

# CHAPTER XIV

## DIGITAL MULTIPLEXING EQUIPMENT

### 14.1 PRINCIPLE OF DIGITAL MULTIPLEXER

14.1.1 All digital multiplexing equipment shall be based on 2048 Kbps; PDH 8.448/34.368Mbps, SDH – (STM -1, STM -4 , STM – 16 or higher) 10 Mbps, 100 Mbps, 1 Gbps (Ethernet) based hierarchy.

### 14.2 MEDIA OF TRANSMISSION

- Digital UHF/MICROWAVE relay system
- Symmetric cable pairs / HDSL modems
- Star quad cable in 25 KV AC electrified areas
- Optical fibre

### 14.3.0 Primary multiplexing equipment

(a) This equipment shall multiplex 30 analogue and/or data channel to 2048 kbps ITU compatible digital stream on transmit side and on receive side, it shall demultiplex ITU compatible 2048 kbps digital stream to 30 analogue voice /data channels.

(b) Following type of primary multiplexers are in use

#### (i) TERMINAL MUX

It shall have one 2048 kbps port each for trans and receive side and shall be used as end multiplexer.

#### (ii) PRIMARY DROP/INSERT MUX

This shall have at least two 2048 kbps ports (P1 and P2 port) each for send and receive side. It shall be possible in drop/insert any channel to P1/P2 port or make a time slot through P1 port to P2 port and vice versa.

#### (iii) DROP/INSERT MUX WITH CONFERENCE FACILITY

Its function is similar to drop insert MUX described above with additional facility of at least 3 party conference between any combination of time slots of either P1 port or P2 port and voice interface.

### **(c) TYPE OF INTERFACE CARDS FOR THE PRIMARY MULTIPLEXER**

Following types of interface cards are provided in primary digital multiplexer –

- 2W speech card with E&M Signalling
- 4W speech card with E&M signalling
- Exchange end interface cards
- Subscriber side interface cards
- Hotline interface cards
- Magneto telephone interface cards
- Conference circuits, omnibus voice circuits
- Data interface cards of various types like
  - (i) G703 codirectional/contradirectional
  - (ii) V.24/RS232C interface
  - (iii) V.35 interface
  - (iv) NX64 Kbps data interface cards etc

#### **14.3.1 Second Order Multiplexing Equipment**

This equipment shall convert four 2048 kbps tributary signal into a 8448 kbps digital signal and vice versa with positive justification.

#### **14.3.2 Third Order Multiplexing Equipment**

This equipment shall convert four 8448 kbps tributary signal into a 34368 kbps signal and vice versa with positive justification.

#### **14.3.3 Third Order Skip Multiplexer**

This equipment shall convert sixteen 2048 kbps tributaries signal into a 34368 kbps signal and vice versa with positive justification.

#### **14.3.4 Third Order Drop Insert Multiplexer**

This equipment shall be used for dropping inserting either 8448 kbps tributary or 2048 kbps tributary from/to 34368 kbps main tributary signal and vice versa with positive justification.

#### **14.3.5** All digital multiplexing equipment shall be as per approved specification of RDSO.

### 14.3.6 CHARACTERISTICS OF INTERFACE

Bit rate, Code, Characteristics of output and input ports for various interfaces are as under :

ITEM	2048 Kbit/s PORT	8448 Kbit/s PORT	34368 Kbit/s PORT
(a) BIT RATE	2048 Kbit/s ± 50 PPM	8448 Kbit/s ± 30 PPM	34368 Kbit/s ± 20 PPM
(b) Code	HDB3	HDB3	HDB3

#### OUTPUT PORT :

(a) Pulse shape	Rectangular as per ITU-T G.703	Rectangular as per ITU-T G.703	Rectangular as per ITU-T G.703
(b) Pulse peak voltage/ impedance	2.37V/75 ohm or 3.0v/120 ohm	2.37V/75 ohm	2.37V/75 ohm
(c) Normal pulse width	244 ns	59 ns	14.55 ns

#### INPUT PORT :

(a) Permissible attenuation	F law 0-6 db at 1024 Khz	F law 0-6 db at 4224 Khz	F law 0-12 db at 17184 Khz
(b) RETURN LOSS			
Frequency Corresponding to normal bit rate			
2.5% to 5%	12	12	12
5% to 100%	18	18	18
100% to 150%	14	14	14

### 14.3.7 REQUIREMENT OF SYSTEM PERFORMANCE

- (i) The overall system performance with the proposed transmission media shall be so designed and ensured that it meets ITU-T parameters. The system availability shall be at least 99.5%.
- (ii) The characteristic of complete circuit shall be measured on the basis of audio frequency 4W/2W interface in respect of characteristic and parameters defined in ITU-T G.712.

