

**Laboratory** Compliance International Telecom Laboratories (A Unit of Compliance International Pvt. Ltd.), X-35, 3rd Floor, Okhla Phase-II, New Delhi

**Accreditation Standard** ISO/IEC 17025: 2005

**Certificate Number** TC-5853

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**Validity** 30.08.2018 to 29.08.2020

**Last Amended on** 12.02.2019

| Sl. | Product / Material of Test | Specific Test Performed | Test Method Specification against which tests are performed | Range of Testing / Limits of Detection |
|-----|----------------------------|-------------------------|---|--|
|-----|----------------------------|-------------------------|---|--|

**ELECTRONICS TESTING**

| <b><u>AT LAB AND AT SITE</u></b> |   |  |  |  |
|----------------------------------|---|--|--|--|
| <b>I.</b>                        | <b>COMMUNICATION EQUIPMENT</b>                |  |  |  |
| <b>1.</b>                        | <b>Products with 2048 kbps (E1) interface</b> | Pulse Shape Characteristics (E1/2048 Kbps)<br>Width<br>Amplitude<br>Mask<br>Time | ITU-T G.703                                    | 1ns to 300 ns<br>2 V to 4 V<br>Waveform shape-As per G.703 |
|                                  |   | Output Jitter/Wander (E1/2048 Kbps)  | ITU-T G.823<br>ITU-T G.732                     | 20 Hz to 100 kHz<br>Upto 1.6 UI p-p<br>Upto 0.8 UI rms     |
|                                  |   | Jitter/Wander Tolerance (E1/2048 Kbps)   | ITU-T G.823<br>ITU-T G.732                     | 20 Hz to 100 kHz<br>0.01 UI to 80 UI                       |
|                                  |   | Return Loss (E1/2048 Kbps)   | ITU-T G.703                                    | 51 KHz to 3.072 MHz<br>Upto 100 dB                         |
|                                  |   | Bit Error Rate (E1/2048 Kbps)  | ITU-T G.821<br>ITU-T G.826                     | Bit, Code, Frame, CRC, REBE                                |
|                                  |   | Clock frequency / Bit Rate with accuracy (E1/2048 Kbps)                          | ITU-T G.703                                    | 2048 kbps/2048 KHz ± 100 ppm                               |
|                                  |   | Bit Slip (E1/2048 Kbps)  | ITU-T G.822<br>TEC/IR/NGS/2MB-001/03<br>DEC.14 | (+) ve Bit slips<br>(-) ve Bit slips                       |
|                                  |   | Wander Measurement / Time Interval Error (E1/2048 Kbps)                          | ITU-T G.823                                    | 10µHz to 10 Hz<br>TIE(p-p)<br>range: 0.1ns to 10000 s      |

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|-----|---|---|---|--|
| 2.  | Products with 34,368 kbps (E3) interface        | Pulse Shape / Characteristics (E3/34368 Kbps)<br>Width<br>Amplitude<br>Mask<br>Time | ITU-T G.703   | 1ns to 300ns<br>0.5 V to 1.5 V<br>Waveform shape-As per G.703                  |
|     |   | Output Jitter/Wander (E3/34368 Kbps)  | ITU-T G.823, ITU-T G.732, ITU-T G.751                       | Upto 1.6 UI p-p<br>Upto 0.8 UI rms   |
|     |   | Jitter/Wander Tolerance (E3/34368 Kbps)   | ITU-T G.823<br>ITU-T G.751                                  | 50 Hz to 800 kHz<br>0.01 UI to 80 UI   |
|     |   | Return Loss (E3/34368 Kbps)   | ITU-T G.703   | 860 KHz to 51.550 MHz<br>Upto 100 dB   |
|     |   | Bit Error Rate (E3/34368 Kbps)  | ITU-T G.821<br>ITU-T G.826                                  | Bit, Code, Frame, CRC, REBE errors   |
|     |   | Clock frequency / Bit Rate with accuracy (E3/34368 Kbps)                            | ITU-T G.703   | 34368 kbps $\pm$ 100 ppm   |
| 3.  | Products with 155mbps (STM-1 optical) interface | Bit Rate/Clock Frequency with accuracy (STM-1)                                      | ITU-T G.957   | 155 mbps $\pm$ 100 ppm   |
|     |   | Operating Wavelength (STM-1)  | ITU-T G.957   | 600 nm to 1700 nm  |
|     |   | Bit Error Rate (STM-1)  | ITU-T G.826<br>ITU-T G.828                                  | Bit, Frame (A1A2), B1, B2, MS-REI, B3, HP-REI, HP-IEC, LP-REI, LP-BIP-2 Errors |
|     |   | Spectral Width (RMS) (STM-1)  | ITU-T G.957   | 600 nm to 1700 nm<br>0.1 nm to 100 nm  |
|     |   | Spectral Width (-20dB) (STM-1)  | ITU-T G.957   | 600 nm to 1700 nm<br>0.1 nm to 100 nm  |

