TECHNICAL REPORT

TR-115
VDSL2 Functionality Test Plan

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Issue Date: March 2018

Issue History

Issue Number	Approval Date	Publication Date	Issue Editor	Changes
1	November 2009	November 2009	Michael Hanrahan, Huawei Technologies	Original
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2 Amendment 1	May 2013	June 2013	Aleksandra Kozarev, Lantiq	Next revision
2 Corrigendum 1	March 2014	April 2014	Aleksandra Kozarev, Lantiq	Next revision
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3 Amendment 1	16 March 2018	11 May 2018	Aleksandra Kozarev, Intel	Next revision

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Executive Summary

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

Update to TR-115 Issue 3 relates to support of G.993.2 operating on frequencies up to 35.324 MHz (G.993.2 Annex Q) and includes revision of the text in the following sections:

(a) Section 4.2.1 BAND PROFILES
(b) Section 4.2.2.1 COMMON LINE SETTINGS
(c) Section 4.2.2.2 GENERAL LINE SETTINGS
(d) Section 4.2.2.3 SPECIFIC LINE SETTINGS
(e) Section 4.2.3 PROFILE LINE COMBINATIONS
(f) Section 4.5 EQUIPMENT FEATURE TABLES
(g) Section 5.2 IMPULSE NOISE PROTECTION TEST
(h) Section 5.3 DUAL LATENCY TEST
(i) Section 5.4.1 BITSWAP TEST
(j) Section 5.4.2 BITSWAP TEST WITH RETRANSMISSION ENABLED
(k) Section 5.4.3 WIDEBAND BITSWAP
(l) Section 5.4.4 SEAMLESS RATE ADAPTATION TEST
(m) Section 5.4.6 BITSWAP TO ZERO-BIT-LOADING TEST
(n) Section 5.5 LOOP DIAGNOSTIC MODE TEST
(o) Section 5.7 PSD TESTS
(p) Section 5.9 VTU-R INM
(q) Section 5.10 DYING GASP TEST
(r) Section 7.1 CONFIGURATION PARAMETER MINSNRM
(s) Section 7.7 PERFORMANCE MONITORING COUNTER FOR SES
(t) Section 7.10 INHIBITION OF PERFORMANCE MONITORING COUNTERS

1 Purpose and Scope

1.1 Purpose

See *Purpose/TR-115 Issue 3*.

1.2 Scope

See *Scope/TR-115 Issue 3*.

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 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 Amendment 2	*Very high speed subscriber line transceivers 2 (VDSL2): Amendment 2*	ITU-T	2016
[3]	RFC 2119	*Key words for use in RFCs to Indicate*	IETF	1997

Requirement Levels

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 Issue 3 Amendment 1 has no impact on Energy Efficiency.

3.2 Security

TR-115 Issue 3 Amendment 1 has no impact on Security.

3.3 Privacy

Any issues regarding privacy are not affected by TR-115 Issue 3 Amendment 1.

4 Updates to the TR-115 Issue 3 related to Annex Q

4.1 Updates to Section 4.2.1 Band Profiles

Revise the text of Section 4.2.1 to reflect Annex Q (revision marks relative to the TR-115 Issue 3 text).

Band Profiles are used to describe the VDSL2 profile under test. The structure of the abbreviation used throughout the document for Band Profiles is as follows.

The abbreviation begins with a letter designating the G.993.2 Annex to which the profile refers. The next letter refers to the US0 type of the profile, hence indicating profiles for

- AA: G.993.2 Annex A with US0 corresponding to Annex A of G.992.5 (VDSL2 over POTS).
- BA: G.993.2 Annex B with US0 corresponding to Annex A of G.992.5 (VDSL2 over POTS). Note that the same abbreviation is used for profile 17a where US0 is not available.
- BB: G.993.2 Annex B with US0 corresponding to Annex B of G.992.5 (VDSL2 over ISDN).
- CG: G.993.2 Annex C (VDSL2 over TCM-ISDN). Note that US0 is not available.
- QA: G.993.2 Annex Q with US0 corresponding to Annex A of G.992.5 (VDSL2 over POTS with Downstream starting at 138 kHz).
- QM: G.993.2 Annex Q with US0 corresponding to Annex M of G.993.2 or of G.992.5 (VDSL2 over POTS with Downstream starting at 276 kHz).

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Amend the text of Table 1 Common Band Profiles with Annex Q band profiles QA35b and QM35b (revision marks relative to the TR-115 Issue 3 text).

Table 1 - Common Band Profiles

Annex Q		
VDSL2 Band-profile	QA35b	QM35b
Profile	35b	35b
Annex	Q	Q
Limit PSD Mask (short name)	998E35-M2x-A (B8-19)	998ADE35-M2x-M (B8-22)
US0 type	M	M
MAXNOMATPds	+17 dBm	+17 dBm

4.2 Updates to Section 4.2.2.1 Common Line Settings

Amend the text of Table 3 with Annex Q band profiles QA35b (revision marks relative to the TR-115 Issue 3 text).