- (iii) The measurement of performance parameters made during the life cycle of the equipment shall be within acceptable limits.

#### **14.3.8 SYNCHRONIZATION**

The equipment shall have provision of deriving timing signal on internal, external and incoming digital signal tributaries. The equipment shall have automatically switching over from one timing signal source to another in case of failure of primary source. Synchronization as per approved scheme shall be ensured.

#### **14.3.9 FRAME STRUCTURE**

##### **(i) 2048 KBPS TRIBUTARY**

The frame structure shall conform to ITU-T Rec.G.704/G.732. The frame shall consist of 32 time slots numbering from time slot 0 to time slot 31. Time slot 0 shall be used for transmission of frame synchronization word and alarms, etc. Time slot 16 shall be used for transmission of signalling of channels 1 to 15 and 16 to 31. Remaining slots shall be used for speech data/channels.

The allocation of bits 1 to 8 of time slot 0 of the frame 0 shall be as under : c0011011

A multi frame shall comprise of 16 consecutive frames and shall be numbered from 0 to 15. A multi frame alignment signal 0000 shall occupy bit 1 to 4 of channel time slot 16 in frame 0.

##### **(ii) 8448 KBPS TRIBUTARY**

Frame structure shall be as per Table 1 of ITU-T G.742 Bit No.12 for set I shall be fixed to 1.

##### **(iii) 34368 KBPS TRIBUTARY**

The frame structure shall be as per Table 1 of ITU-T G.751 Bit No.12 for set I shall be fixed to 1.

#### **14.3.10 FAULT CONDITION AND CONSEQUENT ACTION**

##### **(i) Primary PCM Multiplexer Equipment**

It shall be as per Clause 4 of ITU-T Recommendation G.732 and Table I/G.732. Generally, following minimum alarms are provided :

- (a) Power supply failed.
- (b) Loss of incoming signal at 64 kbps input port
- (c) Loss of incoming signals at 2048 kbps
- (d) Loss of frame alignment

- (e) Loss of multiframe alignment
- (f) Excessive error ratio alarm in framing pattern for 1 in 10E-3
- (g) Remote failure
- (h) AIS alarm
- (i) Loss of transmit clock

**(ii) HIGHER ORDER MULTIPLEXER**

It shall be as per Clause 10 of ITU-T Rec.G.742 Table II/G.742 for second order multiplexer and as per Clause 2.5 of ITU-T Rec.G.751 and Table III/G.751 for third order multiplexer. However, following minimum alarms shall be available: -

- (a) Power supply failure
- (b) Absence of incoming signal on a tributary of multiplexer input and also loss of 0 incoming signal at demultiplexer input
- (c) Loss of frame alignment signal
- (d) Alarm indication received from remote multiplex equipment

**14.3.11 Digital Cross Connect**

Provision of Digital Cross Connect should be made as per ITU-T G.796 at all junctions, to facilitate channel level cross connect features for better operational flexibility. The capacity of the cross connect may be chosen depending on the traffic requirement generally a cross connect of 4 ports to 32 ports capacity may be used.

**14.3.12 INSTALLATION**

**(i) SIZES OF ROOM**

The layout requirement of equipment room shall apart from housing equipment, should cater for enough movement space for doors and routine measurement of equipments.

**(ii) SPACING**

- (a) The spacing between ceiling and cable carrier from the rack may be (min) 30 CM. The cable carrier itself may be mounted 30 CM minimum above the rack.
- (b) There must be a space of 2 meters (min) between two rows of double sided rack.
- (c) The space between equipment rack and wall/other racks should be minimum 2 meters.

(iii) It should be ensured that the room where the equipment is installed is well ventilated and illuminated and is at least 3 meters away from major sources of electromagnetic radiation such as photocopier and facsimile machines.

(iv) The rack on which the equipment is to be mounted shall be either slim rack (2750 mm height, 120 mm width and 220 mm depth) or on standards 19" rack or CP 7 bay. The racks shall be provided with suitable covers on all sides to protect entry of rodent, etc.

