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Title: **Noise model wish list for VDSL performance tests**

Project: **VDSL**

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ABSTRACT

This contribution addresses the information that is required to complete the VDSL noise model. Although much progress has been made, there are still areas where the operator input is required to generate a noise model that is representative of the VDSL reality.

1. Introduction

At the Antwerp meeting, it was agreed to link the VDSL and SDSL efforts regarding the generation of comprehensive noise model representative of each services proposed environment.

This contribution lists various items that are required to complete the task of defining the noise environment of VDSL. A companion contribution (TD 44) addresses SDSL more specifically. For the sake of clarity, the elements that can be applied to both models are labeled GEN-*item number*, those specific to VDSL or SDSL will be labeled VDSL-*item number* or SDSL-*item number*. The various sections and subsections can be found in the VDSL noise specification.

1. Test loops

- [VDSL-L1] - As for SDSL, the electrical length of the test loops must be defined, for each bit rate combination of interest.

  See TD27 for the definition of "electrical length". It is felt that the current values in the VDSL report are estimates without sufficient simulation. TD31, from Orckit Communications Ltd. VDSL Test Loops- Stressing Transceivers' Performance. Antwerp. April 98) provides such a basis for the lengths but its values might be influenced by changes in the VDSL noise model. The final electrical length requirements should be set as soon as the VDSL noise models is stable.

- [VDSL-L2] - The tolerance limits of the test loops must be defined.
  How closely shall a cable simulator meet the target specification for insertion loss, characteristic impedance, etc. In what frequency band. How simple is it to build a cable simulator that approximate the specified insertion loss within 3% on a dB scale, and impedance within 7% on a linear scale? How critical is the group delay (mean and ripple)?. Is 3% accuracy adequate and feasible?

2. Impairment generator

2.1 Cross talk noise models

The current VDSL noise model has some shortcomings and areas need to be updated. One such area is the FEXT noise representation which varies in a cable with the length of the cable while the current model assumes a length independent model. VDSL ranges from 300m to 1500m hence the noise models must account for this, otherwise the FEXT noise predictions will be unrealistic. The VDSL impairment generator concept is prepared for this, by concentrating all NEXT noise in generator "G1", all FEXT noise in generator "G2" and all cable crosstalk coupling functions for NEXT and FEXT in 'isolated' transfer functions. This means that generator "G3" is only intended for background noise that plays a minor role.

This approach has an additional advantage. If the crosstalk functions are changed in the future (they might be inadequate) then there is no need to change anything in generator “G1”, “G2” and “G3”

Due to historical reasons, the overall combination of NEXT, FEXT and Crosstalk was concentrated in one generator: “G3” . To make the impairment generator more accurate and reflect the physical nature of the noise, the following updates are required:

- [VDSL-G1] - A length independent noise model for the Near End Composite Interferer PSD (generator “G1”), that should reflect the power summed crosstalk noise of a realistic worst case technology mix is required.

  The noise model must be independent from the NEXT crosstalk coupling function, since that’s incorporated in a separated function box. It is felt that the rationales behind the FSAN proposal (1997) are adequate, but the noise model (in generator “G3”) of the FSAN proposal needs to be mapped on generator “G1” (and “G2”)

- [VDSL-G2] - Likewise, a length independent noise model for the Far End Composite Interferer PSD (generator “G2”), that should reflect the power summed crosstalk noise of a realistic worst case technology mix is required.

  The noise model must be independent from the NEXT crosstalk coupling function, since that’s incorporated in a separated function box. It is felt that the rationales behind the FSAN proposal (1997) are adequate, but the noise model (in generator “G3”) of the FSAN proposal needs to be mapped on generator “G2” (and “G1).

- [VDSL-G3] - Generator G3 is intended for background noise, so it should not play a dominant role as it does now.

  When the FSAN models are mapped into generator “G1” and “G2”, then generator “G3” should be kept nearly empty.

- [VDSL-G4] The parameters of the NEXT and FEXT transfer functions should be specified in terms of worst case statistics for European cables.

  Currently, the model uses constants from the ANSI standard. Their applicability to the European case should be established.

- [VDSL-G5] - Adequate specification for the time domain distribution function of noise.
  The current specification of “Gaussian distributed” and “Crest factor between 5 and 8” has been shown to be inadequate (see for example TD16 contributed by KPN to the Lulea meeting: “PSD + Crest factor is not sufficient to specify performance”)

- [VDSL-G6] - Specification of the maximum repetition rate of test noise.
  This becomes relevant when the noise is generated as pseudo random noise. It is expected that pseudo random noise (e.g. with an arbitrary wave generator) is the preferred practical implementation of the impairment generators. What shall be the minimum number of random samples?

2.2. Impulse noise model [G7]

- [GEN-IN1] Definition of an adequate impulse noise test and minimum impulse noise margin.