SPECIFICATION PTC 274:2010

REQUIREMENTS FOR
CONNECTION OF VDSL2
CPE TO THE TELECOM
WHOLESALE ACCESS
NETWORK

Draft for public comment

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CONTENTS

Referenced documents

International standards
[1] Very high speed digital subscriber line transceivers 2 (VDSL2)
ITU-T G.993.2 February 2006
Amendment 1 April 2007

[2] Handshake procedures for digital subscriber line (DSL) transceivers
ITU-T G.994.1 (G.hs), May 2003
Further completed with all Corrigenda and Amendments until November 2006.

[3] Physical layer management for digital subscriber line (DSL) transceivers
ITU-T G.997.1 May 2003

[4] RFC 2516 - A Method for Transmitting PPP Over Ethernet (PPPoE)

Telecom PTC documents
[5] Specification PTC 285: 2008
Requirements for VDSL2 Splitters

Chorus Specification
[6] Specification C279:2008
Technical Requirements for connection of deployment class systems to Chorus copper local loop

Telecommunications User's Forum
[7] Interference Management Plan (IMP) Parts 1 to 3

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It must be stressed that there is no guarantee of full or continued inter-operability between Telecom's network and products granted provisional Telepermits under the terms of this Specification. In addition, any inter-operability cannot be guaranteed under all operating conditions likely to be encountered on the Telecom network.

1. INTRODUCTION

1.1. Purpose of this document

This document presents the minimum conditions to be met by VDSL2 customer equipment for connection to Telecom's Wholesale VDSL2 network. The network may or not include POTS service, but given that POTS may be present, and the additional tests are relatively few, the specification assumes that POTS is present.

In general, compliance to this specification will ensure that the VDSL2 CPE will synchronise with the Telecom Wholesale DSLAM, and meet the requirements of the Telecommunications Users Forum (TCF) Interference Management Plan (IMP). Interoperability with equipment beyond the DSLAM is the responsibility of the Service provider.

1.2 VDSL2 Performance factors

Years of experience with ADSL have unveiled the pitfalls and issues related to ADSL deployment. The same issues apply with VDSL2 although because of the higher frequencies used, the effects of impairments on performance are proportionally greater than with ADSL and ADSL2+. As with communications systems in general the ultimate performance limiting factor is noise. This is closely related to signal attenuation, as even in an otherwise electrical quiet environment a signal is attenuated with distance to the point that it is indistinguishable from thermal noise which is a function of receiver bandwidth and temperature. Given this ultimate limit, performance is further limited by induced noise from other sources between the VTU-O and the VTU-R. For example:

- Interference between different telecommunication equipment (crosstalk), negatively impacting performance when more systems are deployed in the same cable binders.
- Bad in-house wiring practices such as untwisted cable, unbalanced wires (e.g. 3-wire), loose connections etc leading to signal distortion and even interruption and/or environmental noise pick-up affecting both performance and stability (service interruptions and packet loss).

With ADSL2+ over POTS reasonable performance can be expected using line filters in front of POTS CPE. With VDSL2, however it is recommended that the VDSL2 signal be separated from the premises wiring by a splitter (PTC285), as even with high quality Cat 5 star wired premises, the cable runs to various Telecommunications outlets are similar in length to the signal wavelengths, so completely unpredictable results are likely. Because of this there is currently no specification for VDSL2 line filters.

1.3 Field impact

Telecom cannot guarantee absolutely that compliance to all requirements listed in this document will not cause any operational problems when deployed in the field. The fulfilment of this specification has merely to be considered as a baseline and minimal set of features for offering reliable VDSL2 connectivity.

2 Definitions

VDSL2 Very High Speed Digital Subscriber Line

eoc Embedded Operations Channel: Channel used for signalling control information between VTU-O and VTU-R.

Interoperability: Two pieces of equipment are dynamically interoperable if they implement a common and compatible set of features, functions and options and can demonstrate satisfactory mutual communication in a real network architecture environment as performance test conditions are varied and exercised.

VTU-O VDSL2 Transceiver at the central office (cabinet) end of the local loop

VTU-R VDSL2 Transceiver at the remote (subscriber) end of the local loop

3. Scope

This PTC covers the requirements for VDSL2 CPE equipment to obtain a Telepermit for connection Telecom's Wholesale VDSL2 access network.

This Specification only covers DSL physical layer requirements. Other requirements, like higher-layer protocols to be supported, in-house networking interfaces, authentication processes, and so on, fall outside the scope of this document.

