Eskom	Standard	Technology

Title: **MULTI-SERVICE ACCESS NETWORK EQUIPMENT SPECIFICATION**

Unique Identifier: **240-128505297**

Alternative Reference Number: **<n/a>**

Area of Applicability: **Engineering**

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COE Acceptance

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This document is STABILISED. The technical content in this document is not expected to change because the document covers: *(Tick applicable motivation)*

1	A specific plant, project or solution	
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Content

Executive Summary

Eskom has a utility telecommunications network to support teleprotection, SCADA, metering and all other OT voice and data services that are used to operate, manage and safeguard the power network.

This standard specifies the requirements for Multi-Service Access Platform (MSAP) for supporting all utility voice and data services including SCADA and teleprotection. The standard only provides the minimum requirements and excludes detailed site specific information.

Throughout this document the terms multiplexer/MSAP will be used interchangeable with both meaning an MSAP network which supports teleprotection, SCADA and all other OT services. This standard includes the voice interfaces but excludes the voice switches/ call managers.

1. Introduction

Eskom Telecommunications (ET) network fulfils a strategic role that is very critical to the power business. The ET network carries delay-sensitive and mission critical applications such as Telecontrol and Teleprotection which are critical for the reliable operation of the power network. Due to the sensitive nature of these applications to delays/latency, ET has primarily relied and invested heavily on a highly deterministic Time Division Multiplexer (TDM) based access platform with very high levels of redundancy and predictable circuit delays. However, as the end customer equipment (CPE) evolves towards Ethernet /Internet Protocol based solutions; there is a need to migrate the access infrastructure towards a packet-switched network capable of meeting future Internet Protocol (IP) requirements whilst simultaneously retaining the salient features of high reliability and predictably low delays inherent in a TDM network. A Multi-Service Access Platform (MSAP) is well-suited to ET's adopted migration philosophy of supporting traditional legacy TDM service while migrating towards a packet-switched network. Furthermore, Multi-Service Access Platform is necessitated by key business drivers including current Bandwidth Management Equipment (BME) equipment obsolescence and the capacity constraints on ET's current network. Henceforth, this specification seeks to define Eskom Telecommunication’s network requirements, specifically the access layer requirements and defines the key functional and equipment requirements of the desired Multi-Service Access Network.

This technical specification therefore, also forms part of Eskom Telecommunications' enquiry process for the supply, delivery, if called for, installation and commissioning of the Multi-Service Access Platform.

2. Supporting clauses

2.1 Scope

This specification defines Eskom Telecommunications' requirements for a Multi-Service Access Platform comprising of various sized (small, medium, large) TDM and Ethernet/IP based multiplexers and related Network Management System(s).The equipment is needed to replace Eskom Telecommunications obsolete Bandwidth Management Equipment.

Equipment and services covered by this specification include:

- TDM and Ethernet/IP Multiplexers of various sizes and capacities.
- Network Management Systems.
- Maintenance, technical support, repairs and training requirements.
- Professional Services and consultancy requirements.
- Supply, installation and commissioning requirements.

This specification is to be used for the issuing of the enquiry with aim to set up a long term enabling contract for the equipment specified herein.

A supplier must complete schedule A & B "Schedule of Technical Compliance" for this specification.

2.1.1 Purpose

The purpose of this document is to define minimum requirements for Multi-Service Access Platform in the Eskom Telecommunications network.

2.1.2 Applicability

This document shall apply throughout Eskom Holdings Limited, its Divisions, subsidiaries and entities whose services are dependent on the communications network.

2.2 Normative/informative references

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

2.2.1 Normative

[1] ISO 9001, Quality Management Systems.

[2] Eskom 240-86458714, Generic Network Management Specification Standard

[3] Eskom ETSP 0337, Operational Requirements for Technology Contracts

[4] Eskom 240-48584707, Operational Technologies over IP/MPLS

[5] IEEE 802.1X, Port-based network access control.

2.2.2 Informative

[6] IEEE C37.94 (2002), IEEE Standard for NX64 Kilobit Per Second Optical Fiber Interfaces between Teleprotection and Multiplexer Equipment.

[7] IEC 61850-7-410, Communication Networks and Systems for Power Utility Automation

[8] IEC 870-2-1 (1995), Telecontrol equipment and systems. Part 2: Operating conditions - Section 1 Power supply and electromagnetic compatibility.

[9] IEC/TS 61000-6-5, Electromagnetic compatibility (EMC) Part 6-5: Generic standards Immunity for power station and substation environments.

[10] ITU-T Recommendation G.703, Physical/Electrical Characteristics of Hierarchical Digital Interfaces.

[11] ITU-T Recommendation G.823, The control of Jitter and Wander within Digital Networks which are based on the 2048 kbit/s hierarchy.

[12] ITU-T Recommendation G.955: Digital line systems based on the 2048 kbit/s hierarchy on optical fibre cables.

[13] ETSI EN 300 385, European Standard (Telecommunications series). Electromagnetic compatibility and Radio spectrum Matters (ERM)

[14] ETSI ETS 300 019, Equipment Engineering (EE); environmental conditions and environmental tests for telecommunications equipment

[15] ITU-T G.652, Characteristics of a single-mode optical fibre and cable.

[16] Eskom NST0042, Minimum Requirements for Health and Safety Specification.

[17] MEF, Technical Specification.

2.3 Definitions

2.3.1 General

Definition	Description
Bandwidth Management Equipment (BME)	A multiplexer used to provision and groom analogue and digital circuits onto 64 kbit/s channels that can be collectively aggregated onto an E1 frame.
Eskom Telecommunications	A business unit mandated to provide telecommunications services throughout Eskom.
Technical Terms	For the purpose of this specification, technical terms used shall be as defined in the documents listed in clause 2. (Normative/Informative References)

2.3.2 Disclosure classification

Controlled disclosure: controlled disclosure to external parties (either enforced by law, or discretionary).

2.4 Abbreviations

Abbreviation	Description
ADM	Add Drop Multiplexer
BER	Bit Error Rate
BME	Bandwidth Management Equipment
BNC	British Naval Connector
CPE	Customer Premises Equipment
DCC	Digital Communications Channel
DCE	Data Communications Equipment
DCN	Digital Communications Network
DTE	Data Terminal Equipment
E & M	Ear and Mouth
EIA	Electronic Industries Alliance
EMC	Electromagnetic Compatibility
EoP	Ethernet over PDH
EoS	Ethernet over SDH
ET	Eskom Telecommunications
FCAPS	Fault Management, Configuration, Accounting, Performance and Security
FXO	Foreign Exchange Office
FXS	Foreign Exchange Station
GbE	Gigabit Ethernet
ICASA	Independent Communications Authority of South Africa
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronic Engineers
IP	Internet Protocol
ITU-R	International Telecommunications Union - Radio communications Sector
ITU-T	International Telecommunications Union - Telecommunications Sector
LAN	Local Area Network
MSAP	Multi-Service Access Platform
MTBF	Mean Time Between Failures
NE	Network Element
NMS	Network Management System
OTN	Optical Transport Network
PBX	Private Branch Exchange
PDH	Plesiochronous Digital Hierarchy

Abbreviation	Description
SCADA	Supervisory Control And Data Acquisition
SDH	Synchronous Digital Hierarchy
STM	Synchronous Transfer Module
TDM	Time Division Multiplexing
WAN	Wide Area Network

2.5 Roles and responsibilities

The responsibility to implement this document lies with all parties within Eskom and its subsidiaries that are directly affected by it, especially those responsible for procuring Multi-Service Access Platform infrastructure.

