Project: VDSL

Title: Proposal for VDSL Performance Requirements

Source: FTW

Authors: Tomas Nordström

Contact: Tomas Nordström
Forschungszentrum Telekommunikation Wien (FTW),
Donau-City-Strasse 1/3
AT-1220 Wien, Austria
Telephone: +43 1 5052830-22
Fax: +43 1 5052830-99
Email: Tomas.Nordstrom@ftw.at

Abstract:

This paper proposes a new set of VDSL performance requirement.

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Introduction

These are the results from FTW's effort to simulate the performance requirements for ETSI VDSL. We propose these performance numbers, given in Section 2, as an update to the tables 24-25 in Draft TS 101 270-1 V2.0.2/ TM-06026 [1].

The performance numbers in Section 2 are based on numbers generated using the FTW xDSL simulator [2]. Appendix A provides the assumptions used (in addition to [1]) when generating the simulation performance numbers. These assumptions are based on recommendations from TD33r1 in Torino [3] and WD14 Praha [4].

Proposed reaches

The European band plan (997):

```
=========================
Loop 2 Noise "A", mask ETSI-VDSL-Template-E1-Pcab-M1  (997)
Actual power DOWN = 4.97 dBm, UP = 7.48 dBm

Service S1 => Len = 1026m, IL = 42.0dB (at  4.0 MHz)
Service S2 => Len =  923m, IL = 43.2dB (at  5.0 MHz)
Service S3 => Len =  676m, IL = 37.3dB (at  6.5 MHz)
Service S4 => Len =  155m, IL =  9.7dB (at  8.0 MHz)
Service A3 => Len =  828m, IL = 36.4dB (at  4.5 MHz)
Service A4 => Len =  155m, IL =  8.1dB (at  6.0 MHz)

=========================
Loop 2 Noise "A", mask ETSI-VDSL-Template-E1-Pcab-M2 UnNotched (997)
Actual power DOWN = 11.33 dBm, UP = 10.10 dBm

Service S1 => Len = 1126m, IL = 46.1dB (at  4.0 MHz)
Service S2 => Len =  985m, IL = 46.1dB (at  5.0 MHz)
Service S3 => Len =  753m, IL = 41.5dB (at  6.5 MHz)
Service S4 => Len =  194m, IL = 12.2dB (at  8.0 MHz)
Service A3 => Len =  991m, IL = 43.5dB (at  4.5 MHz)
Service A4 => Len =  194m, IL = 10.2dB (at  6.0 MHz)

=========================
Loop 2 Noise "A", mask ETSI-VDSL-Template-E1-Pcab-M1 UnNotched (997)
Actual power DOWN = 4.97 dBm, UP = 7.48 dBm

Service S1 => Len = 1097m, IL = 44.9dB (at  4.0 MHz)
Service S2 => Len =  970m, IL = 45.4dB (at  5.0 MHz)
Service S3 => Len =  744m, IL = 41.0dB (at  6.5 MHz)
Service S4 => Len =  191m, IL = 12.0dB (at  8.0 MHz)
Service A3 => Len =  947m, IL = 41.6dB (at  4.5 MHz)
Service A4 => Len =  191m, IL = 10.0dB (at  6.0 MHz)

=========================
Loop 2 Noise "E", mask ETSI-VDSL-Template-E1-Pex-P2-M1  (997)
Actual power DOWN = 14.42 dBm, UP = 7.48 dBm

Service S1 => Len =  965m, IL = 39.5dB (at  4.0 MHz)
Service S2 => Len =  868m, IL = 40.6dB (at  5.0 MHz)
Service S3 => Len =  646m, IL = 35.6dB (at  6.5 MHz)
Service S4 => Len =  213m, IL = 13.4dB (at  8.0 MHz)
Service A3 => Len = 1130m, IL = 49.6dB (at  4.5 MHz)
Service A4 => Len =  332m, IL = 17.4dB (at  6.0 MHz)

=========================
Loop 2 Noise "E", mask ETSI-VDSL-Template-E1-Pex-P2-M2 UnNotched (997)
Actual power DOWN = 14.48 dBm, UP = 10.10 dBm

Service S1 => Len = 1066m, IL = 43.6dB (at  4.0 MHz)
Service S2 => Len =  932m, IL = 43.7dB (at  5.0 MHz)
Service S3 => Len =  713m, IL = 39.3dB (at  6.5 MHz)
Service S4 => Len =  266m, IL = 16.7dB (at  8.0 MHz)
Service A3 => Len = 1224m, IL = 53.8dB (at  4.5 MHz)
Service A4 => Len =  385m, IL = 20.2dB (at  6.0 MHz)

=========================
Loop 2 Noise "E", mask ETSI-VDSL-Template-E1-Pex-P2-M1 UnNotched (997)
Actual power DOWN = 14.42 dBm, UP = 7.48 dBm

Service S1 => Len = 1024m, IL = 41.9dB (at  4.0 MHz)
Service S2 => Len =  911m, IL = 42.7dB (at  5.0 MHz)
Service S3 => Len =  702m, IL = 38.7dB (at  6.5 MHz)
Service S4 => Len =  266m, IL = 16.7dB (at  8.0 MHz)
Service A3 => Len = 1201m, IL = 52.8dB (at  4.5 MHz)
Service A4 => Len =  412m, IL = 21.6dB (at  6.0 MHz)
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The optional regional-specific band plan (998):

