

Essential Requirements
For
DSL Family

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1. Scope

This document describes the essential requirements for **DSL family (ADSL/ADSL2+/ VDSL/VDSL2 technology based RT-remote terminals and COT/DSLAM)** under Mandatory Testing & Certification of Telecommunication Equipment (MTCTE) notified by Government of India vide Gazette Notification no. G.S.R. 113 (E) dated 5th September 2017.

Table I: List of products and product variants										
Division: FA										
Varients → Product s ↓	Variant1	Variant2	Variant3	Variant4	Variant5	Variant6	Variant7	Variant8	Variant9	Variant10
NT (Copper Modem)	NT ADSL (Splitter)	NT ADSL (Splitterless)	NT ADSL2+ (Splitter)	NT ADSL 2+ (Splitterless)	NT VDSL (Splitter)	NT VDSL Splitterless	NT VDSL2 (Splitter)	NT VDSL 2 (Splitterless)	NT G.HN	NT G.FAST
DSLAM / COT										
OMSA N										

2. EMI/EMC Requirements

The equipment shall conform to the EMC requirements as per the following standards and limits indicated therein.

Sr. No.	Test Parameter	Test Result
i)	<p>Conducted and radiated emission (applicable to telecom equipment): Name of EMC Standard: "CISPR 22 (2008) - Limits and methods of measurement of radio disturbance characteristics of Information Technology Equipment". Limits:-</p> <ul style="list-style-type: none"> i. To comply with Class B of CISPR 22 (2008). ii. The values of limits shall be as per TEC Standard No. TEC/SD/DD/EMC-221/05/OCT-16. iii. For Radiated Emission tests, limits below 1 GHz shall be as per Table 4 (a1) (for Class B) or 5 (a1) (for Class A) for measuring distance of 3m. <p style="text-align: center;">OR</p> <p>Name of EMC Standard: "CISPR 32 (2015) - Electromagnetic compatibility of multimedia equipment - Emission requirements"</p> <ul style="list-style-type: none"> i. To comply with Class B of CISPR 32 (2015). ii. For Radiated Emission tests, limits below 1 GHz shall be for measuring distance of 3m. <p><i>Note: Test Reports as per limits of CISPR 22 (2008) mentioned above shall be acceptable only upto March 31, 2019.</i></p>	<p>Test results from Designated CAB of TEC to be submitted for compliance.</p>
ii)	<p>Immunity to Electrostatic discharge: Name of EMC Standard: IEC 61000-4-2 {2008} "Testing and measurement techniques of Electrostatic discharge immunity test".</p> <p>Limits: -</p> <ul style="list-style-type: none"> i) Contact discharge level 2 {± 4 kV} or higher voltage; ii) Air discharge level 3 {± 8 kV} or higher voltage; <p>Performance Criteria shall be as per Table 1 under Clause 6 of TEC Standard No. TEC/SD/DD/EMC-221/05/OCT-16.</p> <p>Applicable Performance Criteria shall be as per Table 3 under Clause 7.2 of TEC Standard No. TEC/SD/DD/EMC-221/05/OCT-16</p>	<p>Test results from Designated CAB of TEC to be submitted for compliance.</p>
iii)	<p>Immunity to radiated RF: Name of EMC Standard: IEC 61000-4-3 (2010) "Testing and measurement techniques-Radiated RF Electromagnetic Field Immunity test" Limits: -</p>	<p>Test results from Designated CAB of TEC to be submitted for compliance.</p>

