

TR-273

Testing of Bonded, Multi-Pair xDSL Systems

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Issue History

Issue Number	Approval Date	Publication Date	Issue Editor	Changes
1	21 August 2012	10 September 2012	Arlynn Wilson, ADTRAN	Original
Corrigendum 1	8 September 2014	24 September 2014	Lincoln Lavoie, UNH-IOL	Corrections
Amendment 1	17 October 2016	31 January 2017	Martin Casey, Calix	Additions

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Executive Summary

See Executive Summary/TR-273.

Updates for Amendment include:

The additional test cases to measure train up time of a bonding group:

1. Section 4.9 Bonding group training up time test
2. Section 4.10 Bonding group train up time with vectoring test

1 Purpose and Scope

1.1 Purpose

See Section 1/TR-273.

1.2 Scope

TR-273 specifies the methods to test the train up time of a DSL bonding group. Testing is limited to CPE devices that allow parallel initialization of the links in the bonding group and, hence, shortening of the bonding group initialization time. Specifically, the handshake operation defined in section 8 of G.998.2 amendment 2 shall be supported, including PME identification, and one of the following handshake operation options:

1. G.994.1-based discovery/aggregation. In this case, the bonding aggregation control protocol (BACP) for discovery/aggregation/ link management is not used;
2. BACP protocol for discovery/aggregation/ link management specified in Annex C of G.998.2 amendment 2. In this case, G.994.1-based discovery/aggregation is not used.

These tests address the Layer 2 bonding functions only, and it is assumed that the individual DSL transceivers also pass applicable DSL-specific testing requirements specified in TR-100 and TR-105 (ADSL2/2plus), TR-114 and TR-115 (VDSL2), and TR-60 (SHDSL). The equipment under test includes network-end equipment (such as a DSLAM) and remote-end equipment (such as a network termination device or CPE). Throughout this document the term CPE is used interchangeably to describe this remote equipment.

2 References and Terminology

2.1 Conventions

In this Technical Report, several words are used to signify the requirements of the specification. These words are always capitalized. More information can be found in RFC 2119 [4].

SHALL	This word, or the term “REQUIRED”, means that the definition is an absolute requirement of the specification.
SHALL NOT	This phrase means that the definition is an absolute prohibition of the specification.
SHOULD	This word, or the term “RECOMMENDED”, means that there could exist valid reasons in particular circumstances to ignore this item, but the full implications need to be understood and carefully weighed before choosing a different course.
SHOULD NOT	This phrase, or the phrase "NOT RECOMMENDED" means that there could exist valid reasons in particular circumstances when the particular behavior is acceptable or even useful, but the full implications need to be understood and the case carefully weighed before implementing any behavior described with this label.
MAY	This word, or the term “OPTIONAL”, means that this item is one of an allowed set of alternatives. An implementation that does not include this option SHALL be prepared to inter-operate with another implementation that does include the option.

2.2 References

The following references are of relevance to this Technical Report. At the time of publication, the editions indicated were valid. All references are subject to revision; users of this Technical Report are therefore encouraged to investigate the possibility of applying the most recent edition of the references listed below.

A list of currently valid Broadband Forum Technical Reports is published at www.broadband-forum.org.

Document	Title	Source	Year
[1] TR-273	<i>Testing of Bonded, Multi-Pair xDSL systems</i>	BBF	2012
[2] G.998.2	<i>Ethernet-based multi-pair bonding, including all in force amendments.</i>	ITU-T	2005
[3] G.993.5	<i>Self FEXT cancellation (vectoring) for use with VDSL2 transceivers</i>	ITU-T	2010

- [4] [RFC 2119](#) *Key words for use in RFCs to Indicate Requirement Levels* IETF 1997

2.3 Definitions

The following terminology is used throughout this Technical Report.

Bonding group up The bonding group is operationally up and is able to pass traffic.

Bridging An aggregate network combining the CPE subscriber side and DSLAM uplink network segments without IP routing.