2.6 Process for monitoring

Not Applicable

2.7 Related/supporting documents

Not Applicable

3. General Information and Requirements

The following requirements apply to all equipment called for in this specification and the information requested will be provided for each of these equipments.

a) Only equipment manufactured to recognised relevant international standards, and complying with the relevant ITU-T, ITU-R and ETSI performance recommendations and reports will be accepted.

b) The MTBF (in hours) of all offered equipment shall be stated. The assumed environmental conditions in the given MTBF figures shall also be specified.

c) The metric system of weights and measures shall be used in all technical documentation.

d) ITU-T/ITU-R terminology shall be adhered to where applicable.

e) MEF standards shall be adhered to where applicable.

f) For all equipment offered the supplier shall state their support and maintenance contract options, terms, costs and durations thereof.

g) The supplier shall state the planned manufacturer's discontinuation date for each piece of equipment offered and the duration of continuing support of the equipment beyond the manufacturer's discontinuation date.

h) Both technical and marketing brochures for all equipment offered shall be supplied with the response documentation to the enquiry.

i) The supplied multiplexer shall fit in a standard 19 inch rack (ETSI 300 119).

j) The supplier shall clearly specify how long it takes for the equipment to be delivered and should specify the minimum delivery period.

4. Interface Requirements

4.1 Interface Characteristics

a) The data interfaces shall support connection of synchronous and asynchronous data devices via X.21, EIA-422, EIA-232 and EIA-485 interfaces.

b) These interfaces shall not be provided in a scaled down version, i.e. for EIA-232, all available functions shall be present (Rxd, Txd, DTE, DCE, RTS, CTS).

c) The multiplexer shall also function as a non-blocking digital cross-connect system capable of regrouping and cross-connecting 64 Kbps and N x 64 kbps data streams and grooming these data streams into E1, STM-n and Ethernet aggregates.

d) The multiplexer shall provide a minimum of 10 x 64Kbps channels for interconnecting foreign teleprotection switches compliant with IEEE C37.94.

e) The multiplexer bridges the gap between the high speed digital transmission lines - E1 (2.048 Mbps) channels and the end-user voice and data customer premises equipment (CPE) operating at sub-E1 rates. For this purpose, the multiplexer should be capable of grooming sub-rate asynchronous and synchronous data streams from 64 kbps and super-rate multiplexing up to 2 Mbps.

f) The equipment shall be provided with 120 Ω balanced E1 electrical interface and support UTP/Shielded Twisted Pair (STP) category 5 and 5e/6 connectors.

g) Where applicable, the necessary patch panels shall be provided with the details on the number of supported ports and pin layouts.

h) E&M Interfaces shall be clean contacts which support +12Vdc to -48Vdc.

i) For E&M interface, UHF/VHF analogue radio repeaters TX/RX require an audio response 300-3000Hz with adjustable input/output levels of -4dBm to +4dBm.

j) Optical transceivers shall operate in the 1310 nm and 1 550 nm optical windows over single mode fibres conforming to [15] ITU-T G.652. The operating wavelengths within the given bands shall be stated.

k) The maximum acceptable path loss and distance for optical transceivers without repeaters shall be stated for the STM-n transmitter.

l) The maximum acceptable path loss and distance for optical transceivers without repeaters shall be stated for the optical GigE transmitter.

m) Suppliers shall specify their systems' optical transmit power for STM-n aggregate.

n) Suppliers shall specify their systems' optical receive sensitivity for STM-n aggregate in terms of minimum and maximum receive power levels.

o) For all optical interfaces, the preferred fibre-optic connector shall be SC-APC (straight connector angle polished) type.

p) Electrical interfaces shall conform to ITU-T G.703 standard.

q) Multiplexers shall support Ethernet over PDH (EoP) interfaces.

r) Multiplexers shall support Ethernet over SDH (EoS) interfaces.

s) Multiplexers shall support dot1q and q&q Ethernet encapsulation

t) The supplier shall provide the MPLS-TP roadmap for the multiplexers.

4.2 Customer interface Requirements

a) E1 – To provide an uplink to the ET TDM network. E1s will also be used to aggregate E&M voice services which will then be terminated on a voice switch.

b) RJ45 10/100/1000 Base-T – To connect electrical Ethernet services.

c) Optical 10/100/1000 Base-T – To connect fibre Ethernet services.

d) PoE – To connect IP telephones and IP cameras. Eskom currently has a lot of analogue telephones which will be converted to IP.

e) FXS/FXO/ E&M - With the intention to migrate to VoIP, support of FXS, FXO and E&M ports will provide smooth migration for sites where Ethernet LAN is not readily available.

f) RS232 (X.25) – To provide X.25 services for disturbance recorders and vectographs. If the proposed equipment does not support X.25, then the supplier shall propose a solution for existing X.25 services.

g) X.21 Asynch/RS422/RS485 and Sync. Asynch is required for SCADA services and Sync is required for teleprotection.

h) SCADA Baud rates: 200 and 1200 serial baud rates shall be supported for SCADA.

i) The supporting of baud rates 9600 and 19200bps is mandatory.

j) It must be noted that RS232 Asynch as a replacement of X.21 Asynch/RS422 will not be sufficient as some 19200bps sites will require more than 15m serial cable.

k) The Supplier shall provide all the cables associated with the above interfaces with their lengths and detailed pinouts.

4.3 Multiplexer Combos

Three different multiplexer sizes are required to meet ET requirements for small, medium and large sites. Therefore system minimum requirements will be specified for small, medium and large multiplexers. Where it is not possible to meet the combo requirements using a single device, the supplier shall clearly indicate and provide details of all the components used to construct a combo. Eskom Telecommunications reserves the right at any stage to decide on which items to use on an offered combo on site-to-site bases. To make this possible, supplier shall provide price per item for all the components used in a combo.

4.3.1 Small Size Multiplexer (Small Substations)

This combo is for small substations which are mostly distribution sites and some few transmission sites. The multiplexer shall at minimum support the following interfaces:

a) 2 X E1 – To provide an uplink to the ET TDM network.

b) 4 X Ethernet (10/100/1000 Base-T) – To provide electrical Ethernet services.

c) 2 X Ethernet (100 Base- T SFP) – To provide fibre Ethernet services.

d) 2 X PoE – To provide IP telephones and IP video surveillance services.

e) 4 X FXS/FXO – To connect analogue telephones and exchange.

f) 2 X E&M – To connect analogue UHF/VHF area radios and PABX.

g) 4 X X.21 (Synch and Asynch/RS422/RS-485) – To provide SCADA and teleprotection circuits. Both point-to-point and point-to-multipoint must be supported for SCADA/ Asynch.

h) Multiplexer shall support Ethernet over PDH (EoP) interfaces.

i) All associated equipment specific cables and patch panels shall be provided by the supplier.

4.3.2 Medium Size Multiplexer (Medium Substation)

This combo is for medium size substations which are mostly transmission sites. The multiplexer shall at minimum support the following interfaces:

a) 2 X E1 – To provide an uplink to the ET TDM network. 8 X Ethernet (10/100/1000 Base-T) – To provide electrical Ethernet services.

b) 4 X Ethernet (100 Base- T SFP) – To provide fibre Ethernet services.

c) 4 X PoE –To provide IP telephones and IP video surveillance services.

d) 8 X FXS/FXO – To connect analogue telephones and exchange.

e) 4 X E&M – To connect analogue UHF/VHF area radios and PABX.

f) 8 X X.21 (Synch and Asynch/RS422/RS485) – To provide SCADA, teleprotection and used as uplink in sites where there is no Ethernet or E1 transport. Both point-to-point and point-to-multipoint must be supported for SCADA/ Asynch.

g) 3 X RS232 (X.25) – To provide X.25 services. If the proposed equipment does not support X.25, then the supplier shall propose a solution for existing X.25 services.

h) 2 X STM-1 interface for SDH transport.

i) 2 X STM-4 interfaces for SDH transport.

j) Multiplexer shall have separate TDM and Ethernet/ MPLS-TP buses.

k) Multiplexer shall support a SIP voice gateway module which can control at least 500 FXS ports.

l) The voice gateway shall support remote site survivability and be interoperable with at least Siemens HiPath Switches and Cisco call managers.

m) All associated equipment specific cables and patch panels shall be provided by the supplier.

