamper the deployment of beneficial broadband services by the telecommunications industry, thereby reducing the efficiency of the wireline infrastructure. It is proposed that consideration of deployment restrictions for existing, deployed services be tabled until realistic interference models are developed [1] and reasonable performance targets can be determined.

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1.0 The current analytical framework does not reflect the real-world deployment realities of DSL over the next 5 years.

The most significant spectral compatibility analysis pertains to the coexistence of Asymmetric technologies, which typically use a non-overlapped division of the frequency spectrum for upstream and downstream transmission, with Symmetric technologies, which typically use overlapping frequencies for upstream and downstream transmission. Symmetric and asymmetric technologies are each appropriate for different applications. A mass market is developing for asymmetric applications with G.lite being the most appropriate technology for mass deployment. Symmetric applications are typically found in a small-medium business environment, with inherently low penetration [2].

Even looking forward 3-5 years, optimistic assumptions call for a symmetric DSL market of 1 million to 2 million lines. This represents approximately 1% of *active* loops in the United States.

The analytic framework of evaluating 20 DSL disturbers in a binder (typically 25 or 50 pairs), while useful for designing systems, is unrealistic. Twenty DSL disturbers would be present only in very rare circumstances. We are unlikely to see a prevalence of binders with 20 disturbers within the lifespan of the technologies. Binders with 20 overlapped DSL disturbers would not represent a significant portion of the market, nor would they represent a significant percentage of the total binders in the United States telecommunications plant.

2.0 Current analytic techniques do not reflect the distributed nature of speed and reach in real-world applications in the outside plant.

Analysis of twenty overlapped DSL disturbers with non-overlapped DSL assumes that all twenty overlapped DSL CPE are a) operating at the same rate and PSD, and b) located at exactly the same point in the plant. Real-world overlapped systems may operate and are currently deployed at a variety of line rates. It is highly unlikely that all twenty disturbers would be operating at the same line rate with identical PSD masks.

In addition, disturbers within a binder would typically be deployed at various distances from the XTU-C location. Even with multiple CPE running at the same rate at exactly the same reach, they would usually be located in different customer premises, which would add several hundred to a thousand feet of separation based on the length of the drop cable. This attenuation is not incorporated in current analytic techniques.

For example, it is very unlikely that CPE from 20 disturbers within a single binder would be located exactly at 9kft and would all be using an identical PSD.

3.0 The deployment restrictions being currently envisaged would be relevant in an unknown, but extremely small percentage of situations

Deployment restrictions have been calculated based on 20 CPE disturbers at the same PSD operating at the same physical point in the plant. It has been qualitatively shown that, for the foreseeable future (and likely beyond the lifespan of the technologies being reviewed), this will be an infinitesimal percentage of real-world situations.

4.0 Deployment restrictions will inhibit the deployment of DSL at a time when the industry is in its infancy

It is counterproductive to the industry to create unnecessary controversy between competitive carriers and alternative vendors at this time. While it is true the stalling all DSL deployment would certainly prevent any potential spectral compatibility problems from emerging, it is not in the interest of the industry.

5.0 Unnecessary deployment restrictions would mean that some customer segments may not be able to get any broadband service at all

To preserve higher performance for a very small percentage of the population, restrictions curtail the deployment of various speed/reach combinations that would benefit entire market segments. Some of these customers may not have

any alternative technologies to meet their needs. For example, cable modems generally do not serve business customers because the cable plant does not run to businesses. These restrictions therefore create inefficiencies in the utilization of the United States' wireline infrastructure. In addition, this would not meet the congressional mandate to encourage deployment of broadband technologies to all segments.

