University of New Hampshire
InterOperability Laboratory

DSL Consortium

Broadband Forum TR-115 Report

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Revision 1.0 April 30, 2015

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Mr. DSL;

Enclosed are the results from the Broadband Forum's TR-115 VDSL2 Functionality Test Plan performed on the VTU-68. The testing was performed according to Version 2.0 of the TR-115 and the latest corrigendum documents, which may be downloaded from the following address:

http://www.broadband-forum.org/technical/download/TR-115_Issue-2.zip
http://www.broadband-forum.org/technical/download/TR-115_Issue-2_Amendment-1.pdf
http://www.broadband-forum.org/technical/download/TR-115_Issue-2_Corrigendum-1.pdf

If you have any questions about the test procedures or results, please feel free to contact me via email at jane@dsl.net, or by phone at 555-5555.

Sincerely,
Jane Doe

Reviewed By,
Lincoln Lavoie

Digitally signed by UNH-IOL
Date: 2015.04.30 16:41:42 -04'00'

Report Revision History

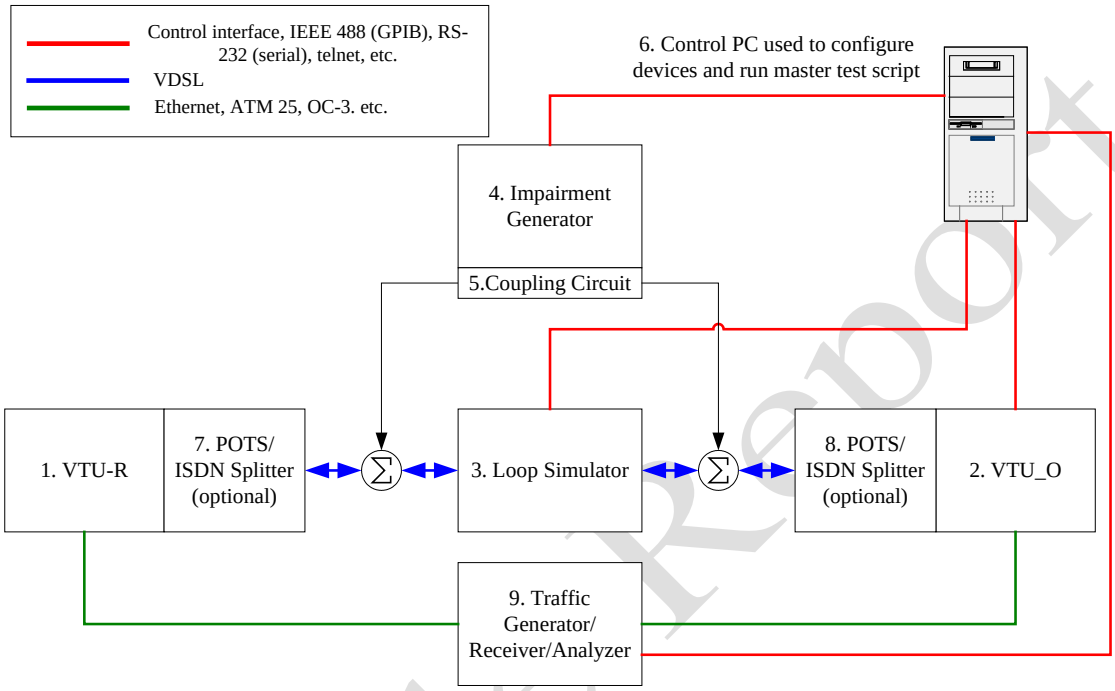
Revision	Date	Author	Description of Changes
1.0	April 30, 2015	Jane Doe	• Initial report.

About Report Revisions:

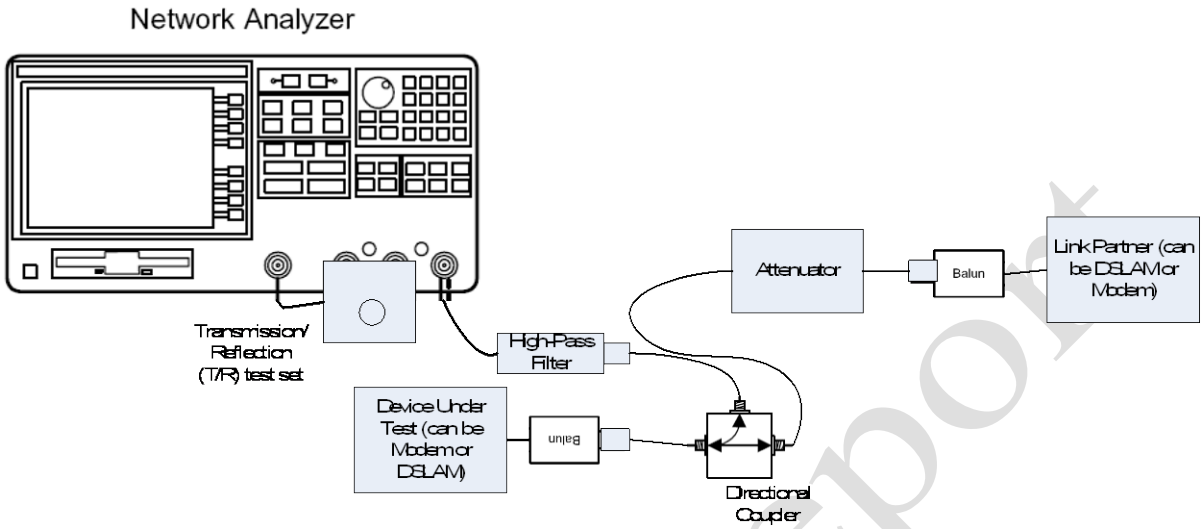
Revisions are typically made to reports to correct errors, typos, or omissions. A revision may also include a retest of one or more test cases, with those test cases identified in the table above. A report revision will not change the software/firmware used during the testing, resulting in some test cases using differing software/firmware versions.

Test Setups

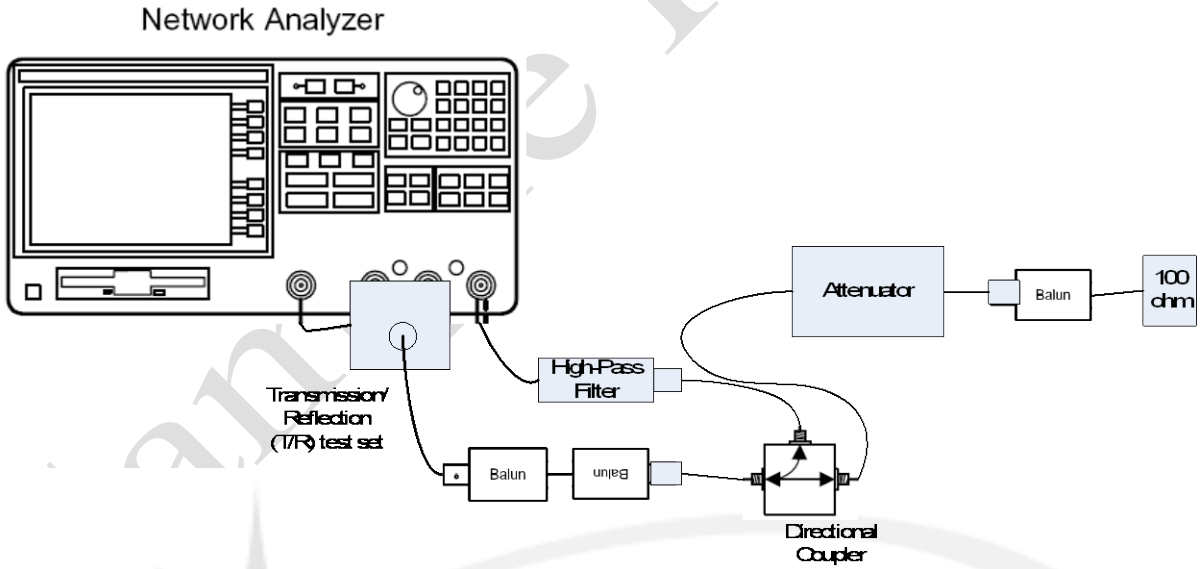
Test Setup 1: General Test Setup



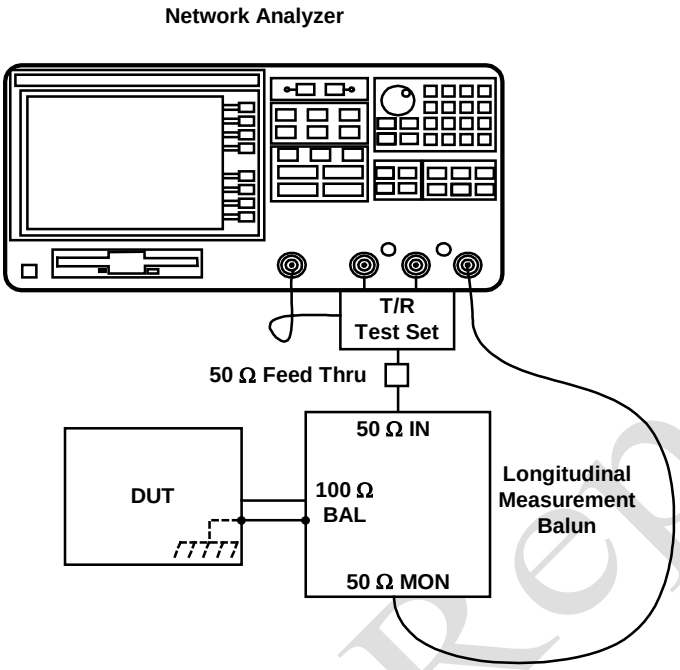
Test Setup 2: PSD Measurement Setup



Test Setup 3: PSD Calibration Setup



Test Setup 4: Longitudinal Balance Measurement Setup



Equipment List

1. VTU-R (VTU-68): DSLTech (IOL ID: 000A)
   - System software version: 1.1.2
   - Chipset make: DSLTech
   - Chipset model: 3.2
   - Chipset firmware version: 45
   - Hardware version: 3
2. VTU-C (VTU-55): DSLTech (IOL ID: 000B)
   - System software version: 1.2.3
   - Chipset make: DSLTech
   - Chipset model: 3.8
   - Chipset firmware version: 5
   - Hardware version: 1
   - Profile used for testing: AA8d_RA_I_096_056
3. Loop simulator: Spirent Communications DLS8131, DLS8132
   - Loop simulator serial #: 3000407, 3000390
   - Compensated loops were not applied
4. Impairment generator: Spirent DLS5500
   - Spirent noise package DLS-5B44 version 1.1.1
   - Compensated noise levels were not applied
5. Coupling circuit: Spirent Communication DLS 5404
6. Network Analyzer: Agilent 4395A (IOL ID: 1498).
   - Agilent 87512A transmission/reflection test set installed.
   - Spectrum Analyzer Level Accuracy: +/- 0.8 dB.
7. Baluns: North Hills Signal Processing
   - Power Spectral Density Measurement Balun: 0301BB
   - Longitudinal Balance Measurement Balun: 0320BF
8. Directional Couplers: Mini-Circuits ZFDC-10-06
9. Traffic Generator: Spirent Communication SmartBits
   - Card: 44
   - Serial: 123ABCD
10. UNH-IOL xDSL Electrical Characteristics GUI
    - Software Version: 3
    - Operating System: Windows XP PRO
11. UNH-IOL xDSL PSD Mask Conformance Tool
    - Hardware Revision 2.0
    - Software Version: 2.1
    - Operating System: Windows XP PRO

Result Key

Result	Meaning	Interpretation
PASS	Pass	The Device Under Test (DUT) was observed to exhibit conformant behavior.
FAIL	Fail	The Device Under Test (DUT) was observed to exhibit non-conformant behavior.
RTC	Refer to Comments	From the observations, a valid pass or fail was not determined. An additional explanation of the situation is included.
Info	Informative	Test is designed for informational purposes only. The results may help ensure the interoperability of the DUT, but are not standards requirements.
Warn	Warning	The DUT was observed to exhibit behavior that is not recommended.
N/A	Not Applicable	This test does not apply to the device type or is not applicable to the testing program selected.
N/S	Not Supported	The Device Under Test (DUT) was not observed to support the necessary functionality required to perform these tests or the requirement is optional and not supported by this device.
N/T	Not Tested	This test was not performed and therefore this is not a complete test report. Please see the comments for additional reasons.
UA	Unavailable	The test was not performed due to limitation of the test tool(s) or interoperable systems, or the test methodology is still under development.