4.3.3 Large Size Multiplexer (Large Substation)

This combo is for large substations which are mostly transmission sites. The multiplexer shall at minimum support the following interfaces:

a) 4 X E1 – To provide an uplink to the ET TDM network.

b) 16 X Ethernet (10/100/1000 Base-T) – To provide electrical Ethernet services.

c) 8 X Ethernet (100 Base- T SFP) – To provide fibre Ethernet services.

d) 8 X PoE –To provide IP telephones and IP video surveillance services.

e) 16 X FXS/FXO – To connect analogue telephones and exchange.

f) 8 X E&M – To connect analogue UHF/VHF area radios and PABX.

g) 16 X X.21 (Sync and Asynch/RS422/RS485) – To provide SCADA and teleprotection circuits. Both point-to-point and point-to-multipoint must be supported for SCADA/ Asynch.

h) 6 X RS232 (X.25) – To provide X.25 services. If the proposed equipment does not support X.25, then the supplier shall propose a solution for existing X.25 services.

i) 2 X STM-1 interface for SDH transport.

j) 2 X STM-4 interfaces for SDH transport.

k) 2 X STM-16 interfaces for SDH transport.

l) Multiplexer shall have separate TDM and Ethernet/ MPLS-TP buses.

m) Multiplexer shall support a SIP voice gateway module which can control at least 500 FXS ports.

n) The voice gateway shall support remote site survivability and be interoperable with at least Siemens HiPath Switches and Cisco call managers.

o) All associated equipment specific cables and patch panels shall be provided by the supplier.

4.4 General Uplink Interface Requirements

a) E1 – To provide an uplink to the ET TDM network.

b) Ethernet (10/100/1000 Base-T) – To connect to ET transport network.

c) The multiplexer must support fibre Ethernet Interfaces.

d) Multiplexer shall provide STM1/4/16 interfaces.

e) Multiplexer shall provide Ethernet over PDH (EoP) interfaces.

f) Multiplexer shall provide Ethernet over SDH (EoS) interfaces.

g) Eskom intends to upgrade the SDH network to OTN and the supplied Multiplexer shall be interoperable with both legacy transport technologies and OTN.

4.5 Modems/Data Termination Units

a) The modems or data termination units are required to reliably and securely extend services from a central location to a remote site. Therefore, the units shall be fully network managed by the offered Network Manager to allow easy end-to-end service management.

b) The units shall at least provide the following options of the user ports:

1) 2 x X.21 (Synch and Asynch/RS422/RS485)

2) 2 x RS-232

3) 4 x Ethernet (10/100/1000 Base T)

c) The line speeds and relevant parameters and attributes of the user ports shall be locally and remotely software configurable.

d) The extension of services from central to remote sites shall be via shielded twisted pair copper cable. However, preference will be given to units supporting both shielded twisted pair copper cable and fibre connectivity.

e) The supplier shall stipulate configurations to meet redundancy requirements i.e. equipment, network interface (port) and line redundancy. Preference will be given to systems which achieve rich or diverse redundancy features at minimal hardware overhead.

f) The units shall support dual modes of operation as Data Termination Equipment (DTE) or Data Communications Equipment (DCE).

g) Suppliers should stipulate the maximum loop distances and associated data rates on the offered equipment.

h) The units shall at minimum support synchronous data rate of 2.048 Mbps, teleprotection synchronous data rates (64 Kbps) and SCADA asynchronous data rates (9600, 19200).

i) To ensure the integrity of transmitted data, the offered equipment shall be capable of dynamic rate adaptation to adjust to transient interferences and deteriorating quality of line connection. Suppliers may stipulate the dynamic rate adaptation technique, standard or protocol employed by the offered equipment and relevant sensitivity.

j) The supplier shall stipulate the diagnostic features of the offered equipment such as power failure detection, line quality etc. All available alarms shall be indicated by LEDs and shall be available as potential-free contacts for possible extension to external supervisory equipment. Preference will be given to systems accessible via HyperTerminal for local system diagnosis and troubleshooting in addition to the remote connectivity requirements stipulated in this specification.

k) Network Resilience and Reliability

a) The multiplexer network shall have circuit redundancy switching capabilities, bypass configuration and line switching features to meet the requirements of high level availability and accessibility. The supplier shall stipulate how these features are achieved by the multiplexer.

b) The supplier shall stipulate the system configurations to meet the requirements of equipment redundancy (hot standby) and controller redundancy (where applicable). Preference will be given to systems capable of hitless switching and bit-error free protection switching at minimal changeover times.

c) The multiplexer network shall have the ability to revert back to the original path after the alternate route has been selected and the original path restored. This is an important security feature to ensure optimal performance of the network. The supplier shall elaborate on how this feature is achieved by the multiplexer.

d) The supplier shall stipulate how remote site connectivity is achieved for providing services from a central location to remote sites through the use of compact and network manageable modems or similar data termination devices.

e) For reasons of interoperability, integration, training, maintenance, system design and support, all multiplexers offered shall be sourced from a single Original Equipment Manufacturer (OEM).

f) All supplied cards/boards shall be hot-swappable and compatible with the larger size multiplexer chassis i.e. they shall also fit in the universal card slots of the larger sized multiplexer.

g) Input and output housekeeping alarm channels are required on the multiplexers. The number of such input and output channels shall be stated.

h) The offered multiplexer shall be remotely configurable via the offered network management system.

i) The offered equipment shall create a network which is scalable in order to accommodate future growth.

j) The supplier shall specify the protocols of choice to achieve this.

k) The supplier shall provide the proposed high level network architecture for 1800 nodes.

4.6 Network Management System and Supervision

a) Suppliers shall comply to 240-86458714 Generic Network Management Specification Standard

b) Suppliers shall provide hardware, software and third party software requirements for the network management system.

c) Suppliers shall provide requirements pertaining to the design of the Data Communications Network (DCN).

d) Supplier shall state their policy with regard to continuing support of superseded software releases.

4.7 Design and Planning Tools

a) The supplier shall propose a network planning and simulation tool that is capable of network, link, and circuit planning and traffic simulation.

b) The proposed tool shall be able to integrate with the management system and be able to use live network data for planning/simulation.

c) The supplier shall provide information on software and hardware requirements of the design planning and simulation tool.

4.8 Roadmap and MTBF

d) The supplier shall provide the roadmap for the proposed equipment.

e) Roadmaps to clearly indicate the release date, the estimated end of sale and the estimated end of life dates for the proposed equipment.

f) The supplier roadmap shall clearly indicate the hardware, software and licences which must be changed when upgrading to the newer versions.

g) The change of hardware when upgrading to newer versions shall be very minimal.

h) The supplier shall support new purchases and support of the proposed equipment for a minimum period of 10 years from the date of signing of contract with Eskom.

i) The supplier shall provide the Mean Time between Failure (MTBF) for all the proposed equipment including the related modules.

5. Power Requirements

5.1 Electrical Power

a) All offered equipment shall operate from a 48V DC +ve earth power source which will be provided by Eskom Telecommunications. The Management System computers and workstations shall operate from standard 230V (+/-10%) 50Hz (+/-2.5 %) mains power; Eskom Telecommunications will provide UPS power at the control centres.

b) Eskom Telecommunication's standard battery chargers have a rated range of 48V +20% - 15%, positive earth. The equipment shall operate to specification within these voltage limits.

c) The supplier shall specify the voltages outside these limits within which the equipment will still operate correctly and without damage.

d) Equipment shall not suffer catastrophic failure in the event of a continually falling DC supply voltage, nor from inadvertent application of reverse polarity.

e) Eskom Telecommunications has a preference for power feed arrangements to sub-racks which permit disconnection of any sub-rack without affecting supply to the other units in the rack. The proposed platforms will be such that this preference can be achieved.

f) The supplier shall state the DC power consumption of all offered equipment; it is preferable that the power consumption be broken down into level of consumption of the chassis and then each individual module/card.

