

Bilag 7: TDC technical requirements for approval of equipment intended for connection to TDC unboundled copper.

Dette bilag udgør bilag 7 til det mellem parterne tiltrådte Produkttillæg for Rå kobber/Delt rå kobber eller Standardaftale for Rå kobber eller Standardaftale for delt rå kobber. Bilaget erstatter samtidig følgende tidligere bilag:

Bilag 6. Formular til godkendelse af DSL-udstyr, 10. december 2008, hørende til Standardaftale for rå kobber

Bilag 6. Formular til godkendelse af DSL-udstyr, 10. december 2008, hørende til Standardaftale for delt rå kobber

Ved krydshenvisning i dette bilag er henvisninger til Generelle vilkår og Produkttillæg for Rå kobber/Delt rå kobber anført med almindelig typografi, mens henvisninger til Standardaftalen for Rå kobber eller Standardaftale for Delt rå kobber er anført med kursiv og indsat i firkantet parentes.

The purpose of this document is to assist applicants seeking approval of equipment for connection to TDC unboundled copper pairs, to assess, if the equipment fulfils the technical requirements for connection. This document contains an extract of the technical requirements given in: TDC "Produkttilæg for Rå kobber/Delt rå kobber", "Standardaftale om Rå Kobber" or "Standardaftale om Delt rå Kobber".

In the following pages the technical requirements for approval are listed in tables 1 - 7. The applicant is requested to compare the requirements listed in the relevant tables with the test reports for the equipment under consideration and check for compliance. If the equipment complies, a reference to the page/clause in the test report(s) documenting compliance should be noted in the blank column provided.

Please fill out separate forms for each product variant to be considered.

The tables with the applicants note and the test reports should subsequently be send to TDC for formal approval. If test reports do not exist, or are incomplete, TDC may perform the necessary measurements against payment.

Reference Dokumenter

- [1] Transmission and Multiplexing (TM); Integrated Services Digital Network (ISDN) basic rate access; Digital transmission system on metallic local lines; ETSI TS 102 080 V.1.3.2 (2000-05)
- [2] Transmission and Multiplexing (TM); High bit-rate Digital Subscriber Line (HDSL) transmissions system on metallic local lines; HDSL core specification and applications for combined BA-ISDN and 2048 kbit/s based access digital sections, ETSI TS 101 135 v1.5.3 (2000-09)
- [3] ITU-T, Transmission systems and media, Digital systems and networks. High bit rate Digital Subscriber Line (HDSL) transceivers, ITU-T G.991.1 (10/98)
- [4] ITU-T, Transmission systems and media, Digital systems and networks. Single-pair high-speed digital subscriber line (SHDSL) transceivers. G.991.2 (02/01)
- [5] Transmission and Multiplexing (TM); Access transmission system on metallic access cables; Symmetrical single pair high bitrate Digital Subscriber Line (SDSL), ETSI TS 101 524 V1.1.1
- [6] ITU-T G.992.1 (06/99): Transmission systems and media, digital systems and networks. Asymmetrical Digital Subscriber Line (ADSL) transceivers.
- [7] Transmission and Multiplexing (TM); Access transmission systems on metallic access cables; Asymmetric Digital Subscriber Line (ADSL) – Coexistence of ADSL and ISDN-BA on the same pair, ETSI TS 101 388 v1.1.1 (1998-11)
- [8] ITU-T G.992.2 (06/99): Transmission systems and media, digital systems and networks. Splitterless Asymmetrical Digital Subscriber Line (ADSL) transceivers.

- [9] Attachment to the Public Switched Telephone Network (PSTN); General technical requirements for equipment connected to an analogue subscriber interface in the PSTN, ETSI ETS 300 001 V.1.5.1 (1998-10)
- [10] ITU-T G.992.3: Transmission systems and media, Digital systems and networks. Digital sections and digital line system – Access networks; Asymmetric Digital Subscriber Line (ADSL) transceivers – 2 (ADSL2), G.992.3 (2005)
- [11] ITU-T G.992.5: Transmission systems and media, Digital systems and networks. Digital sections and digital line system – Access networks; Asymmetric Digital Subscriber Line (ADSL) transceivers (ADSL2+) Recommendation G.992.3 (2005)
- [12] ITU-T Series G: Transmissions systems and media digital systems and networks. Digital sections and digital line system – Access networks; Very high-speed digital subscriber line transceivers 2 (VDSL2) 993.2. (2006)

Overview over equipment types, which may be connected to unbundled copper pairs.