Table 3 - Common Line Settings for BA17a0_D&UPBO and QA35b_D&UPBO Band Profile

Parameter	Setting	Description
All parameters but those specified below	Value as specified in Table 2	
DPBOEPSD	ADSL2plus Annex A	PSD mask that is assumed to be permitted at the exchange
DPBOESEL	27dB@1MHz	E-side electrical length
DPBOESCMA	0.1924	Model of the frequency dependent loss of E-side cable: scalars DPBOESCMA (NOTE)
DPBOESCMB	0.5960	Model of the frequency dependent loss of E-side cable: scalars DPBOESCMB (NOTE)
DPBOESCMC	0.2086	Model of the frequency dependent loss of E-side cable: scalars DPBOESCMC (NOTE)
DPBOMUS	-95 dBm/Hz	Minimum usable receive signal PSD mask
DPBOFMIN	138 kHz	Minimum frequency from which on the DPBO SHALL be applied
DPBOFMAX	2208 kHz	Maximum frequency up to which the DPBO SHALL be applied
UPBOKLF	0	Force CO-MIB electrical loop length (means that kl_0 is estimated during training)
UPBOKL	estimated during training	Upstream electrical loop length (kl_0)
UPBOA US0	40.00	A and B values US band 0 (these values imply no UPBO)
UPBOB US0	0	
UPBOA US1	47.30	A value US band 1
UPBOB US1	21.14	B value US band 1
UPBOA US2	54.00	A value US band 2
UPBOB US2	16.29	B value US band 2
UPBOA US3	54.00	A value US band 3
UPBOB US3	16.29	B value US band 3
NOTE: The values of DPBOESCMA, B and C are referred to a PE 0.4mm loop. Values that are configured according to G.997.1 SHALL be rounded to the nearest scalar value.		

Amend the text of Table 4 with Annex Q band profiles QM35b (revision marks relative to the TR-115 Issue 3 text).

Table 4 - Common Line Settings for BB17a_D&UPBO and QM35b_D&UPBO Band Profile

Parameter	Setting	Description
All parameters but those specified below	Value as specified in Table 2	
DPBOEPSD	ADSL2plus Annex B	PSD mask that is assumed to be permitted at the exchange
DPBOESEL	27dB@1MHz	E-side electrical length
DPBOESCMA	0.1924	Model of the frequency dependent loss of E-side cable: scalars DPBOESCMA (NOTE)
DPBOESCMB	0.5960	Model of the frequency dependent loss of E-side cable: scalars DPBOESCMB (NOTE)
DPBOESCMC	0.2086	Model of the frequency dependent loss of E-side cable: scalars DPBOESCMC (NOTE)
DPBOMUS	-95 dBm/Hz	Minimum usable receive signal PSD mask
DPBOFMIN	254 kHz	Minimum frequency from which on the DPBO SHALL be applied
DPBOFMAX	2208 kHz	Maximum frequency up to which the DPBO SHALL be applied
UPBOKLF	0	Force CO-MIB electrical loop length (means that kl_0 is estimated during training)
UPBOKL	estimated during training	Upstream electrical loop length (kl_0)
UPBOA US0	40.00	A and B values US band 0 (these values imply no UPBO)
UPBOB US0	0	
UPBOA US1	47.30	A value US band 1
UPBOB US1	21.14	B value US band 1
UPBOA US2	54.00	A value US band 2
UPBOB US2	16.29	B value US band 2
NOTE: The values of DPBOESCMA, B and C are referred to a PE 0.4mm loop. Values that are configured according to G.997.1 SHALL be rounded to the nearest scalar value.		

4.3 Updates to Section 4.2.2.2 General Line Settings

Amend the text of Table 11 General line settings to reflect Annex Q (revision marks relative to the TR-115 Issue 3 text).

Table 11 - General Line Settings

General line-setting	Parameter	Setting	Description
R-17/2/41 *(applicable for retransmission enabled profiles, including QA35b)*	RTX_MODE	2	RTX_FORCED
	IAT_REIN_RTX	0	REIN at 100Hz
	INPMIN_REIN_RTX	2	DMT symbols protection against REIN
	INPMIN_SHINE_RTX	41	DMT symbols protection against PEIN/SHINE
	SHINERATIO_RTX	2	Worst case PEIN retransmission overhead (in %)
	LEFTR_THRESH	0.78	Low rate defect threshold
	DELAYMAX_RTX	17	ms
	DELAYMIN_RTX	0	Outlet shaper off
R-12/2/8 *(applicable for QM35b)*	RTX_MODE	2	RTX_FORCED
	IAT_REIN_RTX	0	REIN at 100Hz
	INPMIN_REIN_RTX	2	DMT symbols protection against REIN
	INPMIN_SHINE_RTX	8	DMT symbols protection against PEIN/SHINE
	SHINERATIO_RTX	1	Worst case PEIN retransmission overhead (in %)
	LEFTR_THRESH	0.90	Low rate defect threshold
	DELAYMAX_RTX	12	ms
	DELAYMIN_RTX	0	Outlet shaper off

4.4 Updates to Section 4.2.2.3 Specific Line Settings

Amend the text of Table 12 Specific line settings for Specific line settings for F and I-FEC tests to reflect Annex Q (revision marks relative to the TR-115 Issue 3 text).

Table 12 - Specific line settings for F and I-FEC tests

Specific line-setting	General line-setting	RA-Mode	DS net data rate (NDR) (kbit/s) (max- min)	US net data rate (NDR) (kbit/s) (max-min)
RA_I_400_150	I-8/2	AT_INIT	400000-128	150000-64

Amend the text of Table 13 Specific line settings for Retransmission enabled tests to reflect Annex Q (revision marks relative to the TR-115 Issue 3 text).

Table 13: Specific line settings for Retransmission enabled tests

Specific line-setting	DS General line-setting	US General line-setting	RA-Mode	DS Expected throughput and net data rate (kbps) (ETR_RTX) (max-min) (NDR) (max)	US Expected throughput and net data rate (kbps) (ETR_RTX) (max-min) (NDR) (max)
RA_R-17/2/41_400_150	R-17/2/41	R-17/2/41	AT_INIT	MAXETR_RTX=400000 MAXNDR_RTX=400000 MINR_RTX=518	MAXETR_RTX=150000 MAXNDR_RTX=150000 MINR_RTX=518
RA_R-12/2/8_400_150	R-12/2/8	R-12/2/8	AT_INIT	MAXETR_RTX=400000 MAXNDR_RTX=400000 MINR_RTX=518	MAXETR_RTX=150000 MAXNDR_RTX=150000 MINR_RTX=518

4.5 Updates to Section 4.2.3 Profile Line Combinations

Amend the text of Table 14 Test profiles to reflect Annex Q (revision marks relative to the TR-115 Issue 3 text.