(v) All connections from the equipment to be terminated on the suitable MDF mounted on the rack. All cables may be carried above the wayside on cable carriers separated from the ceiling. The cable carrier may be of 15 CM to 30 CM in width.

**(vi) EARTHING**

All equipment, sheath of underground cable and the screen indoor cable etc. should be connected to the main station earth as per approved standards. The earth resistance shall be maintained less than 2 ohms.

**(vii) POWER SUPPLY**

The equipment shall operate on 48 Volt DC with positive earth. Preferably power supply shall be installed in a separate room adjacent to the equipment room.

The common power supply source for all digital equipments can be provided if:-

- All equipment work on 48 Volt DC with positive earth.
- Capacity of power supply equipment is adequate for all digital communication equipments.

**14.3.13 MAINTENANCE**

**(i) General Precaution and Instructions**

Each equipment is supplied with the detailed precaution to be followed for maintenance and testing. These should be strictly followed.

(ii) Electronics circuits on the multiplexer is easily damaged by electro static discharge. As such following precautions are to be followed: -

- Always wear a proper anti static strap/ wristband.
- Before handling any electronic components, touch the grounded metal surface to discharge static from your

body. It is recommended to use antistatic flooring along the equipments on all the sides.

- Avoid touching the components on the PCB.
- Follow any other safety instructions provided by the manufacturer.

- (iii) Some of the cards cannot be inserted with power supply ON. Proper precaution may be followed for removing or inserting such cards.
- (iv) The PCBs should be transported to the repair center after electrostatically sealing the card and as per the procedure specified by the supplier.
- (v) Maintenance schedule for multiplexing equipment. The measurements may be carried out in line with relevant ITU-T standards being updated from time to time (for eg. ITU-T G.823, 824, 825, etc.)

Following schedule shall be followed for maintenance of multiplexing system.

- Alarm check	....	3 monthly
- Voltage check	....	3 monthly
- Audio level check at 1020 Hz on all 2W/4W channels of primary MUX	....	6 monthly
- Idle channel noise on all channels on 2W/4W circuits of primary MUX	....	6 monthly
- Signalling operation for E&M and Exch.ckt.of primary MUX	....	6 monthly
- Total distortion for 2W/4W circuits of primary MUX	....	Yearly
- Variation of gain with input level for 2W/4W circuits of primary MUX	....	Yearly
- Clock frequency	....	Yearly
- Bit error test on spare time slot/ tributary for a period of at least one week	....	Yearly

(vi) **FAILURES**

The alarm system will help to localize the faults to a particular card or sub-system. The step by step procedure for the localization of fault is given in trouble shooting manual supplied along with the equipment.

A systematic record of faults must be maintained indicating the detail of card, time of failure, duration of failure, action taken to rectify the faults.

(vii) **TEST INSTRUMENT**

The testing instruments are to be provided at a centralized place or with the maintenance gang and need not to be provided separately at each of the station.

- (a) Equipment to be provided at centralized location
  - PCM test set with facility for A to A and A to D, D to A, D to D testing.
  - BER test set with jitter measurement
  - 100 MHz oscilloscope
  - Frequency counter up to 200 MHz
  - Data tester
  - The insulation resistance measuring set
  - Cable fault locator
  - Earth resistance measuring set
  - SDH Analyzer
- (b) Equipment to be provided with each of the maintenance gang –
  - PCM MUX tester with facility to test at least up to 8 Mbit/Sec with framed and unframed signal
  - Digital multi-meter
  - Portable PCM test set
  - Signalling test set

(viii) **INSPECTION, RECORD AND REPORT**

- (a) Three monthly and six monthly test shall be carried out by the JE/SE of the section and he shall maintain all the records.
- (b) Yearly schedule of maintenance shall be carried out by the JE/SE In charge. The critical yearly schedule/tests/adjustments shall be carried out under the supervision of ASTE/DSTE. The records of the tests and maintenance schedule shall be maintained in the relevant pro-forma.
- (c) ASTE/DSTE/Sr.DSTE during their annual inspection shall check the record of tests and failures and availability of proper instruments and details of testing.

**14.4.0**

**SDH EQUIPMENTS**

The synchronous Digital Hierarchy (SDH) has evolved as a result of standardization by ITU. The format allows different types of signal formats to be transmitted over OFC. The STM-N signals are generated using a standard multiplexing pattern. Generally, STM-1 & STM-4 are used in Indian Railways STM-1 can accommodate 63 E1 streams/10/100 Ethernet.