6. Electromagnetic Compatibility and Immunity (EMC/EMI) Requirements

a) Compatibility and Immunity of the equipment to substation electromagnetic environment is required i.e. the equipment shall function properly in the presence of other substation equipment EM emissions (EMI) and shall itself in its functioning not disturb other equipment or affect humans in its vicinity (EMC).

b) The supplier shall indicate if the multiplexers are IEEE 1613 compliant and state the exclusions and compliance levels.

c) The supplier shall indicate if the multiplexers are IEC 61850-3 and state the exclusions and compliance levels.

d) At minimum multiplexers shall comply with all the relevant IEC 61000 EMC standards.

e) Supplier shall indicate if the multiplexer supports fan-less operation.

f) The supplier shall provide a list of all supported EMC, emission and immunity standards.

7. Environmental Requirements

All equipment shall operate as specified under the following environmental conditions:

a) Indoors Installations:

1) Altitude: 0 - 2500 metres above sea level

2) Temperature: -5˚C to +50˚C

3) Diurnal Range:30˚C

4) Humidity : 95% below 35˚ C and 75% above 35° C

5) Barometric Pressure: 76-104 kilopascals

As a minimum requirement, all indoor equipment shall operate in an ETSI ETS 300 019 Class 3.2 environments.

The supplier shall provide a list of all supported vibration and shock standards.

b) Outdoors Enclosure Installations

1) Altitude: 0 - 2500 metres above sea level

2) Shade Temperature: 30˚C to +50˚C

3) Diurnal Range: 30°C

4) Humidity: All weather operation

5) Barometric Pressure: 76-104 kilopascals

As a minimum requirement, all outdoor equipment shall operate in an ETSI 300 019 Class 4.1E.

c) The supplier shall specify the maximum equipment dissipated power.

d) Some Eskom Telecommunications sites are dusty and, although of a non-metallic nature, the dust is frequently abrasive. To ensure that equipment will withstand these conditions the IEC enclosure rating of IP60 is required on all outdoor equipment.

e) Extremely severe lightning conditions occur frequently during summer season. Normal earthing and bonding lightning protection measures are taken by Eskom Telecommunications on all sites. Equipment shall withstand any residual voltage transients. The supplier shall state any lightning protection features the offered equipment possess and the standards to which the protection feature complies.

8. Installation, Testing and Commissioning

Suppliers shall note the following information pertaining to installation, testing and commissioning. This information is given as an indication to potential contractors of what Eskom Telecommunications expects during Installation and commissioning of the replacement network. This information is not meant to substitute the scope of work. Such a scope will be discussed and agreed upon with the appointed contractor. All the statements below must be noted by the supplier and will form the basis of the contract to be signed with the appointed contractor.

8.1 Installation

a) Equipment supplier shall indicate if they will carry out the installation and commissioning or will make use of a separate contractor. The contractor that will be used for installation and commissioning must be stated where separate from the supplier of the equipment.

b) The replacement of Eskom Telecommunication’s aging multiplexer network will be done in stages with each stage being a replacement of a portion of the network. Site specific scope of works shall be drafted and agreed upon on task order basis.

c) In each project stage quotation, the contractor shall be expected to state clearly and explicitly what work and materials have been included in the installation and commissioning quote. Assumptions made in respect of Eskom Telecommunication's specific responsibilities in the project e.g. facilities provided by Eskom Telecommunications, access to and conditions at site, existing equipment, weather, etc. shall be stated.

d) Individual projects will differ in size and makeup; it is therefore not possible to agree in advance on specific contractual prices for installation and commissioning. To provide a basis for negotiation, the contractor shall provide detailed breakdowns of the work, installation materials, man-hours and costs involved in installing and commissioning the specimen projects described in Schedule C in the Annexes. Travel and subsistence shall be excluded and the quote shall be based on the following assumptions: site access is suitable for normal road vehicles; the tower and equipment room are free of other equipments; both AC and DC power are available.

e) The contractor shall provide detailed plans of equipment layout and of rack make-up. These layouts shall be submitted to Eskom Telecommunications for approval before installation commences. These will be accompanied by the project stage execution plan.

8.2 Testing and Commissioning

a) All test records shall be clear, legible and complete. Handwritten results will not be accepted. Test records shall be signed by those performing and witnessing the tests and the names of those persons shall be printed below their signatures. Test records shall be dated.

b) All test equipment used for the tests shall be controlled, calibrated and maintained in accordance with ISO standards.

c) A full set of factory acceptance tests results for all items supplied shall be provided to Eskom Telecommunications on or before delivery of equipment. These should indicate that the equipment meets the requirements of its specification. The equipment shall not be dispatched from the factory for delivery to Eskom Telecommunications until it has passed its Factory Acceptance Tests.

d) The Contractor shall ascertain, in writing, whether or not inspection or witnessed tests, or both, are required. He shall then give Eskom Telecommunications not less than fourteen days' notice of when the equipment will be ready for inspection or for witnessed testing as requested. Such inspection or witness testing shall not relieve the contractor of their responsibility to meet all the requirements of the various specifications, and it shall not prevent subsequent rejection if equipment is later found to be defective when tested after installation. The location for the tests and inspection shall be within the borders of the Republic of South Africa.

e) After Installation, the contractor shall perform in-station, hop and link tests to verify that equipment is still within specification and that the overall systems and sub-systems meet Eskom Telecommunications' requirements and appropriate specifications. Eskom Telecommunications reserves the right to be present during such tests. Only when the contractor is satisfied that the pre-commissioning test results are acceptable shall they request Eskom Telecommunications' presence at the Commissioning Acceptance Tests.

f) Commissioning acceptance tests will be conducted as a formal demonstration to Eskom Telecommunications that the requirements of all applicable specifications have been met. Testing shall be carried out only in the presence of the formally nominated Eskom Telecommunications representative(s). Such representative or representatives will then sign the test result sheets to confirm the correctness of the test procedures and their acceptance on behalf of Eskom Telecommunications of the results. The tests shall be carried out in accordance with a Commissioning Acceptance Test Procedure and Schedule, produced by the contractor and agreed in advance by Eskom Telecommunications. At the conclusion of all other commissioning tests, a 2 Mbps stream between the two ends of the particular system will be soak-tested for 72 hours. The system design criteria shall be met during this period; particular regard will be paid to the BER. Note that no system will be accepted for final payment until the Commissioning Acceptance Test results have been approved.

g) In the event of any Commissioning Acceptance Test results being rejected by Eskom Telecommunications, the discrepancy shall be investigated by the contractor and a report submitted to Eskom Telecommunications. Once the matter has been satisfactorily resolved another series of the relevant Commissioning Acceptance Tests shall be performed.

8.3 Documentation

The following documents will be required at project implementation stage and are not therefore expected to be returned with the bid response documentation.

a) Handbooks (Instruction Manuals) are required for each piece of equipment on paper and electronic formats. They must be comprehensive enough to enable a competent technician to identify each component, test point and terminal and to check supply voltages and signal voltages/signal conditions throughout the module/unit/equipment.

b) All critical voltages and voltage limits shall be indicated on the circuit diagrams or included in the text. All signal levels or signal conditions shall be similarly detailed, together with permissible limits for satisfactory operation of the equipment.

c) A list of factory acceptance tests shall be provided, intended to prove compliance with the specifications, and the method of performing each test.

d) A list of equipment commissioning tests is also required. This list shall include the method of performing each test, and shall detail the type of test equipment needed to perform the test. Limits for satisfactory operation in compliance with the specification shall be indicated, together with instructions for adjustment where appropriate.

e) Factory acceptance and commissioning tests may form part of the handbooks or may be separate documents.

f) Any errors discovered in the handbooks shall be corrected by the contractor and amendments sent to Eskom Telecommunications to ensure that all copies issued are updated. There shall be no charge for such amendments.

g) The contractor shall provide station handbook unique to each station in a project. This handbook shall provide "as built" documentation, such as wiring interconnection tables or drawings, dimensioned sketches of equipment layouts, antenna locations and directions and similar information. Commissioning test results shall also be placed in the station handbook. Additional copies of these handbooks will be supplied to the Eskom Telecommunications Project Manager on the project.

h) A softcopy either with memory stick or CD must be provided.