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|-----------|--|--|---|--|
|           |  | Side Mode Suppression Ratio (STM-1)              | ITU-T G.957   | 600 nm to 1700 nm Upto 100dB   |
|           |  | Mean Launch Power (STM-1)                        | ITU-T G.957   | (-)60 dBm to (+) 26 dBm (850nm,1310nm,1550 nm)                                 |
|           |  | Extinction Ratio (STM-1)                         | ITU-T G.957   | 1310 nm & 1550 nm Upto 50dB  |
|           |  | Receiver Sensitivity (STM-1)                     | ITU-T G.957   | 1200 nm to 1600 nm Upto 60 dBm   |
|           |  | Receiver Reflectance (STM-1)                     | ITU-T G.957   | (1310nm,1550nm) (-)60dB to (+) 26dB  |
|           |  | Eye Pattern Mask (STM-1)                         | ITU-T G.957   | Eye diagram as per :- ITU-T G957   |
|           |  | Output Jitter/Wander (STM-1)                     | ITU-T G.825<br>ITU-T G.783                                  | 500 Hz to 1.3 MHz<br>0 UI p-p to 16 UI p-p                                     |
|           |  | Jitter/Wander Tolerance (STM-1)                  | ITU-T G.825<br>ITU-T G.783                                  | 500 Hz to 1.3 MHz<br>0.01 UI to 50 UI  |
| <b>4.</b> | <b>Products with 622mbps (STM-4 optical) interface</b> | Bit Rate / Clock Frequency with accuracy (STM-4) | ITU-T G.957   | 622 mbps ± 100 ppm   |
|           |  | Operating Wavelength (STM-4)                     | ITU-T G.957   | 600 nm to 1700 nm  |
|           |  | Bit Error Rate (STM-4)                           | ITU-T G.826<br>ITU-T G.828                                  | Bit, Frame (A1A2), B1, B2, MS-REI, B3, HP-REI, HP-IEC, LP-REI, LP-BIP-2 Errors |
|           |  | Spectral Width (RMS) (STM-4)                     | ITU-T G.957   | 600 nm to 1700 nm<br>0.1 nm to 100 nm  |
|           |  | Spectral Width (-20dB) (STM-4)                   | ITU-T G.957   | 600 nm to 1700 nm<br>0.1 nm to 100 nm<br>0.2                                   |