	<p>i) Under Test level 2 {Test field strength of 3 V/m} for general purposes in frequency range 80 MHz to 1000 MHz and</p> <p>ii) Under test level 3 (10 V/m) for protection against digital radio telephones and other RF devices in frequency ranges 800 MHz to 960 MHz and 1.4 GHz to 6.0 GHz.</p> <p>For Telecom Terminal Equipment without Voice interface (s) Under Test level 2 {Test field strength of 3 V/m} for general purposes in frequency range 80 MHz to 1000 MHz and for protection against digital radio telephones and other RF devices in frequency ranges 800 MHz to 960 MHz and 1.4 GHz to 6.0 GHz.</p> <p>Performance Criteria shall be as per Table 1 under Clause 6 of TEC Standard No. TEC/SD/DD/EMC-221/05/OCT-16.</p> <p>Applicable Performance Criteria shall be as per Table 3 under Clause 7.2 of TEC Standard No. TEC/SD/DD/EMC-221/05/OCT-16</p>	
iv)	<p>Immunity to fast transients (burst): Name of EMC Standard: IEC 61000- 4- 4 {2012) "Testing and measurement techniques of electrical fast transients/burst immunity test"</p> <p>Limits: - Test Level 2 i.e. a) 1 kV for AC/DC power lines; b) 0. 5 kV for signal / control / data / telecom lines;</p> <p>Performance Criteria shall be as per Table 1 under Clause 6 of TEC Standard No. TEC/SD/DD/EMC-221/05/OCT-16.</p> <p>Applicable Performance Criteria shall be as per Table 3 under Clause 7.2 of TEC Standard No. TEC/SD/DD/EMC-221/05/OCT-16.</p>	Test results from Designated CAB of TEC to be submitted for compliance.
v)	<p>Immunity to surges: Name of EMC Standard: IEC 61000-4-5 (2014) "Testing & Measurement techniques for Surge immunity test"</p> <p>Limits: - i) For mains power input ports: (a) 1.0 kV peak open circuit voltage for line to ground coupling; (b) 0.5 kV peak open circuit voltage for line to line coupling; (c) 4.0 kV peak open circuit voltage for line to ground coupling; (d) 2.0 kV peak open circuit voltage for line to line coupling ii) For telecom ports: (a) 1.0 kV peak open circuit voltage for line to ground; (b) 0.5 KV peak open circuit voltage for line to line coupling; (c) 4.0 kV peak open circuit voltage for line to ground; (d) 2.0 KV peak open circuit voltage for line to line coupling.</p> <p>Performance Criteria shall be as per Table 1 under Clause 6 of TEC Standard No. TEC/SD/DD/EMC-221/05/OCT-16.</p> <p>Applicable Performance Criteria shall be as per Table 3 under Clause 7.2 of TEC Standard No. TEC/SD/DD/EMC-221/05/OCT-16.</p>	Test results from Designated CAB of TEC to be submitted for compliance.

vi)	<p>Immunity to conducted disturbance induced by Radio frequency fields: Name of EMC Standard: IEC 61000-4-6 (2013) with amendment 1 (2004) & amendment 2 (2006) "Testing & measurement techniques-Immunity to conducted disturbances induced by radio- frequency fields"</p> <p>Limits:- Under the test level 2 {3V r.m.s.} in the frequency range 150 kHz-80 MHz for AC / DC lines and Signal /Control/telecom lines.</p> <p>Performance Criteria shall be as per Table 1 under Clause 6 of TEC Standard No. TEC/SD/DD/EMC-221/05/OCT-16.</p> <p>Applicable Performance Criteria shall be as per Table 3 under Clause 7.2 of TEC Standard No. TEC/SD/DD/EMC-221/05/OCT-16.</p>	<p>Test results from Designated CAB of TEC to be submitted for compliance.</p>
vii)	<p>Immunity to voltage dips & short interruptions (applicable to only ac mains power input ports, if any): Name of EMC Standard: IEC 61000-4-11 (2004) "Testing & measurement techniques- voltage dips, short interruptions and voltage variations immunity tests"</p> <p>Limits:-</p> <ul style="list-style-type: none"> i. a voltage dip corresponding to a reduction of the supply voltage of 30% for 500ms (i.e. 70 % supply voltage for 500ms) ii. a voltage dip corresponding to a reduction of the supply voltage of 60% for 200ms; (i.e. 40% supply voltage for 200ms) iii. a voltage interruption corresponding to a reduction of supply voltage of > 95% for 5s. iv. a voltage interruption corresponding to a reduction of supply voltage of >95% for 10ms. <p>Performance Criteria shall be as per Table 1 under Clause 6 of TEC Standard No. TEC/SD/DD/EMC-221/05/OCT-16.</p> <p>Applicable Performance Criteria shall be as per Table 3 under Clause 7.2 of TEC Standard No. TEC/SD/DD/EMC-221/05/OCT-16</p>	<p>Test results from Designated CAB of TEC to be submitted for compliance.</p>
viii)	<p>Immunity to voltage dips & short interruptions (applicable to only DC power input ports, if any): Name of EMC Standard: IEC 61000-4-29:2000: Electromagnetic compatibility (EMC) - Part 4-29: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests</p> <p>Limits:</p> <ul style="list-style-type: none"> i. Voltage Interruption with 0% of supply for 10ms. Applicable Performance Criteria shall be B. ii. Voltage Interruption with 0% of supply for 30ms, 100ms, 300ms and 1000ms. Applicable Performance Criteria shall be C. 	<p>Test results from Designated CAB of TEC to be submitted for compliance.</p>

