TECHNICAL REPORT

TR-115
VDSL2 Functionality Test Plan

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Executive Summary

See *Executive Summary/TR-115 Issue 2.*

TR-115 contains new tests added to the existing material in TR-115 Issue 2:

1. *Dying Gasp Test* in Section 5.10
2. *Inhibition of Performance Monitoring Counters* in Section 7.10
3. *Bitswap to Zero-Bit-Loading Test* in Section 5.4.5

1 Purpose and Scope

See *Section 1/TR-115 Issue 2.*

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 [3].

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.

See *Section 2.2/TR-115 Issue 2*.

Document		Title	Source	Year
[1]	TR-115 Issue 2	*VDSL2 Functionality Test Plan*	BBF	2012
[2]	G.997.1	*Physical Layer Management for Digital Subscriber*	ITU-T	2012

		Line (DSL) Transceivers, including all in force amendments and corrigenda		
[3]	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.

See *Section 2.3/TR-115 Issue 2*.

2.4 Abbreviations

This Technical Report uses the following abbreviations:

See *Section 2.4/TR-115 Issue 2*.

LOS	Loss-of-signal
LPR	Loss-of-power
REIN	Repetitive Electrical Impulse Noise

2.5 G.997.1 Parameters

This Technical Report uses the following abbreviations:

See *Section 2.5/TR-115 Issue 2*.

Parameter	**Section in G.997.1**
ACTINP	7.5.2.4
ACTNDR	7.5.2.8
LOSS-L	7.2.1.1.4
LOSS-LFE	7.2.1.2.4
LPR-FE	7.1.1.2.3

3 Technical Report Impact

3.1 Energy Efficiency

TR-115 has no impact on Energy Efficiency.

3.2 IPv6

TR-115 has no impact on IPv6.

3.3 Security

TR-115 has no impact on Security.

3.4 Privacy

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

4 Dying Gasp Test

Add section 5.10 Dying Gasp Test as follows:

5.10 Dying Gasp Test

Far-end Loss-of-Power (LPR-FE) failure is declared by the VTU-O after occurrence of a far-end LPR primitive (e,g. dying gasp message generated by VTU-R) followed by contiguous near-end LOS defects, detected by VTU-O (Section 7.1.1.2.3/G.997.1 [2]).

This test verifies that

- LPR-FE failure is generated after removal of power from the VTU-R
- the LPR-FE failure is not generated after successful initialization
- the LPR-FE failure is cleared when power to the VTU-R is restored and is followed by successful initialization
- the LPR-FE is not generated on loop disconnection only

Table 1 – Dying Gasp Test

Test Configuration	(1) See Section 4.1 [1] for the test configuration (use Figure 1 [1]). (2) As per VDSL2 band-profile to be tested, configure the SUT according to the Specific Line Setting "RA_F_150_150", as defined in Section 4.2.2 [1]. (3) Set the loop to a. 1350ft 26AWG for profiles up to 17MHz or 450ft 26AWG for 30MHz profiles or b. 450m PE 0.4mm for profiles up to 17MHz or 150m PE 0.4mm for 30MHz profiles
Method of Procedure	(1) Force a new initialization and wait for the modems to synchronize. (2) Wait for 1 minute after initialization. (3) Record the VTU-O LPR-FE failure bit state. (4) Disconnect the power supply from the VTU-R by removing the power supply from the mains supply. (5) Wait for 10 seconds. (6) Record the VTU-O LPR-FE failure state. (7) Re-apply power to the VTU-R by plugging in the power supply into the mains supply and wait for the modems to synchronize. (8) Wait for 1 minute after initialization. (9) Record the VTU-O LPR-FE failure state.

	(10) Disconnect the loop between the VTU-O and VTU-R. (11) Wait for 10 seconds. (12) Record the VTU-O LPR-FE failure state.
Expected Result	(1) No LPR-FE failure is present in MOP(3), MOP(9) and MOP(12). (2) LPR-FE failure is declared by the VTU-O in MOP(6).

5 Inhibition of Performance Monitoring Counters

Add section 7.10 Inhibition of Performance Monitoring Counters as follows:

7.10 Inhibition of Performance Monitoring Counters

Purpose of these tests is to verify that the inhibition and non-inhibition of some DSL performance counters (CV, ES, SES, LOSS) is implemented correctly according to Section 7.2.7.13/G.997.1 [2].

The test SHALL be done with bursts of the repetitive impulse noise (REIN) in addition to the background noise. The REIN noise duration is T_{Burst}. The REIN pulse consists of a "Burst of pseudo random AWGN" at a level of –90dBm/Hz differential mode from 25 kHz up to 30 MHz, where the out-of-band noise shall not be higher than -140dBm/Hz. The pulse duration Δ_{REIN} depends on the specific test profile. The pulse SHALL be repeated every 10 ms (T_{REIN}).