Finally, this Specification only covers requirements put on the CPE devices themselves. Requirements on filters and/or central splitters, wiring practices and other fall outside the scope of this Specification.

4. RECOMMENDED MODEM REQUIREMENTS

4.1 General

- VDSL2 Standard: ITU-T G993.2 Annex B, including all current Annex B Corrigenda and Amendments
- DSLAM Chipset: IKANOS CO-5 release ISR 3.7.3
- Recommended Modem Chipset: IKANOS CP-5 with IKANOS proxy which is compliant with the proxy releases shipped with ISR 3.7.04 IKANOS proxy 8.4 and backward compatible with ISR 3.3.05 IKANOS proxy 7.3.
- Band Plans: 997 symmetrical, profiles 8b and 17a (possibility that 30a may be introduced at a later date)
- Handshake: ITU-T 994.1 (2/07) including amendments 1 (11/07) and 2 (4/08)
- Support for Transport Protocol Specific Transmission Convergence (TPS-TC) functions: Packet Transmission Mode (PTM) via 64/65b encapsulation method described in IEEE 802.3ah-2004
- Physical Layer Management: G.997.1 including current Corrigenda and Amendments
- Modulation: Multi-Carrier Modulation (MCM)
- Interleaving: General Convolution
- Signal Bandwidth: 8b = 8 MHz, 17a = 17.6 MHz, (30a = 30 MHz)
- Tone Spacing: 4.3125 kHz (8.625 kHz for 30a)
- No of DMT tones: 4096 upstream and downstream (max)
- Impulse Noise protection (INP): up to 16 symbols
- Support:
    - Upstream power back-off (UPBO) algorithm
    - Performance monitoring
    - Dying Gasp
    - Vitual Noise

- RFC 2516: PPP over Ethernet (PPPoE). Note PPP over ATM (PPPoA) is not supported

5. GENERAL REQUIREMENTS

5.1 Supplier Information

The following information shall be provided as part of an application for a Telepermit:

1. Equipment Manufacturer:

2. Equipment model no. or product name:

3. Bands Supported:

Band	Frequency Lower edge (kHz)	Frequency Upper edge (kHz)	Supported (Y/N)
US0	25	138	
DS1	138	3000	
US1	3000	5100	
DS2	5100	7050	
US2	7050	12000	
DS3	12000	14000	
US3	14000	17664 *(19500)*	
DS4	*(19500)*	*(27000)*	*Not supported*
US4	*(27000)*	*(30000)*	*Not supported*

4. Hardware Version:

5. Firmware Version:

6. Configurations Details:

   - *Configuration details are limited to those parameters which, if altered would affect compliance against this Specification*

   - *Such parameters shall not be able to be changed under user control in customer equipment*

7. Is DC applied for wetting current or line powering:

6. SPECIFIC REQUIREMENTS AND TESTS

6.1 Total Aggregate Power

The total aggregate transmit power measured across the entire pass band shall comply with the limits set in the New Zealand Copper Local Loop Interference Management Plan Part 3 for the appropriate Deployment class. The terminating impedance is specified for each deployment class.

- *Ref: IMP Part 1 Appendix B.3.1*

6.2 PSD compliance

The PSDs of both the VTU-O and VTU-R shall comply with the limits set in the New Zealand Copper Local Loop Interference Management Plan Part 3 for the appropriate Deployment class.

- *Ref: IMP Part 1 Appendix B.3.2*

6.3 Longitudinal Balance

The Longitudinal Balance of both the network and customer equipment shall comply with the limits set in the New Zealand Copper Local Loop Interference Management Plan Part 3 for the appropriate Deployment class.

- *Ref: IMP Part 1 Appendix B.3.3*

6.4 Longitudinal output voltage

The Longitudinal Output Voltage of both the network and customer equipment shall comply with the limits set in the New Zealand Copper Local Loop Interference Management Plan Part 3 for the appropriate Deployment class.

- *Ref: IMP Part 1 Appendix B.3.4*
- *The detailed measurement techniques used may vary for different deployment classes, but shall follow the general methodology documented in the New Zealand Copper Local Loop Interference Management Plan Part 1 Appendix B.*
- *Where the equipment uses DC power feed or wetting current, the test set-up shall include these components and suitably sized blocking capacitors shall be included in the test circuit.*

6.5 Electrical safety

(1) The electrical safety requirements of AS/NZ 60950 shall be complied with by all CPE items covered by this Specification.