Permission to connect to unbundled pairs is limited to equipment making use of one or more of the listed technologies:

1. **PSTN** equipment or terminals intended for connection to analogue leased lines making use of the frequency band below 15 kHz, as specified in **table 1 and 2**.
2. **ISDN** with 2B1Q linecode, as specified in **table 1, 2 and 3**.
3. **HDSL**, symmetrical connections with transmission rates up to 2.048 MB/s, as specified in **table 1 and 4**.
4. **(G)SHDSL**, symmetrical connections with transmission rates up to 3.1 MB/s, as specified in **table 1 and 5**.
5. **ADSL(2/2+)**, asymmetrical connections as specified in **table 1 and 6**.
6. **VDSL2** with DMT line code and frequency plan 998 (asymmetrical) as specified in **table 1 and 7**.

The specific technical requirements for the different types of products are listed in tables 1 -7.

The required documentation for approval of equipment types is listed in the table below:

Equipment type	Technical requirements Specified in table:	Documentation required
PSTN or similar operating below 15 kHz	Tables 1 and 2	Declaration of compliance
ISDN	Table 1, 2 and 3	Declaration of compliance
HDSL	Table 1 and 4	Test report/certificate
(G)SHDSL	Table 1 and 5	Test report/certificate
ADSL, ADSL 2, ADSL 2+ or ADSL lite *	Table 1 and 6	Test report/certificate
VDSL2	Tabel 1 and 7	Test report/certificate

- In case of ADSL over PSTN or ISDN the requirements for PSTN or ISDN must also be meet (declaration of compliance).

Note. If a ADSL2/2+ or VDSL2 DSLAM is used for cabinet deployment, it must be possible to apply the downstream spectral shaping profile specified for the particular cabinet location. TDC will on request specify the shaping profile to be used in each particular cabinet location in the form of a list of breakpoints (kHz; dBm/Hz).

Measurement of downstream spectral shaping is however not a part of the general approval procedure, as the profile is location specific.

General information on product:

Equipment type (ISDN,HDSL etc.)_____

Designation (type no etc.):_____

Test report: _____

General requirements for equipment (Table 1)

All equipment to be connected to unbundled copper pairs must meet the requirements set in table 1.

Requirement	Limit	Recommended test method.	Applicants notes. Are requirements meet? If meet, reference to page/paragraph in test report.
Signalling relative to ground/chassis	Neither DC nor AC signals must be transmitted using ground as one conductor	Inspection	
Isolation to ground	Ref [9] section 2.2. This requirement does not apply to equipment feeding DC current to the line, if the DC source is connected to ground	Ref [9] section A 2.2 (Note 1)	
Impedance to ground	Ref [9] section 10.3 (DK) This requirement does not apply to equipment feeding DC current to the line, if the DC source is connected to ground	Ref [9] A section 10.3 (DK)	
AC voltages in the frequency band below 300 Hz <i>(continues next page)</i>	The maximum continuous AC voltage must not exceed 50 Vrms in the frequency range below 95 Hz. For higher frequencies the maximum voltage is reduced by 60 dB/dek down to 1.55 Vrms at 300 Hz. <i>(continues next page)</i>	Selective level voltmeter with internal resistance of minimum 1 MOhm and a measurement bandwidth of 10 Hz. <i>(continues next page)</i>	
AC voltages in the frequency band below 300 Hz <i>(continued from previous page)</i>	In the frequency band 20 – 55 Hz ringing signals with an rms voltage not exceeding 120 V are allowed provided the duration does not exceed 3 sec. Generator internal impedance must be 150 Ohm or higher. Note 2.		

DC feeding ground potential	If the DC voltage between the two wires in the pair – ring and tip – does not exceed 15 V, it is allowed that the DC source is floating (not connected to ground)		
Maximum currents	The terminal equipment must not be able to generate DC or AC currents with a combined RMS value exceeding 100 mA.	To be measured by RMS amperemeter connected between terminals.	
Maximum combined DC and AC voltage	For all voltages measured between line terminals and any terminal and ground, the combined DC and AC voltages must fulfil the following criteria, ringing voltages excluded: $(U_{ac}/70,7 + U_{dc}/65) < 1$ Uac designates AC voltage peak values at any frequency, in Volts. Udc designates DC Voltage.	Peak indicating voltmeters must be connected between line terminals and between any terminal and ground. None of the instruments must indicate a peak voltage (combined AC and DC), exceeding the specified limit.	

Table 1: General limits for terminal equipment.

General note (Table 1): For DSL equipment not using ringing or line feeding it is not necessary to measure all requirements, a declaration of compliance is sufficient.

Note 1. If overvoltage protection is integrated in the equipment referring to ground, the test voltage should be reduced to a value below the threshold voltage, however not less than 120 V.

