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मैनेज्ड मीडिया कन्वर्टर (ईथरनेट/ई1 से ऑप्टिकल) Managed Media Converter (Ethernet/E1 to Optical)			



सत्यमेव जयते

मैनेज्ड मीडिया कन्वर्टर (ईथरनेट/ई1 से ऑप्टिकल)

**Managed Media Converter (Ethernet/E1 to Optical)**

स्पेसिफिकेशन संख्या आरडीएसओ / एसपीएन/ टीसी /103/2013

**Specification No. RDSO/SPN/TC/103/2013**

दूरसंचार निदेशालय

अनुसंधान अभिकल्प और मानक संगठन

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**MINISTRY OF RAILWAYS MANAK NAGAR, LUCKNOW - 226011**

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<b>DOCUMENT DATA SHEET</b>
<b>SPECIFICATION: RDSO/SPN/TC/103/2013</b>
<b>TITLE OF DOCUMENT: RDSO SPECIFICATION FOR MANAGED MEDIA CONVERTER (ETHERNET/E1 TO OPTICAL)</b>
<b>AUTHOR: DIRECTOR/ TELECOM-I/ RDSO</b>
<b>APPROVED BY EXECUTIVE DIRECTOR/ TELECOM/ RDSO</b>
<b>ABSTRACT</b>
<b>THIS DOCUMENT SPECIFIES TECHNICAL SPECIFICATION OF MANAGED MEDIA CONVERTER (ETHERNET/E1 TO OPTICAL)</b>

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### DOCUMENT CONTROL SHEET

NAME	ORGANIZATION	FUNCTION	LEVEL
DIRECTOR/TELECOM-I	RDSO	MEMBER	PREPARE
EXECUTIVE DIRECTOR / TELECOM	RDSO	-	APPROVE

### REVISIONS

VERSION	REVISION	EFFECTIVE MONTH/YEAR
RDSO/SPN/TC/103/2013	FIRST ISSUE	MARCH 2014
RDSO/SPN/TC/103/2013 REV.1	SECOND ISSUE	MAY 2020
RDSO/SPN/TC/103/2013 REV.2	THIRD ISSUE	MARCH 2021

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## I. Summary:

This document covers the requirements of Managed Media Converter The purpose of Media converter is to convert:

- (i) Ethernet to Optical signal and vice versa (option-1)
- (ii) Ethernet & E1 to Optical signal (option-2 )
- (iii) Ethernet & E1 to Optical signal/ DSL 2W Copper single (option-3)

## II. Source:

Draft specification for Managed Media Converter (Ethernet to Optical) is issued by RDSO Lucknow to comply recommendations of 37<sup>th</sup> TCSC accepted by Railway Board vide letter No. 2011/Tele/9(1) dated 10.01.2013.

## III. Foreword:

RDSO/ SPN specification is issued as draft specification. This specification is circulated to customers/ Railways and field inspection units for comments.

In the absence of IRS specification, procurement may be made as per RDSO/ SPN specification.

This specification contains reference to many national and international standards. Wherever, reference to any specifications appears in this document, it shall be taken as a reference to the latest version of that specification unless the year of issue of the specification is specifically stated.

## 1.0 Introduction:

The specification covers the specification of Managed media converter. **The purpose of Media converter is :**

- (i) **Option 1 :** To convert Ethernet to Optical signal and vice versa for transport of Ethernet frames over optical fiber cable. Typical use case is shown in the diagrams below.

