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TITLE           **Problems with proposed models for crosstalk from multiple locations**

PROJECT        SpM-2

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STATUS         for discussion and decision

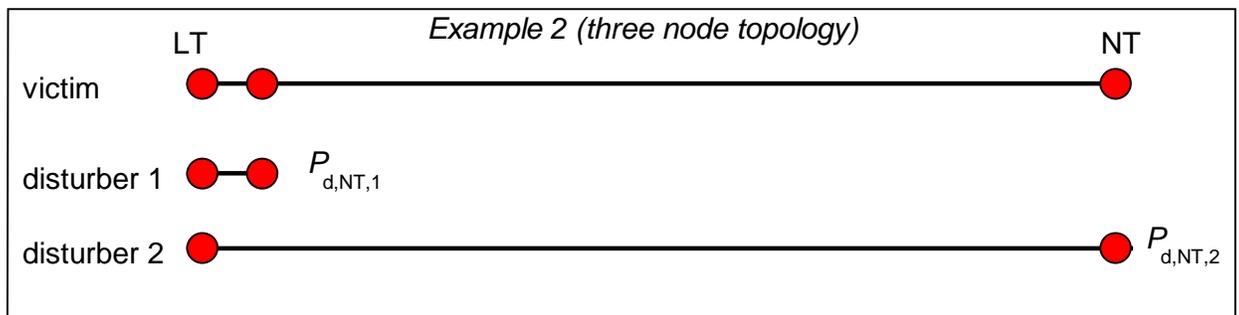
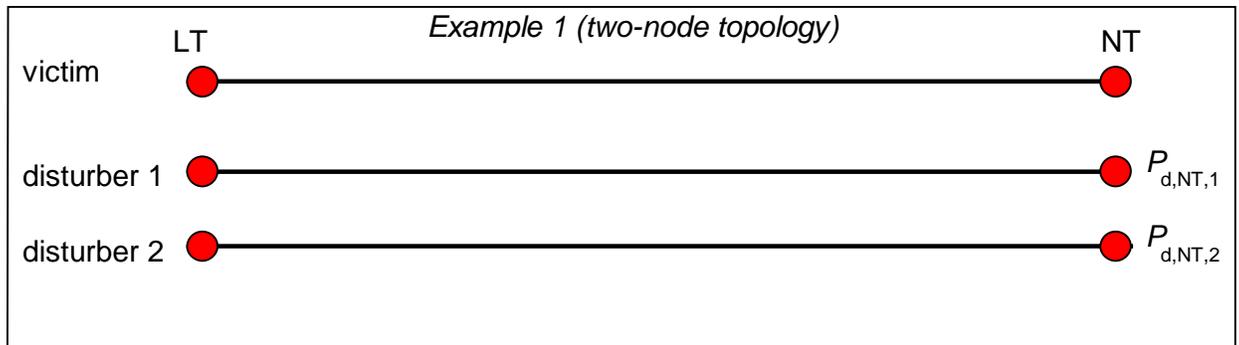
ABSTRACT       Models for crosstalk from multiple locations are being studied for inclusion in SpM-2. TD17 from Czech Telecom is an appreciated contribution to get progress on this. However, there are fundamental problems with the formulas being proposed so far, and they have to be resolved first. This contribution highlights the problems, to explain why we cannot agree on the proposal so far.

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### Problem 1: predicting of inconsistent results

A model that is suitable for predicting crosstalk from multiple locations should at least be able to predict a simple three-node scenario with a “Local exchange”, a “short distance”, and one at a “long distance” involved.

For instance the two simple scenarios, below, where the branched length have been put to zero, and only the difference in coupling length is accounted for.



In example 1, a victim modem is disturbed by two equal disturbers, that are both co-located at the LT and the NT side. This is similar for example 2, but with the difference that disturber #1 has a significant shorter loop. It is obvious that the NEXT at the NT side is lower in the second example for the simple reason that the coupling length of the short loop is lower than from the long loop. For the same reason the FEXT from these disturbers at the LT side will also be different for both scenarios

The formulas in TD17 of this meeting (054t17a0) appear not to account for this. When evaluating the proposed expression, it will predict the same “equivalent disturber” levels for both examples. Therefore we cannot agree on the proposal in TD17 and previous TD’s.

**Problem 2: expanding the two-node approach in a too straight-forward way.**

In many multimode scenarios, the crosstalk can be expressed by means of *two* equivalent disturbers, that are *by definition* collocated with the LT and NT node of the victim, and *by definition* coupled with some “equivalent crosstalk coupling” function. (Such equivalent disturbers do not exist for all scenarios, since sometimes a negative power would be required for it.) For those scenarios where equivalent disturbers do exist, the expression for the two equivalent disturbers requires in principle the involved coupling function from each individual disturber pair.

However in the special case of a two-node scenario, the formula for crosstalk can be split-up in (a) common coupling functions only, and (b) a cumulation of all power from co-located individual disturbers (without any coupling function). This split-up has been used in the published SpM-2 to describe the crosstalk formulas for the two-node situation.

The approach proposed in TD17, and its previous proposals, seems to expand from that simplification (without proof of plausibility), as if all co-located disturbers can be cumulated first into some equivalent disturber (while ignoring the coupling functions) and that the total crosstalk can subsequently be evaluated by combining these powers with coupling functions. We believe that this is a wrong assumption, and that more study is required to have it solved.