Test Summary

Test Number	Test Name	Result
Section 5 – Physical Layer Tests		
5.1	Interleaving Delay Test	**PASS**
5.2	Impulse Noise Protection Test	**PASS**
5.4.1	Bitswap Test	**PASS**
5.4.2	Wideband Bitswap Test	**PASS**
5.4.3	Seamless Rate Adaptation Test	**PASS**
5.5	Loop Diagnostic Mode Test	**PASS**
5.6	VTU-R Inventory Test	**PASS**
5.7.1	PSD Mask Test	**PASS**
5.7.2	Total ATP Test	**PASS**
5.7.3	RFI Notch Configuration Test	**PASS**
5.7.4	Downstream Power Back-off Test	**PASS**
5.7.5	Upstream Power Back-off Test	**PASS**
5.8	Longitudinal Conversion Loss Test	**PASS**
5.10	Dying Gasp Test	**PASS**
Section 6 – System Level Tests		
6.1	64/65-Octet Encapsulation Far-End PTM-TC Performance Monitoring Test	**PASS**
Section 7 - Testing G.ploam Configuration Parameters and Performance Monitoring Counters		
7.1	Configuration Parameter MINSNRM	**PASS**
7.2	Configuration Parameter TARSNRM	**PASS**
7.3	Configuration Parameter PSDMASK	**PASS**
7.4	Configuration Parameter VDSL2-CARMASK	**PASS**
7.5	Configuration Parameter MAXNOMATP	**PASS**
7.6	Performance Monitoring Counters for Code Violations and Errored Seconds	**PASS**
7.7	Performance Monitoring Counter for SES	**PASS**
7.8	Performance Monitoring Counter for Unavailable Seconds (UAS)	**PASS**
7.9	Performance Monitoring Counters for Full initialization and Failed Full initialization	**PASS**

Test Detail

Section 5 – Physical Layer Tests

Test 5.1 Interleaving Delay Test

Test Number and Label						**Result**
5.1 – Interleaving Delay Test						**PASS**
Purpose: The purpose of this test is to verify the validity of Interleaving Delay. It assumes that the system delay without interleaving delay is constant within a tolerance of 1ms and that the reported interleaving delay is equal to the actual delay.						
Results for I-8/2:						
Upstream			**Downstream**			**Result** (Pass if US_RD≤8ms and DS_RD≤8ms)
Reported Delay (ms)	**System Delay (ms)**	**ΔU1 = (SD-RD) (ms)**	**Reported Delay (ms)**	**System Delay (ms)**	**ΔD1 = (SD-RD) (ms)**	
7	**10**	3	7	8	1	**PASS**
Results for I-16/2:						
Upstream			**Downstream**			**Result** (Pass if US_RD≤16ms and DS_RD≤16ms)
Reported Delay (ms)	**System Delay (ms)**	**ΔU2 = (SD-RD) (ms)**	**Reported Delay (ms)**	**System Delay (ms)**	**ΔD2 = (SD-RD) (ms)**	
7	10	3	7	8	1	**PASS**
Delta Calculation:						
Upstream			**Downstream**			**Result** (PASS IF ΔU≤1MS AND ΔD≤1MS)
ΔU = | ΔU1 - ΔU2 | (ms)			ΔD = | ΔD1 - ΔD2 | (ms)			
0			0			**PASS**
Notes about test implementation:						
None						
Comments on Test Results:						
None						

Test 5.2 Impulse Noise Protection Test

Test Number and Label				Result
5.2 – Impulse Noise Protection Test				**PASS**
Purpose: The purpose of this test is to verify the functionality of INP				
Results:				
Upstream CRC		**Downstream CRC**		
Allowed	**Measured**	**Allowed**	**Measured**	
1	0	1	1	
Test Metrics:				
1. The number of errored seconds measured after the initial wait period SHALL be ≤ 1 for the test to pass.				**PASS**
Notes about test implementation:				
None				
Comments on Test Results:				
None				

Test 5.3 Dual Latency Test (Optional)

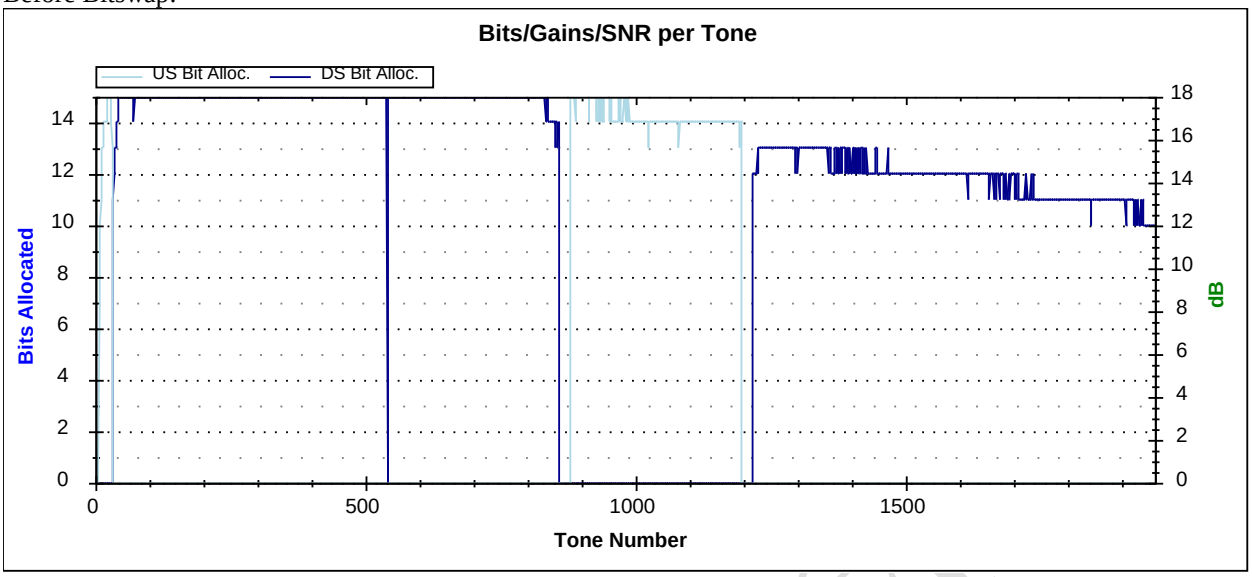
Test Number and Label					**Result**
5.3 –Dual Latency Test (Optional)					**PASS**
Purpose: Not Provided by the TR-115 technical document.					
-140dBm/Hz VTU-O & -110dBm/Hz VTU-R					
Channel 1			**Channel 2**		
ES	**CV**	**DELAY 1**	**ES**	**CV**	**DELAY 2**
3	11	2.5	2	6	5
-140dBm/Hz VTU-R & -110dBm/Hz VTU-O					
Channel 1			**Channel 2**		
ES	**CV**	**DELAY 1**	**ES**	**CV**	**DELAY 2**
4	12	3.4	3	6	6.2
Test Metrics:					
1. The measured delay on the low latency channel (Delay1) SHALL be < the one of the higher latency (Delay2).					**PASS**
2. The number of reported code violations in channel_2 SHALL be < channel_1.					**PASS**
Notes about test implementation:					
None.					
Comments on Test Results:					
None					

Test 5.4.1 Bitswap Test

Test Number and Label			Result	
5.4.1 –Bitswap Test			**PASS**	
Purpose: The purpose of this test is to verify that the link between a VTU-R and VTU-O stays in show-time and that bit-swapping occurs as a result of narrow band noise on a line.				
Upstream Bitswap:				
	I-8/2		**F-1/0**	
	US0	**US1**	**US0**	**US1**
Selected Tone (integer)	14	888	14	888
Total_Bits_US_Old (integer)	5000	5000	4500	4500
Total_Bits_US_New (integer)	5000	5000	4500	4500
CRC count during BER test	0	0	0	0
SES count during BER test	0	0	0	0
Estimated BER (based on Table 23/TR-114)	0	0	0	0
Downstream Bitswap:				
	I-8/2		**F-1/0**	
	DS1	**DS2**	**DS1**	**DS2**
Selected Tone (integer)	91	1220	91	1220
Total_Bits_US_Old (integer)	16000	16000	20000	20000
Total_Bits_US_New (integer)	16000	16000	20000	20000
CRC count during BER test	0	0	0	0
SES count during BER test	0	0	0	0
Estimated BER (based on Table 23/TR-114)	0	0	0	0
Test Metrics:				
1. No retrain SHALL occur during the test			**PASS**	
2. BITSpsus_New, recorded in step MOP(10), SHALL differ from BITSpsus_Old in step MOP(7), if tone n is in the bands of upstream direction.			**PASS**	
3. BITSpsds_New, recorded in step MOP(10), SHALL differ from BITSpsds_Old in step MOP(7), if tone n is in the bands of downstream direction.			**PASS**	
4. Transmitted_Bits_US_Old SHALL equal Transmitted_Bits_US_New			**PASS**	
5. Transmitted_Bits_DS_Old SHALL equal Transmitted_Bits_DS_New			**PASS**	
6. SES SHALL NOT increase			**PASS**	
7. The estimated BER SHALL NOT exceed 1e-7			**PASS**	
Notes about test implementation:				
1. To save space within the report, the values of BITSpsus and BITSpsds are not reported above.				
Comments on Test Results:				
None				

Figure 1: Bitswap Upstream Interleaved Profile US0

Before Bitswap:



After Bitswap:

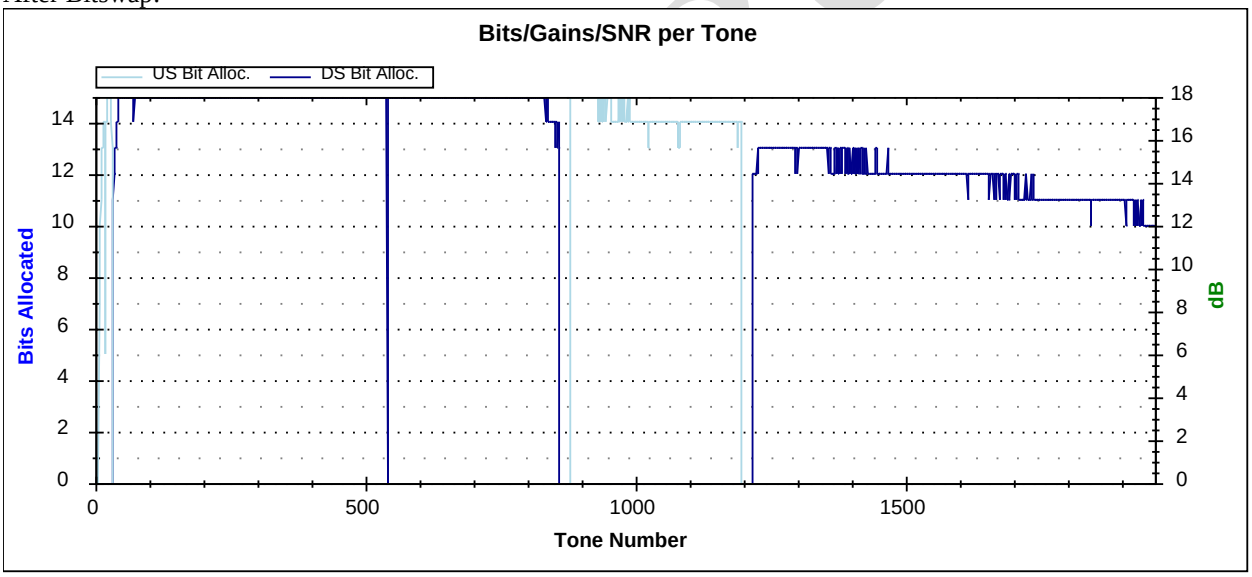
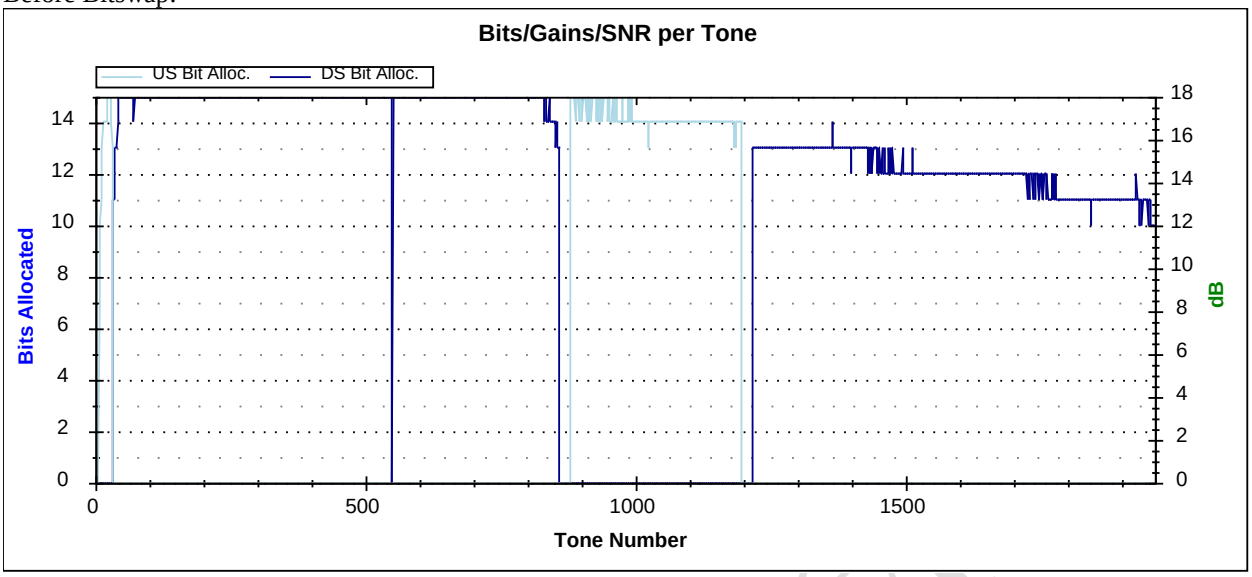


Figure 2: Bitswap Upstream Interleaved Profile US1

Before Bitswap:



After Bitswap:

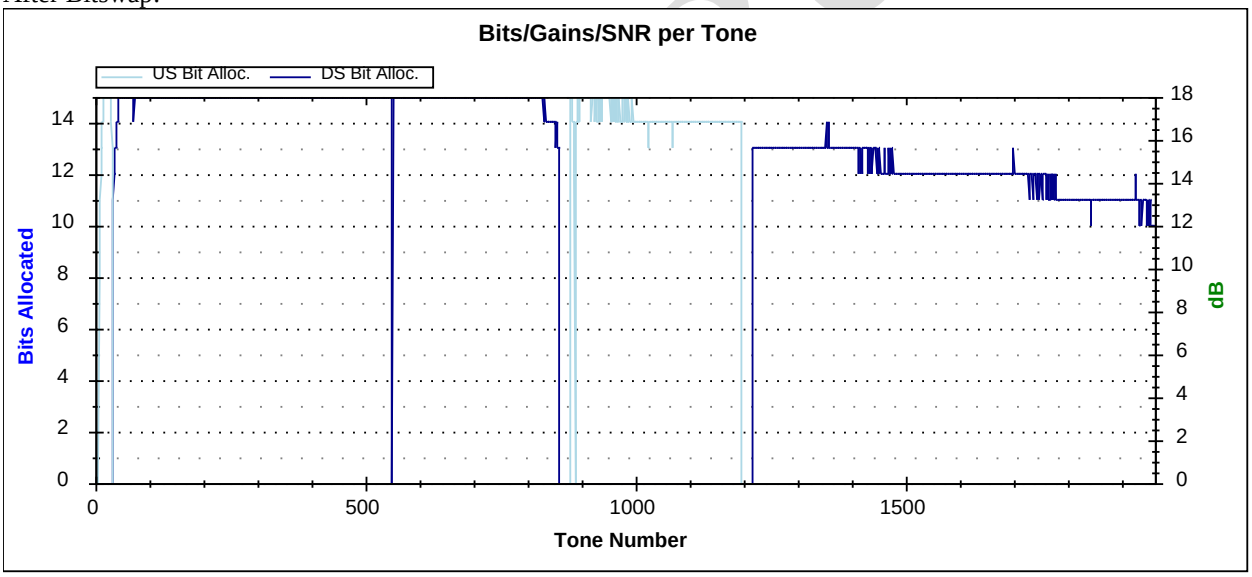
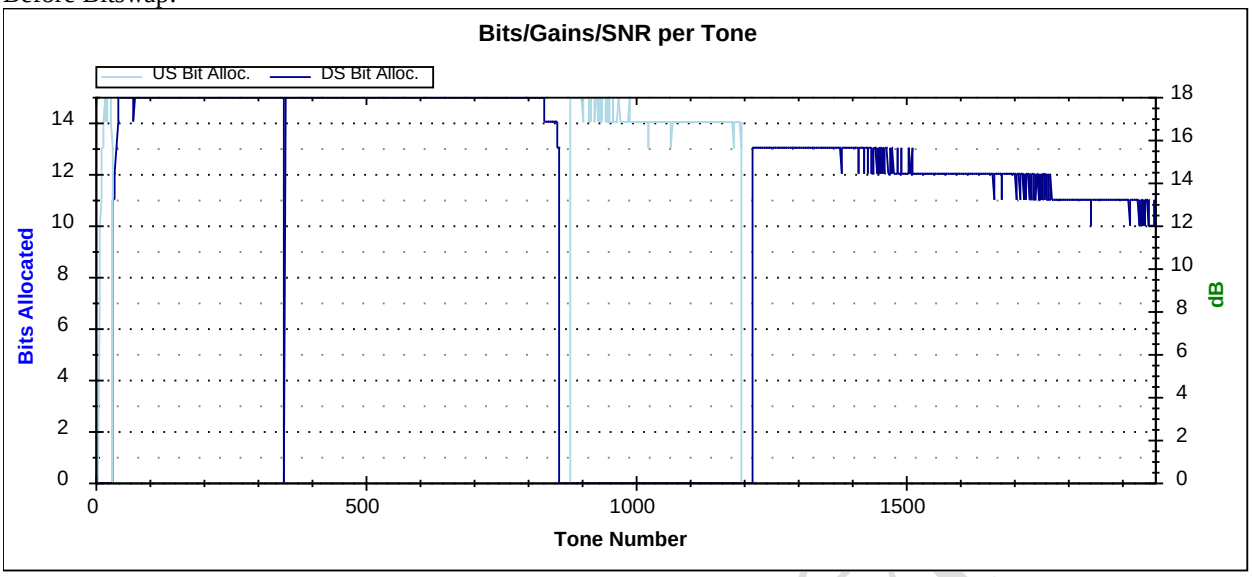


Figure 3: Bitswap Downstream Interleaved Profile DS1

Before Bitswap:



After Bitswap:

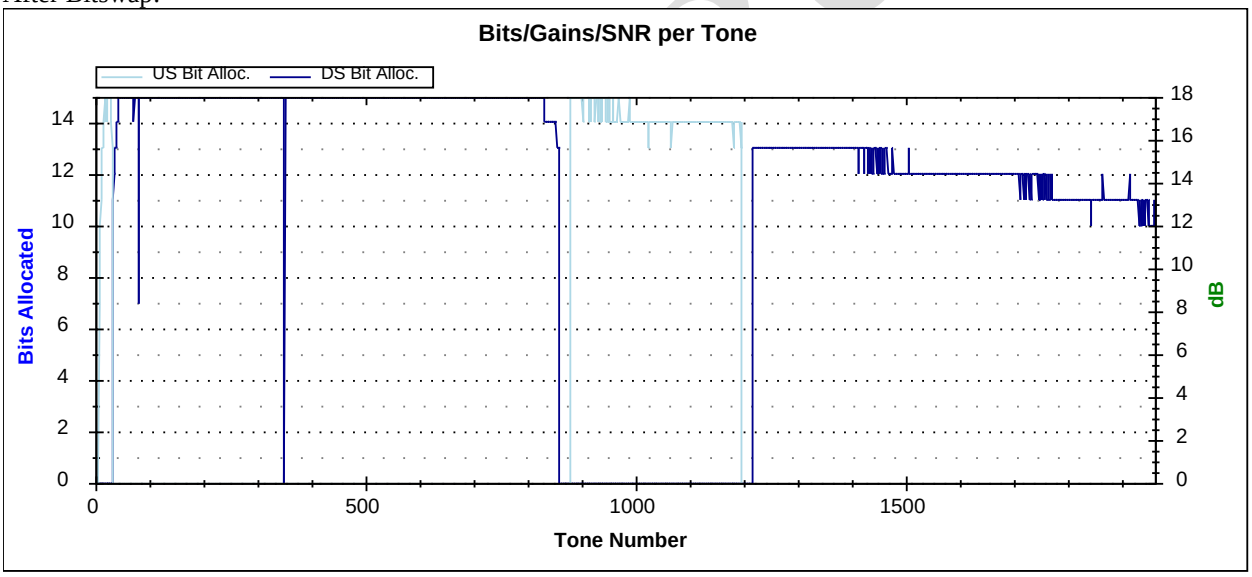
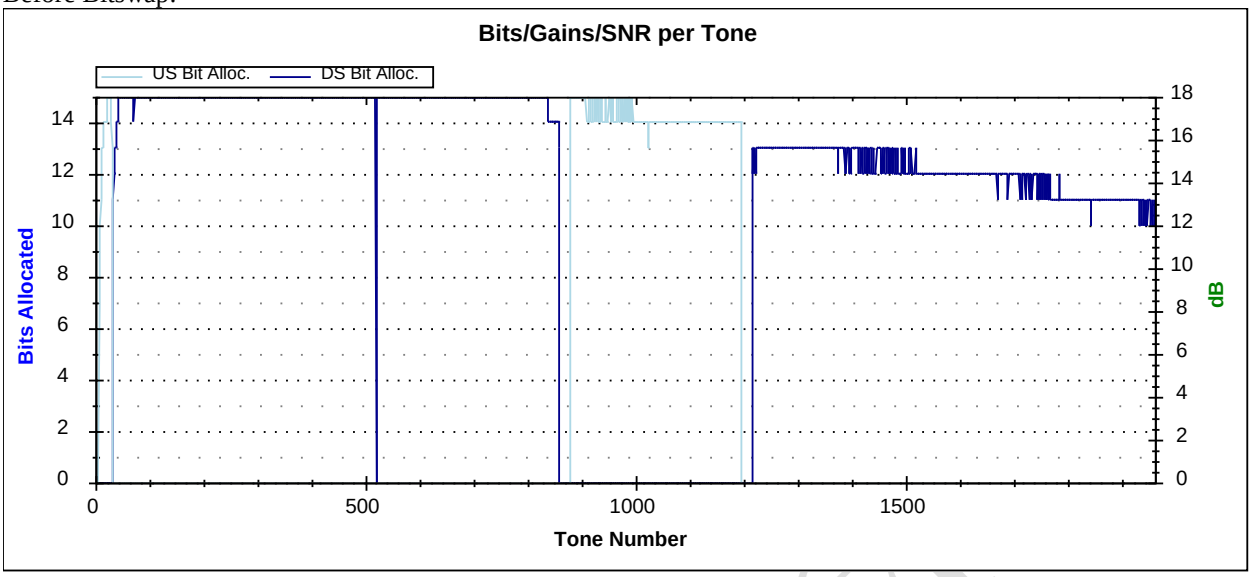