Note 2. Legal requirements for electric safety prevents that maximum DC voltage, maximum AC voltage and maximum ringing time apply simultaneous.

Requirements for terminal equipment using limited bandwidth (Tables 2 and 3)

Requirements permit the use of PSTN and other types of terminal equipment making use of the frequency band 0 – 15 kHz only and ISDN BRI using 2B1Q linecode, as specified in ref. [1].

Requirements for equipment are listed in tables 2 (PSTN etc.) and table 3 (ISDN BRI)

Requirement	Limit	Recommended test method	Applicants notes. Are requirements meet? If meet, reference to page/paragraph in test report
Balance to earth LCL, 40 Hz til 15 kHz	NET 4, 4.2.1 (DK)	NET 4, 4.2.1 (DK)	
Power in frequency range 300 Hz til 15 kHz: <ul style="list-style-type: none"> Peak voltage in frequency range 300 til 15000Hz Average power in frequency range 300 til 4000 Hz Spectral density in frequency range 4 til 15 kHz 	Max. 3,5 Vpp connected to 600 Ohm termination Max. 0 dBm connected to 600 Ohm termination Max. – 30 dBm/Hz connected to 600 Ohm termination	Instrument input impedance 100 kOhm, max. Rise time 50 µs Average measured over any 10 sec. period Measurement bandwidth 300 Hz	
Spectral density in frequency range from 15 kHz to 1 MHz	- 30 dBm/Hz decreasing to -57 dBm/Hz by 120 Ohm termination	Measurement bandwidth 1 kHz	
Spectral density in frequency range 1 to 30 MHz	-80 dBm/Hz by 120 Ohm termination	Termination bandwidth 10 kHz	

Table 2: Requirements and test methods for PSTN and other types of terminal equipment using frequency band below 15 kHz only

Requirement	Limit	Recommended test method	Applicants notes. Are requirements meet? If meet, reference to page/paragraph in test report
Spectral density in frequency range 1 to 30 MHz	Section A.12.4 i ref. [1].	Section A.12.4 i ref. [1].	

Table 3: Requirements and test methods for ISDN BRI equipment

Requirements for HDSL equipment (table 4)

The requirements permit connection of HDSL equipment utilising 2B1Q line code as specified in ref. [2] or [3] with symmetrical data rates up to 2.048 kB/s.

Requirement	Limit	Recommended test method	Applicants notes. Are requirements meet? If meet, reference to page/paragraph in test report
Balance to earth	Section 5.8.5 in ref. [2] or [3]	Section 5.8.5 in ref. [2] or [3]	
Spectral density from 0 to 30 MHz	Section 5.8.4.3.2 in ref. [2] or [3]	Section 5.8.4.3.2 in ref. [2] or [3]	

Table 4: Requirements and test specifications for HDSL equipment requiring extended bandwidth

If the equipment can operate at more than one data rate the spectral density should be measured at all rates. If the number of possible data rates is higher than 3, it is sufficient to measure at the lowest, the highest and one interim data rate.

Requirements for (G)SHDSL equipment (Table 5)

The requirements permit connection of (G)SHDSL equipment using PAM line code as specified in ref. [4] or [5] with symmetrical data rates up to 2.3 MB/s PAM 16 and 3.1 MB/s PAM 32.

Requirements	Limit	Recommended test method	Applicants notes. Are requirements meet? If meet, reference to page/paragraph in test report
Balance to earth	Section 11.3 in ref. [4] or section 11.3 in ref. [5].	Section 11.1 in ref. [4] or section 9.3 in ref. [5].	
Spectral density from 0 Hz to 30 MHz	Section B.4.1 in ref. [4] or section 9.4.1 in ref. [5].	Section B.4.1 in ref. [4] or section 9.4.1 in ref. [5].	

Table 5: requirements and test specification for (G)SHDSL equipment

The spectral density should be measured at 0 dB power backoff.

If the equipment can operate at more than one data rate the spectral density should be measured at all rates. If the number of possible data rates is higher than 3, it is sufficient to measure at the lowest, the highest and one interim data rate.

Requirements for ADSL equipment (Table 6)

Requirements allow the connection of ADSL equipment utilising DMT line code, as listed in table 6.

