TITLE **Unofficial Living List for revising SpM-2.**

PROJECTS SpM-2

SOURCE: Rapporteur

AUTHOR: Rob van den Brink (TNO)

CONTACT: Rob F. M. van den Brink,
TNO Telecom
PO Box 5050
2600 GB Delft
The Netherlands
tel +31.15.2857059
fax: +31.15.2857354
e-mail: R.F.M.vandenBrink@telecom.tno.nl

STATUS for discussion

ABSTRACT The ETSI AbC procedure ("Approval by Correspondence) is still ongoing, and closes at sept 21th. Therefore that workitem isn't closed yet, and a new work item for revising SpM-2 cannot be opened yet. This contribution is therefore to collect all ideas that have been identified so far for inclusion in such a revision. It has been compiled from what was left in the living list for creating SpM-2: m01p01a15.pdf)

2. STUDY POINTS FOR REVISING SPM-2 (TR 101 830-2)

SP	Title	Owner	Status
2-1	Performance model for ADSL 2 and ADSL2+	Laurent Cuvelier (Alcatel)	US
2-2	Modelling sidelobe pick-up in DMT Receivers **Action 1:** provide literal text for generic model **Action 2:** extent specific (ADSL?) model with this mechanism	Laurent Cuvelier (Alcatel)	US
2-3	Text for preventing invalid bit-loading constellations	Tomas Nordstrom (FTW)	US
2-4	Calculation methods for distributed cable tree topologies	Czech Telecom (Milan Meninger)	US
2-5	Transmitter/disturber model for POTS signals	Peter Reusens (LEA)	US
2-6			
2-7			
2-8			
2-9			

The current agreed procedure for changing the status of living list items is in Annex A of TM6 working methods.

Part 2 study points

SP 2-1 Performance model for ADSL2 and ADSL2+
New flavours of ADSL have been introduced in the ITU, and dedicated performance models are desired for SpM studies. A useful performance benchmark for ADSL2+ is unfortunately lacking, since there are currently no reach requirements in a standard that pushes these modem with extend spectrum to their true performance limits. Therefore this study point has also to address the way of preventing the inclusion of models in the SpM-2 standard that are predicting overoptimistic results
Related Contributions:

- *034t33, Sophia 2003 - Receiver models for G.992.3@A and G.992.5@A - TI*

SP 2-2 Modelling sidelobe pick-up in DMT Receivers
In order to improve the validity of performance models for DMT receivers, the impact of sidelobe pick-up in DMT receivers may be a useful addition to the model, including a model for input filtering that reduces the impact of sidelobe pick-up. The main issues are detailed in 041t22, and this study point is to develop the text that should be added to the description of the DMT performance model.
Related Contributions:

- *991t30, Villach 1999 - Adopting HDSL2 components in SDSL (Fig 1 & table 1)*
- *034w13, Sophia 2003 - Sidelobe pick-up in DMT receivers - Alcatel, Conexant*
- *041t22, Sophia 2004 - Sidelobe pick-up in ADSL DMT receivers - Alcatel*
- *041t23, Sophia 2004 - Modeling filtering in ADSL receivers - Alcatel*

SP 2-3. Text for preventing invalid bit-loading combinations
The current draft on SpM-2 has a note in clause 5.2.4, to warn against an invalid combination of loaded bits. This note is relevant, but not very helpful for those who are not highly skilled in the art of DMT simulations. This study point is to provide a more descriptive text.

- *042w10, Gent 2004 - Additional note for the generic DMT model on bit loading - TNO*

SP 2-4 Calculation methods for multi-node crosstalk model (distributed cable tree topologies)
A commonly used simplification of modeling crosstalk coupling in a loop assumes a two-node topology, as if all disturbers are co-located at the NT side as well as the LT side. In some cases, more advanced models for crosstalk coupling are required, accounting for the fact that NT modems are not co-located but "scattered" along the loop, and connected with branches. These models (without branching) have been used in various VDSL studies, but a *punctual* description of that approach is lacking.
This study point is to develop a literal text proposal on a mathematical description to specify such a multi-node crosstalk model.

- *033w07, Sophia 2003 – Method on Xtalk Calculations in a Distributed Environment*
- *051t21, Sophia, feb 2005 – Distributed cable tree installation scenario – Czech Telecom*
- *052t06, Sophia, june 2005 –Generic crosstalk model, for one/multi node collocation – Czech Telecom*
- *052t07, Sophia, june 2005 –Crosstalk model, based on distribution of coupling – Czech Telecom*
- *053t22, Ghent, sept 2005 –Editorial changes for draft text of SP 2-44 (see LL used for creating SpM-2) – Czech Telecom*

SP 2-5 Transmitter/disturber model for POTS signals
POTS systems may to the overall crosstalk noise in a cable, especiialy when they share the line with xDSL systems. However, this is commonly ignored in spectral management studies. This study point is to develop a model that can represent the impact from POTS disturbers to xDSL victims

- *052t17, Sophia, june 2005 –"Same pair" POTS noises: to be referenced by SpM? – LEA*

Text proposals, for inclusion in the revised SpM-2.