	<ul style="list-style-type: none">iii. Voltage dip corresponding to 40% & 70% of supply for 10ms, 30 ms. Applicable Performance Criteria shall be B.iv. Voltage dip corresponding to 40% & 70% of supply for 100ms, 300 ms and 1000 ms. Applicable Performance Criteria shall be C.v. Voltage variations corresponding to 80% and 120% of supply for 100 ms to 10s as per Table 1c of IEC 61000-4-29. Applicable Performance Criteria shall be B.	
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3. Safety Requirements

Sr. No	Requirements	Test Result
i.	The equipment shall conform to IS 13252 parts 1:(2010) “information technology Equipment Safety Part 1: General Requirements {equivalent to IEC 60950-1 (2005)}. The manufacturer/supplier shall submit a certificate in respect of compliance to these requirements.	Test results from Designated CAB of TEC to be submitted for compliance.

4. Technical Requirements

Refer Table II, III & IV for Essential Requirements of Fixed Access Division.

Table II: List of interfaces for products/ variants						
Division: FA						
Product → Interfaces ↓	OMSAN	DSLAM	NT ADSL/ADSL 2+	NT VDSL/VDSL 2	NT G.HN	NT G.FAST
2 Wires (POTS)		Y	Y	Y	Y	Y
10 Ethernet Electrical	Y	Y	Y	Y	Y	Y
100 Ethernet Electrical	Y	Y	Y	Y	Y	Y
1000 Ethernet Electrical	Y	Y	Y	Y	Y	Y
WI-FI (single band)			Y	Y	Y	Y
WI-FI (dual band)			Y	Y	Y	Y
USB	Y	Y	Y	Y	Y	Y
RF Video	Y				Y	Y
ADSL2+	Y	Y	Y			
VDSL/VDSL2/VDSL2 vectoring/VPLUS	Y	Y		Y		
G.Fast	Y	Y				Y
G.hn	Y	Y			Y	
1G Ethernet Optical	Y	Y				
10G Ethernet Optical	Y	Y				
PON port	Y	Y				

Table III**Table III.(A)**

Applicable to→ Test Parameter↓	10 Base T Ethernet	10/100 Base T Ethernet	10/100/1000 Base T Ethernet	1000 Base LX, SX (Gigabit Ethernet) Interface	10 GE interface (SR/LR/ER)	40 GE base (SR4/LR 4)	100 GE (SR10/L R4/ER4)	FE or 100 Base (FX/SX/ LX)
Auto negotiation Ethernet Interface	Functional Lab Test	Functional Lab Test	Functional Lab Test					
Differential output Voltage	Refer 14.3.1.2.1 IEEE 802.3 section 1	Refer 23.5.1.2.1 IEEE 802.3 section 2	Refer 40.6.1.2.1 IEEE 802.3 section 3					
Receiver Differential input impedance	Refer 14.3.1.3.4 IEEE 802.3 section 1	Refer 23.5.1.3.3 IEEE 802.3 section 2						
Output timing Jitter	Refer 14.3.1.2.3 IEEE 802.3 section 3	Refer 23.5.1.2.5 IEEE 802.3 section 3	Refer 40.6.1.2.6 IEEE 802.3 section 3					
Mean Launch power				Refer cl. 38.3.1 for SX and 38.4.1 for LX of IEEE	Refer table 52-7 for SR, 52-12 for LR & 52-16 for ER of IEEE 802.3ae	Refer table 86-6 for SR4 and 87-7 for LR4 of	Refer table 86-6 for SR10, 88-7 for LR4/ER4 of	IEEE 802.3au