(2) Test reports to AS/NZ 60950 or its equivalent shall be supplied by a testing laboratory which is either recognised by Office of the Chief Electrical Engineer of the Ministry of Consumer Affairs (a division of the Ministry of Economic Development), or which is accredited by IANZ or one of its affiliated overseas laboratory registration authorities for electrical safety testing.

- *A considerable proportion of telecommunications equipment now available was originally manufactured for the North American and Japanese markets, where the mains voltage is only 100-110 V. Such overseas equipment is often designed with inadequate internal clearances between its*

components to meet New Zealand electrical safety requirements, which are based on 230 V operation.

(3) Any separate external power supply used shall also comply with the requirements of AS/NZ 60950 or its equivalent.

(4) Any separate external power supply used shall be suitably labelled so that it is easily and positively identifiable as being associated with the modem.

- *The power supply is critical to the performance of the modem, and it cannot be substituted for generic power supplies of similar rating.*

6.6 EMC compliance

(1) The requirements of AS/NZ 55022 (CISPR 22 or its direct overseas equivalent) shall be complied with by all CPE items covered by this Specification.

• The New Zealand requirements for general EMC compliance by items of equipment intended to be installed in customer's premises are the same as those applicable in most overseas countries, including Australia, which most suppliers seem to regard as a single market with New Zealand. As such, test reports acceptable in New Zealand will generally already be available as the result of testing carried out for other markets.

(2) It is a regulatory requirement that test reports to AS/NZS 55022 or its equivalent shall be held by suppliers of this class of equipment and that a formal Declaration of Conformity shall be submitted to the Ministry of Economic Development before such products are offered for sale or put into use in this country.

6.7 CPE identification test

6.7.1 Requirements

(1) It shall be possible to uniquely identify the CPE through the combination of modem vendor information (as defined in G.994.1) and system vendor information (in eoc channel, see e.g. G.992.3).

(2) The CPE manufacturer shall ensure that the system vendor information is correctly filled in. This information should be easy to interpret.
The manufacturer shall describe its methodology of linking system vendor info with actual CPE types. The methodology should link system vendor info with both HW and firmware versions of the CPE.

(3) By default, the CPE shall indicate all operating modes it supports in G.994.1 CLR message.

(4) Operation modes should not be enabled/disabled by the end-user (via any vendor-specific interface between PC and CPE) but should by default all be allowed. It is up to the DSLAM and the configured profile to select the appropriate operation mode out of the list of available modes. The CPE shall follow the operation mode imposed by the DSLAM.

6.7.2 Test rationale

The ability to identify CPE types is invaluable for diagnosing faults. Easily rectified problems such as running out of date firmware can be easily identified remotely. Also should interoperability problems occur with specific CPE models, this can easily be identified, and communicated back to the Telepermit holder.

6.7.3 Test procedure

1. Bring the test port out of service. Configure the test port with default profile. Power cycle the CPE.

2. Bring the test port in service. Wait until the modem has trained.

3. Retrieve following data on the DSLAM:

Type	Parameter	Number bytes	Reference
Far-End System Vendor Identification	vendor Id	8	G.992.3 par 9.4.1.4
	version number	16	
	serial number	32	
Far-End Modem Vendor Identification	vendor Id	8	G.994.1 par 9.3.3.1
Far-End operation mode capability list		Bitmap	G.994.1 par 9.4 (SIF)

- *The test has to be power-cycled (step 1) too ensure it is not keeping history data. It is allowed that the CPE uses so-called "warm init" by immediately sending MS from second initialisation on.*

Pass/Fail criteria

Test is successful if:

(a) Operation mode capability list at least indicates the modes required in 6.1.3(3).

(b) Modem and system vendor information of the CPE are available, filled in correctly and in line with information on identification strategy provided by the vendor to Telecom.

- *This initial test is merely informational for Telecom to identify the CPE under test. Telecom has the right to request the CPE vendor to change/update the vendor information in case it is ambiguous, incomplete or same as other equipment already deployed in the Telecom network.*

Number of tests

1 initialisation

6.8. Basic Performance test

6.8.1 Requirement
This test sets the minimum downstream performance to be achieved by the modem on a typical customer line.

6.8.2 Test rationale
This test case is designed to give an indication that the modem will connect to a Telecom DSLAM and exceed a minimal data rate. This test is not a comprehensive performance test, but eliminates any product which is not fit for purpose.

