COMMITTEE T1 – TELECOMMUNICATIONS
Working Group T1E1.4 (DSL Access) **T1E1.4/2001-284**
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CONTRIBUTION

TITLE: **Possible MIB extensions for DSM compatibility**

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ABSTRACT

This contribution proposes several new data items to be included in an extension of the existing DSL line MIBs to facilitate operation of DSM-enabled modems. It also discusses options for exchanging DSM-Data and DSM-Control information between the modems and the DSL Spectrum Maintenance Center. Some minor augmentations to existing parameters in the pending G.dmt.bis/G.lite.bis standard are noted, and the group's opinion on proposing such augmentations to the ITU is solicited.

NOTICE

This contribution has been prepared to assist Accredited Standards Committee T1–Telecommunications. This document is offered to the Committee as a basis for discussion and is not a binding proposal on Voyan Technology, Stanford University, Aware, or any other company. The requirements are subject to change in form and numerical value after more study. Voyan Technology, Stanford University and Aware specifically reserve the right to add to, amend, or withdraw the statements contained herein.

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1. Introduction

The DSM effort in T1E1.4 is aimed at improving network performance and reliability through the coordination of transmission parameters across modems operating on different lines (see [1], [2]). In order to implement this coordination, more detailed physical-layer measurements need to be made available from the modems, such as frequency-dependent SNR measurements (for *Level 1 DSM-Data* compatibility) or even time-stamped waveforms (for *Level 2 DSM-Data* compatibility). Moreover, the modems should be able to accept recommendations for time-invariant transmission parameters (for *Level 1 DSM-Control* compatibility) or even commands for time-varying coordination of physical-layer signals (for *Level 2 DSM-Control* compatibility).

In order to implement this exchange of commands and data, the existing framework of DSL network management data needs to be extended. Since the DSM working group has not yet finalized the data and commands that would need to be exchanged between modems for different levels of DSM compatibility, the main goal of this contribution is to solicit input from the DSM Working Group members on this issue. As a starting point for this discussion, we propose some data items that may be appropriate for Level 1 DSM-Data and Level 1 DSM-Control compatibility, denoted as *Level 1/1 DSM* compatibility.

Another issue that needs to be discussed in the DSM working group is the platform on which to implement the transfer of this information between the DSLAMs and the DSL Spectrum Maintenance Center (SMC). The two obvious candidates are SNMP (Simple Network Management Protocol) and CORBA (Common Object Request Broker Architecture). The two groups that deal with these topics are the DSL Forum and T1M1.5; the DSM working group needs to provide this information to both of those groups and to coordinate with them how to proceed with the implementation of the proposed extensions.

2. Suggested Parameters for Level 1/1 DSM Compatibility

The list included here is based on the list of test parameters under discussion in ITU-T SG15/Q4 to be included the G.dmt.bis/G.lite.bis standards [3]. This list is intended as a proposal for Level 1/1 DSM compatibility of *DMT-based modems only,* specifically ADSL and DMT VDSL. Additional study is required to generate a similar list for non-DMT modems.

While the G.dmt.bis/G.lite.bis list [3] is extensive and probably adequate for most things one could envision for DSM Level 1, there are a few minor modifications that would be desirable. These are clearly marked in the following tables, and should be discussed in the DSM working group in order to decide whether or not they should be proposed to ITU-T for inclusion in the G.dmt.bis/G.lite.bis standard, which has not been finalized yet.

In particular, the G.dmt.bis/G.lite.bis proposal [3] suggests that parameters be computed in two modes:

- *Diagnostics mode* can be invoked on-demand in order to compute diagnostics parameters accurately and exchange them reliably between the modems, even in conditions of poor SNR that would not normally allow the line to go into showtime. In fact, diagnostics mode is not followed by showtime.

- *Initialization mode* is the same training mode as in the current G.dmt/G.lite standards, and when it is successfully completed it is followed by showtime mode. The computation of test parameters in initialization mode is less accurate, because it is constrained by the timing requirements of training. Moreover, the computed parameters are not exchanged between modems by default as they are in diagnostics mode. Instead, they are stored in modem buffers and are transmitted over the ADSL overhead channel on demand (within 10 seconds of receiving the request). Some of these parameters are updated during showtime, again on demand: when an external request for that parameter is issued, the modem re-computes the parameter, updates its buffer, and transmits the new value, fulfilling the request.

The changes proposed here are: (i) that the main channel transfer function H(f) also be updated on-demand for the active bins during showtime; and (ii) that the range, accuracy, and measurement period of some of the test parameters be increased. The reason for these changes is that DSM aims to use this information for ongoing management and coordination of transmitted spectra; in order to realize its greatest potential, DSM might best quickly and accurately recognize and respond to changing conditions in the binder, such as modems being turned on and off, and non-stationary CPE ingress noise sources. These changes are in line with what has already been standardized by ITU-T in G.997.1 [4] and implemented in the SNMP MIBs [5].

The tables below list the test parameter specifications that are included in the current G.dmt.bis/G.lite.bis proposal [3] to the ITU; suggested changes are marked in ***bold italics***.