In Railways, SDH only upto level 16 are used. The various SDH signal levels along with the bit rates are shown below.

<b>SDH LEVEL</b>	<b>BIT RATE Mbits/sec</b>
STM-1	155.520
STM-4	622.080
STM-16	2488.320

### **Standards**

The relevant standards to be followed in the SDH architecture are as below.

- (a) ITU-T G.691 – Optical Interfaces for single channel SDH systems with Optical Amplifiers and STM-64 systems.
- (b) ITU-T G.707 – Network Node Interface for the Synchronous Digital Hierarchy (SDH).
- (c) ITU-T G.781 – Structure of Recommendations on Equipment for the Synchronous Digital Hierarchy (SDH)
- (d) ITU-T G.782 – Types and characteristics of Synchronous Digital Hierarchy (SDH) Equipment.
- (e) ITU-T G.783 - Characteristics of Synchronous Digital Hierarchy (SDH) Equipment Functional blocks.
- (f) ITU-T G.803 – Architecture of Transport Networks based on the Synchronous Digital Hierarchy (SDH).
- (g) ITU-T G.813 – Timing Characteristics of SDH Equipment Slave Clocks (SEC).
- (h) ITU-T G.825 – The Control of Jitter and Wander Within Digital Networks which are based on the Synchronous Digital Hierarchy (SDH).
- (i) ITU-T G.826 – Error Performance Parameters and Objectives for International, Constant Bit rate Digital paths at or above the primary rate.
- (j) ITU-T G.831 – Management Capabilities of Transport Networks based on Synchronous Digital Hierarchy (SDH).
- (k) ITU-T G.957 – Optical Interfaces for Equipment and Systems relating to the Synchronous Digital Hierarchy (SDH).
- (l) ITU-T G.958 – Digital Line Systems based on the Synchronous Digital Hierarchy (SDH) for use on Optical Fiber Cables.
- (m) ITU-T – 1.432 – B-ISDN User Network Interface Physical Layer Specification criteria.

(a) The specification laid down by RDSO RDSO/SPN/TC/053-2005 with amendments, if any and TEC Generic requirement No.GR/SDH-04/02 with amendments will be adopted. The system shall be capable of interfacing with optic fibre cable as per RDSO specification IRS.TC.55-2000 with latest amendments. The system should support long haul as well as short haul applications and should be capable of working at 1310 nms and 1550 nms windows of operation.

(b) **Configuration**

The system should support various application configurations required by Indian Railways like –

- Point to point topology
- Bus topology
- Mesh topology
- Ring topology

(c) **Multiplexing**

The system should be compatible with MUX as per RDSO specifications IRS/TC: 68/04 with latest amendments, if any.

(d) **Tributaries**

The SDH system should facilitate transport of the various tributaries like –

- PDH system (2Mb/sec, 34 Mb/sec, 140 Mb/sec)
- Tributary STMs
- DS3 (44.736) signals
- 10/100 Mb/sec Ethernet systems

(e) **Alarms & Indications**

The SDH system should have adequate failure alarms indication for easy maintenance. This should be brought out on the Network Management Systems (NMS). The system in general should have the management capabilities as per ITU-T G.831.

**Wherever STM-4 or higher are used the equipment room must be air-conditioned.**

(f) **Installations**

The guidelines described as per para 14.3.13 shall be adopted for the installations of SDH equipments also. The system shall be commissioned after carrying out all pre-commissioning checks specified by the manufacturer or the laid down policies.

(g) **Protection switching**

The communication systems provided should preferably have Automatic protection switching. Generally, the switching should take place within 60 m sec. Revertive (systems reverts automatically to the original circuits after restoration of defect) systems shall be adopted, normally.

(i) **SYNCHRONIZATION**

The equipment shall have provision of deriving timing signal on internal, external and incoming digital signal tributaries. The equipment shall have automatically switching over from one timing signal source to another in case of failure of primary source. The system should also have facility for manual selection of clock. Synchronization as per approved scheme shall be ensured.

**14.4.2 MAINTENANCE**

(i) The SE/JE of the section should maintain close liaison with the Engineers/Managers of RailTel Corporation of India (RCIL) in ensuring proper maintenance of the SDH equipment wherever the maintenance is being carried out by RCIL.

- A proper log/record of incidences of interruptions occurring in the sections.
- Maintain the history of all the equipment failures and keep track of defective and working spare modules.