Table 14 – Test profiles

Band-profile	Specific line-setting	Profile-line combination
Annex Q		
QA35b_D&UPBO	RA_R-17/2/41_400_150	QA35b_D&UPBO_RA_R-17/2/41_400_150
QM35b_D&UPBO	RA_R-12/2/8_400_150	QM35b_D&UPBO_RA_R-12/2/8_400_150

4.6 Updates to Section 4.5 Equipment Feature Tables

Amend the text of Table 15 VTU-O information with Annex Q band profiles QA35b and QM35b (revision marks relative to the TR-115 Issue 3 text).

Table 15 - VTU-O Feature Table

Feature	Specification
VDSL2 Band-Profiles supported: - AA8d - BA8b, BA17a0, BA17ade - BB8b, BB12a, BB17a - CG8d, CG12a, CG17a, CG30a - QA35b, QM35b	

Amend the text of Table 16 VTU-R information with Annex Q band profiles QA35b and QM35b (revision marks relative to the TR-115 Issue 3 text).

Table 16 - VTU-R Feature Table

Feature	Specification
VDSL2 Band-Profiles supported: - AA8d - BA8b, BA17a0, BA17ade - BB8b, BB12a, BB17a - CG8d, CG12a, CG17a, CG30a - QA35b, QM35b	

4.7 Updates to Section 5.2 Impulse Noise Protection test

Amend the text of Table 18 Capabilities of Impulse Noise Protection with Annex Q (revision marks relative to the TR-115 Issue 3 text).

Table 18 - Capabilities of Impulse Noise Protection

Test Configuration	(1) See Section 4.1 for the test configuration depending on the customer interface of the modem. (2) According to the band-profile to be tested, configure the SUT with one of the profile line combinations using the general line setting I-8/2, I-16/2, R-12/2/8 or R-17/2/41 associated to that band profile (see Section 4.2.3). If for the specific band-profile, profile-line combination is defined with DPBO and/or UPBO enabled, these SHALL be applied. (3) Connect VTU-O and VTU-R to one of the loop types 26AWG, PE 0.4mm or TP100: a. 2700ft or 900m ~~26AWG~~ for profiles up to 17MHz ~~or 900ft 26AWG for 30MHz profiles~~ ~~or~~ b. 900ft ~~m PE 0.4mm for profiles up to 17MHz~~ or 300m ~~PE 0.4mm~~ for 30MHz and 35MHz profiles

4.8 Updates to Section 5.3 Dual Latency test

Amend the text of Table 19 Capabilities of Impulse Noise Protection per changes below (revision marks relative to the TR-115 Issue 3 text).

Table 19 - Verification of the Function of Dual Latency (Optional)

Test Configuration	(1) See Section 4.1 for the test configuration. (2) According to the VDSL2 band-profile to be tested, configure the SUT with one of the profile-line combinations, except the ones with the retransmission general line setting, associated to that band-profile (see Section 4.2.3). If, for the specific band-profile, profile-line combinations are defined with DPBO and/or UPBO enabled, these SHALL be applied. (3) Connect the VTU-R to the VTU-O through a loop with Noise generator, and connect VTU-R and VTU-O to Traffic Analyzer. (4) Set two channels with the following channel profiles F-1/0 for channel_1 and I-8/2 for channel_2. (5) ~~Set up the loop to~~ Connect VTU-O and VTU-R to one of the loop types 26AWG, PE 0.4mm or TP100: a. 2400ft or 750m ~~26AWG~~ for profiles up to 17MHz ~~or 800ft 26AWG for 30MHz profiles~~ ~~or~~ b. ~~750~~ 800ft ~~m PE 0.4mm for profiles up to 17MHz~~ or 250m ~~PE 0.4mm~~for 30MHz and 35MHz profiles

4.9 Updates to Section 5.4.1 Bitswap test

Amend the text of Table 20 Bitswap Test per changes below (revision marks relative to the TR-115 Issue 3 text).

Table 20 - Bitswap Test

Test Configuration	(1) See Section 4.1 for the test configuration. (2) Connect VTU-O and VTU-R to one of the loop types 26AWG, PE 0.4mm or TP100: a. 1350ft or 450m ~~26AWG~~ for profiles up to 17MHz b. 450ft ~~PE 0.4mm~~ or 150m ~~PE 0.4mm~~ for 30MHz and ~~30MHz~~ 35MHz profiles (3) According to the band-profile to be tested, configure the SUT with one of the profile line combinations, except the ones with the retransmission line setting, associated to that band-profile (see Section 4.2.3). If for the specific band-profile, profile-line combination is defined with DPBO and/or UPBO enabled, these SHALL be applied. (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-R and VTU-O modems 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. (5) Set the noise generator to -140 dBm/Hz AWGN noise at both VTU-O and VTU-R.

4.10 Updates to Section 5.4.2 Bitswap test with Retransmission enabled

Amend the text of Table 21 Bitswap Test with retransmission per changes below (revision marks relative to the TR-115 Issue 3 text).

Table 21 – Bitswap Test with retransmission

Test Configuration	(1) See Section 4.1 for the test configuration. (2) Connect VTU-O and VTU-R to one of the loop types 26AWG, PE 0.4mm or TP100: a. 1350ft or 450m ~~26AWG~~ for profiles up to 17MHz ~~profile~~ b. 450ft ~~PE 0.4mm~~ or 150m ~~PE 0.4mm~~ for 30MHz and ~~30MHz~~ 35MHz profiles (3) According to the band-profile to be tested, configure the SUT with one of the profile line combinations associated to that band-profile (see Section 4.2.3). 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). (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-R and VTU-O modems 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. (5) Set the noise generator to -140 dBm/Hz AWGN noise at both VTU-O and VTU-R. (6) SRA SHALL be disabled.