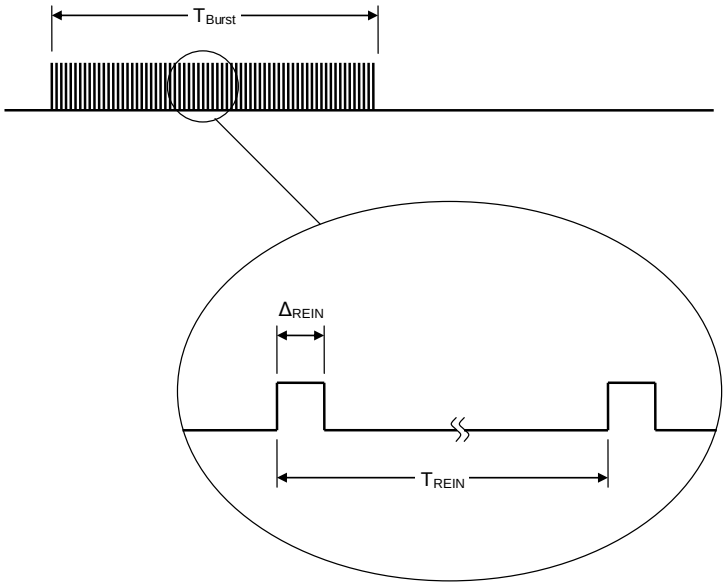

Figure 1 REIN Noise for the inhibition test of CV, ES, SES and LOSS counter

Table 2 - Test of inhibition and non-inhibition of CV, ES, SES, LOSS counters

Test Configuration	(1) See Section 4.1 [1] for the test configuration. (2) As per VDSL2 band-profile to be tested, configure the SUT according to the Specific Line Setting "RA_F_150_150" and "RA_I_150_150", as defined in Section 4.2.2 [1]. (3) Additional test conditions: OPTIONAL OLR (SRA, SOS) SHALL not be used. (4) Connect VTU-O and VTU-R to a. 1350ft 26AWG for profiles up to 17MHz or 450ft 26AWG for 30MHz profiles or b. 450m PE 0.4mm for profiles up to 17MHz or 150m PE 0.4mm for 30MHz profiles
Method of Procedure	(1) Set the noise generator to -120dBm/Hz AWGN at the VTU-R side and to -110dBm/Hz AWGN at the VTU-O side of the loop. (2) Force an initialization and wait for modem to sync. Wait 1 minute following synchronization. (3) Note down the value of the CV-C, CV-CFE, ES-L, ES-LFE, SES-L, SES-LFE, LOSS-L and LOSS-LFE performance monitoring counters at the VTU-O and, if available, the value of the CV-C, ES-L, SES-L and LOSS-L counters at the VTU-R. (4) Inject the REIN noise of duration T_{Burst}=2sec at the VTU-R side of the loop with a pulse duration Δ_{REIN} depending on the specific test profile: • RA_F_150_150: Δ_{REIN} =100µs • RA_I_150_150: calculate Δ_{REIN} as a. [(max(ACTINPus, ACTINPds) +1) x 0.25ms] x 2, rounded up to the nearest ms, for profiles up to 17MHz b. [(max(ACTINPus, ACTINPds) +1) x 0.125ms] x 2, rounded up to the nearest ms, for the 30MHz profiles (5) Force performance monitoring counters update and wait 30 seconds for the counters to be read out. (6) Note down the values of the counters as in MOP(3). (7) Calculate the increase of these counters between the values from MOP(6) and MOP(3). (8) Force one "micro-interruption" of duration 200ms. (9) Force performance monitoring counters update and wait 30 seconds for the counters to be read out. (10) Note down the values of the counters as in MOP(3). (11) Calculate the increase of these counters between the values from MOP (10) and MOP (6).

