TITLE **The rationale behind TD4 on Spectral Compatibility of SDSL**

PROJECT SDSL

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STATUS for information

The purpose of this WD is to explain in short what approach KPN has followed to come to the conclusion that SDSL PSD's are spectral compatible with existing services (see FSAN statement in TD4). That conclusion was drawn in several steps:

First the service mix demand, that is expected after a few years, was defined. In our calculations we assumed per cable:
- 25 × a 2 Mb/s leased line service
- 200 × voice+data services (like Fast internet)
- 150 × voice only, based on ISDN
- rest voice only, based on POTS

Secondly, several technology mix scenario's were defined to provide our customers with this service demand. For all evaluated technology mix scenario's the above service mix scenario's were kept constant.

Next it was assumed that SDSL will be deployed in high volumes, and that it becomes a serious competitor for ADSL. So scenario's, in which half of the planned voice+data services are offered via SDSL and the rest via ADSL. These scenario's are summarized in figure 1

Scenario's (see figure 1)
Three degrees of spectral management scenario's have been evaluated. The scenario's in figure 1 have in common that 250 broadband systems are involved in a 900 wire pair cable. (200 ADSL/SDSL kind of services are involved, and 50 HDSL-kind of services).
The three scenario's in each colomn vary from weak to strong spectral management.
- Scenario A: low degree of spectral management, many incompatible systemen in the same cable
- Scenario B: improved degree spectral management, but HDSL/2B1Q is forbidden
- Scenario C: high degree of spectral management: HDSL/2B1Q and ADSL/ISDN are forbidden

When SDSL is available, it will replace 50% of the ADSL systems, to keep the total number of broadband systems at constant level.

Calculations (see all succeeding figures)
For each technology mix, the change in performance has been calculated for all existing technology mixtures when SDSL is introduced as a 512kb/s, 1024kb/s or 2048kb/s symetrical service. In our example this was:
- ADSL over POTS performance
- ADSL over ISDN performance
- HDSL/CAP (2-pair) performance

For ADSL this means the calculation of the maximum bitrate for a range of cable lengths (as illustrated in figure 2) at given noise margin (6 db). For HDSL this means the calculation of the noise margin for a range of cable lengths at the specified 2 Mb/s bitrate.
This was performed for no-SDSL, 0.5 Mb/s SDSL, 1 Mb/s SDSL and 2 Mb/s SDSL.

	Scenario A0, without SDSL		**Scenario A1, with SDSL**
75	ADSL.DMT/POTS.dn:fsan[FDM.kpn]	38	ADSL.DMT/POTS.dn:fsan[FDM.kpn]
75	ADSL.DMT/POTS.dn:fsan	37	ADSL.DMT/POTS.dn:fsan
25	ADSL.DMT/ISDN.dn:fsan[FDM.kpn	13	ADSL.DMT/ISDN.dn:fsan[FDM.kpn
25	ADSL.DMT/ISDN.dn:fsan	12	ADSL.DMT/ISDN.dn:fsan
40	HDSL.2B1Q/2:fsan	40	HDSL.2B1Q/2:fsan
10	HDSL.CAP/2:etsi-mask	10	HDSL.CAP/2:etsi-mask
150	ISDN.2B1Q:fsan	150	ISDN.2B1Q:fsan
		100	**SDSL**

	Scenario B0, without SDSL		**Scenario B1, with SDSL**
75	ADSL.DMT/POTS.dn:fsan[FDM.kpn]	38	ADSL.DMT/POTS.dn:fsan[FDM.kpn]
75	ADSL.DMT/POTS.dn:fsan	37	ADSL.DMT/POTS.dn:fsan
25	ADSL.DMT/ISDN.dn:fsan[FDM.kpn	13	ADSL.DMT/ISDN.dn:fsan[FDM.kpn
25	ADSL.DMT/ISDN.dn:fsan	12	ADSL.DMT/ISDN.dn:fsan
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50	HDSL.CAP/2:etsi-mask	50	HDSL.CAP/2:etsi-mask
150	ISDN.2B1Q:fsan	150	ISDN.2B1Q:fsan
		100	**SDSL**