(ii) **PROCEDURE FOR FAULT RECTIFICATION :**

(a) When the fault is conveyed by NCC/Control Office, sectional SE/JE must consult NCC/Control Office to ascertain the exact nature of fault and plan the rectification in coordination with the NCC. He/She shall mobilize the maintenance team and proceed to the site of interruption by fastest means.

(b) After reaching the site, OTDR testing may be done on short haul fibers from either side of the cable hut on both sides from the nearest OFC POP for localization of the fault as close as possible.

(c) Fault rectification shall be taken up in such a manner that working fibers are made through from both ends and link restored first and then proceed ahead to restore the remaining fibers. Splicing of fibers should be done in the prescribed order. It should not happen that only a few fibers are restored while others are not attended. Testing shall be got done and SE/JE should personally satisfy himself that the work has been done properly.

(d) During an OFC outage, prime goal of the sectional SE/JE shall be to restore the link. In case fault localization becomes difficult due to site conditions, the link should be made through by temporary patching the OFC/mechanical splice or by laying

OFC on the ground or by use of aerial OFC, so as to minimize the outage.

### 14.4.3 SCHEDULE OF INSPECTION AND MAINTENANCE

(i) Inspection of each equipment will have to be done thoroughly keeping time for it. A normal or casual visit for any other reason will not be treated as inspection. An inspection register will be kept at each location wherein inventory shall also be recorded with date of inspection. The brief inspection note shall be recorded by visiting officers. Compliance of the inspection notes should also be recorded by sectional SE/JE. Indoor equipment for long haul and short haul links shall be inspected and recorded. Following minimum schedule shall be followed.

(ii) **Every indoor location – (ASTE/DSTE/Sr.DSTE)**

-	Electronics	:	half yearly
-	Power supply equipment	:	half yearly
-	Checking of proper functioning Of external alarms	:	half yearly
-	DG sets (if provided)	:	half yearly
-	Air conditioning	:	half yearly
-	Earth	:	yearly
-	Fire alarm system	:	yearly

**Centralised checking**

-	Link budget	:	yearly
-	Testing of AC-DC alarms and its appearance on NMS	:	half yearly

(iii) **Section Incharge – (JE/SE)**

-	Electronics	:	monthly
-	Power supply equipment	:	monthly
-	DG set	:	quarterly
-	Air-conditioning	:	quarterly
-	Earth	:	half yearly
-	Fire alarm system	:	quarterly
-	General upkeep of co-located Equipment	:	quarterly
-	Checking of proper functioning of external alarms	:	quarterly

The officer in-charge should verify the above details during his/her annual inspections in details.

(iv) **Periodical Checks And Preventive Maintenance**

Preventive maintenance of all indoor and outdoor equipment is to be done for their proper upkeep and availability of network. The same will cover the following, however, additional items may have to be done based on manufacturer's guidelines or the condition of the equipment. The various checks (measurements performed should be suitably recorded (ref. Annexure A – D).

**(a) Electronics**

As prescribed by the manufacturer.

**(b) Battery charger**

- Testing of auto changeover of SMRs
- Current setting as per load
- Checking of input and output voltages
- Reporting of alarms to NMS
- Proper connection of input and load cables
- Other checks as prescribed in the manual

**(c) Battery set**

- Checking of electrolyte level/gravities in case of low maintenance battery sets.
- Checking of cell voltages and battery voltage at equipment end.
- Cell whose voltage is found to be below prescribed value by the manufacturer should be noted and immediate corrective action taken for their replacement.
- Checking of sulfation/physical damage
- Testing of AH capacity (During installation and periodically as decided by the Railway)
- Proper connection of load cables.

**(d) Diesel Generator Set, wherever provided**

- Testing on load
- Testing of auto-start in case of AC failure
- Checking of hour meter readings
- Checking of diesel oil/engine oil level
- Checking of oil/air filters
- Battery voltage (self start)
- Cleanliness
- Water level (in radiator) if applicable
- Any other check prescribed in the manual

**(e) Air-conditioning**

- Working of the air conditioners
- Cleaning of filters
- Working of changeover arrangement, if provided

Any defect noticed may be reported to the Electrical staff/Maintenance in charge.