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|-----|--|-------------------------------------|---|--|
|     |  | Side Mode Suppression Ratio (STM-4) | ITU-T G.957   | 600 nm to 1700 nm<br>Upto 100 dB                 |
|     |  | Mean Launch Power (STM-4)           | ITU-T G.957   | (-) 60dBm to (+) 26dBm<br>(850nm,1310nm,1550 nm) |
|     |  | Extinction Ratio (STM-4)            | ITU-T G.957   | 1310nm & 1550nm:<br>Upto 50dB                    |
|     |  | Receiver Sensitivity (STM-4)        | ITU-T G.957   | 1200nm to 1600nm<br>Upto 60dBm                   |
|     |  | Receiver Reflectance (STM-4)        | ITU-T G.957   | (1310nm,1550nm)<br>(-) 60dB to (+) 26dB          |
|     |  | Eye Pattern Mask (STM-4)            | ITU-T G.957   | Eye diagram as per -ITU-T G957                   |
|     |  | Output Jitter/Wander (STM-4)        | ITU-T G.825<br>ITU-T G.783  | 1 KHz to 5 MHz<br>0 UI p-p to 16 UI p-p          |
|     |  | Jitter/Wander Tolerance (STM-4)     | ITU-T G.825<br>ITU-T G.783  | 1 KHz to 5 MHz<br>0.01 UI to 200 UI              |
| 5.  | PABX, Group Audio Terminal and other products with 2 wire analog interface | Cross Talk                          | TEC/IR/SW/PBX-104/04/OCT-17<br>ITU-T Q.552                            | 20 Hz to 3.99 KHz<br>Upto (-)100 dBmo            |
|     |  | Longitudinal Conversion Loss        | TEC/IR/SW/PBX-104/04/OCT-17<br>ITU-T Q.552                            | 20 Hz to 3.99 KHz<br>Upto (-) 100 dB             |
|     |  | Return Loss (Analog)                | TEC/IR/SW/PBX-104/04/OCT-17<br>TEC/IR/FAX-01/05.MAR-15<br>ITU-T Q.552 | 20 Hz to 3.99 KHz<br>Upto 50 dB                  |
|     |  | Idle Channel Noise                  | TEC/IR/SW/PBX-104/04/OCT-17<br>ITU-T Q.552                            | 20 Hz to 3.99 KHz<br>(+) 10 dBm to (-) 100 dBm   |

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|-----|----------------------------|---|--|--|
|     |                            | DTMF Frequency Measurement  | TEC/IR/SW/PBX-104/04/OCT-17<br>TEC/IR/TX/PST-01/02.MAR 2015<br>ITU-T Q.23      | 20 Hz to 3.99 KHz  |
|     |                            | DTMF Level Measurement  | TEC/IR/SW/PBX-104/04/OCT-17<br>TEC/IR/TX/PST-01/02.MAR 2015<br>ITU-T Q.23      | Level Upto 19.9dB  |
|     |                            | Dial Speed  | TEC/IR/SW/PBX-104/04/OCT-17  | 3.0 IPS to 20.0 IPS  |
|     |                            | Make Brake Ratio  | TEC/IR/SW/PBX-104/04/OCT-17<br>TEC/IR/TX/PST-01/02.MAR 2015                    | 10 % to 90 %   |
|     |                            | Inter Digital Pause   | TEC/IR/SW/PBX-104/04/OCT-17<br>TEC/IR/TX/PST-01/02.MAR 2015                    | 164 ms to 999 ms   |
|     |                            | Loop Current  | TEC/IR/SW/PBX-104/04/OCT-17<br>ETSI EN 300 001                                 | 1 mA to 100 mA   |
|     |                            | Insulation Resistance   | TEC/IR/SW/PBX-104/04/OCT-17<br>TEC/IR/TX/PST-01/02.MAR 2015<br>ETSI EN 300 001 | Upto 20 MOhms  |
| 6.  | PABX                       | General Functions/<br>Features of PABX<br><br>Inter/Intra PABX Calls<br>PSTN Connectivity<br>Emergency services | TEC/IR/SW/PBX-104/04/OCT-17  | Functions/Features of PABX as per TEC standard through-<br>1. Verification of Equipment under Test<br>2. Verification of |

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|-----|---------------------------------------|--|---|---|
|     |                                       | Compatibility with existing Networks<br>Fault Localization<br>Operation & Maintenance features<br>Security & logs<br>Performance monitoring<br>Other general functions/features etc. |   | Traffic/ Call reports   |
| 7.  | Digital Switch                        | General Functions / Features of Digital Switch<br>PSTN Connectivity & compatibility<br>Voice/Data functions<br>Performance Reporting<br>O & M features                               | TEC/IR/NGS/2MB-001/03 DEC.14<br>TEC/IR/NGS/STM-001/03 DEC.14  | Functions / Features of Digital Switch as per TEC standard  |
| 8.  | Products with SS7 signaling interface | SS7 Signaling Protocols<br>MTP-2<br>MTP-3<br>ISUP  | ITU-T Q.781<br>ITU-T Q.782<br>ITU-T Q.784   | SS7 Protocol Suite<br>MTP-2<br>MTP-3<br>ISUP  |
| 9.  | Products with IP protocol interface   | IP Protocols   | RFC 791<br><br>RFC 2460, RFC 4861, RFC 4862, RFC 4443, RFC 1981<br><br>RFC 793<br>RFC 768<br>RFC 1661<br>RFC 2516<br>RFC 4349<br>RFC 3442<br>RFC 2453<br>RFC 2328 | IP version 4<br><br>IP version 6<br><br>TCP<br>UDP<br>PPP<br>PPPoE<br>HDLC<br>Static Routing<br>RIP<br>OSPF |