```
=========================
Loop 2 Noise "A", mask ETSI-VDSL-Template-E2-Pcab-M1  (998)
Actual power DOWN = 6.82 dBm, UP = 5.95 dBm

Service S1 => Len =  855m, IL = 35.0dB (at  4.0 MHz)
Service S2 => Len =  748m, IL = 35.1dB (at  5.0 MHz)
Service S3 => Len =  286m, IL = 15.7dB (at  6.5 MHz)
Service S4 => Len =   69m, IL =  4.3dB (at  8.0 MHz)
Service A3 => Len = 1087m, IL = 47.7dB (at  4.5 MHz)
Service A4 => Len =  499m, IL = 26.1dB (at  6.0 MHz)

=========================
Loop 2 Noise "A", mask ETSI-VDSL-Template-E2-Pcab-M2 UnNotched (998)
Actual power DOWN = 11.49 dBm, UP = 8.31 dBm

Service S1 => Len =  869m, IL = 35.6dB (at  4.0 MHz)
Service S2 => Len =  762m, IL = 35.7dB (at  5.0 MHz)
Service S3 => Len =  289m, IL = 15.9dB (at  6.5 MHz)
Service S4 => Len =   67m, IL =  4.2dB (at  8.0 MHz)
Service A3 => Len = 1221m, IL = 53.7dB (at  4.5 MHz)
Service A4 => Len =  660m, IL = 34.6dB (at  6.0 MHz)

=========================
Loop 2 Noise "A", mask ETSI-VDSL-Template-E2-Pcab-M1 UnNotched (998)
Actual power DOWN = 6.82 dBm, UP = 5.95 dBm

Service S1 => Len =  856m, IL = 35.0dB (at  4.0 MHz)
Service S2 => Len =  752m, IL = 35.2dB (at  5.0 MHz)
Service S3 => Len =  290m, IL = 16.0dB (at  6.5 MHz)
Service S4 => Len =   67m, IL =  4.2dB (at  8.0 MHz)
Service A3 => Len = 1163m, IL = 51.1dB (at  4.5 MHz)
Service A4 => Len =  649m, IL = 34.0dB (at  6.0 MHz)

=========================
Loop 2 Noise "E", mask ETSI-VDSL-Template-E2-Pex-P2-M1  (998)
Actual power DOWN = 14.43 dBm, UP = 5.95 dBm

Service S1 => Len =  802m, IL = 32.8dB (at  4.0 MHz)
Service S2 => Len =  703m, IL = 32.9dB (at  5.0 MHz)
Service S3 => Len =  278m, IL = 15.3dB (at  6.5 MHz)
Service S4 => Len =   62m, IL =  3.9dB (at  8.0 MHz)
Service A3 => Len = 1109m, IL = 48.7dB (at  4.5 MHz)
Service A4 => Len =  793m, IL = 41.6dB (at  6.0 MHz)