				802.3z section-3		IEEE 802.3ba	IEEE 802.3ba	
Wavelength /Spectrum /Extinction Ratio				Refer 38.3.1 for SX and 38.4.1 for LX of IEEE 802.3z section-3	Refer table 52-7 for SR, 52-12 for LR & 52-16 for ER of IEEE 802.3ae	Refer table 86-6 for SR4 and 87-7 for LR4 of IEEE 802.3ba	Refer table 86-6 for SR10, 88-7 for LR4/ER4 of IEEE 802.3ba	IEEE 802.3au
Receiver Sensitivity				Refer 38.3.2 for SX and 38.4.2 for LX of IEEE 802.3z section-3	Refer table 52-9 for SR, 52-13 for LR & 52-17 for ER of IEEE 802.3ae	Refer table 86-8 for SR4 and 87-8 for LR4 of IEEE 802.3ba	Refer table 86-8 for SR10, 88-8 for LR4/ER4 of IEEE 802.3ba	IEEE 802.3au
Through put test	RFC 2544	RFC 2544	RFC 2544	RFC 2544	RFC 2544	RFC 2544	RFC 2544	RFC 2544
Addressing IPv4	RFC 791	RFC 791	RFC 791	RFC 791	RFC 791	RFC 791	RFC 791	RFC 791
Addressing IPv6	RFC 2460	RFC 2460	RFC 2460	RFC 2460	RFC 2460	RFC 2460	RFC 2460	RFC 2460

Table III. (B)

Applicable to→ Test Parameter↓	64 Kbps	2 Mbps (E12)	8 Mbps (E22)	34 Mbps (E31)	45 Mbps (E32)	140 Mbps (E4)	STM-1 electrical
Nominal Bit Rate with Tolerance	G.703	G.703	G.703	G.703	G.703	G.703	G.703
Pulse Shape	G.703	G.703	G.703	G.703	G.703	G.703	G.703
Operating Wavelength range							
Input Port Return loss	G.703	G.703	G.703	G.703	G.703	G.703	G.703
Output Jitter	G.703	G.823	G.823	G.823	G.824	G.823	G.825
Input Port Jitter Tolerance	G.823	G.823	G.823	G.823	G.824	G.823	G.825
DC Power					G.703		
Mean Launched power							
Receiver Sensitivity							
Receiver Overload							
Addressing IPv4	RFC 791	RFC 791	RFC 791	RFC 791	RFC 791	RFC 791	RFC 791
Addressing IPv6	RFC 2460	RFC 2460	RFC 2460	RFC 2460	RFC 2460	RFC 2460	RFC 2460

Table III (C)

Applicable to→ Test Parameter↓	GPON	EPON	XGPON	XGSPON	WDMPON	NGPON2	WDM couplers	RF Video
Optical power @ OLT	G.984.2	IEEE 802.3ah	G.987.2	G.9807.1	G.694.1	G.989.2		
Sensitivity @OLT	G.984.2	IEEE 802.3ah	G.987.2	G.9807.1	G.694.1	G.989.2		
Optical power @ ONT	G.984.2	IEEE 802.3ah	G.987.2	G.9807.1	G.694.1	G.989.2		
Sensitivity @ONT	G.984.2	IEEE 802.3ah	G.987.2	G.9807.1	G.694.1	G.989.2		
Wavelength Tx	G.984.2	IEEE 802.3ah	G.987.2	G.9807.1	G.694.1	G.989.2		
Wavelength Rx	G.984.2	IEEE 802.3ah	G.987.2	G.9807.1	G.694.1	G.989.2		
Protocol	Ethernet over GEM G.984.2		G.987.2 X-GEM	G.9807.1 X-GEM	G.698.3	G.989.2		
Line testing	IEEE 802.3ah	IEEE 802.3ah	IEEE 802.3ah	IEEE 802.3ah	IEEE 802.3ah	IEEE 802.3ah		
Through put test	G.984.1 RFC 2544	RFC 2544	G.987.1 RFC 2544	G.9807.1 RFC 2544	RFC 2544	G.989.2 RFC 2544		
RF video o/p Bandwidth								52+/- 870MHz
RF O/P level								14dBmV
RF O/P tilt								0dB
Addressing IPv4	RFC 791	RFC 791	RFC 791	RFC 791	RFC 791	RFC 791	RFC 791	RFC 791
Addressing IPv6	RFC 2460	RFC 2460	RFC 2460	RFC 2460	RFC 2460	RFC 2460	RFC 2460	RFC 2460

Table III (D)

Product → Interfaces ↓	2 Wires (POTS)	WI-FI (single band)	WI-FI (dual band)	USB	G.fast	G.hn
Longitudinal/ Transverse Conversion Loss/ (Impedance Unbalance about earth)	Q.552 (CI 2.1.2)					
Return loss	Q.552 (CI 2.1.1.2)					
Over voltage/over current protection	K.21					
Max loop current	ETSI EN 300 001(<60mA)					
Idle state current	ETSI EN 300 001(<60mA)					
Insulation test	ETSI EN 300 001(<60mA)					
Compliance		Certificate for Conformance to IEEE 802.11a/b/g/n/ac				
Frequency of operation		NFAP	NFAP			
EIRP		NFAP	NFAP			
Compliance certificate		For 2.4Ghz: ETSI EN 300 328 For 5Ghz: ETSI EN 301 893				
PSD						G.9964
Profile					106Mhz G.9700	G.9960 (CI 6)

