TITLE **A fixed impairment definition for variable testloops**

PROJECT VDSL

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STATUS Proposal, for action

ABSTRACT In the Lannion meeting, it was agreed that WD13 could serve as a template to define the impairment on a simple and unambiguous way. WD13 proposed a functional diagram that separated length from frequency dependency of NEXT and FEXT. This approach enabled one fixed definition for NEXT and FEXT that remains unchanged for all loop configurations and all loop lengths. This contribution is a text proposal for the VDSL draft.

Problem description

The VDSL performance tests describe various impairment signals like NEXT, FEXT, Broadcast RF noise, etc. We have defined 4 loops, and 7 bitrates which means that we have to define 4×7=28 different situations for each impairment contribution. This is not practical.

In the Lannion meeting, it was agreed that working document WD13 of KPN could serve as a template to simplify the impairment definition significantly. WD13 proposed a functional diagram, in which impairment signal are split-up in a frequency and a length dependent part. This approach enabled one fixed definition for all impairment “generators” that remains unchanged for all loop configurations and all loop lengths.
WD 13 took advantage from the fact that the insertion loss of all the four testloops are normalized at a specified test frequency. This enabled the use of one average transfer function for all the four loops at a specified payload bitrate. Another simplification was achieved by using the average length of the four loops, in stead of four different values. This isn’t perfect, but good enough.

This contribution is a text proposal for the VDSL draft, to implement the ideas of WD13. When we would take full advantage of this simplification, it is highly recommended to reshuffle chapter 9 on performance tests a little bit. This contribution proposes such an improvement too.

Proposed reshuffle of chapter 9

9. Transmission performance
9.1 Test Procedure (*now in 9.7*)
9.1.1 Test set-up definition (*now in 9.7.1*)
9.1.2 Signal level definition (*now in 9.7.2*)
9.1.3. Measuring noise and impulse margin (*now in 9.7.3*)
9.2 Test loops (*now in 9.1*)
9.3. Impairment generator
9.3.1. Functional description (***this proposal***)
9.3.2. NEXT noise amalgam (model A_{NT}, A_{LT}, B_{NT}, etc….) (*now in 9.2*)
9.3.3. FEXT noise amalgam (model A,B, ….) (*now in 9.2*)
9.3.4. Background noise amalgam (*now in 9.2*)
9.3.5. White noise (*now in 9.2*)
9.3.6. Broadcast RF noise (*now in 9.2*)
9.3.7. Amateur RF noise (*now in 9.2*)
9.3.8. Impulsive noise (*now 9.3*)
9.4. Transmission Performance tests
9.4.1. Bit error rate requirement (*now in 9.6*)
9.4.2. Downstream tests (***this proposal***)
9.4.3. Upstream tests (***this proposal***)
9.5. Micro Interruption tests (*now 9.4*)
9.6. Jitter & Wander tests (*now 9.5*)

The proposed text below, can be copied literally into the VDSL draft, when accepted. It is restricted to the missing parts, the parts that should be updated, or that should change in order.

9.x. Impairment generator

9.x.1. Functional description

Figure x defines a functional diagram of the composite impairment signal. It defines a functional description of the combined impairment signal, as it must be probed at the receiver input of a VDSL modem under test. This probing is defined in sub-clause 9.7.2.
The functional diagram has the following elements:

- The seven impairment "generators" G1..G7 generate signals as defined in sub-clause 9.x.2 to 9.x.7. Their signal characteristics are independent from the testloops and bitrates.
- The transfer function H1(ω) models the testloop dependency of the NEXT impairment. Its transfer is nearly 1 for most loop lengths (and frequencies), but reduces the NEXT impairment for the shortest lengths (and the lowest frequencies). Function $s_{T0}(\omega)$ represents an average transfer function of the four testloops at specified payload bitrate. Its transfer is independent on the loopset number, but changes with the payload bitrate.
- The transfer function H2(ω) models the length dependency of the FEXT impairment. Function $s_{T0}(\omega)$ represents an average transfer function and L_{avg} an average length of the four testloops at specified payload bitrate. Their values are independent on the loopset number, but change with the payload bitrate. Value L_0 is a chosen reference length, and equals L_0=1 km.
- Switch S1..S7 models if a specific impairment generator contributes to the total impairment or not during a test.

In a practical implementation of the test setup, there is no need to give access to any of the internal signals of the diagram in figure x. These function blocks may be incorporated with the testloop and the adding element as one integrated construction.

The average transfer function $s_{T0}(\omega)$ of the four testloops equals the s_{21} transfer parameter in 135Ω of testloop #1 at specified payload bitrate. It is considered as an average of all the four loops, because all these loops are normalized in insertion loss at a specified test frequency.