Table 1: Per-bin parameters for Level 1 DSM-Data compatibility of DMT modems

	Diagnostics Mode	**Initialization Mode**
H(f)		
Range	(Scale)*(2^{-15} to 1), linear complex, Scale is 2^{-15} to 2	-102.3 to 0 dB
Granularity	Scale	0.1 dB
Size	Single 16 bit scale + 2x16 bit per bin	10 bits per bin
Filters removal	Best effort	Best effort
Measurement period	1 second	Best effort ***(0.5 seconds)***
Showtime update	N/A	None ***(on-demand on active bins)***
QLN(f)		
Range	-140 to -12.5 ***(-140 to 0)*** dBm/Hz	-140 to -12.5 ***(-140 to 0)*** dBm/Hz
Granularity	0.5 ***(0.1)*** dB	0.5 ***(0.1)*** dB
Size	8 ***(11)*** bits per bin	8 ***(11)*** bits per bin
Filter removal	Best effort	Best effort
Measurement period	1 second, RMS value	Best effort ***(0.5 seconds)***, RMS value
Showtime update	N/A	N/A
SNR(f)		
Range	-32 to +96 dB	-32 to +96 dB
Granularity	0.5 ***(0.1)*** dB	0.5 ***(0.1)*** dB
Size	8 ***(11)*** bits per bin	8 ***(11)*** bits per bin
Measurement time	1 second	Best effort ***(0.5 seconds)***
Showtime update	N/A	On-demand on active bins

Table 2: Aggregate parameters for Level 1 DSM-Data compatibility of DMT modems

	Diagnostics Mode	**Initialization Mode**
Line Attenuation		
Range	0 to 63 dB	0 to 63 dB
Granularity	0.1 dB	0.1 dB
Size	10 bits	10 bits
Showtime update	N/A	None
Signal Attenuation		
Range	0 to 63 dB	0 to 63 dB
Granularity	0.1 dB	0.1 dB
Size	10 bits	10 bits
Showtime update	N/A	On-demand
SNR Margin		
Range	-63 to 64 dB	-63 to 64 dB
Granularity	0.1 dB	0.1 dB
Size	11 bits	11 bits
Showtime update	N/A	On-demand
Attainable Bitrate		
Range	0 to 2^{32}-1	0 to 2^{32}-1
Granularity	1 bit/sec	1 bit/sec
Size	32 bits	32 bits
Showtime update	N/A	On-demand

In terms of controlling the transmission parameters of modems, the draft G.dmt.bis/G.lite.bis standard introduces the following capabilities:

- CO MIB may limit the maximum transmitted power per bin of the ATU-R and ATU-C, in order to affect bitloading during initialization;
- change the PSD levels independently for each bin during initialization and showtime;
- change the minimum/target/maximum bitrate during initialization and showtime;
- change the minimum/target/maximum SNR margin during initialization;
- command the modem to operate at minimum power for a given specified bitrate and SNR margin (L2 low power mode).

These commands should be adequate for Level 1 DSM-Control compatibility of DMT modems.

In order to avoid discrepancies between the DSM recommendations and the upcoming ITU bis standards, it is proposed that any document produced by the DSM group as a result of this contribution contain as requirements for DSM compatibility of DMT-based ADSL modems only what is slated for inclusion in the new standards. The changes suggested in this contribution, if

agreed upon by the DSM group, should be proposed to the ITU for inclusion in the new standards; only those changes that are actually included by the ITU should appear in future versions of the DSM draft documents.

3. Framework for Information Transport

Another issue that needs to be discussed in the DSM working group is the platform on which to implement the transfer of this information between the DSLAMs and the DSL Spectrum Maintenance Center (SMC). The two obvious candidates are SNMP (Simple Network Management Protocol) and CORBA (Common Object Request Broker Architecture). SNMP is the natural candidate, since the SNMP MIBs defined in [5] are already implemented by several equipment vendors. However, SNMP is not very efficient for bi-directional exchange of large blocks of data, due to its limited flexibility in defining sub-structures of data to be requested and transmitted; CORBA appears to be more flexible in that respect, and therefore more efficient for the purpose of exchanging data for DSM purposes. In addition, CORBA encompasses IDL (Interface Definition Language), which provides a uniform framework for developing machine-to-machine interfaces quickly and easily.

The organization that has dealt extensively with SNMP MIBs is the DSL Forum, while CORBA falls within the purview of T1M1.5. The DSM working group needs to coordinate with both of those groups on how to proceed with the implementation of the proposed MIB extensions.

References

[1] J. Cioffi et al., "Indication of capability to release channel information", Contribution T1E1.4/2001-146R2.

[2] J. Cioffi et al., "Proposed scope and mission for Dynamic Spectrum Management", Contribution T1E1.4/2001-188R4.

[3] F. Van der Putten, Ed., "G.dmt.bis: G.lite.bis: Discussion summary on definition of test parameters", ITU-T Temporary Document 032(WP1/15).

[4] "Physical layer management for digital subscriber line (DSL) transceivers", ITU-T Recommendation G.997.1.

[5] G. Bathrick and F. Ly, "Definitions of managed objects for ADSL lines", IETF RFC 2662.