	Balance to earth		Spectral density	
	Limit	Recommended test method	Downstream	Upstream
ADSL Annex A	Ref. [6] section A.4.3.1	Ref. [6] Annex A section A.4.3.1	Ref. [6] Annex A 1.2 Ref. [8] Annex A 2 or Annex B 1 Ref. [7] section 5.4	Ref. [6] Annex A 2.4 Ref. [8] Annex A1 Ref. [7] section 6.10
ADSL Annex B	Ref. [6] section A.4.3.1	Ref. [6] Annex A section A.4.3.1	Ref. [6] Annex B1.3 Ref. [8] Annex A 2 or Annex B 1 Ref. [7] section 5.4	Ref. [6] Annex B 2.2 Ref. [8] Annex A1 Ref. [7] section 6.10
ADSL2 Annex A	Ref. [10] Annex A section A.4.3.3.1	Ref. [10] Annex A section A4	Ref. [10] Annex A section A.1.2 (overlapped) sec. A.1.3 (nonoverlapped)	Ref. [10] Annex A section A.2.2
ADSL2 Annex B	Ref. [10] Annex B section B.4.1.3.1	Ref. [10] Annex A section A4	Ref. [10] Annex B section B.1.2 (overlapped) section B.1.3 (non- overlapped)	Ref. [10] Annex I section B.2.2
ADSL2 Annex I	Ref. [10] Annex I section I.4.3.1	Ref. [10] Annex A section A4	Ref. [10] Annex I section I.1.2 (overlapped) sec. I.1.3 (nonoverlapped)	Ref. [10] Annex I section I.2.2
ADSL2 Annex J	Ref. [10] Annex J section J.4.1	Ref. [10] Annex A section A4	Ref. [10] Annex J section J.1.2 (overlapped) sec. J.1.3 (nonoverlapped)	Ref. [10] Annex J section J.2.2 Upstream mask 1-9 are allowed
ADSL2 Annex L	Ref. [6] section A.4.3.1	Ref. [10] Annex A section A4	Ref. [10] Annex L section J.1.2 (overlapped) sec. J.1.3 (nonoverlapped)	Ref. [10] Annex L section L.2.2 or section L.2.3.
ADSL2 Annex M	Ref. [6] section A.4.3.1	Ref. [10] Annex A section A4	Ref. [10] Annex M section M.1.2 (overlapped) sec. M.1.3 (nonoverlapped)	Ref. [11] Annex M section M.2.2. Upstream mask 1-9 are allowed
ADSL2+ Annex A	Ref. [11] Annex A section A.4	Ref. [10] Annex A section A4	Ref. [11] Annex A section A.1.2 (overlapped) sec. A.1.3 (nonoverlapped)	Ref. [11] Annex A section A.2.2
ADSL2+ Annex B	Ref. [11] Annex B section B.4	Ref. [10] Annex A section A4	Ref. [11] Annex B section B.1.2 (overlapped) sec. B.1.3 (nonoverlapped)	Ref. [11] Annex B section B.2.2
ADSL2+ Annex I	Ref. [11] Annex I section I.4	Ref. [10] Annex A section A4	Ref. [11] Annex M section M.1.2 (overlapped) sec. M.1.3 (nonoverlapped)	Ref. [11] Annex I section I.2.2

Table 6: Requirements and test specifications for ADSL equipment

The applicant is requested to indicate which ADSL modes of operation the equipment supports.

Mode of operation	Applicants notes	
	Does the equipment support this mode of operation (yes or no)?	Are requirements meet? If meet, reference to page/paragraph in test report. Note 3.
ADSL Annex A		
ADSL Annex B		
ADSL2 Annex A		
ADSL2 Annex B		
ADSL2 Annex I		
ADSL2 Annex J		
ADSL2 Annex L		
ADSL2 Annex M		
ADSL2+ Annex A		
ADSL2+ Annex B		
ADSL2+ Annex M		

Note3. Measurement data for balance to earth and spectral density must be supplied. If the equipment supports several modes of operation, it is sufficient to supply measurement data for the modes having the greatest spectral extension, upstream and downstream.

Requirements for VDSL equipment (Table 7)

The requirements permit connection of VDSL2 equipment using DMT line code and frequency plan 998 as specified in ref. [12].

Requirements	Limit	Recommended test method	Applicants notes. Are requirements meet? If meet, reference to page/paragraph in test report
Balance to earth	Section 8.1.3 in ref. [12].	Section 8.1.3 in ref. [12].	
Spectral density from 0 Hz to 30 MHz	Profile 998 12a/b PSD mask M1 or M2 (ref. [12] annex B)	Annex B in ref. [12]	

Table 7: Requirements and test specification for VDSL equipment

The spectral density should be measured at 0 dB power back-off.

If the equipment can operate at more than one data rate the spectral density should be measured with the equipment operating at maximum data rate and in the mode of operation having the greatest spectral extension of the line signal, upstream and downstream.

VDSL2 modems shall use Upstream Power Back Off (UPBO).