PPPoE					RFC 2516	
PVC					Support	
VPI/VCI					Support	
Loop resistance					EN 300 001	
Insulation resistance					>= 5 Mega ohms	
Impulse noise protection					Better than 2	
Through put test					500Mbps @100m @ 0.5mm copper	
Addressing IPv4	RFC 791	RFC 791	RFC 791	RFC 791	RFC 791	RFC 791
Addressing IPv6	RFC 2460	RFC 2460	RFC 2460	RFC 2460	RFC 2460	RFC 2460

Table III (E)

Product → Interfaces ↓	ADSL	ADSL Lite (G.lite)	ADSL (G.dmt)	ADSL over POTS	ADSL over ISDN	RE-ADSL2	ADSL2	Splitterless ADSL2	ADSL2+	ADSL2+M	VDSL	VDSL2	VDSL2 (Vectoring)	VDSL2 Annex QV Plus/35b
standard	ANSI T1.413- Issue 2	ITU G.992.2	ITU G.992.1	ITU G.992.1 Annex A	ITU G.992.1 Annex B	ITU G.992.3 Annex L	ITU G.992.3	ITU G.992.4	ITU G.992.5	ITU G.992.5 Annex M	ITU G.993.1 & ETSI TS 101 270-1 V1.2.1	ITU G.993.2	ITU G.993.5	ITU G.993.2 Amendment 1 (11/15)
Downstream rate	8.0 Mbit/s	1.5 Mbit/s	8.0 Mbit/s	8.0 Mbit/s	8.0 Mbit/s	5.0 Mbit/s	13.0 Mbit/s	1.5 Mbit/s	24.0 Mbit/s	24.0 Mbit/s	55 Mbit/s	125 Mbit/s (998ADE17)	125 Mbit/s (998ADE17)	300 Mbit/s (998ADE35)
Upstream rate	1.0 Mbit/s	0.5 Mbit/s	1.1 Mbit/s	1.1 Mbit/s	1.5 Mbit/s	0.8 Mbit/s	1.1 Mbit/s	0.5 Mbit/s	1.2 Mbit/s	2.6 Mbit/s	3 Mbit/s	60 Mbit/s	60 Mbit/s	60 Mbit/s
PSD		ITU G.992.2 annexII	G.992.1(annex- A)	G.992.1(annex- A)	G.992.1(annex- A)		G.992.3		G.992.5		G.993.1 (cl 6.2)	G.993.2 (cl 7.2) – Annex A,B&C	G.993.2 (cl 7.2) – Annex A,B&C	G.993.2 (cl 7.2) – Annex A,B&C
Transmitted power at xTU-C		ITU G.992.2 (cl 7.10.1)		20.4 dBm	19.9 dBm	18.8 dBm	20.4 dBm		20.4 dBm	19.3 dBm	11.5 dBm	14.5 dBm	14.5 dBm	17.0 dBm
Transmitted power at ATU-C With splitter									+20.4 dBm					
Transmitted power at xTU-R With splitter				12.5 dBm	13.3 dBm	12.5 dBm	12.5 dBm		+12.5 dBm	12.5 dBm		14.5 dBm	14.5 dBm	14.5 dBm