9. Miscellaneous Requirements

9.1 Spares

a) The contractor shall provide a priced spares breakdown for each item of equipment. The level of breakdown shall be compatible with the maintenance policy of field replacement of faulty sub-units or modules.

b) The supplier shall provide a recommended list of spares that the employer should hold. The quantity of such spares shall be a function of the installed base and MTBF figures (Mean Time Between Failures).

c) The supplier remains accountable for all spares required for the system under warranty while the customer will provide spares for equipment out of warranty.

d) The supplier shall provide a list of spares distribution centres across the country.

9.2 Tools and Test Equipment

a) The supplier shall recommend a list of the test equipment that is considered necessary to perform on-site maintenance and fault-finding on all offered equipment. Test sets that are proprietary to the manufacturer shall only be recommended where commercial general, purpose test equipment cannot be employed, or where its use would be grossly uneconomic to do so.

b) The contractor shall supply a list priced of the special tools, connector cords, outriggers, card extenders, etc. that are considered necessary to perform on-site maintenance and fault finding on the on all offered equipment.

c) A list of recommended tools shall also be provided.

d) For special-to-type tools and test equipment, the manufacturers cost and delivery time shall be stated.

9.3 Training

a) Training courses for Eskom Telecommunications' technicians, network planners (engineers), and network operators shall be provided in the Republic of South Africa. Such courses will be separately ordered from time to time as needs dictate and the first course will be required shortly before the first commissioning commences.

b) Courses shall be structured on a modular basis by individual equipment, such that a series of modules may be run consecutively to meet the needs of a particular group of trainees. The modules shall cover: the operation of the equipment to block diagram level, testing, commissioning, and fault finding to field-removable module level. Management system software training is also required.

c) Unless the training needs to be provided in a specialised facility in South Africa, It is desirable that courses be conducted at various Eskom Telecommunications centres around the country where both classrooms and student accommodation exist.

d) The cost of each module shall be broken into two elements: cost of instructor to present the module to a maximum of 10 students and the cost of training manuals, etc. per student. The cost of a module shall NOT include course establishment costs, such as instructor travel, etc. Such costs shall be separately identified.

e) Supplier must give an outline syllabus of the offered courses and details of the qualifications and the experience of the proposed instructor/s.

9.4 Warranty

a) Suppliers shall state the warranty period on all offered equipment and the terms thereof.

b) It will not, be practical to require the contractor to attend to every on-site fault. It is a requirement; therefore, that the supplier accepts that on-site fault investigation shall be carried out by Eskom Telecommunications' technicians with the warranty remaining intact. Only in the event of obscure faults will the supplier be required to send staff to site. Removed units, sub-units or modules will be returned to the contractor for repair or replacement under the terms of the Warranty. Technicians working on the equipment shall undergo the supplier provided training in terms of subsection 9.3 of this specification.

9.5 Repairs

a) The supplier shall provide a repair service for faulty units, sub-units and modules removed from site by Eskom Telecommunications' technicians. This service shall form part of the support service called for in sub-subsection 3f) of this specification. The period for which this service will run after equipment manufacture discontinuation date will be specified.

b) Within the contracted repair turnaround time, the supplier shall return to Eskom Telecommunications either the repaired item or a replacement thereof. In the case of a repaired item a brief report, detailing the work carried out and components replaced, shall be included with the item. Historical records of repairs to units shall be maintained.

c) Repaired items shall be warranted against a repetition of the same fault for a period of 3 months from the date of return.

10. Safety Requirements

All the SHE requirements are as specified in the SHE documents issued with the enquiry.

11. Authorization

This document has been seen and accepted by:

Name and surname	Designation
Cornelius Naidoo	COE Design Engineering Manager – PTM&C
Danie Du Plessis	Senior Manager - Grids
Paul Grobler	Chief Engineer - Tx
Prudence Madiba	Senior Manager - GX
Sikelela Mkhabela	Senior Manager - Dx
Joe Manyisa	Senior Manager – Eskom Telecommunications (Acting)
Nondumiso Zibi	Senior Manager - GIT

12. Revisions

Date	Rev	Compiler	Remarks
Sept 2017	1	N. Ndlovu	Second issue(revised to include TDM and IP/Ethernet multiplexer)
Oct 2009	0	S.Seetswane	First issue

13. Development team

The following people were involved in the development of this document:

- Zwelandile Mbebe
- Eric Mabotja
- Bongani Shezi

14. Acknowledgements

Not applicable

Annex A – Schedule A - Schedule Of Technical Compliance

Schedule A provides technical details against tendered equipment/Tenderer's statement of compliance or non-compliance.

Clause No.	Description	ET's minimum technical requirements	Suppliers statements of compliance or non-compliance
3.	**General Information and Requirements**		
a)	Only equipment manufactured to recognised relevant international standards, and complying with the relevant ITU-T, ITU-R and ETSI performance recommendations and reports will be accepted.	Compliance Required	
b)	The MTBF (in hours) of all offered equipment shall be stated. The assumed environmental conditions in the given MTBF figures shall also be specified.	To be stated	
c)	The metric system of weights and measures shall be used in all technical documentation.	Compliance Required	
d)	ITU-T/ITU-R terminology shall be adhered to where applicable.	Compliance Required	
e)	MEF standards shall be adhered to where applicable.	Compliance Required	
f)	For all equipment offered the supplier shall state their support and maintenance contract options, terms, costs and durations thereof.	To be stated	
g)	The supplier shall state the planned manufacturer's discontinuation date for each piece of equipment offered and the duration of continuing support of the equipment beyond the manufacturer's discontinuation date.	To be stated	
h)	Both technical and marketing brochures for all equipment offered shall be supplied with the response documentation to the enquiry.	Compliance Required	
i)	The supplied multiplexer shall fit in a standard 19 inch rack (ETSI 300 119).	Compliance Required	
j)	The supplier shall clearly specify how long it takes for the equipment to be delivered and should specify the minimum	To be stated	

Clause No.	Description	ET's minimum technical requirements	Suppliers statements of compliance or non-compliance
	delivery period.		
4.1	**Interface Characteristics**		
a)	The data interfaces shall support connection of synchronous and asynchronous data devices via X.21, EIA-422, EIA-232 and EIA-485 interfaces.	Compliance Required	
b)	These interfaces shall not be provided in a scaled down version, i.e. for EIA-232, all available functions shall be present (Rxd, Txd, DTE, DCE, RTS, CTS).	Compliance Required	
c)	The multiplexer shall also function as a non-blocking digital cross-connect system capable of regrouping and cross-connecting 64 Kbps and N x 64 kbps data streams and grooming these data streams into E1, STM-n and Ethernet aggregates.	Compliance Required	
d)	The multiplexer shall provide a minimum of 10 x 64Kbps channels for interconnecting foreign teleprotection switches compliant with IEEE C37.94.	Compliance Required	
e)	The multiplexer bridges the gap between the high speed digital transmission lines - E1 (2.048 Mbps) channels and the end-user voice and data customer premises equipment (CPE) operating at sub-E1 rates. For this purpose, the multiplexer should be capable of grooming sub-rate asynchronous and synchronous data streams from 64 kbps and super-rate multiplexing up to 2 Mbps.	Compliance Required	
f)	The equipment shall be provided with 120 Ω balanced E1 electrical interface and support UTP/Shielded Twisted Pair (STP) category 5 and 5e/6 connectors.	Compliance Required	