Figure 4: Bitswap Downstream Interleaved Profile DS2

Before Bitswap:



After Bitswap:

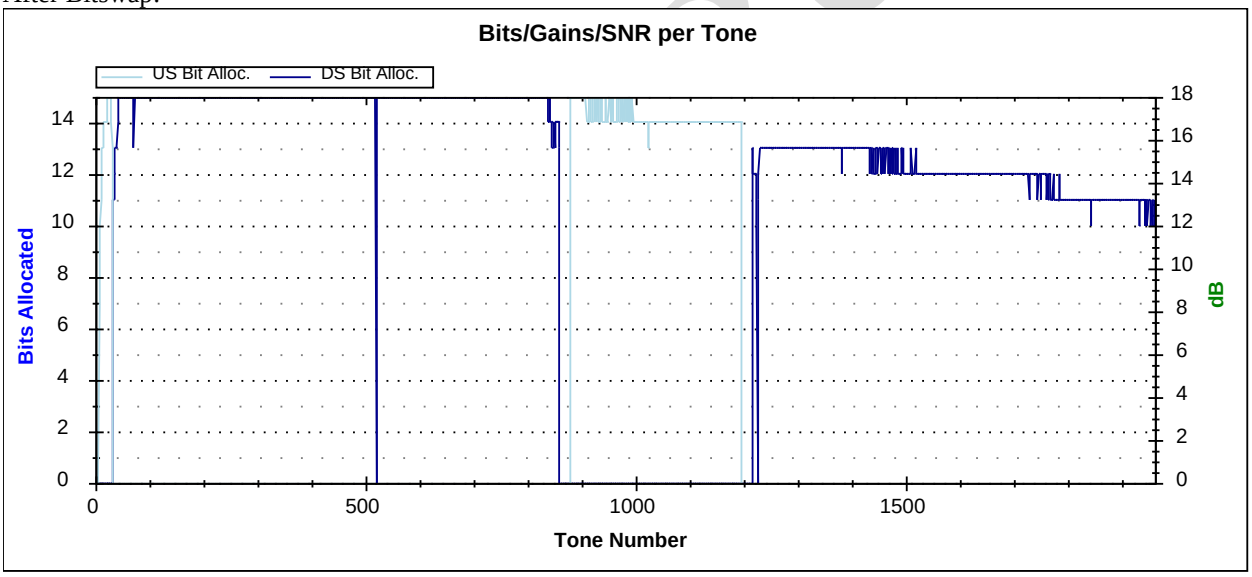
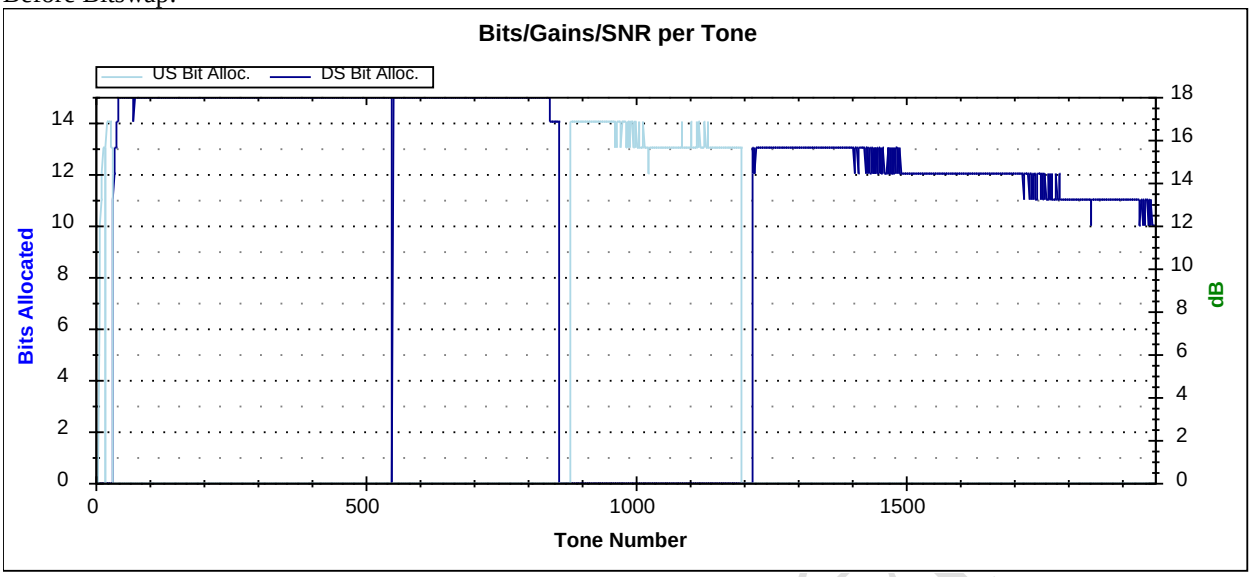
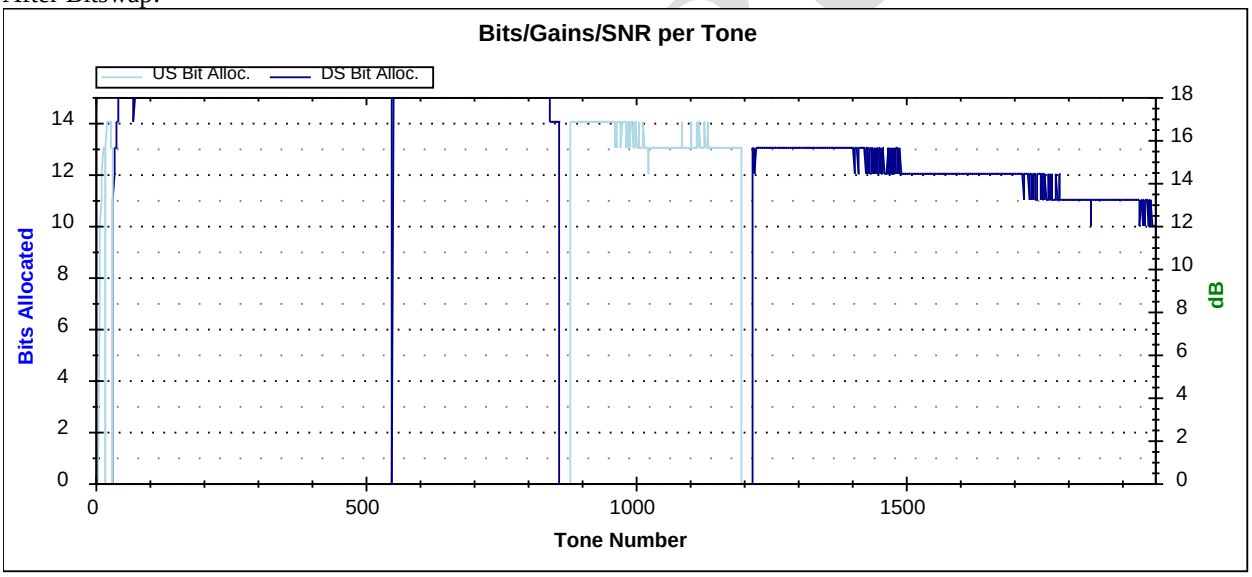


Figure 5: Bitswap Upstream Fast Profile US0

Before Bitswap:



After Bitswap:

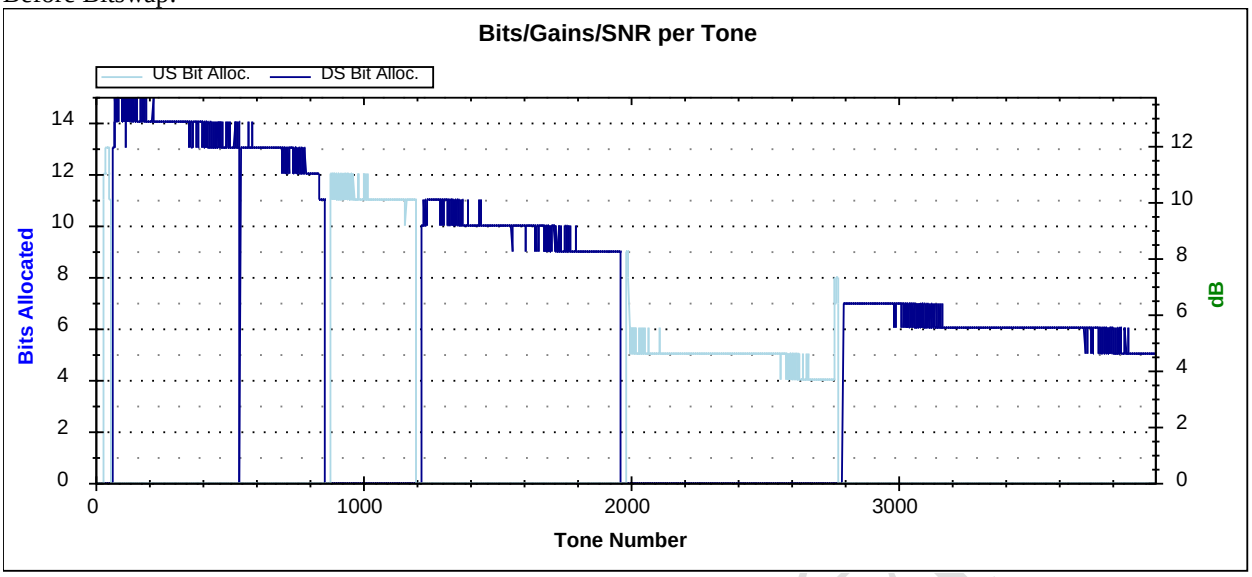


Test 5.4.2 Wideband Bitswap Test

Test Number and Label	Result
5.4.2 –Wideband Bitswap Test	**PASS**
Purpose: The purpose of this test is to verify that the link between a VTU-R and VTU-O stays in show-time and that bit-swapping occurs as a result of wideband noise on a line.	
Downstream wideband bit swap:	
Number of CRC errors reported (integer)	0
Upstream wide band bit swap:	
Number of CRC errors reported (integer)	0
Test Metrics:	
1. No retrains during the test	**PASS**
2. BITSpsds_New recorded in MOP(10) SHALL differ from the bit allocation, BITSpsds_Old, in MOP(3), with band DS1 showing a decreased number of bits, and band DS2 showing an increased number of bits.	**PASS**
3. BITSpsus_New recorded in MOP(10) SHALL differ from BITSpsus_Old in MOP(3), with band US1 showing an decreased number of bits, and band US2 showing a increased number of bits.	**PASS**
4. The number of measured CRC's during the measurement period in MOP(11) SHALL be ≤ 1	**PASS**
Notes about test implementation:	
1. To save space within the report, the values of BITSpsus and BITSpsds are not reported above.	
Comments on Test Results:	
None.	