Transmitted power at ATU-C With ISDN									19.9 dBm					
Transmitted power at ATU-R With ISDN									13.8 dBm					
Line port impedance									135 ohm		135 ohm	135 ohm		
Longitudinal balance									G.992.5 (cl A.4.3.3.1)		55dB(lower frequency) 43dB(higher frequency)	G.993.2(c l 7.4)	G.993.2(c l 7.4)	G.993.2(c l 7.4)
Insertion loss									G.992.3 (cl E.4.3.3.1)					
Return Loss									14 dB		G.993.1(c l 6.5)			
Profile												G.993.2(c l 7.2)	G.993.2(c l 7.2)	35b
PPPoE	RFC 2516	RFC 2516	RFC 2516	RFC 2516	RFC 2516	RFC 2516	RFC 2516	RFC 2516	RFC 2516	RFC 2516	RFC 2516	RFC 2516	RFC 2516	RFC 2516
PVC	Support	Support	Support	Support	Support	Support	Support	Support	Support	Support	Support	Support	Support	Support
VPI/VCI	Support	Support	Support	Support	Support	Support	Support	Support	Support	Support	Support	Support	Support	Support
Loop resistance	EN 300 001	EN 300 001	EN 300 001	EN 300 001	EN 300 001	EN 300 001	EN 300 001	EN 300 001	EN 300 001	EN 300 001	EN 300 001	EN 300 001	EN 300 001	EN 300 001
Insulation resistance	>= 5 Mega ohms	>= 5 Mega ohms	>= 5 Mega ohms	>= 5 Mega ohms	>= 5 Mega ohms	>= 5 Mega ohms	>= 5 Mega ohms	>= 5 Mega ohms	>= 5 Mega ohms	>= 5 Mega ohms	>= 5 Mega ohms	>= 5 Mega ohms	>= 5 Mega ohms	>= 5 Mega ohms

Impulse noise protection	Better than 2	Better than 2	Better than 2	Better than 2	Better than 2	Better than 2	Better than 2	Better than 2	Better than 2	Better than 2	Better than 2	Better than 2	Better than 2	Better than 2
Addressing IPv4	RFC 791	RFC 791	RFC 791	RFC 791	RFC 791	RFC 791	RFC 791	RFC 791	RFC 791	RFC 791	RFC 791	RFC 791	RFC 791	RFC 791
Addressing IPv6	RFC 2460	RFC 2460	RFC 2460	RFC 2460	RFC 2460	RFC 2460	RFC 2460	RFC 2460	RFC 2460	RFC 2460	RFC 2460	RFC 2460	RFC 2460	RFC 2460

Note: Wherever RFC are referred, only 'shall' clauses given in the RFCs should be tested against the parameter referred in this ER.

Table IV-A for ADSL/ADSL2+ equipment

Applicable to→ Test Parameter↓	Standard	ADSL- COT	ADSL- RT With splitter	ADSL- RT: splitterless	ADSL2+ COT	ADSL2+ RT With splitter	ADSL2+ RT: splitterless	Remarks
ATU-R and ATU-C shall support the following DSL encapsulations- a) RFC 2364 PPP over ATM AAL5 (PPPoA)	RFC 2364				Y	Y	Y	
ATU-R and ATU-C shall support the following DSL encapsulations- a) RFC 2516 PPP over Ethernet relay (PPPoE)	RFC 2516				Y	Y	Y	
ATU-R and ATU-C shall support the following DSL encapsulations- a) RFC 1483 bridge mode.	RFC 1483				Y	Y	Y	
Impedance	ETSI standard TS 101 952-1		Y			Y		600ohms
Return loss	ETSI standard TS 101 952-1		Y			Y		The return loss of Tele port and line port against 600 Ohms shall be as follows: <ul style="list-style-type: none"> • 200Hz-1500Hz = 11dB • 1500Hz-2000Hz =10 dB • 2000Hz-3400Hz =9 dB
Insertion Loss:	ETSI standard TS 101 952-1		Y			Y		The tele-port to Line port insertion loss for 600 ohms <0.3 db at1KHz
Delay distortion	ETSI standard		Y			Y		delay distortion caused by POTS splitter shall be:

	TS 101 952-1							<ul style="list-style-type: none"> From 0.6-3.2 kHz delay distortion shall be 200 micro-second. From 0.2-4.0kHz delay distortion shall be 250 micro-second.
Isolation:	ETSI standard TS 101 952-1		Y			Y		<p>Isolation resistance between tip and ring and between earth is 10 Mega-ohms.</p> <p>Isolation resistance with line port is 10 Mega-ohms.</p>
Longitudinal balance of POTS splitter:	ETSI standard TS 101 952-1		Y			Y		The balance shall be greater than 58 dB for frequency between 200 Hz-1 kHz with a straight line-level decreasing to 53 dB at 3 kHz.
Signal Power:	ETSI standard TS 101 952-1		Y			Y		<p>Maximum peak signal power in 200-4000Hz shall be</p> <p>Loop current shall be <63mA.</p>

Note: Wherever RFC are referred, only ‘shall’ clauses given in the RFCs should be tested against the parameter referred in this ER.

