TECHNICAL REPORT

TR-115
VDSL2 Functionality Test Plan

Issue: 3 Amendment 2
Issue Date: November 2019

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Issue History

Issue Number	Approval Date	Publication Date	Issue Editor	Changes
1	November 2009		Michael Hanrahan, Huawei	Original
2	July 2012		Michael Hanrahan, Huawei	Next revision
2 Amendment 1	28 May 2013	1 June 2013	Aleksandra Kozarev, Lantiq	Next revision
2 Corrigendum 1	3 March 2014	3 April 2014	Aleksandra Kozarev, Lantiq	Next revision
2 Corrigendum 2	16 June 2014	7 July 2014	Aleksandra Kozarev, Lantiq	Next revision
3	25 January 2016	2 May 2016	Aleksandra Kozarev, Intel	Next revision
3 Amendment 1	16 March 2018	11 May 2018	Aleksandra Kozarev, Intel	See Executive Summary
3 Amendment 2	26 November 2019	26 November 2019	Aleksandra Kozarev, Intel Herman Verbueken, Nokia	See Executive Summary

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Executive Summary

See *Executive Summary/TR-115 Issue 3*.

This update to TR-115 Issue 3 relates to support of VDSL2 Long Reach (VDSL2-LR) G.993.2 operation and includes revision of the text in the following sections:

(a) Section …

1 Purpose and Scope

1.1 Purpose

See *Purpose/TR-115 Issue 3*.

1.2 Scope

See *Scope/TR-115 Issue 3*.

This amendment to TR-115 Issue 3 defines in Annex L the following functional tests for systems operating as VDSL2 Long Reach (VDSL2-LR), according to Annex D in Amendment 3 to ITU-T G.993.2 (2015) and Annex B in Amendment 2 to ITU-T G.993.5 (2015):

- Tests for VDSL2 Long Reach mode and operation type control
- Tests for reporting parameters for CPE support, operation type reporting and the actual nominal ATP

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 be 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 adjective "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 adjective "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.

See *References/TR-115 Issue 3*.

Document		Title	Source	Year
[1]	TR-115 Issue 3	*VDSL2 Functionality Test Plan*	BBF	2016
[2]	G.993.2 (2015) Amendment 3	*Very high speed subscriber line transceivers 2 (VDSL2): Amendment 3*	ITU-T	02/2018
[3]	G.993.5 (2015)	*Self FEXT cancellation (vectoring) for use*	ITU-T	12/2017

	Amendment 2	*with VDSL2 transceivers: Amendment 2*		
[4]	RFC 2119	*Key words for use in RFCs to Indicate Requirement Levels*	IETF	1997

2.3 Definitions

See *Definitions/TR-115 Issue 3*.

2.4 Abbreviations

See *Abbreviations/TR-115 Issue 3*.

2.5 G.997.1 Parameters

See *G.997.1 Parameters/TR-115 Issue 3*.

3 Technical Report Impact

3.1 Energy Efficiency

TR-115 has no impact on Energy Efficiency.

3.2 Security

TR-115 has no impact on Security.

3.3 Privacy

Any issues regarding privacy are not affected by TR-115.

4 Updates to the TR-115 Issue 3 related to VDSL2-LR

Add the text below in section 5 as new sections 5.11, 5.11.1 and 5.11.2

5 Physical layer tests

…

5.11 VDSL2-LR specific tests

In this section functional tests for systems operating as VDSL2 Long Reach (VDSL2-LR), according to Annex D in Amendment 3 to ITU-T G.993.2 (2015)[2] and Annex B in Amendment 2 to ITU-T G.993.5 (2015)[3] are defined.

5.11.1 VDSL2-LR Operation type control and reporting

The purpose of this test is to verify that the VDSL2-LR Operation type can be configured on the VTU-O, that both VTU-O and VTU-R can report the supported types and report the actual operation type.

The testcase verifies operation for 8 cases: all operation types enabled, a mix of operation types allowed, and all operation types not allowed effectively disabling VDSL2-LR. Table 1 and Table 2 provides the operation types to be configured for each test case and the test loops to be used.

Table 1 – Operation types enabled for long reach VDSL

	G.997.1 operation type (VDSL2-LR_ENABLE)		
Test case	Short loop	Medium loop	Long loop
1	allowed	allowed	allowed
2	allowed	not allowed	allowed
3	not allowed	not allowed	not allowed
4	not allowed	allowed	allowed
5	allowed	allowed	not allowed
6	allowed	not-allowed	not allowed
7	not allowed	allowed	not allowed
8	not allowed	not allowed	allowed

Table 2 – Test loops for long reach VDSL

Testloop	TP100(m)	PE04(m)
Short loop	450	300
Medium loop	2100	1500
Long loop	4200	3000