	Scenario C0, without SDSL		**Scenario C1, with SDSL**
100	ADSL.DMT/POTS.dn:fsan[FDM.kpn]	50	ADSL.DMT/POTS.dn:fsan[FDM.kpn]
100	ADSL.DMT/POTS.dn:fsan	50	ADSL.DMT/POTS.dn:fsan
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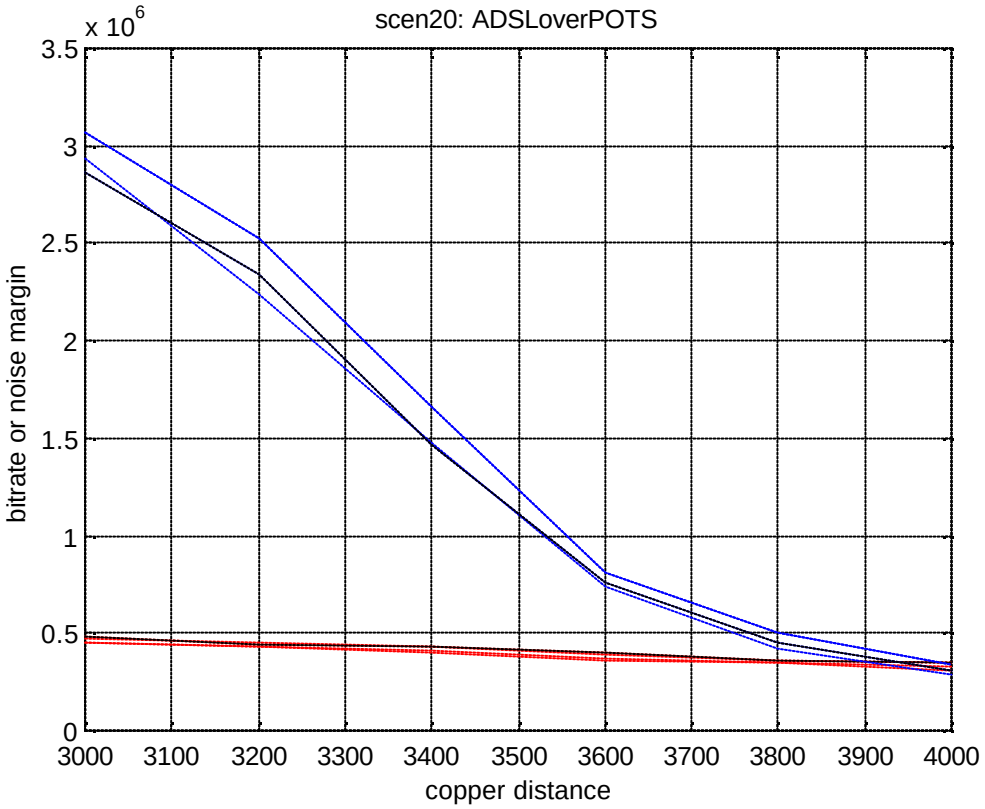
50	HDSL.CAP/2:etsi-mask	50	HDSL.CAP/2:etsi-mask
150	ISDN.2B1Q:fsan	150	ISDN.2B1Q:fsan
		100	**SDSL**