Figure 6: Wideband Bit Swap Upstream

Before Bitswap:



After Bitswap:

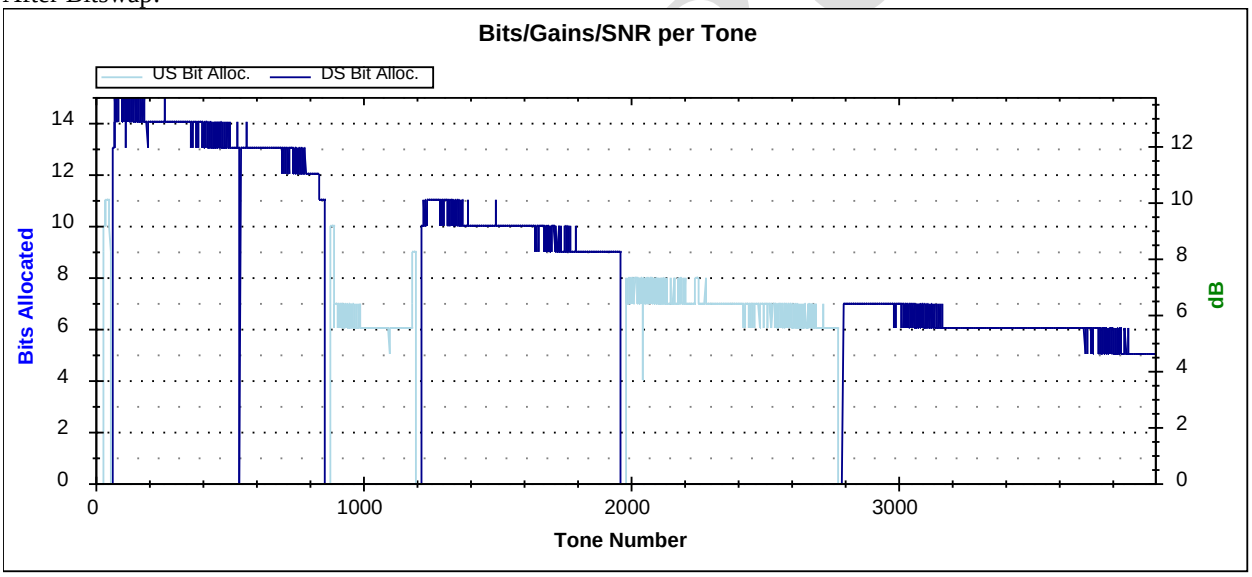
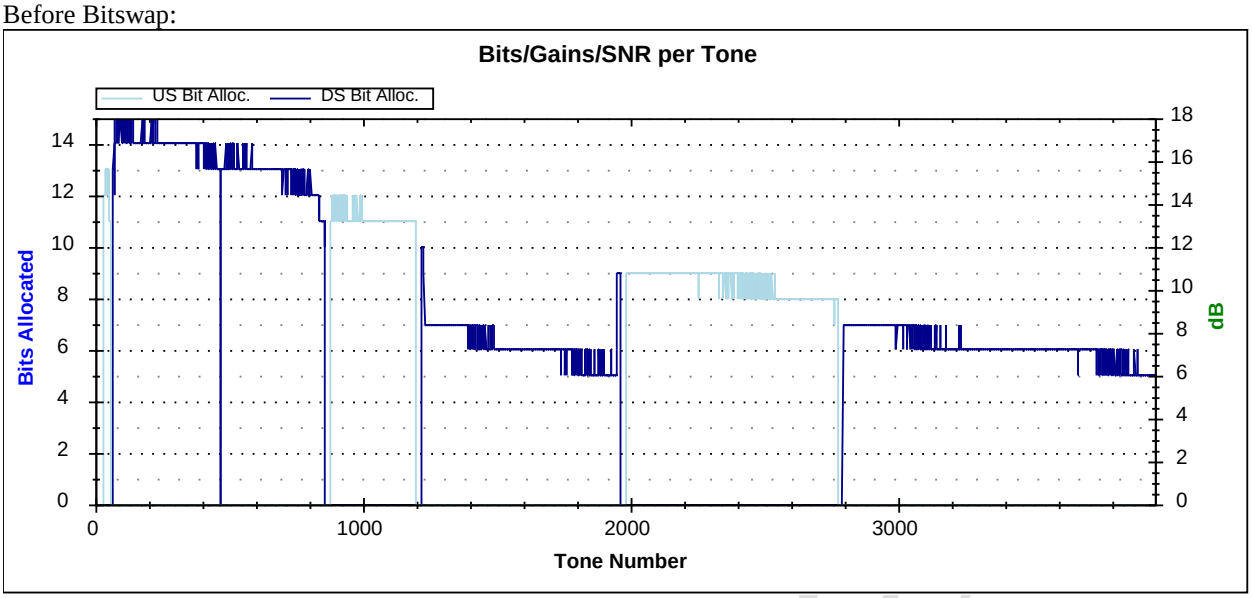
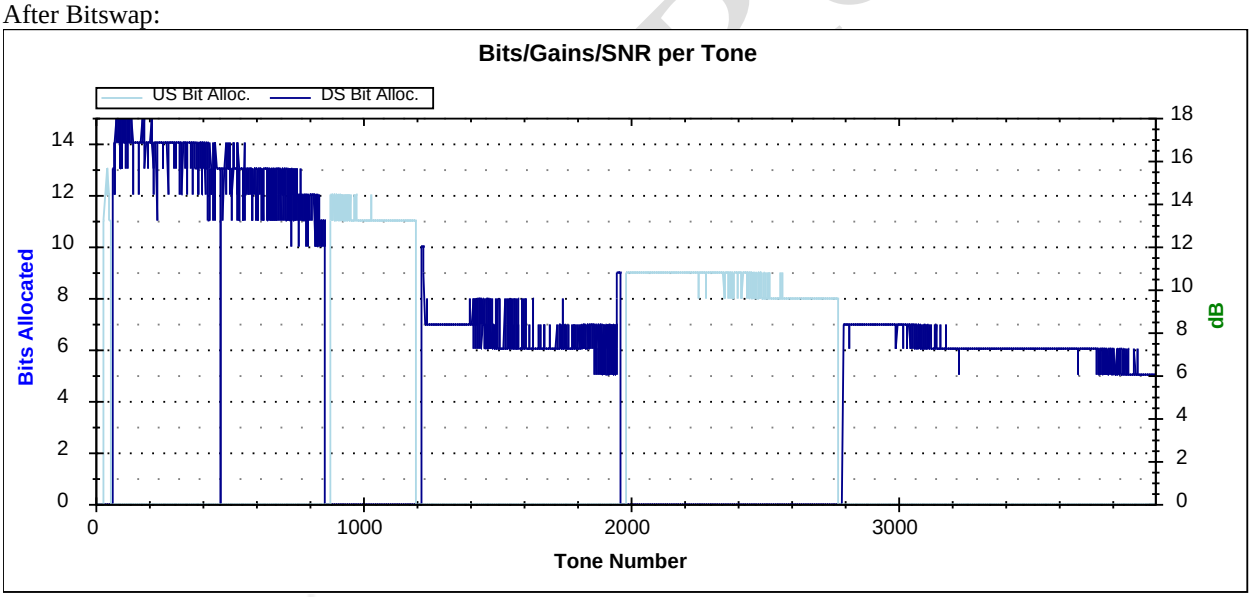


Figure 7: Wideband Bit Swap Downstream

Before Bitswap:



After Bitswap:



Test 5.4.3 Seamless Rate Adaptation Test (Optional)

Test Number and Label				**Result**
5.4.3 –Seamless Rate Adaptation Test (Optional)				**PASS**
Purpose: The purpose of this test is to verify the functionality of SRA.				
Results for Downshift case:				
	Upstream		**Downstream**	
	Before SRA	After SRA	Before SRA	After SRA
Bit Rate (kbps)	10000	9000	40000	38000
Noise Margin (dBm)	6	5	6.1	4.5
CRC count (integer)	0		0	
Estimated BER	0		0	
Results for Upshift case:				
	Upstream		**Downstream**	
	Before SRA	After SRA	Before SRA	After SRA
Bit Rate (kbps)	10000	11000	40000	41000
Noise Margin (db)	6.2	7	6.5	7.8
CRC count (integer)	0		0	
Estimated BER	0		0	
Test Metrics:				
1. No retrain SHALL occur during the test				**PASS**
2. No DS SES SHALL be reported.				**PASS**
3. BER should not exceed 1e-7				**PASS**
4. Upshift case: After SRA, Noise Margin ≤ 8db				**PASS**
5. Downshift case: After SRA Noise Margin ≥ 4db				**PASS**
6. Upshift case: After SRA Bit Rate > Before SRA Bit Rate				**PASS**
7. Downshift case: After SRA Bit Rate < Before SRA Bit Rate				**PASS**
Notes about test implementation:				
1. To save space within the report, the values of bi map and gi map are not reported above.				
Comments on Test Results:				
None				

Test 5.4.4 SOS Test (Optional)

Test Number and Label							Result
5.4.4 – SOS Test (Optional)							**PASS**
Purpose: The purpose of this test is to verify that the optional OLR mechanism SOS is implemented according to the directions of Amendment 3 of ITU-T G.993.2. The test SHALL apply to the SOS functionality with enabled ROC (robust overhead channel).							
Results:							
Upstream				**Downstream**			
Noise	**REINIT**	**NDR_Beg**	**NDR_End**	**Noise**	**REINIT**	**NDR_Beg**	**NDR_End**
-130	**5000**	**6000**	**4500**	**-130**	**18000**	**21000**	**15000**
Test Metrics:							
1. No retrain SHALL occur during the test, after enabling SOS function.							**PASS**
2. NDR_SOS_BEG_DS > MIN-SOS-BR-ds							**PASS**
3. NDR_SOS_END_DS > 0.8*NDR_REINIT_DS							**PASS**
Notes about test implementation:							
1. For the following test configuration, the MIN-SOS-BR is configured to be greater than Min-NDR.							
Comments on Test Results:							
None							

Test 5.4.5 Bitswap to Zero-Bit-Loading Test

Test Number and Label					Result
5.4.5 –Bitswap to Zero-Bit-Loading Test					**PASS**
Purpose: 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.					
Results:					
Upstream			**Downstream**		
N-Tone	**N-Bits**	**ACTNDR-us**	**N-Tone**	**N-Bits**	**ACTNDR-ds**
14	**13**	**5000**	**90**	**14**	**20000**
Test Metrics:					
1. No retrain SHALL occur during the test.					**PASS**
2. The number of bits assigned to the affected tone before MOP(12) SHALL equal zero.					**PASS**
Notes about test implementation:					
None.					
Comments on Test Results:					
None					

Figure 11: Bitswap to Zero-Bit-Loading Upstream

Before Bitswap:

Figures omitted in sample report.

After Bitswap:

Figures omitted in sample report.

Figure 12: Bitswap to Zero-Bit-Loading Downstream

Before Bitswap:

Figures omitted in sample report.

After Bitswap:

Figures omitted in sample report.

