
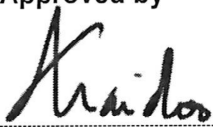
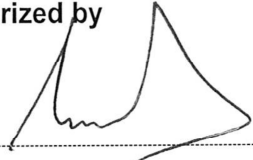
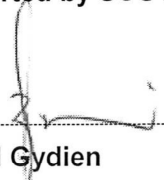


	<b>Standard</b>	<b>Technology</b>
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Supported by SCOT/SC



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## 1. Introduction

Cellular modems using Circuit Switched Data (CSD) and General Packet Radio Service(GPRS) utilising Access Point Name (APN) based mobile connectivity are currently widely used in Eskom as communication media for machine to machine remote access applications used to monitor, control or manage the power network.

This document provides a specification for a generic cellular modem that can be used within the operational technology space when remote access is required.

## 2. Supporting clauses

### 2.1 Scope

#### 2.1.1 Purpose

This document details the specification for a cellular modem that can be used to remotely connect to devices in the field.

#### 2.1.2 Applicability

This document shall apply throughout Eskom Holdings Limited Divisions.

### 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

##### 2.2.1.1 International Documents

- [1] 3GPP TS 51.010-1, Mobile station conformance specification – part 1
- [2] ETSI EN 301 489-1 & 7, Electromagnetic compatibility (EMC) standard for radio equipment and services
- [3] ETSI EN 301 511, Global System for Mobile communications (GSM); Harmonized EN for mobile stations in the GSM 900 and GSM 1800 bands covering essential requirements of article 3.2 of the R&TTE directive (1999/5/EC)
- [4] GCF-CC, Global Certification Forum – certification criteria
- [5] IEC61000-4-2, Electrostatic Discharge (ESD)
- [6] IEC61000-4-3, Electromagnetic radiated HF susceptibility
- [7] IEC61000-4-4, Fast transient Burst test
- [8] IEC61000-4-5, Impulse voltage test
- [9] IEC61000-4-6, Surge Immunity test
- [10] IEC61850, Standard for Communication networks and systems in substations
- [11] IEC 60529, Specification for degrees of protection provided by enclosures (IP code)
- [12] IEEE-1613, Communication networking devices in electrical power substations
- [13] RFC 5246, The Transport Layer Security (TLS) Protocol, Version 1.2
- [14] RFC 6101, The Secure Sockets Layer (SSL) Protocol , IETF

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**2.2.1.2 South African National Documents**

- [15] SANS 61000-4-2, 3,4,5 & 8, Electromagnetic compatibility (EMC) standards
- [16] SANS 60950-1, Information technology equipment safety
- [17] SANS 301489-7, EMC standard for radio equipment and services

**2.2.1.3 Eskom National Documents**

- [18] DSP\_34-1079, User requirements specification for GSM-Based communication for Telecontrol
- [19] DSP\_34-1085, High-Level user requirements for Telecontrol communication distribution
- [20] DGL\_34-383, Application guideline to use GPRS for SCADA
- [21] DSP\_34-1967, Specification for GSM/GPRS modems for remote metering
- [22] DST\_240-57855742, Secure Remote Access system specification for substation IED access
- [23] 240-55410927, Cyber Security standard for operational technology

**2.2.2 Informative**

None

**2.3 Definitions**

**2.3.1 General**

Definition	Description
<b>Authentication:</b>	Authentication refers to the process of verifying the identity of a user, process, or device, often as a prerequisite to allowing access to resources in an information system
<b>Cyber Security</b>	Cyber security is the collection of tools, policies, security concepts, security safeguards, guidelines, risk management approaches, actions, training, best practices, assurance and technologies that can be used to protect the cyber environment and organization and user's assets.
<b>Encryption:</b>	Encryption refers to the cryptographic transformation of data into a form that conceals the data's original meaning to prevent it from being known or used. If the transformation is reversible, the corresponding reversal process is called "decryption", which is a transformation that restores encrypted data to its original state.
<b>Operational data:</b>	This is data that is crucial to the monitoring and operation of the power system network and is applicable to Supervisory, Control and Data Acquisition (SCADA) systems. It includes real-time analogue network loading data such as voltages, currents, power flows, and also the status of primary plant equipment such as breakers and isolators. It is the fundamental information required to monitor and control the network.
<b>Virtual private network</b>	A VPN is a communications environment in which access is controlled to permit peer connections only within a defined community of interest, and is constructed though some form of partitioning of a common underlying communications medium, where this underlying communications medium provides services to the network on a nonexclusive basis