The text fragments below have been proposed for inclusion in the draft version of SpM part 2, but are still in the "under study" status. If agreement is achieved, they will be moved into the Draft

Text portions, proposed for inclusion in clause 8

8 Crosstalk models

ED NOTE The text is based on 052t06r1, and is still too immature to be included directly into the draft. This needs to be improved first.

8.6. Topology crosstalk model for multi-node co-location

8.6 Generic Crosstalk Model for Multi-Node Co-Location

Two-node crosstalk model is suitable for network topology, where majority of customers (network termination points) is located practically at one place. Application of this model in a situations, where network termination points are distributed on the whole cable tree territory may result in:

- too pessimistic noise levels at NT points,
- rather optimistic noise level at LT point (if power cutback is not applied).

For these situations a one-node/multi-node crosstalk model was derived, which was completed with features capable to express some specifics of customer distribution it the network.

8.6.1 Architecture of one-node/multi-node cable tree model

One-node/multi-node cable tree installation scenario assumes homogeneous distribution of customers in network, which may be modelled by a hypothetical CT topology depicted on **Fig. 1**, where cable tree idealisation is based on the following fundamentals:

- Territory of customers covered by a cable tree is decomposed into small sub-areas called ***access cells*** treating customers living on their territory around a terminal distribution frame.
- Dimensions of all access cells are identical and have square shape.
- Interconnection of access cells with central office is modelled with a cable feeder network in shape of a fish skeleton, see Fig. 2, with gradual pair dropping in junctions or primary or secondary distribution frames, drawn as small circles.
- All NT transceivers of all DSLs in one access cell are collocated at one point.
- There is identical number of DSLs, with identical technological mixture in all access cells.