=========================
Loop 2 Noise "E", mask ETSI-VDSL-Template-E2-Pex-P2-M2 UnNotched (998)
Actual power DOWN = 14.47 dBm, UP = 8.31 dBm

Service S1 => Len =  817m, IL = 33.4dB (at  4.0 MHz)
Service S2 => Len =  717m, IL = 33.6dB (at  5.0 MHz)
Service S3 => Len =  285m, IL = 15.7dB (at  6.5 MHz)
Service S4 => Len =   62m, IL =  3.9dB (at  8.0 MHz)
Service A3 => Len = 1188m, IL = 52.2dB (at  4.5 MHz)
Service A4 => Len =  878m, IL = 46.0dB (at  6.0 MHz)

=========================
Loop 2 Noise "E", mask ETSI-VDSL-Template-E2-Pex-P2-M1 UnNotched (998)
Actual power DOWN = 14.43 dBm, UP = 5.95 dBm

Service S1 => Len =  804m, IL = 32.9dB (at  4.0 MHz)
Service S2 => Len =  706m, IL = 33.1dB (at  5.0 MHz)
Service S3 => Len =  285m, IL = 15.7dB (at  6.5 MHz)
Service S4 => Len =   62m, IL =  3.9dB (at  8.0 MHz)
Service A3 => Len = 1110m, IL = 48.8dB (at  4.5 MHz)
Service A4 => Len =  891m, IL = 46.7dB (at  6.0 MHz)
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References

[1] ETSI RTS/TM-06026 (Draft), “Transmission and Multiplexing (TM); Access transmission systems on metallic access cables; Very high speed Digital Subscriber Line (VDSL); Part 1: Functional requirements”, ETSI Draft TS 101 270-1 (m01p06a2), Version 2.0.2, July 2002.

[2] Nordström T., D. Bengtsson, *FTW xDSL simulation tool*, Version 3.0alpha1, 2002. Version 2.3 is available at <http://www.xdsl.ftw.at/xdslsimu/ >.

[3] Nordström T., “Second Proposal for VDSL Simulation Parameters”, ETSI TD33r1 Torino (021t33r1), 2002

[4] Rapporteur, “Report on break-out session to discuss simulation parameters for VDSL”, ETSI WD14 Praha (023w14), 2002

[5] van den Heuvel B., R. Persico, “PSD masks for VDSL, and corresponding templates”, ETSI TD03r1 Darmstadt (024t03r1), 2002

Appendix A Simulation assumption

The simulations to generate the performance numbers are based on the following assumptions:

Shannon gap	9.8 dB
SNR cross-talk margin	6.0 dB
Coding gain	3.8 dB
Implementations losses	2 dB
Time-domain overhead	12%
Maximum useful SNR	57 dB (15 bits)
Power back-off	Assume equal length scenario for the disturbing systems
Maximum transmit power	+14.5dBm for FTTEx downstream else +11.5 dBm.
FEXT coupling	–45 dB at 1MHz growing as f^2
NEXT coupling	–50 dB at 1MHz growing as f^1.5
Self FEXT and NEXT from	Crosstalk combination use the FSAN rule 20 VDSL (of the same kind, i.e., same PSD)
AWGN	–140 dBm/Hz
Noise model	VDSL Noise A, E
Loops	Loop #2, (cable TP150)
Frequency plans	997 (E1), 998 (E2)

Use 125 kHz guard band from each side, except 138 kHz and 12 Mhz.
The optional low frequency band is not to be used.
No transmission (i.e., at –80 dBm/Hz) is assumed in the HAM bands.

Nominal PSD masks specified	Pcab, Pex-P2
Mask variations:	M1 with notching, M2 without notching, and M1 without notching.

Templete masks as defined in TD03r1 [5] have been used (with a slightly higher delta for some cases to actually go below 14.5 dBm). For Pcab-M2 and the optional plan the point at 1394kHz have been lowered to –53 dBm/Hz to keep the power below 11.5 dBm.

Out of band PSD levels as specified in ETSI VDSL specification Part 2.

Only performance numbers with 4-band systems are calculated.