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### 2.3.2 Disclosure classification

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

## 2.4 Abbreviations

Abbreviation	Description
AES	Advanced Encryption Standard
AC	Alternating Current
APN	Access Point Name
ARP	Address resolution protocol
BPS	Bit Per Second
CTS	Clear to Send
DC	Direct Current.
DMZ	Demilitarised Zone
DNP3	Distributed Network Protocol v.3
EFT	Electrical Fast Transient
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
ESD	Electrostatic discharge
FPI	Fault Path Indicator
FTP	File Transfer Protocol
GPRS	General Packet Radio Service
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol Secure
IED	Intelligent Electronic Device
IP	Internet Protocol
IPsec	Internet Protocol Security
LED	Light-emitting Diode
MIB	Management Information Base

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Abbreviation	Description
mm	millimetre
N/A	Not Applicable
NAT	Network Address Translation
No	Number
NTP	Network Time Protocol
PPTP	Point to Point Tunneling Protocol
PPP	Point to Point Protocol
RF	Radio Frequency
RTS	Request to Send
RTU	Remote Terminal Unit
SCADA	Supervisory, Control and Data Acquisition
SIM	Subscriber Identifier Module
SMS	Short Messaging Service
SNMP	Simple Network Management Protocol
SNTP	Simple Network Time Protocol
SSL	Secure Socket Layer
TCP	Transfer Control Protocol
UDP	User Datagram Protocol
VPN	Virtual Private Network
WAN	Wide Area Network
XOFF	Transmit Off
XON	Transmit On

**2.5 Roles and responsibilities**

N/A

**2.6 Process for monitoring**

N/A

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**2.7 Related/supporting documents**

N/A

**3. Requirements**

**3.1 General**

**3.1.1** This section covers the requirements for a GPRS modem to be used for secure remote access to remote devices. Each requirement has an associated requirement ID, a brief description where necessary as well as to whether the requirement is mandatory, preferred or optional through the letters M, P and O respectively.

- a) M – Mandatory system or services requirements; 100% compliance required.
- b) P – Preferred support is desired by Eskom but not mandatory
- c) O – Optional support shall be detailed in the technical schedule.

**3.1.2** Each requirement has also been given a priority based on the relevance and importance of that requirement and function to the Eskom business currently. The priorities are high, medium and low represented with the letters H, M and L respectively

**3.2 EMC, EMI immunity and radiation requirements**

Requirement ID	EMC, EMI standard requirements	Mandatory/ Preferred/ Optional	Priority [High/Med/Low]	Description
3.2.1	The modem should preferably comply with the IEEE 1613 class 2 standard	P	H	IEEE 1613 is the IEEE standard for Environmental and Testing Requirements for Communications Networking Devices in Electric Power Substations
3.2.2	The modem should preferably comply with IEC TS 61000-6-5:2001	P	H	IEC TS 61000-6-5:2001, The specification of EMC immunity requirements for generation, transmission and distribution of electricity and related telecommunication systems.
3.2.3	The modem should preferably comply IEC61850-3	P	H	IEC 61850 Ed 1, Standard for Communication networks and systems in substations. IEC61850-3 General requirements including EMI type tests)

### 3.3 Operating and storage temperature requirements

Requirement ID	Operating Temp requirements	Mandatory/ Preferred/ Optional	Priority [High/ Med/Low]	Description
3.3.1	The modem shall have a minimum operating temperature specification of -10°C to 60°C	M	H	The modem shall be capable of operating in a wide range of temperatures. As minimum requirement the modem shall support -10°C to +60°C allowing it to be used in most places in the country
3.3.2	The modem should preferably have a storage temperature specification of -20°C to 85°C	P	H	To protecting modems from damage while they are in storage, the modems need to have good storage temperature rating. The supplier should specify the modem storage temperature rating.