Clause No.	Description	ET's minimum technical requirements	Suppliers statements of compliance or non-compliance
g)	Where applicable, the necessary patch panels shall be provided with the details on the number of supported ports and pin layouts.	Compliance Required	
h)	E&M Interfaces shall be clean contacts which support +12Vdc to -48Vdc.	Compliance Required	
i)	For E&M interface, UHF/VHF analogue radio repeaters TX/RX require an audio response 300-3000Hz with adjustable input/output levels of -4dBm to +4dBm.	Compliance Required	
j)	Optical transceivers shall operate in the 1310 nm and 1 550 nm optical windows over single mode fibres conforming to [15] ITU-T G.652. The operating wavelengths within the given bands shall be stated.	Compliance Required	
k)	The maximum acceptable path loss and distance for optical transceivers without repeaters shall be stated for the STM-n transmitter.	To be stated	
l)	The maximum acceptable path loss and distance for optical transceivers without repeaters shall be stated for the optical GigE transmitter.	To be stated	
m)	Suppliers shall specify their systems' optical transmit power for STM-n aggregate.	To be stated	
n)	Suppliers shall specify their systems' optical receive sensitivity for STM-n aggregate in terms of minimum and maximum receive power levels.	To be stated	
o)	For all optical interfaces, the preferred fibre-optic connector shall be SC-APC (straight connector angle polished) type.	Compliance Required	
p)	Electrical interfaces shall conform to ITU-T G.703 standard.	Compliance Required	
q)	Multiplexers shall support Ethernet over PDH (EoP) interfaces.	Compliance Required	

Clause No.	Description	ET's minimum technical requirements	Suppliers statements of compliance or non-compliance
r)	Multiplexers shall support Ethernet over SDH (EoS) interfaces.	Compliance Required	
s)	Multiplexers shall support dot1q and q&q Ethernet encapsulation	To be stated	
t)	The supplier shall provide the MPLS-TP roadmap for the multiplexers.	To be provided	

Clause No.	Description	ET's minimum technical requirements	Suppliers statements of compliance or non-compliance
4.2	**Customer Interface Requirements**		
a)	E1 – To provide an uplink to the ET TDM network. E1s will also be used to aggregate E&M voice services which will then be terminated on a voice switch.	Compliance Required	
b)	RJ45 10/100/1000 Base-T – To connect electrical Ethernet services.	Compliance Required	
c)	Optical 10/100/1000 Base-T – To connect fibre Ethernet services.	Compliance Required	
d)	PoE – To connect IP telephones and IP cameras. Eskom currently has a lot of analogue telephones which will be converted to IP.	Compliance Required	
e)	FXS/FXO/ E&M - With the intention to migrate to VoIP, support of FXS, FXO and E&M ports will provide smooth migration for sites where Ethernet LAN is not readily available.	Compliance Required	
f)	RS232 (X.25) – To provide X.25 services for disturbance recorders and vectographs. If the proposed equipment does not support X.25, then the supplier shall propose a solution for existing X.25 services.	Compliance Required	
g)	X.21 Asynch/RS422/RS485 and Sync. Asynch is required for SCADA services and Sync is required for teleprotection.	Compliance Required	

Clause No.	Description	ET's minimum technical requirements	Suppliers statements of compliance or non-compliance
h)	SCADA Baud rates: 200 and 1200 serial baud rates shall be supported for SCADA.	To be stated	
i)	The supporting of baud rates 9600 and 19200bps is mandatory.	Compliance Required	
j)	It must be noted that RS232 Asynch as a replacement of X.21 Asynch/RS422 will not be sufficient as some 19200bps sites will require more than 15m serial cable.	To be stated	
k)	The Supplier shall provide all the cables associated with the above interfaces with their lengths and detailed pinouts.	Compliance Required	
4.3.1	**Small Size Multiplexer (Small Substation)**		
a)	2 X E1 – To provide an uplink to the ET TDM network.	Compliance Required	
b)	4 X Ethernet (10/100/1000 Base-T) – To provide electrical Ethernet services.	Compliance Required	
c)	2 X Ethernet (100 Base- T SFP) – To provide fibre Ethernet services.	Compliance Required	
d)	2 X PoE – To provide IP telephones and IP video surveillance services.	Compliance Required	
e)	4 X FXS/FXO – To connect analogue telephones and exchange.	Compliance Required	
f)	2 X E&M – To connect analogue UHF/VHF area radios and PABX.	Compliance Required	
g)	4 X X.21 (Synch and Asynch/RS422/RS-485) – To provide SCADA and teleprotection circuits. Both point-to-point and point-to-multipoint must be supported for SCADA/ Asynch.	Compliance Required	
h)	Multiplexer shall support Ethernet over PDH (EoP) interfaces.	Compliance Required	
i)	All associated equipment specific cables and patch panels shall be provided by the supplier.	Compliance Required	

Clause No.	Description	ET's minimum technical requirements	Suppliers statements of compliance or non-compliance
4.3.2	**Medium Size Multiplexer (Medium Substation)**		
a)	2 X E1 – To provide an uplink to the ET TDM network.	Compliance Required	
b)	8 X Ethernet (10/100/1000 Base-T) – To provide electrical Ethernet services.	Compliance Required	
c)	4 X Ethernet (100 Base- T SFP) – To provide fibre Ethernet services.	Compliance Required	
d)	4 X PoE –To provide IP telephones and IP video surveillance services.	Compliance Required	
e)	8 X FXS/FXO – To connect analogue telephones and exchange.	Compliance Required	
f)	4 X E&M – To connect analogue UHF/VHF area radios and PABX.	Compliance Required	
g)	8 X X.21 (Synch and Asynch/RS422/RS485) – To provide SCADA, teleprotection and used as uplink in sites where there is no Ethernet or E1 transport. Both point-to-point and point-to-multipoint must be supported for SCADA/ Asynch.	Compliance Required	
h)	3 X RS232 (X.25) – To provide X.25 services. If the proposed equipment does not support X.25, then the supplier shall propose a solution for existing X.25 services.	Compliance Required	
i)	2 X STM-1 interface for SDH transport.	Compliance Required	
j)	2 X STM-4 interfaces for SDH transport.	Compliance Required	
k)	Multiplexer shall have separate TDM and Ethernet/ MPLS-TP buses.	Compliance Required	
l)	Multiplexer shall support a SIP voice gateway module which can control at least 500 FXS ports.	Compliance Required	

Clause No.	Description	ET's minimum technical requirements	Suppliers statements of compliance or non-compliance
m)	The voice gateway shall support remote site survivability and be interoperable with at least Siemens HiPath Switches and Cisco call managers.	Compliance Required	
n)	All associated equipment specific cables and patch panels shall be provided by the supplier.	Compliance Required	
4.3.3	**Large Size Multiplexer (Large Substation)**		
a)	4 X E1 – To provide an uplink to the ET TDM network.	Compliance Required	
b)	16 X Ethernet (10/100/1000 Base-T) – To provide electrical Ethernet services.	Compliance Required	
c)	8 X Ethernet (100 Base- T SFP) – To provide fibre Ethernet services.	Compliance Required	
d)	8 X PoE –To provide IP telephones and IP video surveillance services.	Compliance Required	
e)	16 X FXS/FXO – To connect analogue telephones and exchange.	Compliance Required	
f)	8 X E&M – To connect analogue UHF/VHF area radios and PABX.	Compliance Required	
g)	16 X X.21 (Sync and Asynch/RS422/RS485) – To provide SCADA and teleprotection circuits. Both point-to-point and point-to-multipoint must be supported for SCADA/ Asynch.	Compliance Required	
h)	6 X RS232 (X.25) – To provide X.25 services. If the proposed equipment does not support X.25, then the supplier shall propose a solution for existing X.25 services.	Compliance Required	
i)	2 X STM-1 interface for SDH transport.	Compliance Required	
j)	2 X STM-4 interfaces for SDH transport.	Compliance Required	
k)	2 X STM-16 interfaces for SDH transport.	Compliance Required	