Test 5.5 Loop Diagnostic Mode Test

Test Number and Label				Result
5.5 – Loop Diagnostic Mode Test				**PASS**
Purpose: The purpose of this test is to verify the functionality of the Loop Diagnostic mode. Loop Diagnostic mode is intended to identify channel conditions at both ends of the loop without transitioning to the L0 state. The modems SHALL return to L3 state after completion of the Loop Diagnostic mode.				
Results:				
	Diagnostic Requested by VTU-O		**Diagnostic Requested by VTU-R**	
	Upstream	**Downstream**	**Upstream**	**Downstream**
LATN	16 dB	15 dB	16 dB	15 dB
SATN	13 dB	15 dB	13 dB	15 dB
SNRM	6.2 dB	6.3 dB	6.2 dB	6.3 dB
ATTNDR	15000 kbps	55000	15000 kbps	55000
ACTATP	9.5 dBm	12 dBm	9.5 dBm	12 dBm
Test Metrics:				
1. The line returns to the L3 state				**PASS**
2. Line configuration parameter LDSF set to 0				**PASS**
3. The requirements for the line diagnostic parameters: Loop attenuation per band (LATN), Signal attenuation per band (SATN) and Signal-to-noise ratio margin per band (SNRM) apply within the specified ranges as specified in Section 7.5.1.9/10, 7.5.1.11/12 and 7.5.1.14/17 of G.997.1.				**PASS**
4. The requirements for the line diagnostic parameters: Attainable net data rate (ATTNDR) and Actual aggregate transmit power (ACTATP) apply within the specified ranges as specified in Section 7.5.1.19/20 and 7.5.1.24/25 of G.997.1.				**PASS**
5. The requirements for the linear channel characteristics function per subcarrier group: representation scale (HLINSC), group size (HLING) and an array of complex values in linear scale for Hlin(f) (HLINps) apply within the specified ranges as specified in Section 7.5.1.26.1-3 and 7.5.1.26.7-9 of G.997.1.				**PASS**
6. The requirements for the logarithmic channel characteristics function per subcarrier group: measurement time (HLOGMT), group size (HLOGG) and an array of real values in dB for Hlog(f) (HLOGps) apply within the specified ranges as specified in Section 7.5.1.26.4-6 and 7.5.1.26.10-12 of G.997.1.				**PASS**
7. The requirements for the Quiet line noise PSD per subcarrier group: measurement time (QLNMT), group size (QLNG) and an array of real values in dBm/Hz for QLN(f) (QLNps) apply within the specified ranges as specified in Section 7.5.1.27.1-3 and 7.5.1.27.4-6 of G.997.1.				**PASS**
8. The requirements for the Signal-to-noise ratio per subcarrier group: measurement time (SNRMT), group size (SNRG) and an array of real values in dB for SNR(f) (SNRps) apply within the specified ranges as specified in Section 7.5.1.28.1-3 and 7.5.1.28.4-6 of G.997.1.				**PASS**
Notes about test implementation:				
1. To save space within the report, the values of HLINSC, HLING, HLINps, HLOGMT, HLOGG, HLOGps, QLNMT, QLNG, QLNps, SNRMT, SNRG, SNRps are not reported above.				
Comments on Test Results:				
None				

Test 5.6 VTU-R Inventory Test

Test Number and Label			Result
5.6 – VTU-R Inventory Test			**PASS**
Purpose: The purpose of this test is to verify that the VTU-R inventory formatting is correct according to Section 7.4 of G.997.1 and the information contained within the fields is consistent with the equipment identification information provided by the equipment supplier to the test lab.			
Results:			
	Provided	**Reported**	
VTU-R Vendor ID	BB99'ABCD'7777	BB99'ABCD'7777	
VTU-R System Vendor ID	BB99'ABCD'7777	BB99'ABCD'7777	
VTU-R Version Number	V145TB	V145TB	
VTU-R Serial Number	ABCD12345	ABCD12345	
Test Metrics:			
1. VTU-R Vendor ID is correct as specified in Section 7.4.2/G.997.1 a. The T.35 country code (2 octets) is correct for the country of the vendor of the VTU-R VDSL2 Chipset. b. The T.35 provider code (vendor identification) (4 octets) correctly identifies the vendor of the VDSL2 Chipset.			**PASS**
2. VTU-R System Vendor ID is correct as specified in Section 7.4.4/G.997.1 a. The T.35 country code (2 octets) is correct for the country of the system integrator (VTU-R vendor). b. The T.35 provider code (vendor identification) (4 octets) correctly identifies VTU-R vendor. Note: System Vendor ID MAY be different from the Vendor ID.			**PASS**
(3) VTU-R version number is correct as specified in Section 7.4.6/G.997.1 a. It contains the VTU-R firmware version and the VTU-R model. Both SHALL be encoded in this order and separated by a space character, i.e. "<VTU-R firmware version> <VTU-R model>".			**PASS**
(4) VTU-R serial number is correct as specified in Section 7.4.8/G.997.1 a. It contains the equipment serial number, the equipment model and the equipment firmware version. All SHALL be encoded in this order and separated by space characters, i.e. "<equipment serial number> <equipment model> <equipment firmware version>".			**PASS**
Notes about test implementation:			
None			
Comments on Test Results:			
None			

Test 5.7.1 PSD Mask Test

Test Number and Label			Result
5.7.1 – PSD Mask Test			**PASS**
Purpose: The purpose of this test is to verify that the VTU-O and VTU-R power spectral density (PSD) mask in Showtime does not exceed the mask set forth by G.993.2. This measurement SHALL include both the passband and stopband frequencies.			
Results:			
Measurement	**Value**	**Measurement Frequency**	
1. Power Spectral Density (0dB @ 1MHz)	See plot	10 kHz to 35 MHz	
2. Power Spectral Density (5dB @ 1MHz)	See plot		
3. Power Spectral Density (10dB @ 1MHz)	See plot		
4. Power Spectral Density (15dB @ 1MHz)	See plot		
5. Power Spectral Density (20dB @ 1MHz)	See plot		
Test Metrics:			
1. Measured PSD mask SHALL comply with the requirements from Section 7.2.3/G.993.2 and SHALL not exceed the Limit PSD mask (LIMITMASK).			**PASS**
Notes about test implementation:			
1. The UNH-IOL has implemented a more advanced method of measuring the spectrum of an active DSL transceiver, without the need of disconnecting the transceiver from the loop. Further information can be found at the website.			
Comments on Test Results:			
None			

Figure 8: Measured Power Spectral Density with 0dB @ 1MHz loop
Figures omitted in sample report.

Figure 9: Measured Power Spectral Density with 5dB @ 1MHz loop
Figures omitted in sample report.

Figure 10: Measured Power Spectral Density with 10dB @ 1MHz loop
Figures omitted in sample report.

Figure 11: Measured Power Spectral Density with 15dB @ 1MHz loop
Figures omitted in sample report.

Figure 12: Measured Power Spectral Density with 20dB @ 1MHz loop
Figures omitted in sample report.

Test 5.7.2 Total ATP Test

Test Number and Label		Result
5.7.2 – Total ATP Test		**PASS**
Purpose: The purpose of this test is to verify that the DUT aggregate transmit power over the entire band falls under the limit specified in the relevant annex of G.993.2		
Results:		
Measurement	**Value**	**Measurement Frequency**
1. Aggregate Transmit Power (0dB @ 1MHz)	9 dBm	10 kHz to 35 MHz
2. Aggregate Transmit Power (5dB @ 1MHz)	9 dBm	
3. Aggregate Transmit Power (10dB @ 1MHz)	9 dBm	
4. Aggregate Transmit Power (15dB @ 1MHz)	9 dBm	
5. Aggregate Transmit Power (20dB @ 1MHz)	9 dBm	
Test Metrics:		
1. Measured aggregate transmit power SHALL not exceed the maximum aggregate downstream/upstream transmit power specified in Table 6-1/G.993.2.		**PASS**
Notes about test implementation:		
1. The ATP measurement is accomplished by integrating the PSD measurement over the frequency bands used for transmission by the transceiver.		
Comments on Test Results:		
None		

Test 5.7.3 RFI Notch Configuration Test

Test Number and Label			Result
5.7.3 – RFI Notch Configuration Test			**PASS**
Purpose: The purpose of this test is to verify the ability of VDSL2 transmitters to reduce the PSD of the transmitted signal to a level below -80dBm/Hz in 16 arbitrary frequency bands simultaneously. An example list of frequency bands is shown in Table 30. The data is sourced from ITU-T G.993.2 and T-Systems. First two RFI notches are in line with the specification from TR-100 (section A.1 and B.3.7).			
Results:			
Test Metric	**Value**	**Measurement Frequency**	
1. Power Spectral Density	See plot	10 KHZ TO 35 MHZ	
2. Aggregate Transmit Power	9 dBm		
Test Metrics:			
1. Measured PSD mask SHALL comply with the requirements from Section 7.2.3/G.993.2 and SHALL not exceed the Limit PSD mask (LIMITMASK).			**PASS**
Notes about test implementation:			
1. The UNH-IOL has implemented a more advanced method of measuring the spectrum of an active DSL transceiver, without the need of disconnecting the transceiver from the loop. Further information can be found at the website.			
Comments on Test Results:			
None			

Figure 13: Measured Power Spectral Density with RFI Notching Enabled
Figures omitted in sample report.

Test Number and Label				Result
5.7.4 – Downstream Power Back-off Test				**PASS**
Purpose: The purpose of this test is to verify the modified VTU-O transmit PSD mask based on the downstream power back-off configuration parameters and procedure described in section 7.3.1.2.13 in G.997.1.				
Results:				
Measurements		**Value**	**Measurement Frequency**	
DPBOESEL 10dB	PSD	See plot	10 kHz to 30 MHz	
	ATP	14 dBm		
DPBOESEL 20dB	PSD	See plot		
	ATP	13 dBm		
DPBOESEL 30dB	PSD	See plot		
	ATP	12 dBm		
DPBOESEL 40dB	PSD	See plot		
	ATP	13 dBm		
DPBOESEL 50dB	PSD	See plot		
	ATP	14 dBm		
DPBOESEL 60dB	PSD	See plot		
	ATP	14 dBm		
Test Metrics:				
1. Measured PSD mask SHALL comply with the requirements from Section 7.3.1.2.13/G.997.1 and SHALL not exceed the resultant mask (RESULTMASK).				**PASS**
2. VTU-O and VTU-R SHALL synchronize in all tested configurations.				**PASS**
Notes about test implementation:				
1. The UNH-IOL has implemented a more advanced method of measuring the spectrum of an active DSL transceiver, without the need of disconnecting the transceiver from the loop. Further information can be found at the website.				
Comments on Test Results:				
None				

Figure 14: Measured Power Spectral Density with DPBOSEL = 10dB
Figures omitted in sample report.

Figure 15: Measured Power Spectral Density with DPBOSEL = 20dB
Figures omitted in sample report.

Figure 16: Measured Power Spectral Density with DPBOSEL = 30dB
Figures omitted in sample report.

Figure 17: Measured Power Spectral Density with DPBOSEL = 40dB
Figures omitted in sample report.

Figure 18: Measured Power Spectral Density with DPBOSEL = 50dB
Figures omitted in sample report.

Figure 19: Measured Power Spectral Density with DPBOSEL = 60dB
Figures omitted in sample report.

Test 5.7.5 Upstream Power Back Off Test

Test Number and Label			Result
5.7.5 – Upstream Power Back-off Test			**PASS**
Purpose: The purpose of this test is to verify that the upstream power back-off (UPBO) mechanism in the VTU-R is implemented correctly according to the directions of section 7.2.1.3 in G.993.2 standard and that the VTU-R transmit signal in Showtime is adapted to conform to the upstream power backoff mask UPBOMASK(klo,f) while remaining below the transmit PSD mask limit communicated to the VTU-R at the beginning of initialization and within the limit imposed by the upstream PSD ceiling.			
Results:			
Measurements		**Value**	**Measurement Frequency**
0dB @ 1 MHz	PSD	See plot	10 kHz to 30 MHz
	ATP	-20 dBm	
	Reported Estimated kl0		
10dB @ 1 MHz	PSD	See plot	
	ATP	-18 dBm	
	Reported Estimated kl0		
20dB @ 1 MHz	PSD	See plot	
	ATP	-3 dBm	
	Reported Estimated kl0		
20dB @ 1 MHz kl0 = 15db	PSD	See plot	
	ATP	-11 dBm	
Test Metrics:			
1. Measured PSD mask SHALL comply with the requirements from Section 7.2.1.3.2/G.993.2 and SHALL not exceed the reference UPBO mask (UPBOMASK).			**PASS**
2. VTU-O and VTU-R SHALL synchronize in all tested configurations.			**PASS**
Notes about test implementation:			
1. The UNH-IOL has implemented a more advanced method of measuring the spectrum of an active DSL transceiver, without the need of disconnecting the transceiver from the loop. Further information can be found at the website.			
Comments on Test Results:			
None			

Figure 20: Measured Power Spectral Density with 0dB @ 1MHz loop and estimated kl0
Figures omitted in sample report.