**(f) Earthing**

- Watering of the pits
- Checking of the physical connections including at equipment ends.
- Tightening of nuts/bolts
- Checking of earth resistance (value should be less than 1 ohm preferably)

**(g) Fire Alarm System**

- Cleaning of fire sensors
- Simulate the fire situation by applying smoke near to sensors.
- See the fire panels for reports and analysis

**(h) General Upkeep of co-located equipment**

- Ensure cleanliness
- Ensure the tower maintenance is done as per schedule by the nominated agency.

**ANNEXURE – A**

**POWER SUPPLY CHECK DATA LIST**

SN	Item	Frequency	Unit	D1	D2	D3
<b>A. Battery Charger</b>						
1	Current	Monthly	Amp			
2	Voltage	Monthly	V			
3	Alarms	Monthly				
4	Fuse/Grip	Monthly				
5	Connections	Monthly				
6	Checking of protection (X,Y & Z)	Half yearly				
7	Proper working of AC/DC alarms from NMS	Quarterly				
<b>B. Battery Set</b>						
1	Electrolyte Level	Monthly				
2	Total Voltage at Battery	Monthly	V			
3	Total Voltage at equipment	Monthly	V			
4	Sulfation/Physical condition	Monthly				
5	Cell voltage	Monthly	V			
6	AH capacity	Half yearly	AH			
7	Connections	Monthly				
8	Room temperature	Monthly	°C			
<b>C. Diesel Generator Set</b>						
1	Diesel oil level	Monthly	Litre			
2	Engine oil level	Monthly				
3	Water level	Monthly				
4	Testing on load	Monthly				
5	Output voltage	Monthly	V			
6	Output current	Monthly	A			
7	Battery voltage (self start)	Monthly	V			
8	Hour meter reading	Monthly	Hrs			
9	Checking of AMF panel	Monthly				
10	Condition of oil filter	Monthly				
11	Condition of air filter	Monthly				
12	Overhauling	As per schedule				

**ANNEXURE – B****AIR CONDITIONER CHECK DATA LIST**

<b>SN</b>	<b>Item</b>	<b>Frequency</b>	<b>Unit</b>	<b>D1</b>	<b>D2</b>	<b>D3</b>
1	Cleaning air filter	Monthly				
2	Cooling	Monthly				
3	Load current	Quarterly				
4	Cable connections	Quarterly				
5	Auto changeover	Monthly				
6	Overhauling	As per schedule				

**ANNEXURE – C****FIRE ALARM CHECK DATA LIST**

<b>SN</b>	<b>Item</b>	<b>Frequency</b>	<b>Unit</b>	<b>D1</b>	<b>D2</b>	<b>D3</b>
1	Cleaning of sensors	Quarterly				
2	Simulation of fire by applying smoke	Quarterly				
3	Checking of alarm system	Quarterly				

**ANNEXURE – D****EARTHING CHECK DATA LIST**

<b>SN</b>	<b>Item</b>	<b>Frequency</b>	<b>Unit</b>	<b>D1</b>	<b>D2</b>	<b>D3</b>
1	Watering of pits	Monthly				
2	Verification of corrections	Monthly				
3	Measurement of resistance					
3.1	Earth pit	Half yearly	Ohm			
3.2	Overall value outside	Half yearly	Ohm			
3.3	Overall at equipment end	Half yearly	Ohm			



**ANNEXURE – E**

**MAINTENANCE SCHEDULE FOR FIBRE OPTIC SYSTEM**

<b>EQUIPMENT</b>	<b>ITEM</b>	<b>MAINTAINER</b>	<b>SECTIONAL SUPERVISOR</b>	<b>SUPERVISOR INCHARGE</b>
<b>Network Management System</b>	Daily routine monitoring of system.		Daily	
	Analysis & Recording of statistics of Optical and Digital equipments.		Weekly	Quarterly
	Monitoring of alarms.		Weekly	Quarterly
	Periodical check and verification of configuration.		Quarterly	Yearly
	Checking and verification of control functions.		Quarterly	Yearly
<b>OPTICAL LINE TERMINAL EQUIPMENT</b>	TX/RX optical power		Quarterly	Half yearly
	Laser bias current		Quarterly	Half yearly
	Meas. of voltages		Quarterly	Half yearly
	Cleaning of connectors		Quarterly	Half yearly
	Earthing		Quarterly	Half yearly
	Cleaning of dust	Weekly	Quarterly	Half yearly
	Pulse mask		Quarterly	Half yearly
	Alarms	Weekly		
	Orderwire circuit	Weekly		
Recording of statistics		Quarterly		