Clause No.	Description	ET's minimum technical requirements	Suppliers statements of compliance or non-compliance
l)	Multiplexer shall have separate TDM and Ethernet/ MPLS-TP buses.	Compliance Required	
m)	Multiplexer shall support a SIP voice gateway module which can control at least 500 FXS ports.	Compliance Required	
n)	The voice gateway shall support remote site survivability and be interoperable with at least Siemens HiPath Switches and Cisco call managers.	Compliance Required	
o)	All associated equipment specific cables and patch panels shall be provided by the supplier.	Compliance Required	
4.4	**General Uplink Interface Requirements**		
a)	E1 – To provide an uplink to the ET TDM network.	Compliance Required	
b)	Ethernet (10/100/1000 Base-T) – To connect to ET transport network.	Compliance Required	
c)	The multiplexer must support fibre Ethernet Interfaces.	Compliance Required	
d)	Multiplexer shall provide STM1/4/16 interfaces.	Compliance Required	
e)	Multiplexer shall provide Ethernet over PDH (EoP) interfaces.	Compliance Required	
f)	Multiplexer shall provide Ethernet over SDH (EoS) interfaces.	Compliance Required	
g)	Eskom intends to upgrade the SDH network to OTN and the supplied Multiplexer shall be interoperable with both legacy transport technologies and OTN.	Compliance Required	
4.5	**Modem/Data Termination Units**		
a)	The modems or data termination units are required to reliably and securely extend services from a central location to a remote site. Therefore, the units shall be fully network managed by the offered Network Manager to allow easy end-to-end service management.	Compliance Required	
b)	The units shall at least provide the following options of the user		

Clause No.	Description	ET's minimum technical requirements	Suppliers statements of compliance or non-compliance
	ports:		
1)	2 x X.21 (Synch and Asynch/RS422/RS485)	Compliance Required	
2)	2 x RS-232	Compliance Required	
3)	4 x Ethernet (10/100/1000 Base T)	Compliance Required	
c)	The line speeds and relevant parameters and attributes of the user ports shall be locally and remotely software configurable.	Compliance Required	
d)	The extension of services from central to remote sites shall be via shielded twisted pair copper cable. However, preference will be given to units supporting both shielded twisted pair copper cable and fibre connectivity.	Compliance Required	
e)	The supplier shall stipulate configurations to meet redundancy requirements i.e. equipment, network interface (port) and line redundancy. Preference will be given to systems which achieve rich or diverse redundancy features at minimal hardware overhead.	Compliance Required	
f)	The units shall support dual modes of operation as Data Termination Equipment (DTE) or Data Communications Equipment (DCE).	Compliance Required	
g)	Suppliers should stipulate the maximum loop distances and associated data rates on the offered equipment.	To be stated	
h)	The units shall at minimum support synchronous data rate of 2.048 Mbps, teleprotection synchronous data rates (64 Kbps) and SCADA asynchronous data rates (9600, 19200).	Compliance Required	
i)	To ensure the integrity of transmitted data, the offered equipment shall be capable of dynamic rate adaptation to adjust to transient interferences and deteriorating quality of line connection. Suppliers may stipulate the dynamic rate adaptation technique,	Compliance Required	

Clause No.	Description	ET's minimum technical requirements	Suppliers statements of compliance or non-compliance
	standard or protocol employed by the offered equipment and relevant sensitivity.		
j)	The supplier shall stipulate the diagnostic features of the offered equipment such as power failure detection, line quality etc. All available alarms shall be indicated by LEDs and shall be available as potential-free contacts for possible extension to external supervisory equipment. Preference will be given to systems accessible via HyperTerminal for local system diagnosis and troubleshooting in addition to the remote connectivity requirements stipulated in this specification.	Compliance Required	
4.6	**Network Resilience and Reliability**		
a)	The multiplexer network shall have circuit redundancy switching capabilities, bypass configuration and line switching features to meet the requirements of high level availability and accessibility. The supplier shall stipulate how these features are achieved by the multiplexer.	Compliance Required	
b)	The supplier shall stipulate the system configurations to meet the requirements of equipment redundancy (hot standby) and controller redundancy (where applicable). Preference will be given to systems capable of hitless switching and bit-error free protection switching at minimal changeover times.	Compliance Required	
c)	The multiplexer network shall have the ability to revert back to the original path after the alternate route has been selected and the original path restored. This is an important security feature to ensure optimal performance of the network. The supplier shall elaborate on how this feature is achieved by the multiplexer.	Compliance Required	
d)	The supplier shall stipulate how remote site connectivity is achieved for providing services from a central location to remote sites through the use of compact and network manageable	Information Required	

Clause No.	Description	ET's minimum technical requirements	Suppliers statements of compliance or non-compliance
	modems or similar data termination devices.		
e)	For reasons of interoperability, integration, training, maintenance, system design and support, all multiplexers offered shall be sourced from a single Original Equipment Manufacturer (OEM).	Compliance Required	
f)	All supplied cards/boards shall be hot-swappable and compatible with the larger size multiplexer chassis i.e. they shall also fit in the universal card slots of the larger sized multiplexer.	Compliance Required	
g)	Input and output housekeeping alarm channels are required on the multiplexers. The number of such input and output channels shall be stated.	To be stated	
h)	The offered multiplexer shall be remotely configurable via the offered network management system.	Compliance Required	
i)	The offered equipment shall create a network which is scalable in order to accommodate future growth.	Compliance Required	
j)	The supplier shall specify the protocols of choice to achieve this.	To be stated	
k)	The supplier shall provide the proposed high level network architecture for 1800 nodes.	To be provided	
4.7	**Network Management System and Supervision**		
a)	Suppliers shall comply to 240-86458714 Generic Network Management Specification Standard	Compliance Required	
b)	Suppliers shall provide hardware, software and third party software requirements for the network management system.	To be provided	
c)	Suppliers shall provide requirements pertaining to the design of the Data Communications Network (DCN).	To be provided	
d)	Supplier shall state their policy with regard to continuing support of superseded software releases.	To be stated	
4.8	**Design and Planning Tools**		

Clause No.	Description	ET's minimum technical requirements	Suppliers statements of compliance or non-compliance
a)	The supplier shall propose a network planning and simulation tool that is capable of network, link, and circuit planning and traffic simulation.	Compliance Required	
b)	The proposed tool shall be able to integrate with the management system and be able to use live network data for planning/simulation.	Compliance Required	
c)	The supplier shall provide information on software and hardware requirements of the design planning and simulation tool.	Compliance Required	
4.9	**Roadmap and MTBF**		
a)	The supplier shall provide the roadmap for the proposed equipment.	Compliance Required	
b)	Roadmaps to clearly indicate the release date, the estimated end of sale and the estimated end of life dates for the proposed equipment.	To be stated	
c)	The supplier roadmap shall clearly indicate the hardware, software and licences which must be changed when upgrading to the newer versions.	To be stated	
d)	The change of hardware when upgrading to newer versions shall be very minimal.	Compliance Required	
e)	The supplier shall support new purchases and support of the proposed equipment for a minimum period of 10 years from the date of signing of contract with Eskom.	Compliance Required	
f)	The supplier shall provide the Mean Time between Failure (MTBF) for all the proposed equipment including the related modules.	To be stated	

Clause No.	Description	ET's minimum technical requirements	Suppliers statements of compliance or non-compliance
5.1	**Power Requirements: Electrical Power**		
a)	All offered equipment shall operate from a 48V DC +ve earth power source which will be provided by Eskom Telecommunications. The Management System computers and workstations shall operate from standard 230V (+/-10%) 50Hz (+/-2.5 %) mains power; Eskom Telecommunications will provide UPS power at the control centres.	Compliance Required	
b)	Eskom Telecommunication's standard battery chargers have a rated range of 48V +20% - 15%, positive earth. The equipment shall operate to specification within these voltage limits.	Compliance Required	
c)	The supplier shall specify the voltages outside these limits within which the equipment will still operate correctly and without damage.	To be stated	
d)	Equipment shall not suffer catastrophic failure in the event of a continually falling DC supply voltage, nor from inadvertent application of reverse polarity.	Compliance Required	
e)	Eskom Telecommunications has a preference for power feed arrangements to sub-racks which permit disconnection of any sub-rack without affecting supply to the other units in the rack. The proposed platforms will be such that this preference can be achieved.	Compliance Required	
f)	The supplier shall state the DC power consumption of all offered equipment; it is preferable that the power consumption be broken down into level of consumption of the chassis and then each individual module/card.	To be stated	