Table IV-B for VDSL/VDSL2 equipment

Applicable to→ Test Parameter↓	Standard	VDSL- COT	VDSL- RT With splitter	VDSL- RT: splitterless	VDSL2- COT	VDSL2 - RT With splitter	VDSL2-RT: splitterless	Remarks
VTU-R and VTU-C shall support the following DSL encapsulations- a) RFC 2364 PPP over ATM AAL5 (PPPoA)	RFC 2364	Y	Y	Y	Y	Y	Y	
ATU-R and ATU-C shall support the following DSL encapsulations- a) RFC 2516 PPP over Ethernet relay (PPPoE)	RFC 2516	Y	Y	Y	Y	Y	Y	
ATU-R and ATU-C shall support the following DSL encapsulations- a) RFC 1483 bridge mode.	RFC 1483	Y	Y	Y	Y	Y	Y	
Impedance	ETSI TS 101270- 1 V1.2.1		Y			Y		600ohms
Return loss	ETSI TS 101270- 1 V1.2.1		Y			Y		The return loss of Tele-port and line- port shall be better than 18 dB from 200Hz to 4 KHz at 135 ohms impedance as per ETSI TS101270- 1V1.2.1.
Insertion Loss:	ETSI TS 101270- 1 V1.2.1		Y			Y		The Tele-port to Line-port insertion loss shall be < 0.5 db at 135 ohms impedance from 200Hz to 4KHz,

								the insertion loss variation (ripple) over this frequency band shall be <0.2db as per ETSI101270-1V1.2.1.
Isolation	ETSI TS 101270-1 V1.2.1		Y			Y		The Tele-port to VDSL-port isolation should be better than 70 dB over the bands 200Hz.
Signal Power	ETSI TS 101270-1 V1.2.1		Y			Y		Maximum peak signal power in 200-4000Hz shall be <3dbm. Loop current shall be <63mA.
Unbalance about earth	ETSI TS 101270-1 V1.2.1		Y			Y		15Hz-50 Hz > 40 db terminated with 600 ohms. 50Hz- 600 Hz > 46 db terminated with 600 ohms. 600Hz-3400Hz > 52 db terminated with 600 ohms.

Note: Wherever RFC are referred, only ‘shall’ clauses given in the RFCs should be tested against the parameter referred in this ER.

Table IV-C for IP-DSLAM equipment

Applicable to→ Test Parameter↓	Standard	IP-DSLAM	IP-DSLAM With splitter	Remarks
POTS SPLITTERS The broad specifications for splitter shall be: <ol style="list-style-type: none"> 600 ohm impedance ETSI harmonized impedance splitter (ETSI TR 101 728). 			Y	
VLAN Aggregation: The DSLAM shall terminate PVCs on DSL line and aggregate them over a single or multiple Customer-VLANs, Service-VLANs as well as a combination of them, at the uplink interface. It shall also implement 802.1p priority on the Ethernet flows.	IEEE 802.1p	Y	Y	To check if more than 1 vlan can be passed over the same port in DSLAM
Protocol Support DSLAM shall support DHCP based IP access with DHCP relay and DHCP option 82 for direct IP over Ethernet based access for video/gaming and other entertainment services.	RFC 2131 RFC 3046	Y	Y	
<p>PPPoE over ATM (U-interface): Figure 1 depicts the end-to-end protocol stacks associated with PPPoE access method</p> <p>Figure 1-</p>		Y	Y	To check PPPoE session is established on the ADSL or VDSL system. Methodology is mentioned in DSL forum technical report TR-045. Annexure-E: group 3.3_test 1 & Test 2 may be carried out to cater this clause. It is tested through protocol simulator.
<p>IPoE over ATM (U-interface): Figure 2 depicts the end-to-end protocol stacks associated with IPoE access method.</p>		Y	Y	To check if IPOE is established on the ADSL or VDSL system. Methodology is mentioned in DSL forum