Table 3 – VDSL2-LR Operation type control

Test Configuration	(1) See Section 4.1[1] for the test configuration. (2) Configure the VDSL2-LR operation types for testcase 1 as indicated in Table 1. (3) Connect VTU-O and VTU-R to either the PE04 or the TP100 short loop from Table 2 (4) According to the band-profile to be tested, enable the SUT with one of the profile line combinations associated to that band-profile (see section 4.2.1[1]. If for the specific band-profile, profile-line combination is defined with DPBO and/or UPBO enabled, these SHALL be applied. The test SHALL be done for the retransmission line setting (see section 4.2.2.2[1]).
Method of Procedure	(1) Force initialization and wait for the modems to sync. (2) Wait for 1 minute after initialization. (3) Record the VTU-O VDSL2-LR support (VDSL2-LR_SUPPORT_O) and the VTU-R VDSL2-LR support (VDSL2-LR_SUPPORT_R) (4) Record the VDSL2-LR actual operation type (VDSL2-LR_ACTOPTYPE) (5) Repeat MOP(1) to MOP(4) for medium loop and long loop. (6) Configure the short loop (7) Repeat MOP(1) to MOP(6) for test cases 2 to 8.
Expected Result	(1) The VDSL2-LR_SUPPORT_O and VDSL2-LR_SUPPORT_R recorded in MOP(3) SHALL NOT change during the test and SHALL match the vendor declared support. (2) For each test case and test loop, the VDSL2-LR_ACTOPTYPE recorded in MOP(4) SHALL be as indicated in Table 4.

Table 4 – Expected VDSL2-LR_ACTOPTYPE value

	Test loop		
Test case	**Short loop**	**Medium loop**	**Long loop**
1	short-lr	medium-lr	long-lr
2	short-lr	short-lr	long-lr
3	lr mode not operational	lr mode not operational	lr mode not operational
4	medium-lr	medium-lr	long-lr
5	short-lr	medium-lr	medium-lr
6	short-lr	short-lr	short-lr
7	medium-lr	medium-lr	medium-lr
8	long-lr	long-lr	long-lr

Note:
If VDSL2-LR_ACTOPTTYPE equals 0, the line does not operate in VDSL2-LR mode.
If VDSL2-LR_ACTOPTYPE equals 1, the line operates according to the short loop operation type of VDSL2-LR, indicated as 'short-lr'.
If VDSL2-LR_ACTOPTYPE equals 2, the line operates according to the medium loop operation type of VDSL2-LR, indicated as 'medium-lr'.
If VDSL2-LR_ACTOPTYPE equals 3, the line operates according to the long loop operation type of VDSL2-LR, indicated as 'long-lr'.
If a system (DPU or CPE end) does not support all operating modes, then only the testcases matching the XOR of the supported modes and the configured modes apply.

5.11.2 VDSL2-LR ACTATP reporting and highest carrier used.

The purpose of this test is to verify that the reported VDSL2-LR ACTATPds values are not exceeding the allowed ATP and that highest carrier used is below or equal to the maximum allowed carrier for each LR operation type.

Table 5 – VDSL2-LR ACTATP reporting and highest DS carrier used test

Test Configuration	(5) See Section 4.1[1] for the test configuration. (6) Configure the band-profile BA17ade, enable the SUT with one of the profile line combinations associated to that band-profile (see section 4.2.1[1]). If for the specific band-profile, profile-line combination is defined with DPBO and/or UPBO enabled, these SHALL be applied. The test SHALL be done for the retransmission line setting (see section 4.2.2.2[1]). (7) The MAXNOMATPds shall be configured to 20.5dBm (8) Configure the VDSL2-LR operation types to allow short, medium and long loop operation. (9) Connect VTU-O and VTU-R to either the PE04 or the TP100 short loop from Table 2
Method of Procedure	(8) Force initialization and wait for the modems to sync. (9) Wait for 1 minute after initialization. (10) Record the ACTATPds (11) Record the VDSL2-LR actual operation type (VDSL2-LR_ACTOPTYPE) (12) Record the highest used downstream subcarrier index that has bitloading. (13) Repeat MOP(1) to MOP(5) for medium loop and long loop. (14) Configure The MAXNOMATPds to 17dBm (15) Repeat MOP(1) to MOP(6) for medium loop and long loop.
Expected Result	(3) For each loop and MAXNOMATP configuration the reported. ACTATPds for each VDSL2-LR_ACTOPTYPE shall be lower or equal to the value in Table 6. (4) For each loop the highest used DS carrier index shall be below or equal to the value in Table 6.

Table 6 – Expected results for VDSL2-LR ACTATPds and highest used carrier test

	VDSL2-LR_ACTOPTYPE/ACTATPds(dBm)		
MAXNOMATP	**short-lr**	**medium-lr**	**long-lr**
20.5	14.5	20.5	20.5
17	14.5	17	17
Highest used carrier index	4095	1970	511

End of Broadband Forum Technical Report TR-115