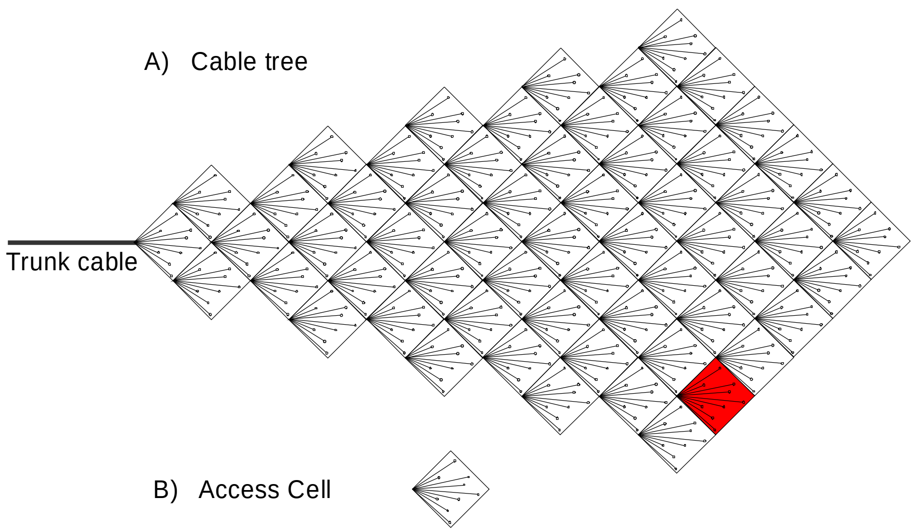

Fig. 1 Approximation of cable tree with a network of access cells

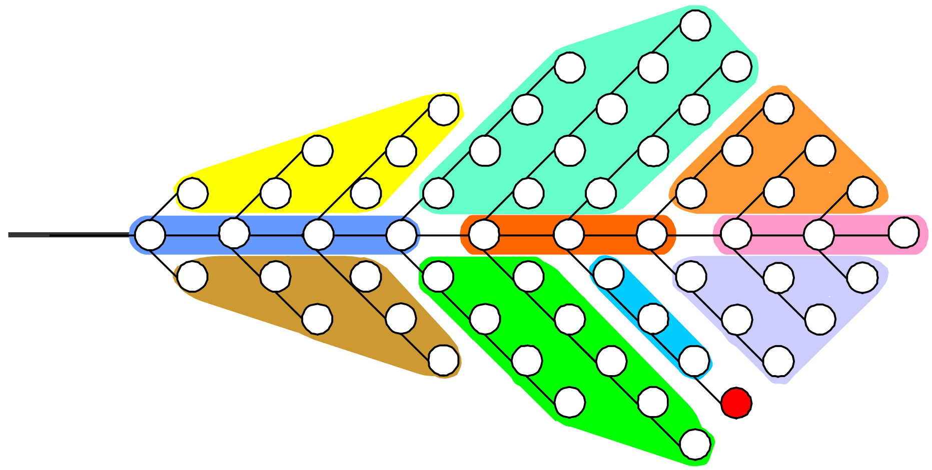

Fig. 2 Feeder network interconnecting access cells of the cable tree at Fig. 1

8.6.2 Cable Tree Topology Simplification Rules

Architecture of the cable tree drawn on **Fig. 1** and **Fig. 2** is for spectral simulations rather complex. Its simplification is based on association of access cells into groups, which are replaced by multiple parallel lines designed and distributed in the cable tree according to the following rules:

- Access cell, which contains a line, which is the subject of spectral analysis is not associated with any other cell, in Fig. 1 this cell is highlighted by red colour,
- Remaining cells are separated into groups. Lines of each group are replaced with multiple parallel lines terminated in a common multiple branch termination point. Separation of access cells into groups is illustrated in Fig. 2 by underlying colour spots. Number of cells associated in one group depends on accuracy, which should be achieved.

NOTE: It is convenient to arrange cells into groups symmetrical around the cable tree backbone, which can be further merged into one multiple branch termination point representing twofold number of original cells without loss of accuracy, see areas A – A' and B – B' at **Fig. 3**.

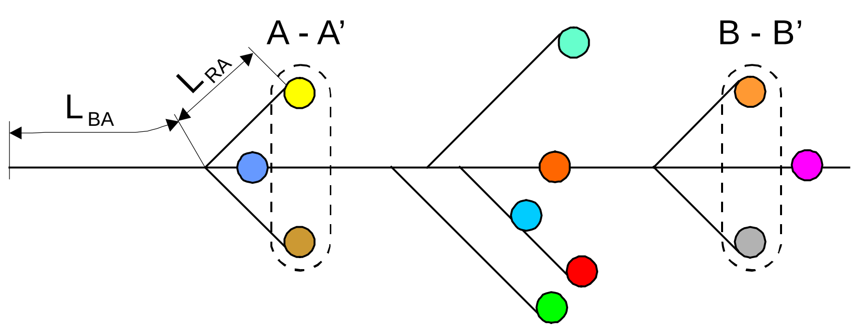

Fig. 3 Cable tree after its topology simplification

Final length L_X and other coordinates of a multiple line assigned to a group *X* are defined by expression 1.

$$L_X = L_{BX} + L_{RX} + L_C$$

$$L_{BX} = \frac{\sum_{i \in X} l_{iX} m_{iX}}{\sum_{i \in X} m_{iX}}$$

$$L_{RX} = C \frac{\sum_{i \in X} \sum_{j=1}^{m_{iX}} j}{\sum_{i \in X} m_{iX}}$$

where

C	Is the length of access cell edge;
L_{BX}	Is the coordinate of branching point from the cable tree backbone of the multiple line constituting group X;
L_{RX}	Is the length of X multiple line feeder tap;
L_C	Is the substituting length of lines in access cell. It may be used e.g. the average length $0{,}765C$ or the maximum length which yields $C\times\sqrt{2}$;
$\sum_{i \in X}$	denotes summation performed on branches constituting group X;
l_{iX}	Is the coordinate of branching point of the i–th original cable tree branch belonging to group X
m_{iX}	Is the number of cells of original i–th branch belonging to group X;

NOTE 1: Transformation process is illustrated in Fig. 3, where are indicated coordinates of a new multiple branch termination point A.

NOTE 2: In case of grouping access cells laying only on the CT backbone $L_{RX} \equiv 0$.

Expression 1: Rules for calculation of branch coordinates of one-node/multiple-node cable tree model

8.6.3 Crosstalk characteristics in one-node/multi-node cable tree model

Crosstalk transfer functions used in one-node/multi-node cable tree model differ a bit from those of straight cable section, described in Clause 8.3.3.1. Reason is in the fact that they have to include also signal transmission over cable sections at which no relevant crosstalk occurs. This situation is illustrated by **Fig. 4** and modelled by Expression 2, where L_{CJX} stands for the pair concurrency length of branches J and X.