Clause No.	Description	ET's minimum technical requirements	Suppliers statements of compliance or non-compliance
6	**Electromagnetic Compatibility and Immunity (EMC/EMI) Requirements**		
a)	Compatibility and Immunity of the equipment to substation electromagnetic environment is required i.e. the equipment shall function properly in the presence of other substation equipment EM emissions (EMI) and shall itself in its functioning not disturb other equipment or affect humans in its vicinity (EMC).	Compliance Required	
b)	The supplier shall indicate if the multiplexers are IEEE 1613 compliant and state the exclusions and compliance levels.	To be stated	
c)	The supplier shall indicate if the multiplexers are IEC 61850-3 and state the exclusions and compliance levels.	To be stated	
d)	At minimum multiplexers shall comply with all the relevant IEC 61000 EMC standards.	Compliance Required	
e)	Supplier shall indicate if the multiplexer supports fan-less operation.	To be stated	
f)	The supplier shall provide a list of all supported EMC, emission and immunity standards.	To be stated	
7	**Environmental Requirements**		
a)	Indoors Installations:		
1)	Altitude: 0 - 2500 metres above sea level	Compliance Required	
2)	Temperature: -5˚C to +50˚C	Compliance Required	
3)	Diurnal Range:30˚C	Compliance Required	
4)	Humidity: 95% below 35˚ C and 75% above 35° C	Compliance Required	
5)	Barometric Pressure: 76-104 kilopascals	Compliance Required	

Clause No.	Description	ET's minimum technical requirements	Suppliers statements of compliance or non-compliance
b)	Outdoors Enclosure Installations		
1)	Altitude: 0 - 2500 metres above sea level	Compliance Required	
2)	Shade Temperature: 30˚C to +50˚C	Compliance Required	
3)	Diurnal Range: 30°C	Compliance Required	
4)	Humidity: All weather operation	Compliance Required	
5)	Barometric Pressure: 76-104 kilopascals	Compliance Required	
c)	The supplier shall specify the maximum equipment dissipated power.	To be stated	
d)	Some Eskom Telecommunications sites are dusty and, although of a non-metallic nature, the dust is frequently abrasive. To ensure that equipment will withstand these conditions the IEC enclosure rating of IP60 is required on all outdoor equipment.	Compliance Required	
e)	Extremely severe lightning conditions occur frequently during summer season. Normal earthing and bonding lightning protection measures are taken by Eskom Telecommunications on all sites. Equipment shall withstand any residual voltage transients. The supplier shall state any lightning protection features the offered equipment possess and the standards to which the protection feature complies.	To be stated	

Annex B – Schedule B – Installation, Testing and Commissioning

The contractor for installation, testing and commissioning work shall complete this schedule indicating acceptance or rejection of Eskom Telecommunications' terms with remarks. The description field is meant to give brief description of the term and not its statement in its entirety. The contractor should therefore refer to the clause itself for details in order to accept/reject the term and to remark.

Acceptance/Rejection will be interpreted as that of the detailed term in the provided clause and not that of the brief description given in the description column.

Clause	Description	ET's Requirement	Accepted/Rejected/Noted	Remarks
8.1	**Installation**			
a)	Installer and Commissioner	Supplier or Subcontractor		
b)	ET's Project implementation strategy	Acceptance Required		
c)	Firm quotations to be submitted per project stage	Acceptance Required		
d)	Specimen Task	Detailed budgetary costs		
e)	Installation plan submitted to ET and accepted prior to commencement	Acceptance Required		
8.2	**Testing and Commissioning**			
a)	Handwritten test results not acceptable	Acceptance Required		
1)	Test results to be signed and dated by both contractor and ET's witnesses	Acceptance Required		
2)	Test equipment shall be controlled, calibrated and maintained according to ISO standards	Acceptance Required		
b)				
c)	Factory acceptance tests results will be supplied to ET prior to or on equipment delivery	Acceptance Required		
1)	Equipment shall not be dispatched from factory for delivery to ET until factory acceptance tests have been passed	Acceptance Required		

Clause	Description	ET's Requirement	Accepted/Rejected/Noted	Remarks
2)	14 days' notice will be given to ET where equipment witness testing is required from ET.	Acceptance Required		
d)	Witnessed tests won't relieve the contractor of their responsibility to meet specification, and ET may still reject the equipment if found faulty after installation	Acceptance Required		
1)	Equipment witnessed tests will be within the borders of the RSA	Acceptance Required		
2)				
3)	Pre-commissioning in-station, hop and link tests will be performed after installation	Acceptance Required		
e)	ET reserves right to be present at these tests	Acceptance Required		
1)	ET will be requested to be present all commissioning acceptance tests after contractor completes pre-commissioning tests	Acceptance Required		
2)	Commissioning Acceptance Tests to be carried out to demonstrate adherence of the installation to specification	Acceptance Required		
3)	Tests to be carried on in the presence of a formally nominated ET representative	Acceptance Required		
4)	Test results shall be signed for acceptance by the ET representative	Acceptance Required		
5)	Commissioning ATP and schedule shall be provided by contractor and accepted prior to tests by ET	Acceptance Required		
6)	Soak testing of 2Mbil/s stream over link for 72 hours	Acceptance Required		

Clause	Description	ET's Requirement	Accepted/Rejected/Noted	Remarks
7)	Payment will not be made until commissioning acceptance tests have been conducted and accepted by ET	Acceptance Required		
8)	If commissioning acceptance test results are rejected by ET contractor will investigate and rectify with a full report given to ET on the investigation and correction	Acceptance Required		
9)	After correction the commissioning acceptance testing will be conducted from scratch	Acceptance Required		
8.3	**Documentation**			
a)	Comprehensive instruction manuals required for each piece of equipment at project implementation to facilitate fault finding	Acceptance Required		
b)	Voltages and voltage limits to be clearly Indicated on circuit diagrams or text	Acceptance Required		
c)	Factory acceptance tests results and method of testing to be provided	Acceptance Required		
d)	Commissioning tests results required with details of test methods used, test equipment used	Acceptance Required		
e)	Errors in the handbook shall be corrected and amendments will be made at no charge to ET	Acceptance Required		
f)	Station handbooks with "as- built" documentation + commissioning results shall be provided at each station	Acceptance Required		

Clause	Description	ET's Requirement	Accepted/Rejected/Noted	Remarks
9.1	**Spares**			
a)	Priced spares breakdown compatible with modules replacement maintenance policy for each equipment offered	To be provided		
9.2	**Tools and Test Equipment**			
a)	A priced list of test equipment necessary for on-site maintenance and fault-finding	To be provided		
b)	A priced list of all tools necessary to perform on-site maintenance and fault- finding	To be provided		
9.3	**Training**			
a)	Training to be provided In RSA and It must be possible to order separately	Acceptance Required		
b)	Modular structured courses for equipment and management system	Acceptance Required		
c)	Training venue preferred to be al ET's regional offices around the country	Preferred venue to be stated		
d)	ET to provide training equipment	Acceptance Required		
e)	Training cost breakdown	To be provided		
9.4	**Warranty**			
a)	Warranty period	To be stated for all offered equipment		
b)	On-site fault investigation and correction to be done by ET technicians (barring exceptional cases) with warranty remaining. Contractor to repair faulty components	Acceptance required		

Clause	Description	ET's Requirement	Accepted/Rejected/Noted	Remarks
9.5	**Repairs**			
a)	Repair service on faulty units, sub-units and modules shall be provided by supplier	Acceptance Required		
b)	Continuing repair service period after equipment manufacture discontinuation date	To be stated		
c)	Working unit will be returned to ET within contracted turnaround time	Acceptance Required		
d)	Repaired items will be returned with report of work carried out on the item	Acceptance Required		
e)	Three months warranty on all repaired items against repetition of faults	Acceptance Required		