Spark
New Zealand

SPECIFICATION PTC 274:2016

REQUIREMENTS FOR
CONNECTION OF CPE TO THE
SPARK VDSL2 NETWORK

Spark New Zealand March 2016

CONTENTS

Referenced documents

International standards

[1] Very high speed digital subscriber line transceivers 2 (VDSL2)
ITU-T G.993.2 January 2015

[2] Handshake procedures for digital subscriber line (DSL) transceivers
ITU-T G.994.1 (G.hs), June 2012
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 June 2012

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

Spark 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 Carriers' 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 Spark'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 Spark 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 Spark's 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 Chorus DSLAM which is integral to the Spark service, and meet the requirements of the Telecommunications Users Forum (TCF) Interference Management Plan (IMP).

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 no specification for VDSL2 line filters.

1.3 Field impact

Spark 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 Spark's VDSL2 service.

This Specification 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, although the ability of the VDSL2 CPE to be able to browse on a Spark Internet connection at a reasonable speed is tested.

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 (01/2015).
- Band Plan: 998ADE17-M2x-A (B8-11), Profiles 8b and 17a
- Handshake: ITU-T 994.1 (6/2012)
- 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 (06/2012)
- Modulation: Multi-Carrier Modulation (MCM)
- Interleaving: General Convolution
- Signal Bandwidth: 8.5 MHz Profile 8b, 17.6 MHz Profile 17a
- 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
    - Virtual 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)	Profile	Supported (Y/N)
US0	25	138	8b, 17a	
DS1	138	3750	8b, 17a	
US1	3750	5200	8b, 17a	
DS2	5200	8500	8b, 17a	
US2	8500	12000	17a	
DS3	12000	17664	17a	

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 from the VTU-R measured across the entire pass band shall comply with the limits specified in ITU-T Rec G.993.2 (01/2015) Section 6 for the appropriate profile.

- *Ref: IMP Part 1 Appendix B.3.1*
- *Ref ITU-T 993.2 (01/2015) Section 6.*

6.2 PSD compliance

The PSDs of the VTU-R shall comply with the limits specified in Annex B of ITU-T Rec G.993.2 (01/2015) Bandplan 998ADE17-M2x-A (B8-11) Table B6A. Profiles 8b and 17a shall be measured.

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- *Ref: ITU-T Rec G.993.2 (01/2015) Table 6.1 for Profile definition*
- *Ref: ITU-T Rec G.993.2 (01/2015) Annex B Table B6A for PSD limits*
- *Below 2200 kHz, the PSD limits are those specified for ADSL2+ ITU-T Rec G992.5 Annex A (PTC 273)*

6.3 Longitudinal Balance

The Longitudinal Balance of the VTU-R shall comply with the limits specified in of ITU-T Rec G.993.2 (01/2015) Section 7.4

- *Ref: IMP Part 1 Appendix B.3.3*
- *Ref: ITU-T Rec G.993.2 (01/2015) Clause 7.4*

6.4 Longitudinal output voltage

The Longitudinal Output Voltage of the VTU-R shall be not greater than – 50 dBV for all frequencies up to 30 MHz.

- *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 Business Innovation and Employment (MBIE)), or which is accredited by IANZ or one of its affiliated overseas laboratory registration authorities for electrical safety testing.

(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 and RF compliance

(1) The requirements of AS/NZ 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) Where the product has wireless interfaces, including, but not limited to, wireless LANs in the 2.4 GHz, 5 GHz and 5.8 GHz bands DECT phone interface, NFC et al, the device shall be tested against the appropriate standard(s). AS/NZS 4268 covers most wireless interfaces. They are also covered by ETSI standards.

(3) It is a regulatory requirement a Supplier Declaration of Conformity (SDoC) shall be held by the supplier along with the relevant EMC and RF Test Reports.

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.994.1 par 9.3.3.1 G.992.3 par 9.4.1.4 G997.1 par 7.4
	version number	16	
	serial number	32	
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 Spark.

- *This initial test is merely informational for Spark to identify the CPE under test. Spark 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 network.*

Number of tests

1 initialisation

6.8. Basic Performance and Compatibility test

6.8.1 Requirement
This test sets the minimum downstream performance to be achieved by the modem on a typical customer line, and also checks that the modem is compatible with the Spark VDSL2 service.