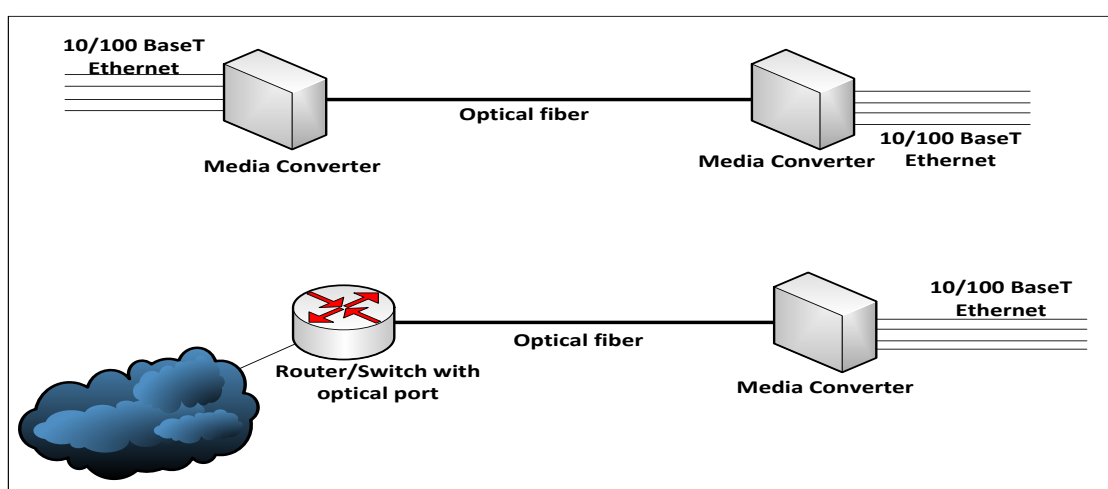


Fig-1 Managed Media Converter (Ethernet to Optical) (Option-1)

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- (ii) **Option-2** : To connect Ethernet & E1 input and other optional item (as per clause No. 2.1.7 (vi)) at the OFC hut and convert it into ethernet frame for transporting as optical signal on Optical Fibre Cable to connect remote end devices like the RTU (for SCADA) by converting the Optical Signal into Ethernet Signal at remote end.

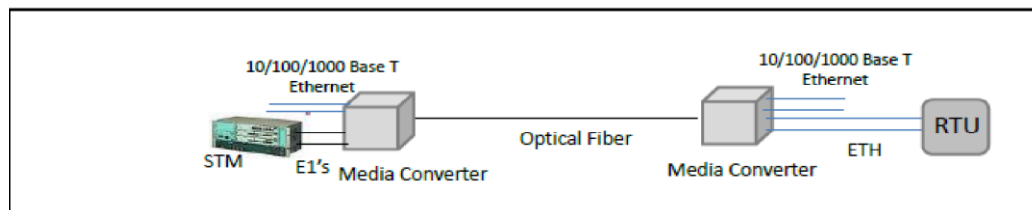


Fig-2 Managed Media Converter (Ethernet & E1 to Optical and Optical to Ethernet) (Option-2)

- (iii) **Option-3** : To connect Ethernet & E1 input and other optional item (as per clause No. 2.1.7 (vi)) at the OFC hut and convert it into ethernet frame for transporting on Optical Fibre / copper cable to connect remote end devices like the RTU (for SCADA) purpose.

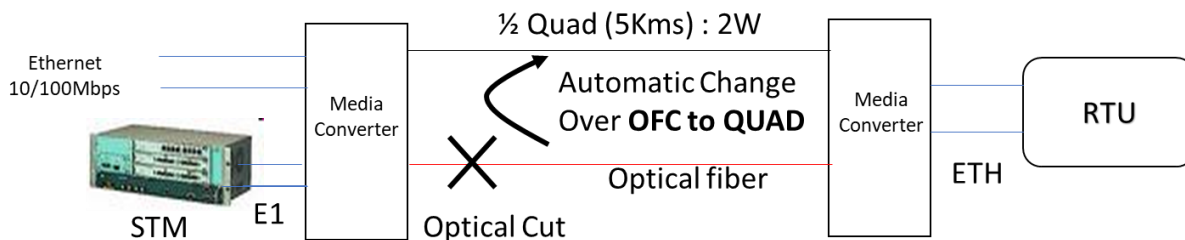


Fig-3 OFC HUT Location RTU Location SSP/SP/TSS etc., locations  
Managed Media Converter (Ethernet & E1 to Optical/copper and Optical/copper to Ethernet) (Option-3)

## 2.0 Technical Requirements:

### 2.1 User Ethernet Interfaces:

#### 2.1.1 Type and Number:

- (i) IEEE 10/100/1000 BASE T, Minimum Four Number (option-1).
- (ii) IEEE 10/100/ BASE T, Minimum Two Number and E1 interface as per ITU-T G.703, G.704 Minimum Two Number (**option-2 & option 3**).