The average length L_{avg} equals the arithmatic average of the four loopsets at specified payload bitrate. It equals $L_{avg} = (L_1+L_2+L_3+L_4)/4$, where $L_1..L_4$ represent the calculated testloop lengths as summarized in table x of Annex A. (*ed. See contribution TD17*)

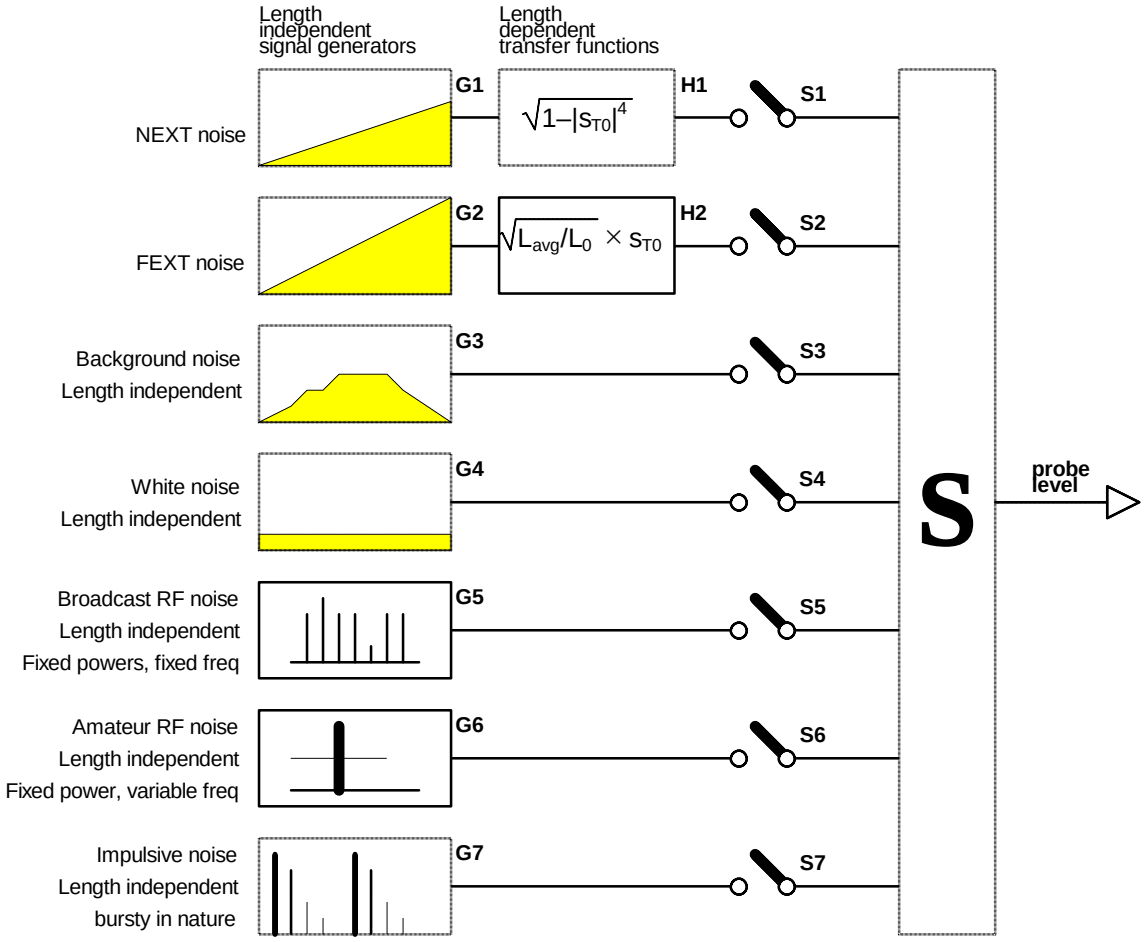

Figure x. Functional diagram of the composition of the impairment signal

9.x.2. NEXT noise amalgam
9.x.3. FEXT noise amalgam
9.x.4. Background noise amalgam
9.x.5. White noise
9.x.6. Broadcast RF noise
9.x.7. Amateur RF noise
9.x.8. Impulsive noise

9.y. Transmission performance tests

9.y.1. Bit error rate requirements

current text of sub-clause 9.6

9.y.2. Downstream tests

The injection of the impairment signals shall be at the NT side of the testloop.
The symbolic names in the tables refer to the labels as defined in sub-clause 9.x

This table is intended as template only
The exact contenets of this tabel is to be decided

test	G1	G2	G3	G4	G5	G6	G7	Bitrate
D1	G1.A.NT	G2.A.NT	G3	G4	G5	G6	–	all
D2	G1.B.NT	G2.B.NT	G3	G4	G5	G6	–	all
D3	?	?	?	?	?	?	G7	all
D4								
D5								

9.y.3. Upstream tests

The injection of the impairment signals shall be at the LT side of the testloop.
The symbolic names in the tables refer to the labels as defined in sub-clause 9.x

This table is intended as template only
The exact contenets of this tabel is to be decided

test	G1	G2	G3	G4	G5	G6	G7	Bitrate
U1	G1.A.LT	G2.A.LT	G3	G4	G5	G6	–	all
U2	G1.B.LT	G2.B.LT	G3	G4	G5	G6	–	all
U3	?	?	?	?	?	?	G7	all
U4								
U5								