6.8.2 Test rationale
This test case is designed to give an indication that the modem will connect to the Spark VDSL2 service and perform satisfactorily relative to a reference modem. This test is not a comprehensive performance test, but eliminates any product which is not fit for purpose.

6.8.3 Test procedure
Configure the modem as follows:

- **PPP Protocol:** PPPoE, (RFC 2516)
- **PPP User name:** user@xtrabb.co.nz
- **PPP Password:** password
- **PPP Auth Type:** PAP
- **Encapsulation:** 802.1Q
- **PCP marking:** 0
- **VLAN ID:** 10
- **MTU:** Auto, Must support MTU of 1500 bytes as per RFC4638. If RFC4638 is not supported then the modem must support MSS clamping to avoid any path mtu issues.

This test uses a short cable (< 1 km) between the Device under test and the Spark VDSL2 service.

- *1 km is not an absolute limit, as long as VDSL2 service has been successfully provisioned on the cable, it may be used for this test.*

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

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

6.8.4 Result
1. The modem must be able to be configured as listed above.
2. The default (out of the box) configuration shall be recorded.
3. The average downstream 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.
4. The average upstream 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 (PTC 285 compliant) remote POTS splitter.

(2) The line termination of VTU-R shall include a DC isolating capacitor having a one minute voltage rating no less than 400 Vdc.

(3) The imaginary part voiceband input impedance shall be in the range -1.1 to -2.0 kohm at 4 kHz.

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

(5) 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 6.9, send 5 cadences of New Zealand 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.

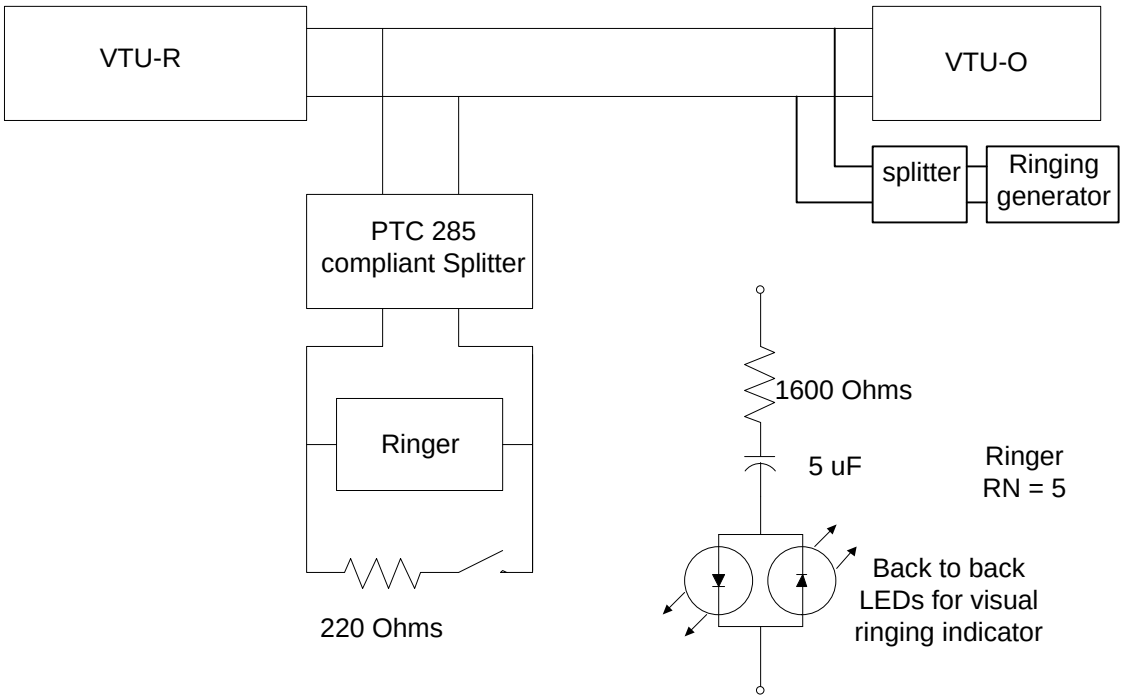

Figure 6.9 Test Set up for ringing and on-hook/off-hook tests

Appendix 1
PTC 274 Test Schedule
Test Report to PTC 274

Report No:…….
Laboratory:…….
Date of issue:…….