#### 2.1.2 Connector type: RJ 45

#### 2.1.3 PoE: There shall be different types of media converters. The purchaser shall be required to mention the type of media converter.

##### 2.1.3.1 Media Converter with PoE: At least two ports shall be PoE compliant as per IEEE802.3af.

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### 2.1.3.2 Media Converter without PoE

### 2.1.3.3 Media Converter with E1 & Ethernet interface available ( option-2 & option 3)

- 2.1.4 Auto sensing of speed on 10/100/1000 ports.
- 2.1.5 Auto negotiation on Ethernet interfaces for speed and mode of communication (full duplex or half duplex).
- 2.1.6 Auto sensing of MDI/MDIX for UTP copper ports.
- 2.1.7 **Option-2 & Option 3:** E1 interface as per ITU-T G.703, G.704,
- i. Line Rate: 2048 Kbps
  - ii. Impedance: 120 Ohms (Balanced)
  - iii. Connector: RJ45
  - iv. CRC: User selectable CRC-4 generation and detection 120 Ohms and minimum two ports to be available
  - v. Two port E1 interfaces
- vi. (Optional Clause) As per requirement of purchaser**
- (a) Media Converter have following ports at input also
    - (i) 2 port E&M interface supporting 2W/4W for TPC.
    - (ii) 2 port for FXO / FXS for extending telephones
  - (b) Option 3: Media Converter have following ports at input and output also.
    - (i) At output DSL 2W Copper single pair operational built interface TCPAM as per ITU-T G 991.2 Line Impedance 135 Ohms Automatic changeover between optical path and 2W DSL Copper in case of optical path is broken
    - (ii) At input 2 port E&M interface supporting 2W/4W for TPC.
    - (iii) At input 2 port for FXO /FXS for extension of telephones.

## 2.2 Network Interfaces:

### 2.2.1 Fibre Port:

- 2.2.1.1 Type and Number: Two SFP ports may be provided.
- 2.2.1.2 These two ports shall provide redundancy. In case of port failure the traffic shall be diverted to the other port.
- 2.2.1.3 It will support Gigabit SFP or SC connector 155Mbps for Option 2 & Option 3
- 2.2.2 One port of **2W (DSL) copper port built in with automatic changeover to it in case of optical path is cut or fiber is unavailable.**

## 2.3 Features of Media converter:

- 2.3.1 VLAN as per IEEE 802.1Q
- 2.3.2 Flow control IEEE 802.3x
- 2.3.3 LLDP as per 802.1AB,
- 2.3.4 Link aggregation as per IEEE 802.3ad
- 2.3.5 DHCP client and server.
- 2.3.6 Spanning tree protocol as per IEEE 802.1D
- 2.3.7 Rapid spanning tree as per IEEE 802.1w
- 2.3.8 MSTP as per IEEE 802.1s
- 2.3.9 BPDU guard Spanning tree root guard

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- 2.3.10 IGMP v1, v2 and v3 snooping
- 2.3.11 Support for frames size atleast 2048 Bytes.
- 2.3.12 NTP V.3 or SNTP for retrieving date and time.

#### 2.4 Security and QoS:

- 2.4.1 Port based user authentication IEEE 802.1x.
- 2.4.2 Unicast MAC filtering.
- 2.4.3 Four dispatching queues per port , mapping the 8 priority queues in IEEE 802.1p
- 2.4.4 WRR
- 2.4.5 Rate limiting per port (Ingress and Egress)
- 2.4.6 Per port broadcast, multicast and unicast storm control.
- 2.4.7 MAC based ACL
- 2.4.8 Broad cast, Multicast and unicast storm control.

#### 2.5 Management and Diagnostics:

- 2.5.1 SNMPv1/ v2c to enable management by third party SNMP manager.
- 2.5.2 RMON
- 2.5.3 CLI based management via console port and Telnet
- 2.5.4 WEB management
- 2.5.5 SSH
- 2.5.6 Trace route and Ping test
- 2.5.7 FTP or TFTP
- 2.5.8 Different levels of access
- 2.5.9 Link monitoring
- 2.5.10 Monitoring of power supply failure

#### 2.6 Option-2&3: : Ethernet Module 10/100 Mbps corresponding to E1 module to support RSTP protocol:

The device to be capable of carrying multiple traffic on E1 and also on Ethernet ports available on the same optical fiber/Copper cable.