4.11 Updates to Section 5.4.3 Wideband Bitswap

Amend the text of Table 22 Wideband Bit Swap Test Noise Definition with Annex Q (revision marks relative to the TR-115 Issue 3 text).

Table 22 - Wideband Bit Swap Test Noise Definition

f in kHz	Noise B-AWGN dBm/Hz	Noise B-DS1a dBm/Hz	Noise B-DS1b dBm/Hz	Noise B-DS2 dBm/Hz	Noise B-US1a dBm/Hz	Noise B-US1b dBm/Hz	Noise B-US2 dBm/Hz
25-2500	-110	-110	-110	-110	-110	-110	-110
2500-3650	-110	-104	-98	-110	-110	-110	-110
3650-3850	-110	-110	-110	-110	-110	-110	-110
3850-5100	-110	-110	-110	-110	-104	-98	-110
5100-5300	-110	-110	-110	-110	-110	-110	-110
5300-8400	-110	-110	-110	-98	-110	-110	-110
8400-8600	-110	-110	-110	-110	-110	-110	-110
8600-11900	-110	-110	-110	-110	-110	-110	-98
11900- ~~30M~~ 35000	-110	-110	-110	-110	-110	-110	-110

Amend the text of Table 23 DS Wideband Bit Swapping Test with Annex Q (revision marks relative to the TR-115 Issue 3 text).

Table 23 - DS Wideband Bit Swapping Test

Test Configuration	(1) See Section 4.1 for the test configuration. (2) ~~Set up the loop simulator to~~ Connect VTU-O and VTU-R to one of the loop types 26AWG, PE 0.4mm or TP100: 700ft ~~26AWG cable for North America~~ or 300m. ~~or 300 m PE 0.4mm for Europe~~ (3) Set the noise generator at VTU-O side to B-AWGN noise. (4) Set the noise generator at VTU-R side to B-DS2 noise. (5) The VDSL2 profile line combination SHALL be configured as follows: a. For European VDSL2overPOTS: BA17ade_RA_I_150_150 BA17a0_RA_R-17/2/41_150_150 QA35b_D&UPBO_RA_R-17/2/41_400_150 QM35b_D&UPBO_RA_R-12/2/8_400_150 ~~Or~~ b. For European VDSL2overISDN: BB12a_RA_I_150_150 BB17a_RA_I_150_150 (6) SRA SHALL be disabled.

Amend the text of Table 24 US Wideband Bit Swapping Test with Annex Q (revision marks relative to the TR-115 Issue 3 text).

Table 24 - US Wideband Bit Swapping Test

Test Configuration	(1) See Section 4.1 for the test configuration. (2) ~~Set up the loop simulator to~~ Connect VTU-O and VTU-R to one of the loop types 26AWG, PE 0.4mm or TP100: 700ft ~~26AWG cable for North America~~ or 300m. ~~or 300 m PE 0.4mm for Europe~~ (3) Set the noise generator at VTU-O side to B-AWGN noise. (4) Set the noise generator at VTU-R side to B-DS2 noise. (5) The VDSL2 profile line combination SHALL be configured as follows: a. For European VDSL2overPOTS: BA17ade_RA_I_150_150 BA17a0_RA_R-17/2/41_150_150 QA35b_D&UPBO_RA_R-17/2/41_400_150 QM35b_D&UPBO_RA_R-12/2/8_400_150 ~~or~~ b. For European VDSL2overISDN: BB12a_RA_I_150_150 BB17a_RA_I_150_150 (6) SRA SHALL be disabled.

4.12 Updates to Section 5.4.4 Seamless Rate Adaptation Test

Amend the text of Table 26 SRA fast mode test – Downstream per changes below (revision marks relative to the TR-115 Issue 3 text).

Table 26 - SRA fast mode test - Downstream

Test Configuration	(1) See Section 4.1 for the test configuration. (2) As per VDSL2 band-profile to be tested, configure the SUT in RA_F_150_150 specific line-setting (see Section 4.2.3). If, for the specific band-profile, profile-line combinations are defined with DPBO and/or UPBO enabled, these SHALL be applied. (3) Configure the SRA settings as indicated in Table 25. (4) Connect VTU-O and VTU-R to one of the loop types 26AWG, PE 0.4mm or TP100 a. 1350ft or 450m ~~26AWG~~ for profiles up to 17MHz ~~or 450ft 26AWG for 30MHz profiles~~ ~~or~~ b. ~~450m~~ 450ft ~~PE 0.4mm for profiles up to 17MHz~~ or 150m ~~PE 0.4mm~~ for 30MHz and 35MHz profiles (5) Inject -110dBm/Hz AWGN noise at both the VTU-O and VTU-R side.

Amend the text of Table 27 SRA fast mode test – Upstream per changes below (revision marks relative to the TR-115 Issue 3 text).

Table 27 - SRA fast mode test - Upstream

Test Configuration	(1) See Section 4.1 for the test configuration. (2) As per VDSL2 band-profile to be tested, configure the SUT in RA_F_150_150 specific line-setting (see Section 4.2.3). If, for the specific band-profile, profile-line combinations are defined with DPBO and/or UPBO enabled, these SHALL be applied. (3) Configure the SRA settings as indicated in Table 25. (4) Connect VTU-O and VTU-R to one of the loop types 26AWG, PE 0.4mm or TP100: a. 1350ft or 450m ~~26AWG~~ for profiles up to 17MHz ~~or 450ft 26AWG for 30MHz profiles~~ ~~or~~ b. ~~450m~~ 450ft ~~PE 0.4mm for profiles up to 17MHz~~ or 150m ~~PE 0.4mm~~ for 30MHz and 35MHz profiles (5) Inject -110dBm/Hz AWGN noise at both the VTU-O and VTU-R side.