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|-----|-------------------------------------|--|--|--|
|     |                                     |  | RFC 3261<br>RFC 3550<br>RFC 4271,<br>4760, 2545<br>TEC/IR/MGW-001/05.JAN<br>2015 | SIP/SDP<br>RTP/RTCP<br>BGP<br>MEGACO<br>MGCP<br>H.323  |
| 10. | <b>Media Gateway</b>                | Functions / Features of Media Gateway<br><br>PSTN Connectivity<br>Voice/Data functions<br>Compatibility with other networks<br>Performance Reporting<br>Operation & Maintenance          | TEC/IR/MGW-001/05.JAN<br>2015  | Functions / Features of Media Gateway as per TEC standard  |
| 11. | <b>Video Conferencing Equipment</b> | Functions / Features of Video Conferencing Equipment with ISDN BRI interface<br><br>PSTN Connectivity<br>Video/Audio<br>Conference Control<br>Connection Rate<br>Availability of Service | TEC/IR/CPE-02/03. OCT<br>2003 (Chapter 7)  | Functions / Features of Video Conferencing Equipment with ISDN BRI interface as per TEC standard |
| 12. | <b>Router</b>                       | General Functions / Features of Router<br><br>PSTN Connectivity<br>Data Rates<br>Availability of service<br>O & M<br>Performance reporting   | TEC/IR/I/TCP-001/05 MAR<br>14  | General Functions / Features of Router   |

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|-----|---|--|--|--|
| 13. | Group Audio Terminal                        | Functions / Features of Group Audio Terminal<br>PSTN Connectivity<br>Availability of Service | TEC/IR/TX/PST-01/02.MAR 2015   | Functions / Features of Group Audio Terminal as per TEC standard |
| 14. | Products with digital and analog interfaces | Group Delay  | TEC/IR/SW/PBX-104/04/OCT-17<br>TEC/IR/NGS/2MB-001/03 DEC.14<br>ITU-T Q.552 | 20 Hz to 3.99 KHz<br>Upto 5000us                                 |
|     |   | Transmission Loss  | TEC/IR/SW/PBX-104/04/OCT-17<br>TEC/IR/NGS/2MB-001/03 DEC.14<br>ITU-T Q.552 | 20 to 3.99 KHz<br>Upto 50dB                                      |
|     |   | Weighted Noise   | TEC/IR/SW/PBX-104/04/OCT-17<br>TEC/IR/NGS/2MB-001/03 DEC.14, ITU-T Q.552   | 20 to 3.99 KHz<br>Upto (-)80dBm                                  |
|     |   | Total Distortion   | TEC/IR/SW/PBX-104/04/OCT-17<br>TEC/IR/NGS/2MB-001/03 DEC.14<br>ITU-T Q.552 | 20 to 3.99 KHz<br>Upto 50 dB                                     |
| 15. | Product with G.957 Optical                  | Optical Return Loss  | ITU-T G.957  | 6dB to 70dB  |
| 16. | Products with ISDN PRI interface            | ISDN PRI protocol  | ITU-T Q.931<br>TEC/SD/ISN-01   | Layer 2 and Layer 3 ISDN Signaling (PRI)                         |
| 17. | Products with ISDN BRI interface            | ISDN BRI Protocol  | ITU-T Q.931<br>TEC/SD/ISN-02   | Layer 2 and Layer 3 ISDN Signaling (BRI)                         |
| 18. | Products with MFC-R2 Protocol interface     | MFC-R2 Protocol  | TEC/GR/LLT-01  | Qualitative  |