#### 2.7 Indications: Following minimum indications shall be provided.

- 2.7.1 Power
- 2.7.2 Alarm
- 2.7.3 Connection data forwarding indication
- 2.7.4 Ethernet link
- 2.7.5 10/100/1000 Mbps speed indication
- 2.7.6 E1 link / LOS, AIS, RAL (option-2 &3)
- 2.7.7 DSL link (Option -3)

#### 2.8 Power Supply:

- 2.8.1 Shall work on both AC and DC supply. This does not imply dual power supply.

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**2.8.2** AC supply range: 100 V to 240 V AC

**2.8.3** DC supply range:

(i) -48 V DC nominal on range-36 V to -60 V DC.

(ii) 110 V DC Nominal with voltage range from -10% to +20%. (**option-2 & option 3**)

**2.8.4** Reverse polarity protection for DC operation.

**2.8.5** Over voltage protection for both AC and DC operation.

**2.9 Electrical Safety:** Shall comply EN60590 or IEC 60950 or UL 60950 or CSA 60950 or equivalent IS 13252.

(“Note: for EN/IEC/UL/CSA/IS, test report/test certificate to be provided from NTH/NABL/NABCB accredited Labs or Internationally reputed test agencies alongwith detailed test reports.”).

**2.10 EMC compliance:**

(“Note: for EN/IEC/CISPR/CE/FCC, test report/test certificate to be provided from NTH/NABL/NABCB accredited Labs or Internationally reputed test agencies alongwith detailed test reports.”)

2.9.1 Emission compliance: EN 55022 class A/B or CISPR22 class A/B or CE Class A/B or FCC class A/B.

2.9.2 Immunity Compliance:

- a. EN61000-4-3 or IEC61000-4-3
- b. EN61000-4-4 or IEC61000-4-4
- c. EN61000-4-5 or IEC61000-4-5
- d. EN61000-3-3 or IEC61000-3-3

**2.11 Operating Condition:** Testing as per BSNL QM-333 or IEC 60068 or IS 9000 or equivalent ISO or MIL STD-810 to show compliance to following parameters.

(“Note: for QM-333/IEC/IS/ISO/MIL, test report/test certificate to be provided from NTH/NABL/NABCB accredited Labs or Internationally reputed test agencies along with detailed test reports.”)

2.10.1 Operating Temperature: 0° to 50°C

2.10.2 Storage Temperature: -20° to 70°C

2.10.3 Humidity: 10% to 90% Non-condensing.

### 3.0 Specification of SFP:

**3.1 Types of SFPs:** Type of the SFP/SFPs to be supplied with Media Converter shall be specified by the purchaser from among the following SFPs.

- a. 1000BASE-LX10: Requires a pair of mono-mode fibers. Data rate 1000 Mbps, Approximate range 10Km.
- b. 1000BASE-EX: Requires a pair of mono-mode fibers. Data rate 1000 Mbps, Approximate range 40Km.
- c. 1000BASE-BX-10U: Requires only one mono-mode fiber for both Trans and Receive. The device at other end must have 1000BASE-



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BX-10D type of SFP. Data rate 1000 Mbps, Approximate range 10Km.

- d. 1000BASE-BX-10D: Requires only one mono-mode fiber for both Trans and Receive. The device at other end must have 1000BASE-BX-10U type of SFP. Data rate 1000 Mbps, Approximate range 10Km.