6.0 It is unclear whether current envisaged deployment restrictions are appropriate relative to the recent FCC order specifying "significant impairment"

If ANSI guards the ability of 1% (or even less—see above) of target asymmetric customers to get 6Mbps instead of 2-3Mbps at the expense of restricting deployment of overlapped spectrum DSL to an entire market segment, is that in the interest of American public and economy? Does it constitute significant impairment when a small number of potential customers are impacted, or is significant impairment relative to even a single customer? When a customer is currently getting 28.8kbps, 56kbps, or 128kbps with ISDN, does it significantly impair that customer to only be able to achieve 1.5Mbps instead of 5-6Mbps?

Proposal

Because of:

a) the limitations of current analytical techniques
b) the inappropriateness of current assumptions relative to existing and anticipated real-world deployment
c) the need for further guidance on the meaning of "significant impairment"

it is proposed that all references to deployment restrictions in initial issue of the ANSI spectral compatibility document be replaced with "To Be Determined".

References:

[1] Jack Yang and Mark Steenstra, T1E1.4/99-349, "Proposal for Reducing Noise Margin and Number of Disturbers in Method B," Conexant, et al, 1999.
[2] Amon and Lindstrom, T1E1.4/99-317, "Deployment Guidelines in a Mass Market Scenario," Nortel, 1999.

COMMITTEE T1 – TELECOMMUNICATIONS
Working Group T1E1.4
Ottawa, Ontario, Canada, June 7-10, 1999

CONTRIBUTION

TITLE: **Proposal for Reconsidering Cross-talk Environment in Method B**
SOURCE: **Conexant, Coppermountain, NorthPoint**[1]
PROJECT: **Spectrum Management**

ABSTRACT

Method B is an analytical method to determine if a system is spectral compatible with a guarded system. Method B inherited the following parameters from specifications of the target guarded system: the cross-talk model, the noise margin, the number of disturbers, and the default locations of the disturbers. In this contribution we show that simply copying these parameters for spectrum management purpose will overly protect the guarded systems and overly restrict others that seek to be guarded or demonstrate spectral compatibility. We propose that the cross-talk environment be reconsidered.

1. Introduction

Method B inherited the following parameters from specifications of the target xDSL system:

1. 1% Unger model.
2 6dB of noise margin (ADSL).
3 20 or more pairs of disturbers.
4 All the disturbers are located right next to the receiver and the NEXT cross-talk from the disturbers is not attenuated.

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It is always a good idea to overly design a system to accommodate unexpected implementation loss and imperfections. Besides, overly designing a system will not hamper the development of other systems. Hence, even these assumptions sound too stringent and unrealistic, it may still be very reasonable to use these assumptions for design and test of a particular xDSL system.

However, copying the same parameters into spectrum management standard is not appropriate. The systems that are guarded will be overly protected and the systems that seek to be guarded or demonstrate spectral compatibility with the guarded systems will overly restricted. The guarded systems will have a loop plant that is cleaner than necessary for broad deployment, and other systems will be assumed to "pollute" the loop plant much more heavily than they actually do. It is not appropriate simply to copy the same parameters for spectrum management purpose without any modifications.

Let us take a closer look at the four assumptions we have mentioned earlier the section.

- The 1% Unger model means that only 1% of the actual noise will be worse and 99% of the actual noise will be better than what we are assuming.
- The 6dB noise margin assures that system operate at the desired bit error rate even if the cross-talk noise level is increased by 300%.
- The 20 or 24 pairs of disturber means that 40% or 48% of a 50-pair bundle is assigned to the same service with the same spectral mask.
- The locations of these disturbers are assumed to be right next to the receiver and the NEXT noise from these disturbers is not attenuated at all.

While the 1% Unger model is too stringent, it is not a viable alternative to develop another model given the amount of work that is required. However, the conservative nature of this model should be taken into our thinking for defining other parameters for spectrum management.

If a xDSL system is among the first ones in a 50-pair bundle that start communications, the systems that are turned on later will change the cross-talk noise level dramatically. Hence from design perspective it is reasonable to assume that the system has a built-in 6dB noise margin to accommodate any possible dramatic change in noise environment. Also, the channel may vary when temperature and other factors change. For typical spectrum management analysis, however, we are assuming the presence of pre-existing disturbers. The noise environment should not vary dramatically and the 6dB of noise margin is excessive for spectrum management purpose.