Amend the text of Table 28 SRA interleaved mode test with DCID – Downstream per changes below (revision marks relative to the TR-115 Issue 3 text).

Table 28 - SRA interleaved mode test with DCID – Downstream

Test Configuration	(1) See Section 4.1 for the test configuration. (2) As per VDSL2 band-profile to be tested, configure the SUT in RA_I_150_150 specific line-setting (see Section 4.2.3). If, for the

	specific band-profile, profile-line combinations are defined with DPBO and/or UPBO enabled, these SHALL be applied. (3) Configure the SRA settings as indicated in Table 25. (4) Connect VTU-O and VTU-R to one of the loop types 26AWG, PE 0.4mm or TP100: a. 1350ft or 450m ~~26AWG~~ for profiles up to 17MHz ~~or 450ft 26AWG for 30MHz profiles~~ ~~or~~ b. ~~450m~~ 450ft ~~PE 0.4mm for profiles up to 17MHz~~ or 150m ~~PE 0.4mm~~ for 30MHz and 35MHz profiles (5) Inject –110dBm/Hz AWGN noise at both the VTU-O and VTU-R side.

Amend the text of Table 29 SRA interleaved mode test with DCID – Upstream per changes below (revision marks relative to the TR-115 Issue 3 text).

Table 29 - SRA interleaved mode test with DCID – Upstream

Test Configuration	(1) See Section 4.1 for the test configuration. (2) As per VDSL2 band-profile to be tested, configure the SUT in RA_I_150_150 specific line-setting (see Section 4.2.3). If, for the specific band-profile, profile-line combinations are defined with DPBO and/or UPBO enabled, these SHALL be applied. (3) Configure the SRA settings as indicated in Table 25. (4) Connect VTU-O and VTU-R to one of the loop types 26AWG, PE 0.4mm or TP100: a. 1350ft or 450m ~~26AWG~~ for profiles up to 17MHz ~~or 450ft 26AWG for 30MHz profiles~~ ~~or~~ b. ~~450m~~ 450ft ~~PE 0.4mm for profiles up to 17MHz~~ or 150m ~~PE 0.4mm~~ for 30MHz and 35MHz profiles (5) Inject –110dBm/Hz AWGN noise at both the VTU-O and VTU-R side.

Amend the text of Table 30 SRA retransmission test – Downstream per changes below (revision marks relative to the TR-115 Issue 3 text).

Table 30 - SRA retransmission test – Downstream

Test Configuration	(1) See Section 4.1 for the test configuration. (2) As per VDSL2 band-profile to be tested, configure the SUT in the retransmission specific line-setting (see Section 4.2.2.2). If, for the specific band-profile, profile-line combinations are defined with DPBO and/or UPBO enabled, these SHALL be applied. (3) Configure the SRA settings as indicated in Table 25. (4) Connect VTU-O and VTU-R to one of the loop types 26AWG, PE 0.4mm or TP100: a. 1350ft ~~26AWG~~ or 450m for profiles up to 17MHz ~~or 450ft 26AWG for 30MHz profiles~~ ~~or~~ b. ~~450m~~ 450ft ~~PE 0.4mm for profiles up to 17MHz~~ or 150m ~~PE 0.4mm~~ for 30MHz and 35MHz profiles (5) Inject –110dBm/Hz AWGN noise at both the VTU-O and VTU-R side.

Amend the text of Table 31 SRA retransmission test – Upstream per changes below (revision marks relative to the TR-115 Issue 3 text).

Table 31 - SRA retransmission test – Upstream

Test Configuration	(1) See Section 4.1 for the test configuration. (2) As per VDSL2 band-profile to be tested, configure the SUT in retransmission specific line-setting (see Section 4.2.2.2). If, for the specific band-profile, profile-line combinations are defined with DPBO and/or UPBO enabled, these SHALL be applied. (3) Configure the SRA settings as indicated in Table 256. (4) Connect VTU-O and VTU-R to one of the loop types 26AWG, PE 0.4mm or TP100: c. 1350ft or 450m ~~26AWG~~ for profiles up to 17MHz ~~or 450ft 26AWG for 30MHz profiles~~ ~~or~~ d. 450ft ~~m PE 0.4mm for profiles up to 17MHz~~ or 150m ~~PE 0.4mm~~ for 30MHz and 35MHz profiles (5) Inject –110dBm/Hz AWGN noise at both the VTU-O and VTU-R side.

Amend the text of Table 33 SRA retransmission with interleaving test – Downstream per changes below (revision marks relative to the TR-115 Issue 3 text).

Table 33 - SRA retransmission with interleaving test– Downstream

Test Configuration	(1) See Section 4.1 for the test configuration. (2) As per VDSL2 band-profile to be tested, configure the SUT in retransmission specific line-setting (see Section 4.2.2.2). If, for the specific band-profile, profile-line combinations are defined with DPBO and/or UPBO enabled, these SHALL be applied. (3) Configure the SRA settings as indicated in Table 25. (4) Connect VTU-O and VTU-R to one of the loop types 26AWG, PE 0.4mm or TP100: a. 1350ft or 450m ~~26AWG~~ for profiles up to 17MHz ~~or 450ft 26AWG for 30MHz profiles~~ ~~or~~ b. ~~450m~~ 450ft ~~PE 0.4mm for profiles up to 17MHz~~ or 150m ~~PE 0.4mm~~ for 30MHz and 35MHz profiles (5) Inject –110dBm/Hz AWGN noise at both the VTU-O and VTU-R side.

Amend the text of Table 33 SRA retransmission with interleaving test – Upstream per changes below (revision marks relative to the TR-115 Issue 3 text).

Table 33 - SRA retransmission with interleaving test– Upstream

Test Configuration	(1) See Section 4.1 for the test configuration. (2) As per VDSL2 band-profile to be tested, configure the SUT in retransmission specific line-setting (see Section 4.2.2.2). If, for the specific band-profile, profile-line combinations are defined with DPBO and/or UPBO enabled, these SHALL be applied. (3) Configure the SRA settings as indicated in Table 25.