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|-----|---------------------------------------|---|--|--|
| 19. | Multi Point Conferencing Server       | Functions & Features of Multi point Conferencing Server with ISDN PRI protocol  | TEC/IR/CPE-02/03.OCT 2003 (Chapter 11)   | Qualitative                            |
|     |                                       | Functions & Features of Multi point Conferencing Server with ISDN BRI protocols | TEC/IR/CPE-02/03.OCT 2003 (Chapter 10)   | Qualitative                            |
| 20. | Products with 2 wire analog interface | Flash   | TEC/IR/SW/PBX-104/04/OCT-17<br>TEC/IR/TX/PST-01/02.MAR 2015<br>ETSI EN 300 001 | 300ms ± 30 ms                          |
|     |                                       | DC Voltage  | TEC/IR/SW/PBX-104/04/OCT-17<br>TEC/IR/TX/PST-01/02.MAR 2015<br>ETSI EN 300 001 | 1 mV to 400V                           |
|     |                                       | AC Voltage  | TEC/IR/SW/PBX-104/04/OCT-17<br>TEC/IR/TX/PST-01/02.MAR 2015<br>ETSI EN 300 001 | 0.1mV to 400V                          |
|     |                                       | DC Current  | TEC/IR/SW/PBX-104/04/OCT-17<br>TEC/IR/TX/PST-01/02.MAR 2015<br>ETSI EN 300 001 | 0.1µA to 10A                           |
|     |                                       | AC Current  | TEC/IR/SW/PBX-104/04/OCT-17<br>TEC/IR/TX/PST-01/02.MAR 2015<br>ETSI EN 300 001 | 0.1µA to 10A                           |

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|-----|--|---|--|--|
|     |  | Resistance  | TEC/IR/SW/PBX-104/04/OCT-17<br>TEC/IR/TX/PST-01/02.MAR 2015<br>ETSI EN 300 001/ETSI TBR-21 | 0.1 ohms to 40Mega ohms  |
| 21. | <b>Products with 2488mbps (STM-16 optical) interface</b> | Bit Rate / Clock Frequency with accuracy (STM-16) | ITU-T G.957  | 2488 MHz $\pm$ 100 ppm   |
|     |  | Operating Wavelength (STM-16)                     | ITU-T G.957  | 600 nm to 1700 nm  |
|     |  | Bit Error Rate (STM-16)                           | ITU-T G.826<br>ITU-T G.828   | Bit, Frame (A1A2), B1, B2, MS-REI, B3, HP-REI, HP-IEC, LP-REI, LP-BIP-2 Errors |
|     |  | Spectral Width (RMS) (STM-16)                     | ITU-T G.957  | 600 nm to 1700 nm<br>0.1nm to 100 nm   |
|     |  | Spectral Width (-20dB) (STM-16)                   | ITU-T G.957  | 600 nm to 1700 nm<br>0.1 nm to 100 nm  |
|     |  | Side Mode Suppression Ratio (STM-16)              | ITU-T G.957  | 600nm to 1700nm<br>Upto 50dB   |
|     |  | Mean Launch Power (STM-16)                        | ITU-T G.957  | (-)60dBm to +26dBm<br>850 nm, 1310nm, 1550 nm                                  |
|     |  | Extinction Ratio (STM-16)                         | ITU-T G.957  | 1310 nm & 1550 nm<br>Upto 50 dB  |
|     |  | Receiver Sensitivity (STM-16)                     | ITU-T G.957  | 1200 nm to 1600 nm<br>Upto 60 dBm  |
|     |  | Receiver Reflectance (STM-16)                     | ITU-T G.957  | (1310 nm, 1550 nm)<br>(-)60 dB to +26 dB                                       |