The 20 or 24 pair of disturbers in a 50 pair bundle represents that 40 or 48% of the pairs are dedicated to the same type of service with the same spectral mask. This is an overly pessimistic assumption.

In most cases the receivers at the R side are at different locations. If receiver A is located closer to the CO than receiver B, or if receiver A and B are in premises that hundreds of feet apart, the NEXT noise from A is attenuated before reaching receiver B. Assuming that all receivers are at the same location is equivalent to artificially raising the NEXT cross-talk level. This is in addition to the 1% Unger cross-talk model that already been assumed.

2. Proposal

It is important not to overly protect some services at the cost of overly restricting others. Based on the previous discussions, we propose that Method B should reevaluate the cross-talk environment for determining spectral compatibility.

COMMITTEE T1 – TELECOMMUNICATIONS
Working Group T1E1.4
Ottawa, Ontario, Canada, June 7-10, 1999

CONTRIBUTION

TITLE: **Proposal for Reducing ADSL Target Data Rate**
SOURCE: **Conexant, Coppermountain, NorthPoint**[1]
PROJECT: **Spectrum Management**

ABSTRACT

In the last T1E1.4 meeting it was proposed that ADSL downstream target data rate be reduced to reflect what it is capable to achieve in certain cross-talk environment [1]. In this contribution we propose that all guarded systems in loop plant should be treated equally and ADSL downstream target data rate should be reduced for spectrum management purpose.

2. Discussion

Let us first define a bandwidth-SNR (BWSNR) factor as following:

BWSNR = BW of the system (MHz) × Average required SNR to achieve its performance target

The BWSNR factor represents the bandwidth and the "cleanness" of the loop plant that the system requires in order to achieve its performance target. If the system is guarded, it represents the guarding level that the system is seeking.

Using the BWSNR definition we calculate the BWSNR of ADSL downstream, HDSL2, and 2B1Q SDSL at several data rates.

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ADSL downstream: in order to achieve 6.1Mbps on bandwidth of 138kHz to 1104kHz, ADSL would require 6.3bit/Hz on average. This is equivalent to 38dB of SNR prior to any coding gain and noise margin, or 40dB of SNR after adjusting for 4dB of coding gain and 6dB of noise margin. The total bandwidth from 138kHz to 1104kHz is 966kHz. The BWSNR factor is 40×0.966 = 38.6.

HDSL2: HDSL2 requires 27.7dB of SNR to meet its performance requirement. HDSL2 downstream uses approximately 400kHz. The BWSNR is 11.08.

2B1Q SDSL: 2B1Q SDSL is assumed to use BW equal to its baud rate (in reality the BW is smaller due to the filter roll-off). The required SNR is 21.7dB.

The results are shown in Table 1.

Table 1 BWSNR of Several Systems

Service Type	BWSNR
ADSL downstream	38.6
HDSL2	11.08
SDSL @ 784kbps	8.5
SDSL @ 1168kbps	12.67
SDSL @ 1552kbps	16.8

From Table 1 we see that the BWSNR factor for ADSL is far greater than any other systems. It requires a much higher guarding level in order to achieve its current performance target.

2. Proposal

We state that all guarded systems should be treated equally or at least none of the systems should be overly guarded. The guarding level for any systems should not be over 20. Using 20 as a guarding level, ADSL downstream is approximately 3bits/Hz, or 3Mbps for downstream data rate. The ADSL downstream should be guarded at a level of 3Mbps. This target data rate is only for spectrum management purpose and would not limit ADSL to carry higher data rate whenever it is capable to.

Proposed Text

In Annex A Method B, Compatibility with ADSL, Evaluation Loops and Performance Levels, Performance of ADSL:

1. 3Mbps downstream, 640kbps upstream at reaches up to 9kft 26 AWG.