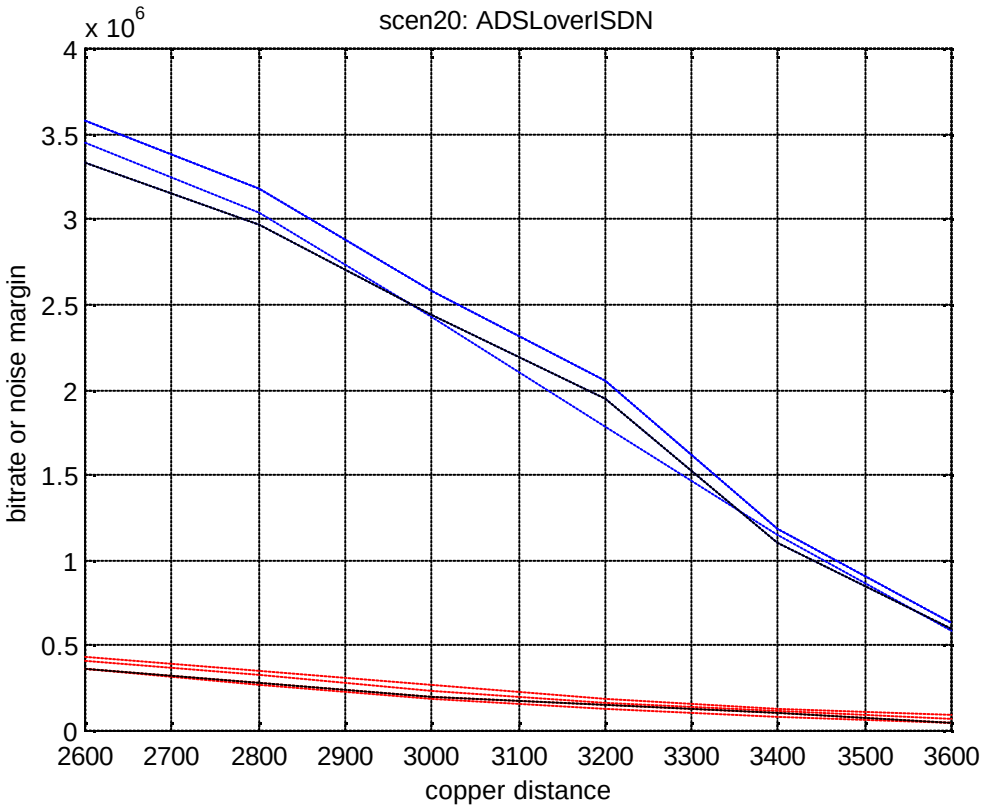
figure 1

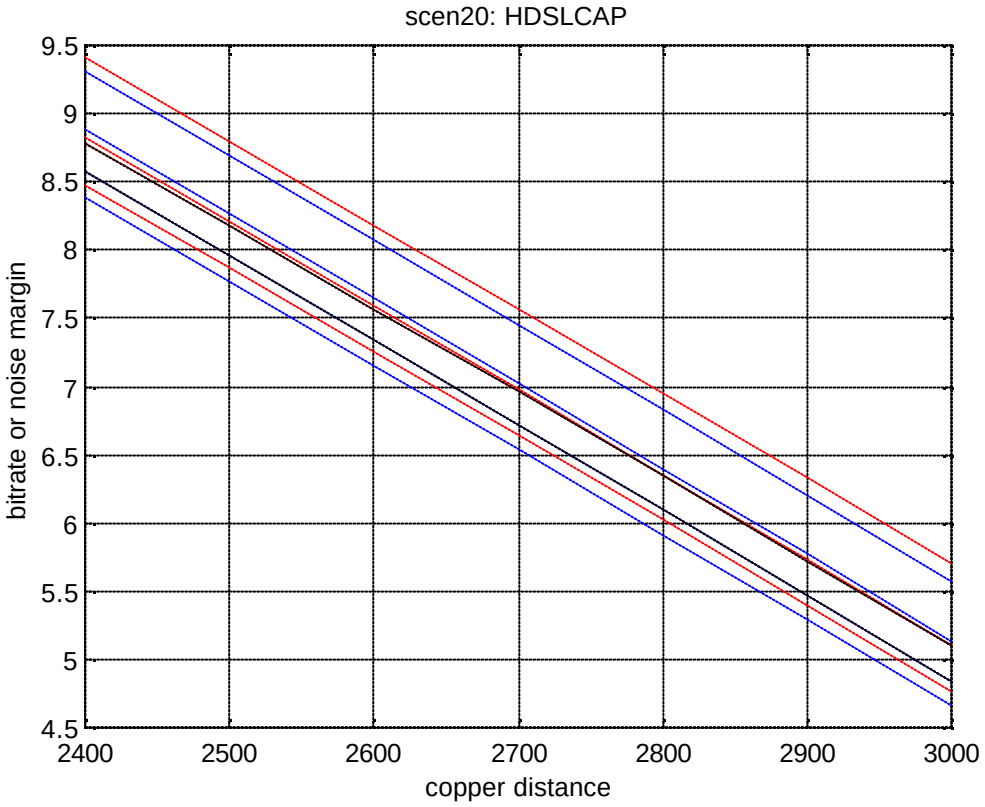
general conclusions:

- Replacement of ADSL by SDSL will hardly change the performance of existing services (usually less than 100 or 200 meter variation). Except for the highest SDSL bitrates (2Mb/s) and the most stringent types of spectral management.
- Upstream performance of ADSL over ISDN is the limiting factor, and reduces the applicability of this product significantly. In fact its a poor solution for providing the combination of FAST Internet and ISDN.
- Deploying 2Mb/s leased line services with HDSL/2B1Q, in stead of HDSL/CAP, will deteriorate the ADSL performance significantly. **Scenarios that exclude HDSL/2B1Q, in favor of HDSL/CAP, are highly recommended!!!**
- Excluding all ADSL over ISDN systems from being deployed, has significantly advantages in favor of ADSL over POTS.
- SDSL is spectral compatible with existing services, under a wide range of spectral management scenario's. Its a prefered solution to provide the combination of Fast Internet or leased lines with ISDN type of services.

Scenarios A: low degree of spectral management



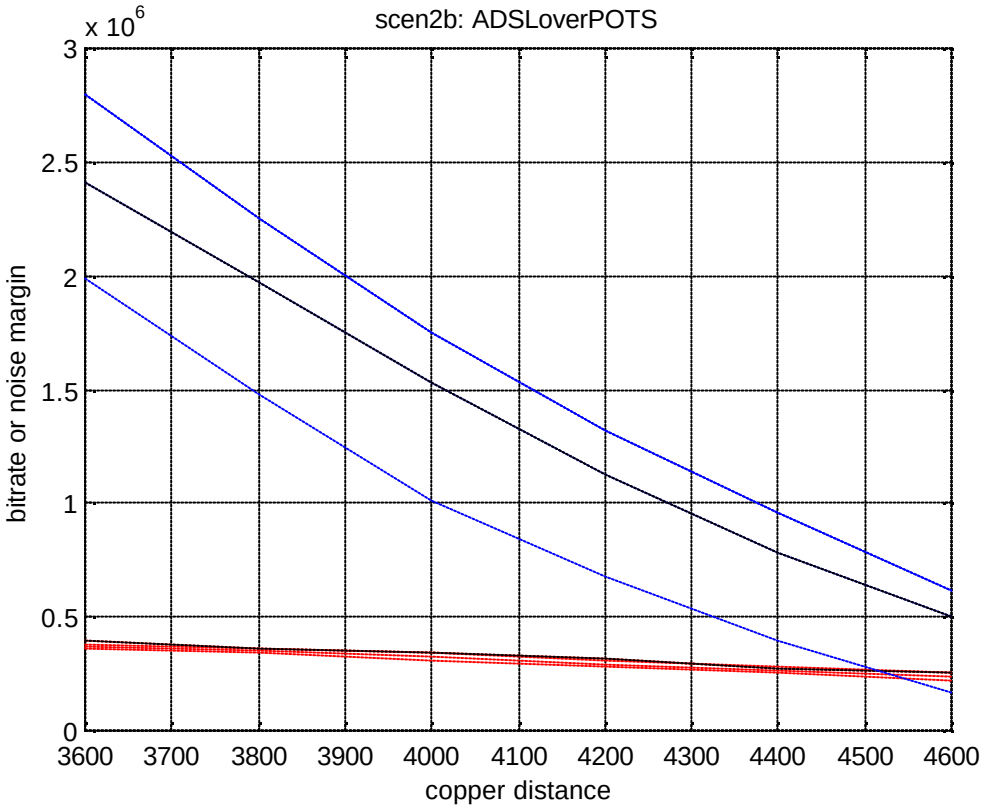


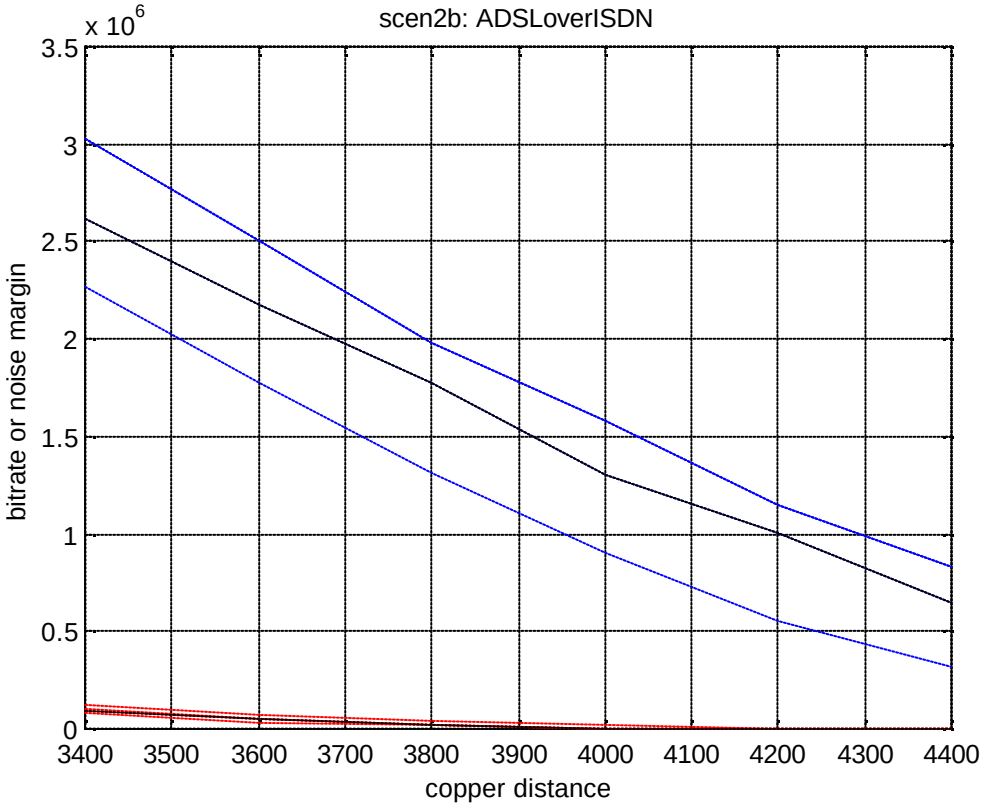


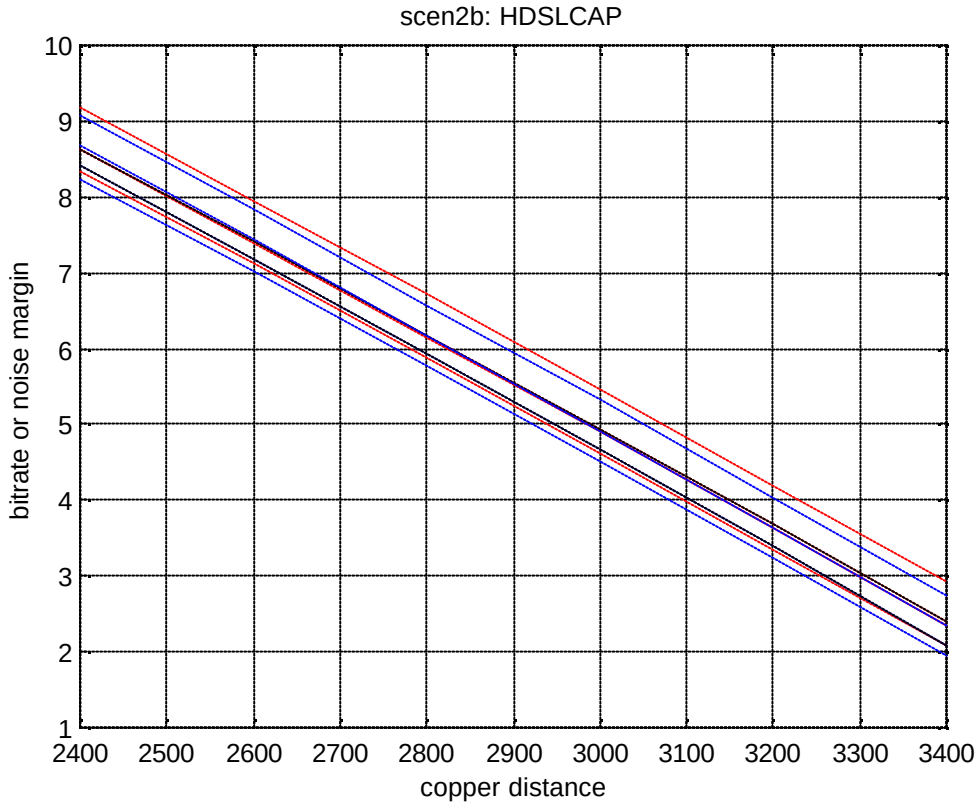
Conclusion:

- replacement of ADSL by SDSL will hardly change the performance of existing service (100 meter variation)
- Upstream performance of ADSL over ISDN is the limiting factor, and reduced the applicability of this product significantly

