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TITLE   **VDSL - Using matched and mismatched testloops**

STATUS   Proposal.

The adoption of *one* nominal design impedance for VDSL causes that most transmission lines are mismatched in practice. The consequence of mismatch is mainly restricted to the deterioration of reflection (=reciprocal of return-loss). The overall transmission (=reciprocal of insertion loss) is hardly deteriorated due to the attenuation of the lines. Low reflection is an advantage only when downstream and upstream signals overlap in frequency, because low reflection reduces the requirements for echo-cancellation significantly. This aspect does not hold for VDSL (and ADSL). Therefore, we think that the relevance to VDSL (and ADSL) of mismatch errors is of limited importance.

Adopting a nominal design impedance implies that this value must be used to specify various properties, including insertion loss and the characteristic impedance of the testloops. Nevertheless, mismatched testloops have to be included to guarantee that the overall performance is maintained when VDSL is connected to mismatched cables. This mismatch must be functional, as simple as possible, and not based on a range of loops having minor deviations in mismatch. Therefore, we propose to restrict the testloops to *one* class of worst-case mismatch.

> We propose to adopt one class of matched testloops and one class of mismatched testloops for VDSL. Loops in the same class are all based on the same cable, but may differ in length.
> - The matched loops must be based on cables having the adopted design impedance (135Ω).
> - The mismatched test loops must be based on cables causing a worstcase mismatch, which is probably the lowest (100 Ω) or highest (150 Ω) characteristic impedance value of major interest.
>
> The insertion loss of all loops must be specified at the adopted design impedance (135Ω). Each loop is specified by its insertion loss, not by its length.

We think that 3MHz is a good midband value for VDSL, to specify the loop insertion loss.
For specifying a sample of a 100Ω cable, the primary line constants of the current VDSL draft are applicable. For specifying 135Ω cables, operators using these cables are invited to specify the associated primary line constants. The primary line constants in table 1 of a 150Ω cable can be used for simulation purposes.

freq. [kHz]	R [Ω/km]	L [µH/km]	C [nF/km]	G [mS/km]
5	168.2	755.5	35.5	0.025
10	168.3	755.5	35.3	0.049
15	168.6	755.4	35.1	0.074
20	168.9	755.2	35.0	0.098
25	169.4	755.1	34.9	0.123
30	169.9	754.8	34.8	0.147
35	170.5	754.6	34.7	0.172
40	171.3	754.3	34.7	0.197
45	172.1	754.0	34.6	0.221
50	173.0	753.6	34.6	0.246
55	174.0	753.2	34.5	0.270
60	175.1	752.8	34.4	0.295
65	176.3	752.3	34.4	0.319
70	177.5	751.8	34.4	0.344
75	178.9	751.2	34.3	0.369
80	180.3	750.7	34.3	0.393
85	181.8	750.1	34.3	0.418
90	183.3	749.5	34.2	0.442
95	185.0	748.8	34.2	0.467
100	186.7	748.1	34.2	0.491
150	206.9	740.1	33.9	0.737
200	230.8	730.7	33.8	0.983
250	256.0	721.0	33.6	1.229
300	280.8	711.7	33.5	1.474
350	304.4	703.1	33.4	1.720
400	326.4	695.5	33.4	1.966
450	346.6	688.7	33.3	2.211
500	365.3	682.8	33.2	2.457
550	382.5	677.7	33.2	2.703
600	398.6	673.2	33.1	2.948
650	413.7	669.2	33.1	3.194
700	428.0	665.7	33.1	3.440
750	441.6	662.6	33.0	3.686
800	454.6	659.8	33.0	3.931
850	467.2	657.2	33.0	4.177
900	479.3	654.9	32.9	4.423
950	491.1	652.8	32.9	4.668
1000	502.6	650.9	32.9	4.914
1500	605.0	637.5	32.7	7.371
2000	692.0	629.5	32.6	9.828
2500	768.8	624.0	32.5	12.285
3000	838.2	620.0	32.4	14.742
3500	902.0	616.9	32.4	17.199
4000	961.4	614.4	32.3	19.656
4500	1017.1	612.3	32.3	22.113
5000	1069.9	610.5	32.3	24.570
5500	1120.1	609.0	32.2	27.027
6000	1168.0	607.6	32.2	29.484
6500	1214.0	606.5	32.2	31.941
7000	1258.2	605.4	32.2	34.398
7500	1300.9	604.5	32.1	36.855
8000	1342.2	603.6	32.1	39.313
8500	1382.2	602.9	32.1	41.770
9000	1421.0	602.2	32.1	44.227
9500	1458.8	601.5	32.1	46.684
10000	1495.6	600.9	32.1	49.141

*Table 1 Primary line constants of a 150**W** twisted pair cable. It is a sample of a PE quad cable that is commonly used in the Netherlands (norm 86, 50*4*0.5mm, sample L1/28). The parameters have been extracted from twoport measurements on a section of 500m Note that this sample is not a worst case sample nor a typical sample. We observed up to 6dB/km variation in insertion loss (ranging between 31-37 dB/km) for various wire pairs at 3MHz.*