### 3.4 Modem enclosure

Requirement ID	Modem enclosure requirements	Mandatory/ Preferred/ Optional	Priority [High/Med/Low]	Description
3.4.1	The modems enclosure shall satisfy IP51 rating as per SANS 60529	M	H	The modems enclosure shall satisfy IP51 rating as per SANS 60529, which dictates the protection ingress of dust particles as well as dripping water
3.4.2	The supplier shall specify actual outer dimensions of the modem enclosure	M	H	Regarding physical dimensions, the supplier shall specify actual outer dimensions of the modem enclosure
3.4.3	The dimensions should preferably not exceed height 180 mm x width 110 mm x depth 80 mm	P	M	For ease of mounting on recloser and FPI cabinets , the dimensions should preferably not exceed height 180 mm x width 110 mm x depth 80 mm
3.4.4	The Modem shall be DIN-rail mountable	M	H	For ease of mounting on reclosers and FPIs, a DIN-rail mountable solution is mandatory
3.4.5	The modem mounting method shall be such that visual indications are not obscured and all electrical connectors are easily accessible	M	M	

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### 3.5 Modem power supply requirements

Requirement ID	Power supply requirements	Mandatory/ Preferred/ Optional	Priority [High/ Med/Low]	Description
3.5.1	The modem shall operate reliably from an input voltage ranging from 5 to 32 Volts DC, in addition to a 230 Volt AC supply input.	M	H	Modems with an input voltage ranging from 5 to 32 Volts DC supply can be powered from the pole mounted recloser's power supply or batteries eliminating the need for an external DC-DC converter.
3.5.2	The modem should preferably operate reliably from an input voltage ranging from 5 to 110 Volts DC, in addition to a 230 Volt AC supply input.	P	H	For use in a wider variety of applications the modem should preferably operate reliably from an input voltage ranging from 5 to 110 Volts DC, in addition to a 230 Volt AC supply input
3.5.3	The modem shall be able to operate with a voltage deviation of $\pm 15\%$ from the rated supply voltage	M	M	The modem's performance shall not be negatively influenced in any way by a dip, spike, or continuous supply voltage that is more or less than 15% of the specified mean supply voltage.
3.5.4	The modem shall preferably have no external adapter for power converting	P	M	An internal power supply is preferred
3.5.5	Where an external power supply is offered, it shall be DIN-rail mountable	M	M	An internal power supply is preferred option but should an external power supplies be used, it shall be DIN-rail mountable
3.5.6	The modems power supply shall offer some form of surge protection, which must be specified	M	H	The supplier shall specify the surge protection techniques implemented and the surge protection rating. Compliance with SANS 61000-4-5 is preferred
3.5.7	The modems power supply should preferably conform to the SANS 60950-1	P	H	The modems power supply should preferably conform to the Information technology equipment safety standard (SANS60950-1)

### 3.6 Modem's power supply connectors

Requirement ID	Power supply connectors requirements	Mandatory/ Preferred/ Optional	Priority [High/Med/Low]	Description
3.6.1	Modems with power supply connectors using Phoenix or Molex 5557-02R type connectors are preferred	P	M	For a secure power supply connection, modem using Phoenix or Molex type connectors are preferred.

### 3.7 Modem antenna connector requirements

Requirement ID	Antenna Connector requirements	Mandatory/ Preferred/ Optional	Priority [High/ Med/Low]	Description
3.7.1	The modem shall be supplied with a SMA Female panel mount antenna connector.	M	H	Eskom's current installation uses SMA female connectors. To be interchangeable with existing installations, the modems shall have an SMA connector.
3.7.2	The modem shall be supplied with a non-reactive impedance of 50 $\Omega$ RF connector	M	H	A large percentage of Eskom's modem install base is on pole mounted reclosers and fault path indicators, therefore a non-reactive RF connector that can with-stand extreme weather conditions is mandatory

### 3.8 Antenna

It is not a requirement that the modem is supplied with an antenna and coaxial cable. However, if an antenna with its coaxial cable is supplied, then it should preferably meet the following specifications.