	(4) Connect VTU-O and VTU-R to one of the loop types 26AWG, PE 0.4mm or TP100: a. 1350ft or 450m ~~26AWG~~ for profiles up to 17MHz ~~or 450ft 26AWG for 30MHz profiles~~ ~~or~~ b. ~~450m~~ 450ft ~~PE 0.4mm for profiles up to 17MHz~~ or 150m ~~PE 0.4mm~~ for 30MHz and 35MHz profiles (5) Inject –110dBm/Hz AWGN noise at both the VTU-O and VTU-R side.

4.13 Updates to Section 5.4.6 Bitswap to Zero-Bit-Loading Tes

Amend the text of Table 36 Bitswap to zero bit loading test per changes below (revision marks relative to the TR-115 Issue 3 text).

Table 36 - Bitswap to zero bit loading test

Test Configuration	(1) See Section 4.1 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 one of the loop types 26AWG, PE 0.4mm or TP100: a. 1350ft or 450m ~~26AWG~~ for profiles up to 17MHz ~~or 450ft 26AWG for 30MHz profiles~~ ~~or~~ b. ~~450m~~ 450ft ~~PE 0.4mm for profiles up to 17MHz~~ or 150m ~~PE 0.4mm~~ for 30MHz and 35MHz 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 and for the 35MHz profile or n x 8.625 kHz for 30MHz profile, with n < Index of highest supported down-/upstream data-bearing subcarrier for the related profile (ITU-T G.993.2, Table 6-1). 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.

4.14 Updates to Section 5.5 Loop Diagnostic Mode Test

Amend the text of Table 37 Test on Loop Diagnostic Mode requested by VTU-O per changes below (revision marks relative to the TR-115 Issue 3 text).

Table 37 - Test on Loop Diagnostic Mode requested by VTU-O

Test Configuration	(1) See Section 4.1 for the test configuration. (2) As per VDSL2 band-profile to be tested, configure the SUT with one of the profile-line combinations associated to that band-profile (see Section 4.2.3). If, for the specific band-profile, profile-line combinations are defined with DPBO and/or UPBO enabled, these SHALL be applied. (3) Specific settings to force the VTU to perform the LD mode: set the line configuration parameter LDSF to 1. (4) Connect VTU-O and VTU-R to one of the loop types 26AWG, PE 0.4mm or TP100: a. 1350ft or 450m ~~26AWG~~ for profiles up to 17MHz ~~or 450ft 26AWG for 30MHz profiles~~ ~~or~~ b. ~~450m~~ 450ft ~~PE 0.4mm for profiles up to 17MHz~~ or 150m ~~PE 0.4mm~~ for 30MHz and 35MHz profiles ~~or~~ ~~c. 450m TP100 for profiles up to 17MHz or 150m TP100 for 30MHz profiles~~ (5) Inject -120 dBm/Hz AWGN noise at both the VTU-O and VTU-R ends.

Amend the text of Table 38 Test on Loop Diagnostic Mode requested by VTU-R per changes below (revision marks relative to the TR-115 Issue 3 text).

Table 38 - Test on Loop Diagnostic Mode requested by VTU-R

Test Configuration	(1) See Section 4.1 for test configuration. (2) As per VDSL2 band-profile to be tested, configure the SUT with one of the profile-line combinations associated to that band-profile (see Section 4.2.3). If, for the specific band-profile, profile-line combinations are defined with DPBO and/or UPBO enabled, these SHALL be applied. (3) Specific settings to force the VTU to perform the LD mode: set the line configuration parameter LDSF to 1. (4) Connect VTU-O and VTU-R to one of the loop types 26AWG, PE 0.4mm or TP100: a. 1350ft ~~26AWG~~ or 450m for profiles up to 17MHz ~~or 450 ft 26AWG for 30MHz profiles~~ ~~or~~ b. 450ft ~~m PE 0.4mm for profiles up to 17MHz~~ or 150m ~~PE 0.4mm~~ for 30MHz and 35MHz profiles ~~or~~ ~~c. 450m TP100 for profiles up to 17MHz or 150m TP100 for 30MHz profiles~~ (5) Inject -120 dBm/Hz AWGN noise at both the VTU-O and VTU-R ends.

4.15 Updates to Section 5.7 PSD Tests

Amend the text of Table 40 PSD Test per changes below (revision marks relative to the TR-115 Issue 3 text).

Table 40 - PSD Test

Test Configuration	(1) The VTU modems SHALL be connected as shown in Section 4.1. (2) The test setup SHALL support the PSD mask measurement over the entire downstream and upstream bands and SHALL provide enough dynamic range to allow the measurements be done over both the passband and stopband frequencies into a resolution bandwidth less than or equal to 10 kHz. (3) According to the VDSL2 band-profile to be tested, configure the SUT with one of the profile line combinations associated to that band-profile (see Section 4.2.3). (4) Line simulator SHALL be set up for the straight homogeneous loop specified for the regional annex, Section 4.4. Its length SHALL be varied in: - 5 steps from the NULL loop to the length at which the loop is the equivalent of 20dB @ 1MHz for profiles up to 17MHz. - 3 steps from the NULL loop to the length at which the loop is the equivalent of 6dB @ 1MHz for ~~profiles up to~~ 30MHz and 35MHz profiles. Alternatively, a flat attenuator MAY be used to perform the measurements, provided its value matches the attenuation of the equivalent loop at 1MHz.

Amend the text of Table 41 Aggregate Transmit Power Test per changes below (revision marks relative to the TR-115 Issue 3 text).