Figure 21: Measured Power Spectral Density with 10dB @ 1MHz loop and estimated kl0
Figures omitted in sample report.

Figure 22: Measured Power Spectral Density with 20dB @ 1MHz loop and estimated kl0
Figures omitted in sample report.

Figure 23: Measured Power Spectral Density with 20dB @ 1MHz loop and kl0 = 15dB
Figures omitted in sample report.

Test 5.8 Longitudinal Conversion Loss Test

Test Number and Label			Result
5.8 – Longitudinal Conversion Loss Test			**PASS**
Purpose: The purpose of this test is to verify that the longitudinal conversion loss of the DUT meets the requirement specified in Broadband Forum WT-115.			
Results:			
Measurements	**Value**	**Measurement Frequency**	
Longitudinal balance	See plot	10 kHz to 30 MHz	
Test Metrics:			
1. Longitudinal Conversion Loss > 38 dB for f < 12MHz, and > 38dB – 20*log10(f/12MHz) for f > 12MHz			**PASS**
Notes about test implementation:			
None			
Comments on Test Results:			
None			

Figure 24: Measured Longitudinal Balance
Figures omitted in sample report.

Test 5.9 VTU-R INM

Test Number and Label	Result
Test 5.9- VTU-R INM	**PASS**

Purpose: The purpose of this test is to verify that the impulse noise monitoring (INM) function and associated control and configuration INM parameters are implemented correctly according to the directions of the G.993.2 (clauses 11.2.3.13, 11.3.4.3, 11.4.2.2) and G.997.1 standard (clauses 7.2.1.5, 7.3.1.9).

Results:

TEST	VTU-O			VTU-R		
	INPEQ - LFE	INMME - LFE	INMIAT – LFE	INPEQ -LFE	INMME - LFE	INMIAT – LFE
1	1	9	1	NA	NA	NA
2	2	8	2	1	9	1
3	3	7	3	2	8	2
4	4	6	4	3	7	3
5	5	5	5	4	6	4
6	6	4	6	5	5	5
7	7	3	7	6	4	6
8	8	2	8	7	3	7
9	9	1	9	8	2	8
10	0	0	0	9	1	9
11	1	9	3	0	0	0
12	2	8	2	1	3	1

Test Metrics:

1. No loss of synchronization SHALL occur during the application of the test impulses.	**PASS**
2. For Test sequence#3, the initial histograms INMINPEQ1..17-LFE and INMIAT0..7-LFE SHALL contain <= 2 events. The INMME-LFE counter SHALL be > 200000 and < 400000.	**PASS**
3. The increase of the the INMME-LFE counter between MOP(4) and MOP(6) SHALL be in the range of the expected result in Sections 5.9.1 to 5.9.7 for each test.	**PASS**
4. The increase of the event count in the INMINPEQ1..17-LFE histogram between MOP(4) and MOP(6) SHALL be equal to the expected result in Sections 5.9.1 to 5.9.7 for each test. A tolerance of +1/-0 on one of the bins SHALL be permitted to allow for unexpected impulse events occurring in the test environment during the test. sequence.	**PASS**
5. The increase of the event count in the INMIAT0..7-LFE histogram between MOP(4) and MOP(6) for each test SHALL equal to the expected result defined in Sections 5.9.1 to 5.9.7. A tolerance of +1/-0 on one of the bins SHALL be permitted to allow for unexpected impulse events occurring in the test environment during the test.	**PASS**
6. For Test sequence#1, the recorded values of INMIAT0..7-LFE and INMINPEQ1..17-LFE in MOP(8) SHALL be equal to the values recorded in MOP(6). A tolerance of +1/-0 on one of the bins SHALL be permitted to allow for unexpected impulse events occurring in the test environment during this step.The INMME-LFE count SHALL be ≥ INMME-LFE count recorded in MOP(6).	**PASS**

Notes about test implementation:

None.

Comments on Test Results:

None

Sequence 1

Test Sequence #1 INMINPEQ Histogram																	
Bin	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Initial																	
Final																	
Difference																	
Metric	25			25			0	25			0	25			0	0	25

Test Sequence #1 INMIAT Histogram								
Bin	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Initial								
Final								
Difference								
Metric	0	0	0	0	0	0	0	125

Sequence 2

Test Sequence #2 INMINPEQ Histogram																	
Bin	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Initial																	
Final																	
Difference																	
Metric	0	30			0	30			0	30			0	30			0

Test Sequence #2 INMIAT Histogram								
Bin	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Initial								
Final								
Difference								
Metric	0	0	0	0	0	0	0	120

Sequence 3

Test Sequence #3 INMINPEQ Histogram																	
Bin	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Initial																	
Final																	
Difference																	
Metric	240-2*q			q (q<=30)			0	0	0	0	0	0	0	0	0	0	0

Test Sequence #3 INMIAT Histogram								
Bin	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Initial								
Final								
Difference								
Metric	30-q		30	0	30	0	30	120

Sequence 4

Test Sequence #4 INMINPEQ Histogram																	
Bin	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Initial																	
Final																	
Difference																	
Metric	240			0	0	0	0	0	0	0	0	0	0	0	0	0	0

Test Sequence #4 INMIAT Histogram								
Bin	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Initial								
Final								
Difference								
Metric	0	30	0	30	0	30	0	150

Sequence 5

Test Sequence #5 INMINPEQ Histogram																	
Bin	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Initial																	
Final																	
Difference																	
Metric	240			0	0	0	0	0	0	0	0	0	0	0	0	0	0

Test Sequence #5 INMIAT Histogram								
Bin	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Initial								
Final								
Difference								
Metric	30	0	30	0	30	0	30	120

Sequence 6

Test Sequence #6 INMINPEQ Histogram																	
Bin	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Initial																	
Final																	
Difference																	
Metric	240			0	0	0	0	0	0	0	0	0	0	0	0	0	0

Test Sequence #6 INMIAT Histogram								
Bin	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Initial								
Final								
Difference								
Metric	0	30	0	30	0	30	0	150

Sequence 7

Test Sequence #7 INMINPEQ Histogram																	
Bin	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Initial																	
Final																	
Difference																	
Metric	240			0	0	0	0	0	0	0	0	0	0	0	0	0	0

Test Sequence #7 INMIAT Histogram								
Bin	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Initial								
Final								
Difference								
Metric	30	0	30	0	30	0	30	120

Sequence 8

Test Sequence #8 INMINPEQ Histogram																	
Bin	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Initial																	
Final																	
Difference																	
Metric	240			0	0	0	0	0	0	0	0	0	0	0	0	0	0

Test Sequence #8 INMIAT Histogram								
Bin	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Initial								
Final								
Difference								
Metric	0	30	0	30	0	30	0	150

Sequence 9

Test Sequence #9 INMINPEQ Histogram																	
Bin	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Initial																	
Final																	
Difference																	
Metric	240			0	0	0	0	0	0	0	0	0	0	0	0	0	0

Test Sequence #9 INMIAT Histogram								
Bin	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Initial								
Final								
Difference								
Metric	30	0	30	0	30	0	30	120

Sequence 10

Test Sequence #10 INMINPEQ Histogram																	
Bin	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Initial																	
Final																	
Difference																	
Metric	240			0	0	0	0	0	0	0	0	0	0	0	0	0	0

Test Sequence #310 INMIAT Histogram								
Bin	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Initial								
Final								
Difference								
Metric	0	30	0	30	0	30	0	150

Sequence 11

Test Sequence #11 INMINPEQ Histogram																	
Bin	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Initial																	
Final																	
Difference																	
Metric	0	0	120			0	0	60			0	0	0	0	0	0	0

Test Sequence #11 INMIAT Histogram								
Bin	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Initial								
Final								
Difference								
Metric	0	0	60	0	0	0	0	120

Sequence 12

Test Sequence #12 INMINPEQ Histogram																	
Bin	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Initial																	
Final																	
Difference																	
Metric	120			0	0	0	0	0	0	0	0	0	0	0	0	0	60

Test Sequence #12 INMIAT Histogram								
Bin	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Initial								
Final								
Difference								
Metric	0	0	0	60	0	0	0	120

Test 5.10 Dying Gasp Test

Test Number and Label	Result
Test 5.10- Dying Gasp Test	**PASS**
Purpose: The purpose of this test is to verify that Far-End Loss-of-Power failure is declared by the VTU-O after an occurrence of a FE-LPR primitive followed by contiguous near-end LOS defects, detected by the VTU-O.	
Results:	

State of System	LPR-FE failure Bit State
1.After first initialization	1
2. After CPE power is Disconnected	2
3. After Power is restored to CPE	3
4. After Loop is disconnected	4

Test Metrics:	
1. No LPR-FE failure is present at states 1,3 and 4	**PASS**
2. LPR-FE failure is declared by the VTU-O at state 2	**PASS**
Notes about test implementation:	
The noise in applied to VTU-R and VTU-O at the same time	
Comments on Test Results:	
None	

Section 6 – System Level Test

Test 6.1 64/65-Octet Encapsulation Far-End PTM-TC Performance Monitoring Test

Test Number and Label			Result
6.1 – 64/65-Octet Encapsulation Far-End PTM-TC Performance Monitoring Test			**PASS**
Purpose: The purpose of this test is to verify that the access node and CPE use the IEEE802.3 Clauses 30, 45 and 57 for retrieval and reporting at the access node of the 64/65-Octet Encapsulation Far-End PTM-TC Performance Monitoring counters.			
Results:			
	Initial Counter	**Final Counter**	
CRC-PFE	0	15	
CV-PFE	0	14	
Test Metrics:			
1. The VTU-R SHALL not lose sync with the VTU-O during the test			**PASS**
2. The test result SHALL consist of reporting at the Q-interface (i.e., at the Access Node) the following two Clause 30 OAM counters: a. CRC-PFE: Downstream TCCRCErrors counter (32-bit) b. CV-PFE: Downstream TCCodingViolations (32-bit)			**PASS**
3. The Clause 30 OAM counters SHALL be observed before and after errors are induced on the loop. The test is passed if the downstream TCCodingViolations counter changes because of the errors induced. The downstream TCCRCErrors counter MAY or MAY not change, depending on the impact of the errors induced on the received 64/65-octet encapsulation syntax.			**PASS**
Notes about test implementation:			
None			
Comments on Test Results:			
None			

Section 7 – Testing G.ploam Configuration Parameters and Performance Monitoring Counters

Test 7.1 Configuration Parameter MINSNRM

Test Number and Label				Result
7.1 – Configuration Parameter MINSNRM				**PASS**
Purpose: The purpose of this test is to verify that a link between VTU-R and VTU-O is dropped when the power of white noise is increased by 6 dBm.				
Results:				
MINSNRM	**TRGTSNRM**	**Upstream Initial SNRM**	**Downstream Initial SNRM**	**Retrain Observed**
5	9	9.2	9.8	**YES**
8	12	12.4	12.1	**YES**
Test Metrics:				
For all SNRM test conditions, the modem must retrain after the power of noise is increased by 6dBm				**PASS**
Notes about test implementation:				
The noise in applied to VTU-R and VTU-O at the same time				
Comments on Test Results:				
None				

Test 7.2 Configuration Parameter TARSNRM

Test Number and Label				Result
7.2 – Configuration Parameter TARSNRM				**PASS**
Purpose: The purpose of this test is to verify that a link between VTU-R and VTU-O is established only if SNR≥TARSNR – 2.				
Results:				
Iteration	**Upstream**		**Downstream**	
	Target SNR	**Recorded SNR**	**Target SNR**	**Recorded SNR**
1	6	12	6	22
2	6	12	6	22
3	6	12	6	22
Test Metrics:				
1. For Region A: Each reported SNR margin SHALL be ≥ (TARSNRM – 2 dB).				**PASS**
2. For Region B: Each reported SNR margin SHALL be ≥ (TARSNRM – 1 dB).				**PASS**
Notes about test implementation:				
None				
Comments on Test Results:				
None				

Test 7.3 PSD Mask Test

Test Number and Label			Result
7.3 – PSD Mask Test			**PASS**
Purpose: The purpose of this test is to verify that the DUT power spectral density falls under the MIBMASK and LMITMASK mask in the relevant annex of G.993.2			
Results:			
Test Metric	**Value**	**Measurement Frequency**	
1. PSD shall not exceed MIBMASK	See plot	10 kHz to 30 MHz	
2. PSD shall not exceed the LMITMASK	See plot		
Test Metrics:			
1. Measured PSD SHALL NOT exceed the MIB PSD mask (MIBMASK) and Limit PSD mask (LMITMASK), and SHALL comply with the requirements from Section 7.2.3/G.993.2.			**PASS**
Notes about test implementation:			
None			
Comments on Test Results:			
None			

Figure 25: Measured Power Spectral Density
Figures omitted in sample report.