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|-----|--|--|---|---|
|     |  | Eye Pattern Mask (STM-16)                          | ITU-T G.957   | Eye diagram as per -ITU-T G957  |
|     |  | Output Jitter/Wander (STM-16)                      | ITU-T G.825<br>ITU-T G.783                                  | 5 KHz to 20 MHz<br>0 UI p-p to 16 UI p-p                                  |
|     |  | Jitter/Wander Tolerance (STM-16)                   | ITU-T G.825<br>ITU-T G.783                                  | 5 KHz to 20 MHz<br>0.01 UI to 200 UI                                      |
| 22. | Product with G.957 interface                 | Multiplexing structure & Mapping (STM-1 to STM-16) | ITU-T G.707   | Qualitative   |
| 23. | Products with Optical Ethernet Interfaces    | Optical Output Power                               | IEEE 802.3  | (-) 60 dBm to (+) 26 dBm  |
|     |  | Operating Wavelength                               | IEEE 802.3  | 600 nm to 1700 nm   |
|     |  | Receiver Sensitivity                               | IEEE 802.3  | Upto 60dBm  |
| 24. | Products with Ethernet Electrical interfaces | Throughput   | IEEE 802.3/RFC 2544   | Qualitative   |
|     |  | Latency  | IEEE 802.3/RFC 2544   | Qualitative   |
|     |  | Frame Loss   | IEEE 802.3/RFC 2544   | Qualitative   |
|     |  | Link speed test                                    | IEEE 802.3  | Qualitative   |
|     |  | Duplex (Full or half)                              | IEEE 802.3  | Qualitative   |
|     |  | Auto Negotiation                                   | IEEE 802.3  | Qualitative   |
| 25. | Products with Layer-2 Protocols              | MAC Learning and Packet Forwarding                 | IEEE 802.1d   | Qualitative   |
|     |  | Spanning Tree Protocol                             | IEEE 802.1d   | Qualitative   |
|     |  | Link Layer discovery protocol (LLDP)               | IEEE 802.1ab  | Qualitative   |
| 26. | Products with IP protocol interface          | SNMPv2 and SNMPV3                                  | SNMPv2-RFC 3410<br>SNMPv3-RFC 3416                          | Qualitative   |
| 27. | Products with 45 Mbps (DS3) interface        | Pulse Shape/ Characteristics (DS3/45 Mbps) Width   | ITU-T G.703   | Width-1ns to 300ns<br>Amplitude-0V to 2.0V<br>Waveform shape-As per G.703 |

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| Sl. | Product / Material of Test             | Specific Test Performed  | Test Method Specification against which tests are performed | Range of Testing / Limits of Detection                                  |
|-----|--|--|---|---|
|     |  | Amplitude Mask Time  |   |   |
|     |  | Output Jitter/Wander (DS3/45 Mbps)                             | ITU-T G.824   | Frequency range: 10 Hz to 400 kHz<br>0.0-5.0 UI p-p<br>0.0-2.5 UI rms   |
|     |  | Jitter/Wander Tolerance (DS3/45 Mbps)                          | ITU-T G.824   | Frequency range: 10 Hz to 400 kHz<br>Amplitude: 0.01 UI to 80 UI        |
|     |  | DC Power   | ITU-T G.703   | Qualitative   |
|     |  | Clock frequency / Nominal Bit Rate with accuracy (DS3/45 Mbps) | ITU-T G.703   | 44.736 Mbps/44.736 MHz $\pm$ 895 bit/s ( $\pm$ 20ppm)                   |
| 28. | Products with SDH interfaces           | Receiver Overload  | ITU-T G.957<br>ITU-T G.691                                  | Upto 60dBm  |
| 29. | Products with STM-64 Optical Interface | Bit Rate / Clock Frequency with accuracy (STM-64)              | ITU-T G.691   | 9.952 GHz @100 ppm  |
|     |  | Operating Wavelength (STM-64)                                  | ITU-T G.691   | (600nm to 1700nm)   |
|     |  | Output Jitter/Wander (STM-64)                                  | ITU-T G.783<br>ITU-T G.825                                  | Frequency Range 20KHz to 80MHz<br>Amplitude Range 0 UI p-p to 16 UI p-p |
|     |  | Jitter/Wander Tolerance (STM-64)                               | ITU-T G.783<br>ITU-T G.825                                  | Frequency Range: 20 KHz to 80 MHz<br>Amplitude Range: 0.01 UI to 200 UI |
|     |  | Mean Launch Power (STM-64)                                     | ITU-T G.691   | (-) 60dBm to (+) 26dBm  |