Table 41 - Aggregate Transmit Power Test

Test Configuration	(1) The VTU modems SHALL be connected as shown in Section 4.1 (2) The test setup SHALL support the aggregate transmit power (ATP) measurement over the entire downstream and upstream bands and SHALL provide enough dynamic range to allow the measurements be done over both the passband and stopband frequencies into a resolution bandwidth less than or equal to 10 kHz. (3) According to the VDSL2 band-profile to be tested, configure the SUT with one of the profile line combinations associated to that band-profile (see Section 4.2.3). (4) Line simulator SHALL be set up for the straight homogeneous loop specified for the regional annex Section 4.4. Its length SHALL be varied in: - 5 steps from the NULL loop to the length at which the loop is the equivalent of 20dB @ 1MHz for profiles up to 17MHz. - 3 steps from the NULL loop to the length at which the loop is the equivalent of 6dB @ 1MHz for ~~profiles up to~~ 30MHz and 35MHz profiles. Alternatively, a flat attenuator MAY be used to perform the measurements, provided its value matches the attenuation of the equivalent loop at 1MHz

Amend the text of Table 43 In-band Spectral Shaping / RFI Notch Configuration Test per changes below (revision marks relative to the TR-115 Issue 3 text).

Table 43 - In-band Spectral Shaping / RFI Notch Configuration Test

Test Configuration	(1) The VTU modems SHALL be connected as shown in Section 4.1. (2) The test setup SHALL support the PSD mask and aggregate transmit power (ATP) measurements over the entire downstream and upstream bands and SHALL provide enough dynamic range to allow the measurements be done over both the passband and stopband frequencies into a resolution bandwidth less than or equal to 10 kHz. (3) According to the VDSL2 band-profile to be tested, configure the SUT with one of the profile line combinations associated to that band-profile (see Section 4.2.3). If, for the specific band-profile, profile-line combinations are defined with DPBO and/or UPBO enabled, these SHALL be applied. (4) Line simulator SHALL be set up for the straight homogeneous loop specified for the regional annex, Section 4.4. Its length SHALL be set to the length at which the loop is the equivalent of: - 20dB @ 1MHz for profiles up to 17MHz. - 6dB @ 1MHz for ~~profiles up to~~ 30MHz and 35MHz profiles. Alternatively, a flat attenuator MAY be used to perform the measurements, provided its value matches the attenuation of the equivalent loop at 1MHz.

Amend the text of Table 44 Downstream Power Back-Off Test per changes below (revision marks relative to the TR-115 Issue 3 text).

Table 44 - Downstream Power Back-Off Test

Test Configuration	(1) The VTU modems SHALL be connected as shown in Section 4.1. (2) The test setup SHALL support the PSD mask and optionally aggregate transmit power (ATP) measurements, over the entire downstream bands and SHALL provide enough dynamic range to allow the measurements be done over both the passband and stopband frequencies into a resolution bandwidth less than or equal to 10 kHz. (3) According to the VDSL2 band-profile to be tested, configure the SUT with one of the profile line combinations associated to that band-profile (see Section 4.2.3). If, for the specific band-profile, profile-line combinations are defined with UPBO enabled, apply the related UPBO configuration parameters. If, for the specific band-profile, profile-line combinations are defined with DPBO enabled, apply the related DPBO configuration parameters. Otherwise define one set of DPBO parameters (DPBOEPSD, DPBOESCMA, -B, -C, DPBOMUS, DPBOFMIN, DPBOFMAX). (4) Line simulator SHALL be set up for the straight homogeneous loop specified for the regional annex Section 4.4. Its length SHALL be set to the length at which the loop is the equivalent of: - 20dB @ 1MHz for profiles up to 17MHz. - 6dB @ 1MHz for ~~profiles up to~~ 30MHz and 35MHz profiles. Alternatively, a flat attenuator MAY be used to perform the measurements, provided its value matches the attenuation of the equivalent loop at 1MHz. (5) Set DPBOESEL to 10 dB.

4.16 Updates to Section 5.9 VTU-R INM

Amend the text of Table 48 VTU-R INM Capability per changes below (revision marks relative to the TR-115 Issue 3 text).

Table 48 - VTU-R INM Capability

Test Configuration	(1) See Section 4.1 for the test configuration. (2) As per VDSL2 band-profile to be tested, configure the SUT in one of the profile line combinations associated to that band-profile in the rate adaptive mode (see Section 4.2.3). (3) The INM control parameters and PEIN test sequence for each test are defined in Table 47. (4) Connect VTU-R and VTU-O to one of the loop types 26AWG, PE 0.4mm or TP100: a. 1350ft ~~26AWG (profiles up to 17MHz)~~ or ~~450ft~~ 450m ~~26AWG~~ for ~~30MHz~~ profiles up to 17MHz ~~or~~ b. 450ft ~~m PE 0.4mm (profiles up to 17MHz)~~ or 150m ~~PE 0.4mm~~ for 30MHz and 35MHz profiles (5) Inject –130dBm/Hz AWGN noise at both the VTU-O and VTU-R ends. (6) Additional test conditions: • The PEIN impulses SHALL be injected at the VTU-R end. • The interval borders of the INM counters SHALL be considered.

4.17 Updates to Section 5.10 Dying Gasp Test

Amend the text of Table 49 Dying Gasp Test per changes below (revision marks relative to the TR-115 Issue 3 text).

Table 49 – Dying Gasp Test

Test Configuration	(1) See Section 4.1 for the test configuration (use Figure 1). (2) According to the VDSL2 band-profile to be tested, configure the SUT with one of the profile line combinations associated to that band-profile (see section 4.2.3). (3) Connect VTU-R and VTU-O to one of the loop types 26AWG, PE 0.4mm or TP100: ~~Set the loop to~~ a. 1350ft or 450m ~~26AWG~~ for profiles up to 17MHz ~~or 450ft 26AWG for 30MHz profiles~~ ~~or~~ b. ~~450m~~ 450ft or 150m ~~PE 0.4mm~~ for profiles ~~up to 17MHz or 150m PE 0.4mm for~~ 30MHz and 35MHz profiles

4.18 Updates to Section 7.1 Configuration Parameter MINSNRM

Amend the text of Table 51 MINSNRM Control Test per changes below (revision marks relative to the TR-115 Issue 3 text).