<table border="1"> <tr> <td>IP</td> <td></td> </tr> <tr> <td></td> <td>Ethernet</td> </tr> <tr> <td></td> <td>RFC 2684</td> </tr> <tr> <td></td> <td>ATM</td> </tr> <tr> <td></td> <td>DSL</td> </tr> </table> <p>RG, xTU-R or terminal xTU-R</p>	IP			Ethernet		RFC 2684		ATM		DSL	<table border="1"> <tr> <td colspan="2">IWF for IPoE</td> </tr> <tr> <td>Ethernet</td> <td>802.1Q, 802.1ad</td> </tr> <tr> <td>RFC 2684</td> <td>Ethernet</td> </tr> <tr> <td>ATM</td> <td></td> </tr> <tr> <td>DSL</td> <td>Some 802.3 Phy</td> </tr> </table> <p>DSLAM</p>	IWF for IPoE		Ethernet	802.1Q, 802.1ad	RFC 2684	Ethernet	ATM		DSL	Some 802.3 Phy	<table border="1"> <tr> <td>IP</td> <td>IP</td> </tr> <tr> <td>802.1Q, 802.1ad</td> <td>Some media</td> </tr> <tr> <td>Ethernet</td> <td></td> </tr> <tr> <td>Some 802.3 Phy</td> <td></td> </tr> </table> <p>BRAS</p>	IP	IP	802.1Q, 802.1ad	Some media	Ethernet		Some 802.3 Phy					<p>technical report TR-045.</p> <p>Annexure-E: group 3.3_test 1 & Test 2 may be carried out to cater this clause. It is tested through protocol simulator.</p>
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<p>Ethernet Scalability</p> <ol style="list-style-type: none"> The device shall provide a means to limit the number of MAC addresses learned on any given port. The device shall support placing all subscriber traffic into a single or multiple VLANs on an uplink. 				Y	Y	<ol style="list-style-type: none"> Limit the port on DSLAM to 1 mac and send two mac traffic only one mac traffic which is defined will run. Check more than 1 vlan can pass through the port 																												
<p>Video application protocol support</p> <ul style="list-style-type: none"> IGMP Proxy IGMPv2/v3 snooping <p>Further-</p> <ol style="list-style-type: none"> IGMP proxy shall handle multicast and control where the packets has to be replicated (in terms of specific customer VLANs or ports). In upstream direction, IGMP proxy function shall forward IGMP messages from subscriber to multicast VLAN. In downstream direction, multicast streams shall be multiplexed in to subscriber's connection based on 'Join' messages received. 			<p>RFC 2236</p> <p>RFC3376</p>	Y	Y	<p>Capability to be demonstrated as describes in clause.</p> <p>Enable IGMP proxy and snooping and check if multicast channel is learnt once the channel is joint</p>																												
<p>Filtering : The DSLAM shall allow the following filters to be defined:</p> <ul style="list-style-type: none"> List of acceptable MAC destination addresses applicable to frames received at the upstream direction on bridged ports. 				Y	Y	<p>Capability to be demonstrated as describes in clause.</p> <p>Set the MAC address to be</p>																												

<ul style="list-style-type: none"> When attached to a bridged port, any frame received with a destination MAC not specified in the list shall be discarded. <p>The DSLAM shall be capable of filtering L2 traffic configurable per Port/PVC/Service basis at least for the following parameters-</p> <ol style="list-style-type: none"> Source IP and MAC Address per port, per PVC, per VLAN Destination IP and MAC Address per port, per PVC, per VLAN. 				<p>allowed per port, send traffic of that mac and see it is going through. Send traffic of other mac and see that traffic is not going</p>
<p>Broadcast Handling: As far as Ethernet broadcast traffic is concerned, all downstream broadcast traffic shall be discarded with the exception cases called for by DHCP Relay Agent, PPPoE Intermediate Agent, and IGMP Snooping/ IGMP Snooping and Proxy functions.</p>		Y	Y	<p>Capability to be demonstrated as describes in clause.</p>
<p>Protection from ARP spoofing attacks</p> <ul style="list-style-type: none"> Source MAC Flooding Broadcast control L2 Peer to Peer (“hair-pin”) Forwarding Source MAC Spoofing 		Y	Y	<ol style="list-style-type: none"> To check if DSLAM can block certain MAC. To check if broadcast mac can be controlled Communication on same vlan can be done or blocked. To check if mac is learnt on the DSLAM

Note: Wherever RFC are referred, only ‘shall’ clauses given in the RFCs should be tested against the parameter referred in this ER.

4.0 Other Requirements

Sr. No	Requirements	Test Result	Sr. No
1	Protection	The protection measures against over voltages and over currents as specified in ITU-T Recommendation K.20 in case of COT and ITU-T Recommendation K.21 in case of RT shall be provided on line interfaces.	Test results from Designated CAB of TEC to be submitted for compliance.

5.0 Security Requirements

As and when prescribed by DoT .

Note: As security requirement has not been finalized yet, it is not possible to anticipate the features required to comply the security requirement and therefore this document can be at best treated as interim document till the security requirement is finalized. Accordingly, more features may be added in the ER.