**Note:**

- *The range given is only for the guidance of purchaser and will depend on condition of fiber.*
- *The SFPs mentioned against item number a and b will work with same type of SFP at other end. For example, 1000BASE-EX will work with 1000BASE-EX at other end etc.*
- *The SFPs mentioned against item number c and d will work in pair. 1000 BASE-BX-10U has to be paired with 1000 BASE-BX-10D.*

**3.2 General Requirements:**

- 3.2.1** Interoperability of each type of SFP shall be tested (reduced range acceptable) with the same type SFP of CISCO made. – option 1
- 3.2.2** Operating Case Temperature: 0°C to 70°C
- 3.2.3** RoHS compliant
- 3.2.4** Optical Safety:
- 3.2.4.1** SFP shall be Class I laser product.
- 3.2.4.2** The optical connector must be protective against dust entry when optical fiber cable is not connected.
- 3.2.4.3** SFP shall comply laser safety standard IEC-60825-1 or equivalent EN standard or FCC 21 CFR Chapter 1, Subchapter J.

**3.3 Technical requirements of SFPs:** (Vendor can take approval for all or some of these SFPs)

- 3.3.1** 1000BASE-LX10
- a. Nominal optical wavelength: 1310 nm.
  - b. Optical power Tx Max: -3dBm
  - c. Optical power Tx Min: -9dBm to -11 dBm
  - d. Rx saturation: -3dBm
  - e. Rx sensitivity: -19.5 dBm or better.
  - f. Compliant to MSA, IEEE 802.3ah
- 3.3.2** 1000BASE-EX
- a. Nominal optical wavelength: 1310 nm.
  - b. Difference between Tx Min optical power and Rx Sensitivity shall be minimum 21dB.
  - c. Compliant to MSA,
- 3.3.3** 1000BASE-BX10-10U
- a. Nominal optical wavelength: Tx-1310 nm, Rx- 1490nm.
  - b. Optical power Tx Max: -3dBm
  - c. Optical power Tx Min: -9dBm

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- d. Rx saturation: -3dBm
- e. Rx sensitivity: -19 dBm or better.
- f. Compliant to IEEE 802.3ah.

#### 3.3.4 1000BASE-BX10-10D

- a. Nominal optical wavelength: Tx-1490 nm, Rx- 1310 nm.
- b. Optical power Tx Max: -3dBm
- c. Optical power Tx Min: -9dBm
- d. Rx saturation: -3dBm
- e. Rx sensitivity: -19 dBm or better.
- f. Compliant to /IEEE 802.3ah

#### 4.0 General requirement regarding quality:

- 4.1 The PCB shall be Class 2 PCB.
- 4.2 The MTBF figure shall be submitted along with documentary support.
- 4.3 The finish of the box should be smooth, without any rough edges.
- 4.4 The box should be powder coated or spray painted.

#### 5.0 Documentation:

- 5.1 Installation, Operation and Maintenance Manual (To be supplied with each media converter): It should cover following,
  - 5.1.1 Safety measures to be observed in handling the equipment;
  - 5.1.2 Precaution for installation, operation and maintenance;
  - 5.1.3 Procedure for configuration of Media converter using CLI and web interface along with screen shots;
  - 5.1.4 Procedure for remote management for fault, alarm and setting of parameters through NMS and third party SNMP manager.
- 5.2 Repair Manual (To be supplied with every 10 media converters or a fraction thereof): It should cover following,
  - 5.2.1 Ordering information for all the replaceable parts;
  - 5.2.2 Systematic trouble shooting chart (fault-tree) shall be given for the probable faults with their remedial actions.

#### 6.0 Type Test:

- 6.1 The compliance to various requirements of this specification shall be verified
- 6.2 Type approval certificate shall contain the following information:
  - 6.2.1 Make and model of approved Media converter.
  - 6.2.2 Media converter with or without PoE and number of PoE ports.
  - 6.2.3 Media converter as per Option-1/Option-2/Option-3 alongwith other optional requirement.
  - 6.2.4 Make and models of approved SFPs of each type.
  - 6.2.5 Number of Ethernet user interfaces (Minimum 4 Numbers)
  - 6.2.6 Power supply options: It will indicate whether the approved device has all the three power supply options (100 V AC -240V AC, -48

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V DC (-36 V DC to -60 V DC) and 110 V DC Nominal (-10% to +20%)..