Table 51 - MINSNRM Control Test

Test Configuration	(1) See Section 4.1 for the test configuration. (2) According to the VDSL2 band-profile to be tested, configure the SUT in one of the profile line combinations associated to that band-profile in the rate adaptive mode (see Section 4.2.3). If, for the specific band-profile, profile-line combinations are defined with DPBO and/or UPBO enabled, these SHALL be applied. (3) SNRM test configurations: a. MINSNRM = 5dB and TARSNRM=9dB b. MINSNRM = 8dB and TARSNRM=12dB (4) Connect VTU-R and VTU-O to one of the loop types 26AWG, PE 0.4mm or TP100: ~~through the~~ 300m ~~PE04~~ or 1kft ~~26AWG~~. (5) Additional test configurations: OPTIONAL OLR (SRA, SOS) SHALL NOT be used.

4.19 Updates to Section 7.7 Performance Monitoring Counter for SES

Amend the text of Table 58 SES Counter Reporting Test per changes below (revision marks relative to the TR-115 Issue 3 text).

Table 58 - SES Counter Reporting Test

Test Configuration	(1) See Section 4.1 for the test configuration. (2) ~~As per VDSL2 band-profile to be tested, configure the SUT in RA_F_150_150, RA_I_150_150 or RA_R-17/2/41_150_150 specific line-setting (see Section 4.2.3).~~ According to the VDSL2 band-profile to be tested, configure the SUT with one of the rate adaptive profile line combinations (RA_F, RA_I and RA_R) associated to that band-profile (see Section 4.2.3). If, for the specific band-profile, profile-line combinations are defined with DPBO and/or UPBO enabled, these SHALL be applied. (3) Connect VTU-R and VTU-O to one of the loop types 26AWG, PE 0.4mm or TP100: a. 1350ft or 450m for profiles up to 17MHz b. 450ft or 150m for 30MHz and 35MHz profiles. (4) Set the noise generator to -120dBm/Hz AWGN noise at both VTU-O and VTU-R. (5) Additional test conditions: OPTIONAL OLR (SRA, SOS) SHALL NOT be used.
Method of Procedure	~~(1) Connect VTU-R and VTU-O through 1350 feet 26AWG or 450 m PE04.~~ ~~(2) Set the noise generator to -120dBm/Hz AWGN at the VTU-R and at the VTU-O side of the loop.~~ (1) Force an initialization and wait for modem to sync. (2) Wait 1 minute following synchronization. (3) Note down the initial value of the SES-L, SES-LFE, UAS-L and UAS-LFE performance monitoring counters at the VTU-O and the initial value of the SES-L and UAS-L counters at the VTU-R. (4) Inject the noise impulse, -110dBm/Hz AWGN at the VTU-R side of the loop, with duration of 590 ± 10 milliseconds for RA_F~~_150_150~~ and RA_I~~_150_150~~, and with duration of 630 ± 10 ms for RA_R ~~17/2/41_150_150~~ test profile. (5) Repeat MOP(~~5~~4) 14 times (for a total of 15 impulse events) with 10s between each event. (6) Force performance monitoring counters update and wait 30 seconds for the counters to be read out. (7) Note down the value of the counter SES-L and UAS-L at the VTU-R. Note down the value of the counters SES-L and SES-LFE, and UAS-L and UAS-LFE at the VTU-O. (8) Calculate the increase of these counters between MOP(~~8~~7) and MOP(~~4~~3). (9) Repeat MOP(~~5~~4) to MOP(~~9~~8), but inject the noise impulse at the VTU-O side of the loop.

4.20 Updates to Section 7.10 Inhibition of Performance Monitoring Counters

Amend the text of Table 61 Test of inhibition and non-inhibition of CV, ES, SES, LOSS counters per changes below (revision marks relative to the TR-115 Issue 3 text).

Table 61 - Test of inhibition and non-inhibition of CV, ES, SES, LOSS counters

Test Configuration	(1) See Section 4.1 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.~~ According to the VDSL2 band-profile to be tested, configure the SUT with one of the rate adaptive profile line combinations (RA_F and RA_I) associated to that band-profile (see Section 4.2.3). If, for the specific band-profile, profile-line combinations are defined with DPBO and/or UPBO enabled, these SHALL be applied. (3) 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. ~~Additional test conditions: OPTIONAL OLR (SRA, SOS) SHALL not be used.~~ (4) Connect VTU-O and VTU-R to one of the loop types 26AWG, PE 0.4mm or TP100: a. 1350ft or 450m ~~26AWG~~ for profiles up to 17MHz ~~or 450ft 26AWG for 30MHz profiles~~ ~~or~~ b. ~~450m~~ 450ft ~~PE 0.4mm for profiles up to 17MHz~~ or 150m ~~PE 0.4mm~~for 30MHz and 35MHz profiles. (5) Additional test conditions: OPTIONAL OLR (SRA, SOS) SHALL not be used.
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.~~ (1) Force an initialization and wait for modem to sync. Wait 1 minute following synchronization. (2) 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. (3) 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 and for the 35MHz profiles b. [(max(ACTINPus, ACTINPds) +1) x 0.125ms] x 2, rounded up to the nearest ms, for the 30MHz profiles (4) Force performance monitoring counters update and wait 30 seconds for the counters to be read out. (5) Note down the values of the counters as in MOP(~~3~~2). (6) Calculate the increase of these counters between the values from MOP(~~6~~ 5) and MOP(~~3~~2). (7) Force one "micro-interruption" of duration 200ms.

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

End of Broadband Forum Technical Report TR-115