	(12) Inject the REIN noise as in MOP(4) but with T_{Burst} =15sec. (13) If the modems retrain, wait until they reach showtime. (14) Wait 10 seconds. (15) Force performance monitoring counters update and wait 30 seconds for the counters to be read out. (16) Note down the values of the counters as in MOP(3). (17) Calculate the increase of these counters between the values from MOP(16) and MOP(10).
Expected Result	**At The VTU-R (if available)**: (1) As measured in MOP(7), the increase of SES-L counter SHALL be ≥ 2 and ≤ 3. If the increase of SES-L counter is 3, the increase of CV-C counter SHALL be ≤ 1. If the increase of SES-L counter is 2, the increase of the CV-C counter SHALL be < 18 × 32 + 1. (2) As measured in MOP(7), the increase of the ES-L counter SHALL be ≥2 and ≤ 4. (3) As measured in MOP(11), the increase of the LOSS-L counter SHALL be ≥1 and ≤ 2. (4) As measured in MOP(17), the increase of the ES-L counter SHALL be ≤ 2. (5) As measured in MOP(17), no increase of the SES-L and LOSS-L counters SHALL be reported. **At the VTU-O:** (6) As measured in MOP(7), the increase of SES-LFE counter SHALL be ≥ 2 and ≤ 3. If the increase of SES-LFE counter is 3, the increase of CV-CFE counter SHALL be ≤ 1. If the increase of SES-LFE counter is 2, the increase of the CV-CFE counter SHALL be < 18 × 32 + 1. (7) As measured in MOP(7), the increase of the ES-LFE counter SHALL be ≥2 and ≤ 4. (8) As measured in MOP(11), the increase of the LOSS-LFE counter SHALL be ≥1 and ≤ 2. (9) As measured in MOP(17), the increase of the ES-LFE counter SHALL be ≤ 2. (10) As measured in MOP(17), no increase of the SES-LFE and LOSS-LFE counters SHALL be reported.

6 Bitswap to Zero-Bit-Loading Test

Add section 5.4.5 Bitswap to Zero-Bit-Loading Test as follows:

5.4.5 Bitswap to Zero-Bit-Loading Test

This test injects noise (a single frequency sine wave) on a specific tone and verifies that bit swap functions lower the bit loading on the affected tone to zero bits as the injected noise is increased.

Table 3 - Bitswap to zero bit loading test

Test Configuration	(1) See Section 4.1 [1] for the test configuration. (2) Configure the SUT according to the settings of the rate adaptive (RA) profile-line combination under test defined in regional annexes (A and B). (3) Connect VTU-O and VTU-R to a. 1350ft 26AWG for profiles up to 17MHz or 450ft 26AWG for 30MHz profiles or b. 450m PE 0.4mm for profiles up to 17MHz or 150m PE 0.4mm for 30MHz profiles (4) All single frequency tone amplitudes that are applied are referenced in terms of power levels (dBm) at the injection point on the loop, calibrated with the VTU-O and VTU-R replaced with calibrated 100 Ohm ± 1% resistors. Measurements SHALL be performed into a 1kHz resolution bandwidth. Note that with a 1kHz resolution bandwidth the power spectral density value (in dBm/Hz) will be 30dB less than the power level (in dBm), limited by the noise floor of the test equipment used for calibration. The frequency of the interfering tone SHALL be set to n x 4.3125 kHz for (profiles up to 17MHz) or n x 8.625 kHz for 30MHz profile. The power of the interfering tone SHALL be -75 dBm. (5) Set the noise generator to -140dBm/Hz AWGN noise at both VTU-O and VTU-R.
Method of Procedure	(1) Force initialization and wait for the modems to sync. (2) Wait for 1 minute after initialization. (3) Record the bit allocation tables (BITSpsus and BITSpsds) and the actual net data rates (ACTNDRus and ACTNDRds). (4) Randomly select an integer value, n, the tone number in a. the upstream passband range for the upstream test and b. the downstream passband range for the downstream test, applicable to the chosen band-profile. Avoid the use of the pilot tone or any unpopulated tones. Ensure that the tone selected has assigned bits as described in the relevant bits per tone map, also after the injection of the RFI in MOP(7).

	(5) Record and report the value of n used. (6) Reprovision the line with the maximum upstream and downstream data rates in the profile set to 90% of the actual data rates recorded in MOP(3). (7) Inject the interfering tone at the: a. VTU-O for the upstream test b. VTU-R for the downstream test (8) Train the link and wait 1 minute after initialization. (9) Record the number of bits for the selected interfering tone. If the number of bits is zero then select (and report the value of) another tone in the related passband and reconfigure the signal generator frequency accordingly. Repeat MOP(7) to MOP(9) until a non-zero bit loading is found. (10) Increase the power of the interfering tone by 5 dBm . (11) Wait 30 seconds and record the number of bits assigned to the tone. Repeat MOP(10) and MOP(11) until the tone has no bits loaded. (12) Remove the interfering tone at the VTU-O side. (13) Repeat MOP(7) to MOP(12) for the downstream test.
Expected Result	(1) The modem SHALL NOT lose sync. (2) The number of bits assigned to the affected tone before MOP(12) SHALL equal zero.

End of Broadband Forum Technical Report TR-115