6.8.3 Test procedure
This test uses a short cable between the Device under test and the Telecom VDSL2 DSLAM.

1. Measure downstream speed of a reference modem
2. Connect modem under test and measure downstream speed
3. Repeat steps 1 and 2

The time between each test shall be not more than 5 minutes

6.8.4 Result
The average speed of the two tests of the modem under test shall be not less than 60% of the average speed of the two tests of the reference modem.

6.9. Compatibility with voiceband services on the same line
(1) POTS band requirements apply at the POTS port of the standard Telecom remote POTS splitter. Conformance shall be verified by test in accordance with Annex A of this specification.

(2) The line termination of VTU-R shall include a DC isolating capacitor having a one minute voltage rating no less than 400 Vdc, in relation to the voiceband input impedance requirement that the imaginary part shall be in the range -1.1 to -2.0 kohm at 4 kHz.

(3) The DC resistance at 250 V dc shall not be less than 5 Mohm.

(4) Operation in the presence of interference from POTS services
The application of POTS network ringing and POTS CPE ring trip shall not cause the modem to re-sync.

Test Procedure
Using the configuration in Fig 3.8, send 5 cadences of Telecom standard ringing. The line is then looped with the designated AC and DC impedance for 15 seconds, then the loop is removed. After a further period of 15 seconds, the sequence is repeated, 25 times.

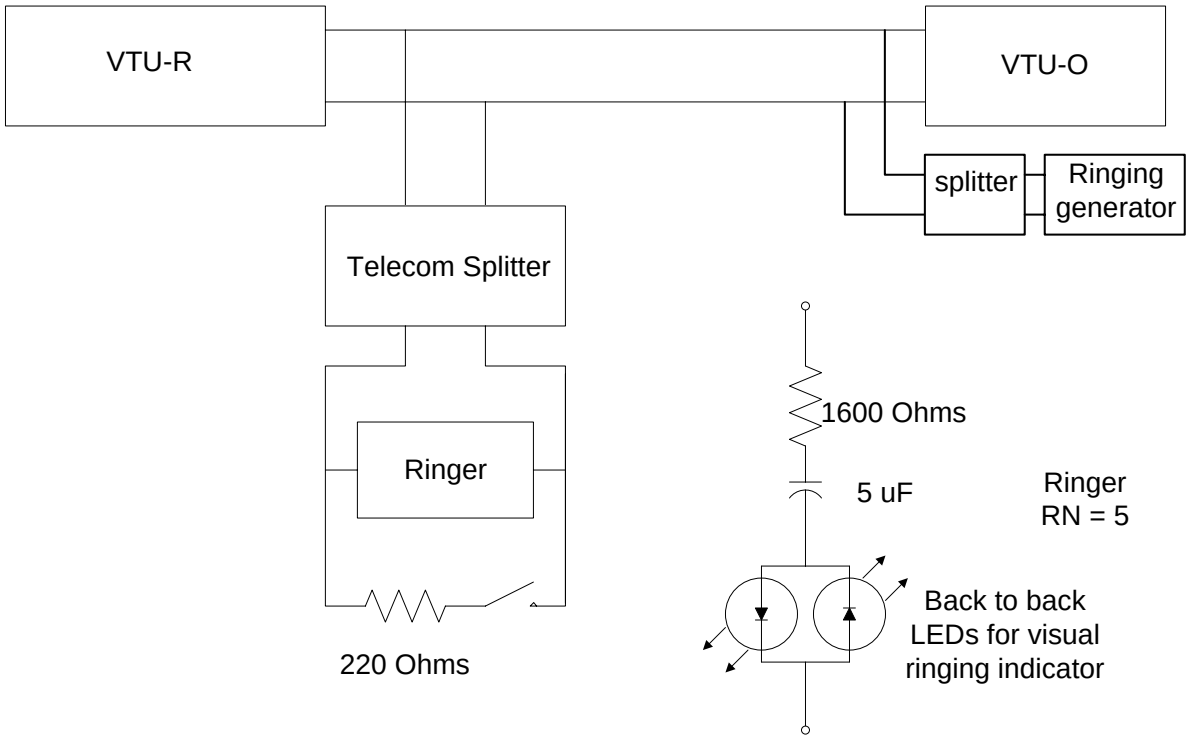

Figure 6.9 Test Set up for ringing and on-hook/off-hook tests