Client:……..
Manufacturer (5.1-1):…….
Product name (5.1-2):……..
Product Serial Number:……..
Bands and other DSL types supported (5.1-3):…….
Hardware version (5.1-4):……..
Firmware Version (5.1-5):……..
Configuration details (5.1-6): Document as appropriate. Enough detail shall be captured to enable system to meet all the compliance requirements.
DC wetting current or line power (5.1-7):…….(Y/N)
Product Description (List additional interfaces, e.g. VoIP phone ports, USB, WAN/LAN/WLAN etc):
……
……
……
……
……
Product functional details:
……
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……
……
……
Overall Compliance:……Yes/No
Comments:
……
……
.....

Test Schedule

PTC 274 clause no.	Test Description	Limits for compliance	Result	Comply Y/N	Comment
6.1	Total Aggregate US Power				
	Profile 8b	<14.5 dBm	……..dBm	……..(Y/N)	
	Profile 17a	<14.5 dBm	……..dBm		
6.2	US PSDs				
	Profile 8b	IMP Pt 3 Table P-3	…PSD Plots 0 – 30 MHz	……..(Y/N)	
	Profile 17a	IMP Pt 3 Table P-3	…PSD Plots 0 – 30 MHz	……..(Y/N)	
6.3	Longitudinal Balance	IMP Pt 3 Table P-3	Plots 0 – 30 MHz	……..(Y/N)	
6.4	Longitudinal Output Voltage	< -50 dBV	Plots 0 – 30 MHz Max…… dBV	……..(Y/N)	
6.5	Electrical Safety				
	Modem	Compliance with AS/NZS 60950	AS/NZS 60950 Test Report	……..(Y/N)	
	Power Supply	Compliance with AS/NZS 60950	AS/NZS 60950 Test Report	……..(Y/N)	
6.6 (1)	EMC				
	Modem and power supply	Compliance with AS/NZS CISPR 22	AS/NZS CISPR 22 Test Report	……..(Y/N)	
6.6 (3)	RF				
	WiFi 2.4 GHz	Compliance with AS/NZS 4268 or EN 300 328	AS/NZS4268 Test Report	……..(Y/N/NA)	
	5 GHz	Compliance with AS/NZS 4268 or EN 301 893	AS/NZS4268 Test Report	……..(Y/N/NA)	
	5.8 GHz	Compliance with AS/NZS 4268 or EN 300 440	AS/NZS4268 Test Report	……..(Y/N/NA)	
	DECT	Compliance with EN301 406	EN 301 406 Test Report	……..(Y/N/NA)	
	Other RF transmission	Specification for compliance	Test Report	……..(Y/N/NA)	
6.7	CPE Identification	Vendor ID (8 octets)	XXXXXXXX	……..(Y/N)	
		Version Number (up to 16 Octets)	XXX---XXX	……..(Y/N)	
		Serial Number (up to 32 Octets)	XXX--XXX	……..(Y/N)	
		CPE Transmission capability	XXXXXXXX	……..(Y/N)	
6.8					
6.8.4(1)	Configuration	User configurable	Configurable …….Y/N (for each parameter listed in 6.8.3)	……..(Y/N)	
6.8.4(2)		Default configuration	…….Default (for each parameter listed in 6.8.3)		

6.8.4(3)	Speed Test	DS & US average speeds to be > 60% of ref	DS Ave DUT……..Mbps Ref……Mbps DUT/Ref……% US Ave DUT……..Mbps Ref……Mbps DUT/Ref……%	……..(Y/N) ……..(Y/N)	
6.9(1)	DC Blocking Capacitor	Withstand 400 Vdc for 1 minute	Rating……	……..(Y/N)	
6.9(2)	Imaginary component of impedance at 4 kHz	Range -1.1 kOhm to -2.0 kOhm	……. kOhm	……..(Y/N)	
6.9(3)	d.c. resistance at 250 V	> 5 MOhm	……MOhm	……..(Y/N)	
6.9(4)	Operation with interference from POTS	No resyncs in presence of ringing and transition to off-hook	……resyncs	……..(Y/N)	