Requirement ID	Antenna requirements	Mandatory/ Preferred/ Optional	Priority [High/ Med/Low]	Description
3.8.1	The antenna should preferably be Omni-directional, weather-proof and suitable for easy outdoor mounting	P	H	A large percentage of Eskom's modem install base is on pole mounted reclosers and fault path indicators, an Omni-directional, weather-proof antenna suitable for easy outdoor mounting is preferred.
3.8.2	The antenna should preferably be terminated with a SMA male connector.	P	M	Eskom's current GPRS antenna installations use a SMA male type connector. To be interchange antennas, preference will be given to antenna's that terminate with a SMA male connector

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**3.9 Modem SIM**

Requirement ID	SIM supported features	Mandatory/ Preferred/ Optional	Priority [High/ Med/Low]	Description
3.9.1	The modem shall support two SIM cards	M	H	The modem shall support two SIM cards, capable of supporting different service providers
3.9.2	Preference will be given to modems that support two chipped SIM cards	P	M	As an added SIM card security feature, the modem should preferably support chipped SIMs.
3.9.3	The modem shall have a fail over mechanism between the two SIM cards	P	M	Should SIM registration fail or network connection to the cellular operator is lost with the active SIM, the fail over mechanism should attempt to restore network connection using the alternative SIM.

**3.10 Network connectivity**

Requirement ID	Network Connection requirements	Mandatory/ Preferred/ Optional	Priority [High/ Med/Low]	Description
3.10.1	The modem's GSM module shall be CE approved and shall comply with the following standards: a) 3GPPP TS 51.010-1 b) ETSI EN 301 511 c) GCF-CC d) ETSI EN 301 489-1&7 e) SANS 60950-1	M	H	3GPPP TS 51.010-1: Mobile station conformance specification.  ETSI EN 301 511: Harmonization standard for MS in the 900 and 1800 frequency bands  GCF-CC: Global Certification Forum – Certification Criteria  ETSI EN 301 489-1&7: Electromagnetic compatibility for radio equipment and services  SANS 60950-1: Information technology equipment safety
3.10.2	The modem shall be type approved by ICASA for use in South Africa	M	H	The Independent Communications Authority of South Africa (ICASA) is the regulator for the South African communications, broadcasting and postal services sector. The modem shall be type approved by ICASA
3.10.3	The modem shall be network approved by all South African network service providers utilised by Eskom	M	H	The modem shall be tested with all South African network services providers and approved for use with all the South African network service providers utilised by Eskom

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Requirement ID	Network Connection requirements	Mandatory/Preferred/Optional	Priority [High/Med/Low]	Description
3.10.4	The modem shall offer connectivity via EDGE	M	H	Fast data transmission rates are a requirement for a remote engineering modem. EDGE delivers higher bit-rates per radio channel, resulting in over 3x increase in capacity and performance over GPRS. Typical speed: GPRS ~ 64kbps EDGE ~ 264kbps
3.10.5	The modem should preferably offer connectivity using 3G or higher	P	M	For even faster data transmission rates than that provided via EDGE, modems offering network connectivity via 3G or HSDPA are preferred. Typical speed: 3G ~ 384kbps HSDPA ~ 1.8 Mbps