Impairment scenarios B: No HDSL/2B1Q



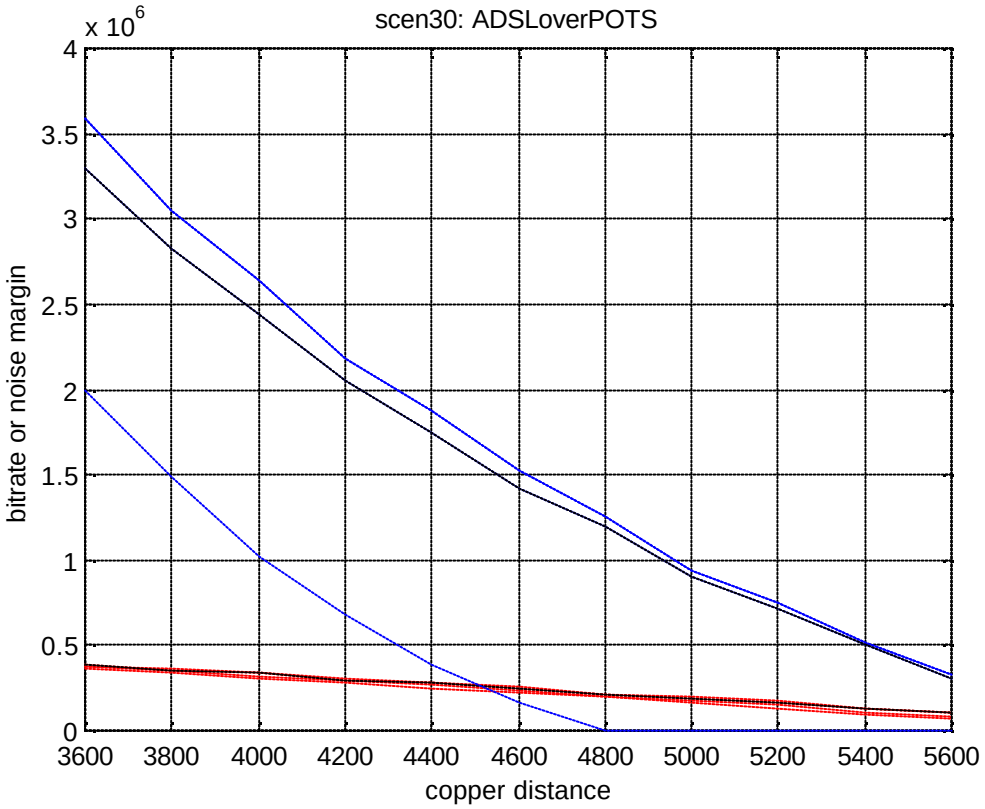


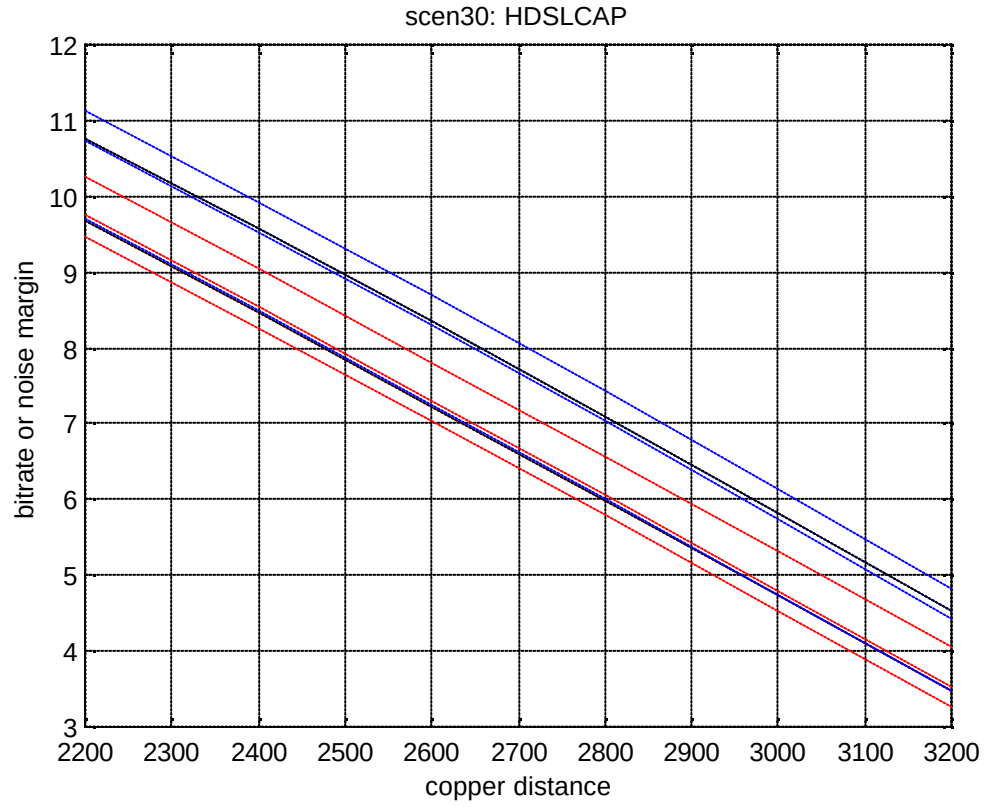


Conclusions:

- replacement of ADSL by SDSL will hardly change the performance of existing service (200 meter variation). SDSL bitrates of 1Mb/s or lower will even improve the overall ADSL performance.
- Deploying 2Mb/s leased line services with HDSL/2B1Q, in stead of HDSL/CAP will deteriorate the ADSL performance significantly. **Scenarios that exclude HDSL/2B1Q, in favor of HDSL/CAP, are highly recommended!!!**
- Upstream performance of ADSL over ISDN is the limiting factor, and reduced the applicability of this product significantly

Impairment scenarios C: No HDSL/2B1Q, No ADSL/ISDN





Conclusions:

- excluding all ADSL over ISDN systems from being deployed, has significantly advantages in favor of ADSL over POTS.
- Servicing customers with SDSL up to 1 Mb/s, (in stead of ADSL over POTS) will slightly improve the remaining ADSL performance. Deploying 2Mb/s SDSL systems bring the ADSL performance back to the case wher ADSL over ISDN would have been used.