#### 6.2.7 Version number of approved documents as per clause 5.0

**7.0 Acceptance Test:** The following shall constitute the acceptance tests which shall be carried out by the inspecting authority for the purpose of acceptance on 10% of the lot (minimum 2 numbers of Media Converter and minimum one number of SFP of each type) offered for inspection by the supplier:

- 7.1 Verification make and model of media converter from the approved make and model.
- 7.2 Verification make and model of SFPs from the approved make and model – option 1 or SC connector built in for optical fiber for Option 2 / Option 3
- 7.3 Clause 2.1.3; Verification of PoE capability if applicable as per the option
- 7.4 Clause 2.2.1.2; Redundancy against fiber disconnection for all options
- 7.5 Clause 2.2.1.3; Support for SFPs of both speed (Gigabit and FE as per option).
- 7.6 **SNMP capability by showing generation of at least one trap/alarm, and setting and getting at least one parameter remotely through SNMP manager for option 1 or web interface for option-2 & 3**
- 7.7 Clause 2.5.6; Trace route and ping test for option 1
- 7.8 E1 module testing with Ethernet Module at the corresponding unit with RSTP feature ( **option-2 & option 3**)
- 7.9 Option -2 to verify the FXS / FXO & E&M interface working on optical fiber connected back to back.
- 7.10 Option -3 to verify the FXS/FXO / E&M interface working on optical fiber & 2W DSL port on copper connected back to back with automatic change over between optical fiber & Copper if optical path is broken
- 7.11 Clause 2.5.10; Monitoring of power supply failure- option 1
- 7.12 Clause 2.7; Power supply as per purchaser's requirement and tests for
  - 7.12.1 Clause 2.7.2 or 2.7.3 as applicable
  - 7.12.2 Clause 2.7.4; Reverse polarity protection for DC operation.
  - 7.12.3 Clause 2.7.5; Over voltage protection for both AC and DC operation.
- 7.13 Clause 3.2.1; Interoperability with CISCO make SFPs. For option 1
- 7.14 Clause 5.0; Documentation as per approved documents
- 7.15 Clause 9.0; Marking.
- 7.16 Any other tests shall be carried out as considered necessary by the inspecting authority.

**8.0 Routine Test:** All the tests included in Acceptance test shall be carried out as routine tests. Firm may carry out additional test before offering the product for inspection.

**9.0 Marking:** The following information shall be clearly marked at a suitable place on each equipment:

- a. Name and Address of the manufacturer.
- b. Month & Year of the manufacturing.

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- c. Serial number of Equipment.
- d. Specification number.

**10.0 Packing:** The equipment and its sub-assemblies shall be packed in thermocole boxes and the empty spaces shall be filled with suitable filling material. Before keeping in the thermocole box, the equipment shall be wrapped with bubble sheet. The equipment shall be finally packed in a box of sufficient strength so that it can withstand bumps and jerks generally encountered in a road/rail journey.

**11.0 Information to be given by purchaser:**

SN	Item	Corresponding Clause	Quantity	Remark
1	Type of Media converter	1.0		Purchaser specify requirement of Media Converter as per Option-1 or Option-2 or Option-3.
1	Media converter with PoE or without PoE	2.1.3		As per purchaser requirement
2	Patch cord cables			Patch cord cables are not included along with this product. Suitable patch cord cables should be procured separately.
3	Power supply: -48 V DC nominal or 110V DC for SCADA	2.7		As per purchaser requirement
4	SFP	3.3		(i) As per purchaser requirement. (ii) The SFPs 1000BASE-LX10 and 1000BASE-EX will work with same type of SFP at other end. For example, 1000BASE-EX will work with 1000BASE-EX at other end etc. (iii) The SFPs 1000BASE-BX-10U and 1000BASE-BX-10D will work in pair. 1000 BASE-BX-10U has to be paired with 1000 BASE-BX-10D.

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मैनेज्ड मीडिया कन्वर्टर (ईथरनेट/ई1 से ऑप्टिकल) Managed Media Converter (Ethernet/E1 to Optical)			

**12.0 Information to be given by purchaser:**

“All the provisions contained in RDSO’s ISO procedures laid down in Document No. QO-D-8.1-11 (titled “Vendor-Changes in approved status”) and subsequent versions/amendments thereof, shall be binding and applicable on the successful vendor/vendors in the contracts floated by Railways to maintain quality of products supplied to Railways”.

\*\*\*\*\*End of Document\*\*\*\*\*