**3.11 Communication ports**

Requirement ID	Communication port requirements	Mandatory/Preferred/Optional	Priority [High/Med/Low]	Description
3.11.1	The modem shall have at least one serial port	M	H	Most of Eskom's end devices have serial communication ports, so it is a mandatory requirement that the modem should have at least one serial port
3.11.2	The modem should preferably have two serial ports	P	H	The modem should preferably have two serial ports, one port to be used for remote access and a second port that can be used for SCADA or metering, for example.
3.11.3	The modem shall support RS232 on each serial port	M	H	The modem shall support RS232 on the serial communication ports
3.11.4	The modem should preferably support both RS232 and RS485 per serial port.	P	M	The modem should preferably have an option to select between RS232 and RS485 per serial port. RS232 or RS485 should preferably be software selectable during configuration.
3.11.5	The modem's communication serial ports should preferably be optically isolated and have surge protection as per SANS 61000-4 Class 3 standard.	P	M	The modem's serial ports should be optically isolated or have surge protection to ensure no damage is done to the modem internal electronics due to external surges

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Requirement ID	Communication port requirements	Mandatory/ Preferred/ Optional	Priority [High/ Med/Low]	Description
3.11.6	The modem's serial ports shall support the following data rates: 1200, 4800, 9600, 19200, 38400, 57600 and 115200 bps	M	H	The modem shall support data rates between 1200 and 115200 bps. The data rates should be software selectable for each serial port.
3.11.7	The modem shall support the following framing options for data streams: a)One start bit b)One and two stop bits c)Even, odd and no parity	M	H	The framing option per port shall be software selectable.
3.11.8	The modem shall support control signalling for RS232 ports.	M	H	The modem shall support request to send (RTS) and clear to Send (CTS) hardware handshaking.
3.11.9	The modem's serial ports shall have Transmit and Receive light indications	M	H	LED indications for Tx and Rx are mandatory. This is a crucial to for monitoring port status and during fault finding.
3.11.10	The modem shall have at least one standard RJ45 Ethernet port with support for both 10BaseTx and 100BaseTx.	M	H	The modem shall have a standard copper type Ethernet port with a RJ45 connector.  Eskom has devices that only support 10BaseT and devices that support 100BaseT. To be able to provide remote access to these devices, the modem's Ethernet card or network card drivers should support both 10 Mbit/s and 100 Mbit/s
3.11.11	The modem should preferably have more than one Ethernet port	P	M	Preference will be given to modems that have more than one standard Ethernet port
3.11.12	The modem shall be able to maintain multiple simultaneous TCP/UDP socket connections	M	H	To allow multiple connections from remote users to the same engineering device, the modem should be capable of hosting multiple simultaneous socket connections.
3.11.13	The modem should preferably support a raw socket connection to a serial port	P	H	Raw socket connection to a serial port allows direct sending and receiving of packets without any protocol-specific transport layer formatting.

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Requirement ID	Communication port requirements	Mandatory/ Preferred/ Optional	Priority [High/ Med/Low]	Description
3.11.14	The modem shall support active and passive connection. These settings should be configurable per serial port	M	H	<p>Passive connection is when the modem waits passively for incoming connections from the host device. Passive connections are typically used when using modems for remote access.</p> <p>Active connection is when the modem can actively establish TCP/UDP connections to a pre-defined host when serial data arrives.</p> <p>Active connections are typically used when communication can be initiated from either the client or the server. SCADA typically uses active as the connection can be initiated from the slave or from the master</p>

**3.12 Network communication**

Requirement ID	Network Communication Feature requirements	Mandatory/ Preferred/ Optional	Priority [High/ Med/Low]	Description
3.12.1	The modem shall support Ethernet	M	H	The modem shall support Ethernet as specified in the IEEE 802.3 standard.
3.12.2	The modem shall support Internet Protocol version 4 (IPv4). The supplier should also state IPv6	M	H	As a minimum requirement the modem should support IPv4 as the networking layer
3.12.3	The modem shall support TCP	M	H	As a mandatory requirement, The modem shall support User Transport Control Protocol (TCP). TCP/IP is the current used method by Eskom for remote engineering connections.
3.12.4	The modem shall support UDP	M	H	The modem shall support User Datagram Protocol /Internet Protocol , this is currently used by Eskom for SCADA communication