Test 7.4 VDSL2 CARMASK Test

Test Number and Label	Result
7.4 – VDSL2-CARMASK Test	**PASS**
Purpose: The purpose of this test is to verify that the bits of disabled subcarriers are set to zero	
Results:	
See Plot.	
Test Metrics:	
The reported bits of disabled subcarriers BITSpsds and BITSpsus SHALL be set to 0.	**PASS**
Comments on Test Results	

Figure 29: CARMASK

Downstream:

Figures omitted in sample report.

Upstream

Figures omitted in sample report.

Test 7.5 MAXNOMATP Test

Test Number and Label				Result
7.5 – MAXNOMATP Test				**PASS**
Purpose: The purpose of this test is to verify that the DUT aggregate transmit power over the entire band falls under the limit specified in the relevant annex of G.993.2				
Results:				
Measurement	**Measured Value**	**VTU-O reported value**	**Configured Value**	**Measurement Frequency**
US Aggregate Transmit Power	5 dBm	5.1 dBm	5 dBm	10 kHz to 30MHz
DS Aggregate Transmit Power	7 dBm	7.3 dBm	7 dBm	10 kHz to 30MHz
Test Metrics:				
The measured power SHALL be lower than MAXNOMATP.				**PASS**
Notes about test implementation:				
None				
Comments on Test Results				
None				

Test 7.6 Monitoring Counters for Code Violations and Errored Seconds

Test Number and Label					Result
7.6 –Monitoring Counters for Code Violations and Errored Seconds					**PASS**
Purpose: The purpose of this test is to verify the performance monitoring counters CV and ES					
Results for Fast Profile:					
		Initial Value	**Final Value**	**Change in Value**	
VTU-O Side	CV-C	0	15	15	
	CV-CFE	0	14	14	
	ES-L	0	12	12	
	ES-LFE	0	12	12	
	SES-L	0	0	0	
	SES-LFE	0	0	0	
	UAS-L	10	10	0	
	UAS-LFE	10	10	0	
VTU-R Side	CV-C	5000	5015	15	
	ES-L	0	16	16	
	SES-L	0	0	0	
	UAS-L	0	0	0	
Results for Interleaved Profile:					
US INP	**DS INP**	**Initial Value**	**Final Value**	**Change in Value**	
2	3				
VTU-O Side	CV-C	0	15	15	
	CV-CFE	0	14	14	
	ES-L	0	12	12	
	ES-LFE	0	12	12	
	SES-L	0	0	0	
	SES-LFE	0	0	0	
	UAS-L	10	10	0	
	UAS-LFE	10	10	0	
VTU-R Side	CV-C	5000	5015	15	
	ES-L	0	16	16	
	SES-L	0	0	0	
	UAS-L	0	0	0	
Test Metrics:					
1. No loss of synchronization shall occur during the test.					**PASS**
2. No increase of SES-L, SES-LFE, UAS-L and UAS-LFE at the VTU-O SHALL be reported.					**PASS**
3. If available, no increase of SES-L and UAS-L at the VTU-R SHALL be reported.					**PASS**
4. The increase of CV-C counter at the VTU-R SHALL be equal to the increase of CV-CFE counter at the VTU-O.					**PASS**
5. The increase of CV-C counter at the VTU-R, as well as the increase of both CV-CFE and CV-C counters at the VTU-O, SHALL be at least equal to 15 and ≤ 35 for DS and ≤ 32 (31 for Interleaved profile) for US.					**PASS**
6. The increase of ES-L counter at the VTU-R SHALL be equal to the increase of ES-LFE counter at the VTU-O.					**PASS**
7. The increase of ES-L counter at the VTU-R, as well as the increase of both ES-LFE and ES-L counters at the VTU-O, SHALL be at least equal to 15 and ≤ 35 for DS and ≤ 32 (31 for Interleaved profile) for US.					**PASS**
Notes about test implementation:					
None					
Comments on Test Results:					
None					

Test 7.7 Performance Monitoring Counter for SES

Test Number and Label							Result
7.7 – Performance Monitoring Counter for SES							**PASS**
Purpose: The purpose of this test is to verify the performance monitoring counters SES							
Results For RA_F_150_150							
		Downstream			**Upstream**		
		Initial	**Final**	**Change**	**Initial**	**Final**	**Change**
VTU-O Side	SES-L	0	0	0	0	20	20
	SES-LFE	0	20	20	0	0	0
	UAS-L	0	0	0	0	0	0
	UAS-LFE	0	0	0	0	0	0
VTU-R Side	SES-L	0	20	20	0	0	0
	UAS-L	0	0	0	0	0	0
Results For RA_I_150_150							
		Downstream			**Upstream**		
		Initial	**Final**	**Change**	**Initial**	**Final**	**Change**
VTU-O Side	SES-L	0	0	0	0	20	20
	SES-LFE	0	20	20	0	0	0
	UAS-L	0	0	0	0	0	0
	UAS-LFE	0	0	0	0	0	0
VTU-R Side	SES-L	0	20	20	0	0	0
	UAS-L	0	0	0	0	0	0
Test Metric:							
1. No loss of synchronization SHALL occur during the test.							**PASS**
2. No increase of UAS-L and UAS-LFE at the VTU-O SHALL be reported.							**PASS**
3. If available, no increase of and UAS-L at the VTU-R SHALL be reported.							**PASS**
4. The increase of SES-L counter at the VTU-R SHALL be equal to the increase of SES-LFE counter at the VTU-O.							**PASS**
5. The increase of SES-L counter at the VTU-R, as well as the increase of SES-LFE counter at the VTU-O, SHALL be at least equal to 15 and less than 30(Downstream)							**PASS**
6. The increase of SES-L counter at the VTU-O SHALL be at least equal to 15 and less than 30(Upstream)							**PASS**
Notes about test implementation:							
Test metric #5 from the TR-115 Functionality test plan was broken down into two parts, the upstream and the downstream for easier interpretation of the results.							
Comments on Test Results:							
None							

Test 7.8 Performance Monitoring Counter for UAS

Test Number and Label					Result
7.8 – Performance Monitoring Counter for Unavailable Seconds (UAS)					**PASS**
Purpose: The purpose of this test is to verify the performance monitoring counters UAS					
Results:					
		Initial Value	**Final Value**	**Change in Value**	**Disconnect + train up time**
VTU-O Side	UAS-L	0	100	100	100
	UAS-LFE	0	100	100	
VTU-R Side	UAS-L	0	100	100	
Test Metrics:					
1. Change in UAS-L at the VTU-O SHALL not differ from the train up time by more than 10s.					**PASS**
2. If available, change in UAS-L at the VTU-R SHALL not differ from the train up time by more than 10s.					**PASS**
3. Change in UAS-LFE at the VTU-O SHALL not differ from the train up time by more than 14s.					**PASS**
4. If available, change in UAS-L at the VTU-R SHALL not differ from the change of UAS-LFE at the VTU-O by more than 13s.					**PASS**
Notes about test implementation:					
None					
Comments on Test Results:					
None					

Test 7.9 Performance Monitoring Counters for Full initialization and Failed Full initialization

Test Number and Label			Result
7.9 – Performance Monitoring Counters for Full initialization and Failed Full initialization			**PASS**
Purpose: The purpose of this test is to verify the performance monitoring counters FI and FFI			
Results:			
	Initial Value	**Final Value**	**Change in Value**
Full initialization	**0**	**30**	**20**
Failed full initialization	**0**	**20**	**30**
Test Metric:			
1. The increase of the Full initialization count SHALL be equal to 5 or greater.			**PASS**
2. The difference between the increase of Full initialization count and the increase of Failed full initialization count SHALL be equal to 5.			**PASS**
3. The increase of the Failed Full initialization count Shall be equal to 5 or greater.			**PASS**
Notes about test implementation:			
None			
Comments on Test Results:			
None			

Test 7.10 Inhibition of Performance Monitoring Counters

Test Number and Label	Result
7.10 – Inhibition of Performance Monitoring Counters	**PASS**

Purpose: The 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].

Results For RA_F_150_150

		Initial	Tburst 2	Change1	Tburst 2	Single Interrupt	Change2
VTU-O Side	CV-C	0	1	1	5	7	9
	CV-CFE	0	2	2	5	9	8
	ES-L	0	2	2	4	5	7
	ES-LFE	0	3	3	5	1	6
	SES-L	0	5	5	4	3	5
	SES-LFE	0	6	6	8	2	4
	LOSS-L	0	7	7	9	8	3
	LOSS-LFE	0	8	8	6	4	2
VTU-R Side	CV-C	0	9	9	2	9	1
	ES-L	0	1	1	4	5	2
	SES-L	0	5	5	3	7	3
	LOSS-L	0	6	6	5	6	4

Results For RA_I_150_150

		Single Interrupt	Tburst 15	Change3
VTU-O Side	CV-C	1	5	1
	CV-CFE	2	3	2
	ES-L	3	2	3
	ES-LFE	4	1	4
	SES-L	5	2	5
	SES-LFE	6	3	6
	LOSS-L	4	4	7
	LOSS-LFE	5	5	8
VTU-R Side	CV-C	6	6	9
	ES-L	7	7	1
	SES-L	8	8	2
	LOSS-L	9	9	3

Test Metric on next Page

Test Metric:	
1. VTU-R Change1 SES-L counter SHALL be ≥ 2 and ≤ 3. If the increase of SES-L is 3, the increase of CV-C counter SHALL be ≤ 1. If the increase of SES-L is 2, the increase of the CV-C counter SHALL be < 18 * 32 + 1.	**PASS**
2. VTU-R Change1 ES-L SHALL be ≥2 and ≤ 4.	**PASS**
3. VTU-R Change2 LOSS-L SHALL be ≥1 and ≤ 2.	**PASS**
4. VTU-R Change3 ES-L SHALL be ≤ 2.	**PASS**
5. VTU-R Change3 SES-L and LOSS-L SHALL be equal to zero.	**PASS**
6. VTU-O Change1 SES-LFE SHALL be ≥ 2 and ≤ 3. If the increase of SES-LFE is 3, the increase of CV-CFE SHALL be ≤ 1. If the increase of SES-LFE is 2, the increase of the CVE-CFE SHALL be < 18 * 32 + 1.	**PASS**
7. VTU-O Change1 ES-LFE SHALL be ≥2 and ≤ 4.	**PASS**
8. VTU-O Change2 LOSS-LFE SHALL be ≥1 and ≤ 2.	**PASS**
9. VTU-O Change3 ES-LFE SHALL be ≤ 2.	**PASS**
10. VTU-O Change3 SES-LFE and LOSS-LFE SHALL be equal to zero.	**PASS**
Notes about test implementation:	
None.	
Comments on Test Results:	
None	

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