2.4 Abbreviations

This Technical Report uses the following abbreviations:

BACP	Bonding Aggregation Control Protocol
CPE	Customer Premises Equipment
DHCP	Dynamic Host Configuration Protocol
DSLAM	Digital Subscriber Line Access Multiplexer

3 Technical Report Impact

3.1 Energy Efficiency

TR-273 has no impact on Energy Efficiency.

3.2 Security

TR-273 has no impact on Security.

3.3 Privacy

TR-273 has no impact on Privacy.

4 Differences from TR-273 issue 1

Add section 4.9 Bonding Group Train up Time Test as follows:

4.9 Bonding Group Train up Time Test

The purpose of the test defined in Table 7 is to verify that a bonding group which was active before disconnecting the lines can train up and reach showtime and restore traffic services in the specified time when reconnecting these lines. This test covers all configurations on the CPE for establishing a traffic path (DHCP, PPPoE, bridging). The number of lines in the bonding group shall be N=2.

Table 7 Bonding group train up time test

Test Configuration	<ol style="list-style-type: none"> (1) The test setup SHALL be as shown in Figure 1/TR-273. (2) Set up the loop simulators or real cable to a very small loop length (back to back). (3) Set up the traffic generator to send Ethernet frames in both directions.
Method of Procedure	<ol style="list-style-type: none"> (1) Configure the bonded group and place all N lines into the group. (2) Configure the DSLAM to the profile line configuration allowing maximum net data rates in both directions on all N loops. (3) Let the lines train and wait until the bonding group is up, then wait 30 seconds. (4) Setup the traffic generator to send 1500 byte packets in both directions at a the required frame rate (using Equation 5/TR-273 or Equation 6/TR-273). (5) Allow the traffic to run for at least 10 seconds. (6) Force all N lines in the bonding group to retrain via disconnecting and reconnecting all the links in the bonding group and starting the timer. (7) Measure the time it takes for all N lines to reach showtime and the traffic to start flowing again in both directions at the required bit rate.
Expected Result	<p>The test is passed is if all N lines reach showtime and the traffic passes through the group at the required bitrate within 200 seconds. Otherwise the test is declared failed.</p>

Add section 4.10 Bonding Group Train up Time (Vectoring) Test as follows:

4.10 Bonding Group Train up Time (Vectoring) Test

The purpose of the test defined in Table 8 is to verify that a bonding group which was active before disconnection of the lines can train up and reach showtime and restore traffic services in the specified time when reconnecting these lines. This test covers all configurations on the CPE for establishing a traffic path (DHCP, PPPoE, bridging). The number of lines in the bonding group shall be N=2. This test is only applicable to systems supporting VDSL2 vectoring (G.993.5).

Table 8 Bonding group train up time (vectoring) test

Test Configuration	<ol style="list-style-type: none"> (1) The test setup SHALL be as shown in Figure 1/TR-273. (2) Set up the loop simulators or real cable to a very small loop length (back to back). (3) Set up the traffic generator to send Ethernet frames in both directions.
Method of Procedure	<ol style="list-style-type: none"> (1) Configure the bonded group and place all N lines into the vectoring group of size N. All other ports on DSLAM shall be administratively turned off. (2) Configure the DSLAM to the profile line configuration allowing maximum net data rates in both directions on all N loops. (3) Let the lines train and wait until the bonding group is up, then wait 30 seconds. (4) Setup the traffic generator to send 1500 byte packets in both directions at a the required frame rate (using Equation 5/TR-273 or Equation 6/TR-273). (5) Force all N lines in the bonding group to retrain via disconnecting and reconnecting all the links in the bonding group and starting the timer. (6) Measure the time it takes for all N lines to reach showtime and the traffic to start flowing again in both directions at the required bit rate.
Expected Result	<p>The test is passed is if all N lines reach showtime and the traffic passes through the group at the required bite rate within 200 seconds. Otherwise the test is declared failed.</p>

End of Broadband Forum Technical Report TR-273