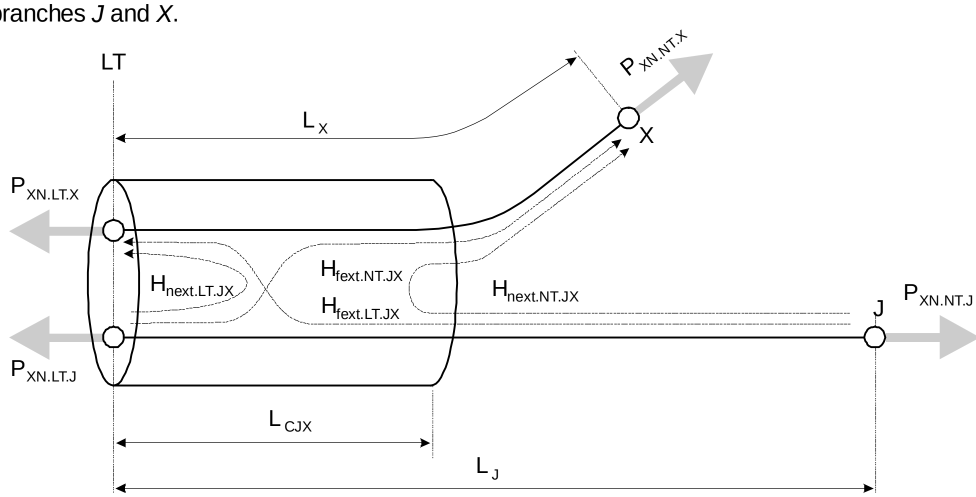

Fig. 4 Transmission parameters of cable tree branches *J* and *X*

$$H_{nextNT.JX}(f,L_X,L_J)=K_{xn}\times\left(f/f_0\right)^{0.75}\times\sqrt{1-\left|s_T(f,L_{CJX})\right|^4}\times\left|s_T(f,L_X+L_J-2L_{CJX})\right|$$

$$H_{next.LT.JX}(f,L_X,L_J)=K_{xn}\times\left(f/f_0\right)^{0.75}\times\sqrt{1-\left|s_T(f,L_{CJX})\right|^4}$$

$$H_{fext.NT.JX}(f,L_X,L_J)=K_{xf}\times\left(f/f_0\right)\times\sqrt{L_{CJX}/L_0}\times\left|s_T(f,L_X)\right|$$

$$H_{fext.LT.JX}(f,L_X,L_J)=K_{xf}\times\left(f/f_0\right)\times\sqrt{L_{CJX}/L_0}\times\left|s_T(f,L_J)\right|$$

Note 1: A victim pair belongs always to branch X.

Note 2: Crosstalk transfer function in one-node/multi-node model is generally related to two cable tree branches referred by their lengths L_X and L_J. In case, when modelled crosstalk occurs only between pairs of one cable tree branch, the crosstalk transfer function parameter description degenerates only to one length parameter, which is L_X .

Expression 2: Crosstalk transfer functions for one-node/multi-node model

8.6.4 Signal transmission in one-node/multi-node cable tree model

Noise spectra at NT and LT points of a victim pair in a branch X are given by Expression 3, where B denotes number of multiple line branches constituting the final cable tree model.

$$P_{XNNT.X}(f)=\left|H_{fextNT.X}(f,L_X)\right|^2P_{d.eqLT.X}(f)+\left|H_{nextNT.X}(f,L_X)\right|^2P_{d.eqNT.X}(f)+P_{bnNT}+$$
$$+\sum_{\substack{J=1\\J\neq X}}^{B}\left|H_{fextNT.JX}(f,L_X,L_J)\right|^2P_{d.eqLT.J}(f)+\sum_{\substack{J=1\\J\neq X}}^{B}\left|H_{nextNT.JX}(f,L_X,L_J)\right|^2P_{d.eqNT.J}(f)$$

$$P_{XNLT.X}(f)=\left|H_{fextLT.X}(f,L_X)\right|^2P_{d.eqNT.X}(f)+\left|H_{nextLT.X}(f,L_X)\right|^2P_{d.eqLT.X}(f)+P_{bnLT}+$$
$$+\sum_{\substack{J=1\\J\neq X}}^{B}\left|H_{fextLT.JX}(f,L_X,L_J)\right|^2P_{d.eqNT.J}(f)+\sum_{\substack{J=1\\J\neq X}}^{B}\left|H_{nextLT.JX}(f,L_X,L_J)\right|^2P_{d.eqLT.J}(f)$$

Where

$P_{XN.NT.X}$ is the total crosstalk power induced into a victim pair of branch X at NT side

$P_{d.eq.NT.X}$ is the cumulated noise power from interferers located at NT side of branch X.

Expression 3: Evaluation of the crosstalk power levels that flow into the noise injection blocks of the one-node/multi-node model

End of literal text proposals