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| Sl. | Product / Material of Test             | Specific Test Performed                                    | Test Method Specification against which tests are performed          | Range of Testing / Limits of Detection |
|-----|--|--|--|--|
|     |  | Receiver Sensitivity (STM-64)                              | ITU-T G.691  | Upto 60dB                              |
| 30. | Products with PON interfaces           | Optical power  | ITU-T<br>G.984.2/G.9807.1/G.989.2/<br>G.987.2/ IEEE<br>802.3/G.694.1 | (-)50 dBm to 50 dBm                    |
|     |  | Receiver Sensitivity                                       | ITU-T<br>G.984.2/G.9807.1/G.989.2/<br>G.987.2/ IEEE<br>802.3/G.694.1 | 0 to (-)50 dBm                         |
|     |  | Wavelength   | ITU-T<br>G.984.2/G.9807.1/G.989.2/<br>G.987.2/ IEEE<br>802.3/G.694.1 | 1260 nm to 1630 nm                     |
|     |  | Protocol   | Ethernet over GEM<br>G.984.2/G.987.2/G.9807.1/<br>G.989.2            | Qualitative                            |
|     |  | Line testing   | IEEE 802.3   | Qualitative                            |
| 31. | Functions and Features of PON Products | User name and password-based authentication                | ITU-T G.984.3 section 9.2.2<br>ITU-T G.984.3 section 12              | Qualitative                            |
|     |  | Support of 802.1x authenticator functionality (MAC based)  | IEEE 802.1x  | Qualitative                            |
|     |  | MAC address limitation per-ONT                             | IEEE 802.3   | Qualitative                            |
|     |  | DOS prevention, SSH v1/2 for CLI                           | ITU-T G.984.3 section V.2,<br>SSH v2- RFC 4251                       | Qualitative                            |
|     |  | Maximum bandwidth limiting<br>Minimum guaranteed bandwidth | ITU-T-REC-G.984.3-<br>200803 Section 7.5                             | Qualitative                            |

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|-----|---|---|---|--|
|     |   | Minimum two classes of classification   |   |  |
|     |   | Switch fabric in OLT shall be able to handle full wired speed throughputs. MAC learning shall be supported at OLT<br>The operator shall be able to enable/disable MAC address learning function and configure the MAC address learning aging time | G.984.1<br>IEEE 802.3(testing procedure)                    | Qualitative  |
|     |   | Port id based VLAN shall be supported at OLT<br>VLAN stacking towards the network at OLT shall be supported   | G.984.1/<br>IEEE 802.1Q (testing procedure)-                | Qualitative  |
| 32  | <b>All Products with OTU interfaces</b> | Nominal Bit Rate  | ITU-T G.709   | 2.6GHz to 100GHz ± 20ppm   |
|     |   | Output Jitter   | ITU-T G.8251  | Frequency range<br>5KHz -80MHz<br>Amplitude Range<br>0 UI p-p to 10 UI p-p |
|     |   | Jitter Tolerance  | ITU-T G.8251  | Frequency Range:<br>5KHz – 80 MHz<br>Amplitude Range:<br>0.01 UI – 20 UI   |
|     |   | Receiver Sensitivity  | ITU-T G.959.1<br>ITU-T G.693                                | 0 to -60dB   |
|     |   | Mean Total Input/output Power   | ITU-T G.959.1<br>ITU-T G.693                                | -60dBm to +60dBm   |

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|-----|----------------------------|-------------------------|---|---|
|     |                            | Central Frequency       | ITU-T G.959.1<br>ITU-T G.693                                | 1250nm to 1650nm/180 THz to 240 THz (@ spacing- 12.5 GHz to 200GHz) |
|     |                            | Receiver Overload       | ITU-T G.959.1<br>ITU-T G.693                                | -30dBm to +6 dBm  |
| 33. | DWDM product               | Channel Spacing         | ITU-T G.694.1   | 12.5 GHz to 200 GHz<br>600nm to 1700nm                              |