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Requirement ID	Network Communication Feature requirements	Mandatory/ Preferred/ Optional	Priority [High/ Med/Low]	Description
3.12.5	The modem shall support HTTP	M	H	The modem shall support Hypertext Transfer Protocol, for device configuration and diagnostics. For detailed specific requirements on device configuration and diagnostics see requirement 3.16 on page 20.
3.12.6	The modem should preferably support HTTPS	P	H	The modem should preferably support Hypertext Transfer Protocol Secure (HTTPS), for device configuration and diagnostics.
3.12.7	The modem shall support SNMP	M	H	The modem shall support Simple Network Management Protocol, to provide the device status and data acquisition.  For detailed specific requirements on network management, see section 3.14 on page 19,
3.12.8	The modem should preferably support SMS	P	L	The modem should preferably support Short Message Service (SMS), for diagnostics purposes. Should SMS be supported, as a minimum requirement the modem should be capable on providing device status information using SMS
3.12.9	The modem shall support PPP	M	H	The modem shall support the Point to Point Protocol (PPP), to establish the link onto the APN.
3.12.10	The modem should preferably support FTP	P	M	The modem should preferably be capable of hosting File Transfer Protocol (FTP) sessions, as an FTP server. Should an FTP server be supported on the device it shall as a minimum: <ul style="list-style-type: none"> <li>a) Support the retrieval of data pertaining to the modem's status such as the modem's event logs and system files.</li> <li>b) Be capable of receiving configuration files and firmware upgrades from an FTP client.</li> </ul>

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Requirement ID	Network Communication Feature requirements	Mandatory/ Preferred/ Optional	Priority [High/ Med/Low]	Description
3.12.11	The modem should preferably support TELNET	P	M	The modem should preferably support a Terminal network session to enable an alternative means of configuration and diagnostics
3.12.12	The modem should preferably support Network Address Translation (NAT)	P	H	As a security feature the modem should preferably support NAT, as specified in the IEEE802.11 standard
3.12.13	The modem shall support port-forwarding	M	M	The modem shall support port-forwarding between the WAN connection and Ethernet ports. The ability shall exist to map any internal port to a WAN-based external port, whether the same or not.
3.12.14	The modem shall support Virtual Private Networks (VPN) to provide a secure link between SCADA, remote engineering systems and the end devices as a VPN server	M	H	The Cyber Security standard (NERC CIP-005) requires that critical cyber assets be protected by an electronic perimeter. The modem shall at least be PPTP enabled and facilitate secure connections to remote devices in a secure manner. For more specific on network security, see section 3.13 on page 18.
3.12.15	Preference will be given to modems that support both VPN server and client functions	P	M	To permit modem to modem tunnelling, preference will be given to modems that support both VPN server and client functions
3.12.16	The modem should preferably support SNTP version 4 both client and server	P	M	The modem should preferably include a Simple Network Time Protocol client and server to receive time synchronization from a SNTP server and to distribute the time to end devices.
3.12.17	The modem shall support SSL	M	H	The modem shall support Secure Socket Layer (SSL), cryptographic protocol to secure the link between remote engineering systems and the end devices

### 3.13 Network security

Cyber and WAN security is vital to ensuring the reliability of Eskom's power system. Typically SCADA and remote access systems are within DMZ architecture, with firewalls used to protect the SCADA or remote access system from the corporate and engineering networks. However, if the system is not suitably secured, any person with a modem connected to the APN can remotely log onto the end device, change configurations or worse, maliciously control primary plant assets. One way of minimizing this risk is to secure the link between the remote access system and the end devices and block all other means of access through the use of a firewall. Internet Protocol Security (IPsec), Secure Socket Layer (SSL) and Virtual Private Networks (VPNs) are technologies that provide the means to protect communications between physically distant sites. IPsec uses encryption to safeguard data and embed authentication information in TCP/IP packets. VPNs combine IPsec technology and firewalls to form a point-to-point secure connection over public networks, so that from a privacy standpoint it appears to be a single internal network as shown in the example in Figure 1 below.

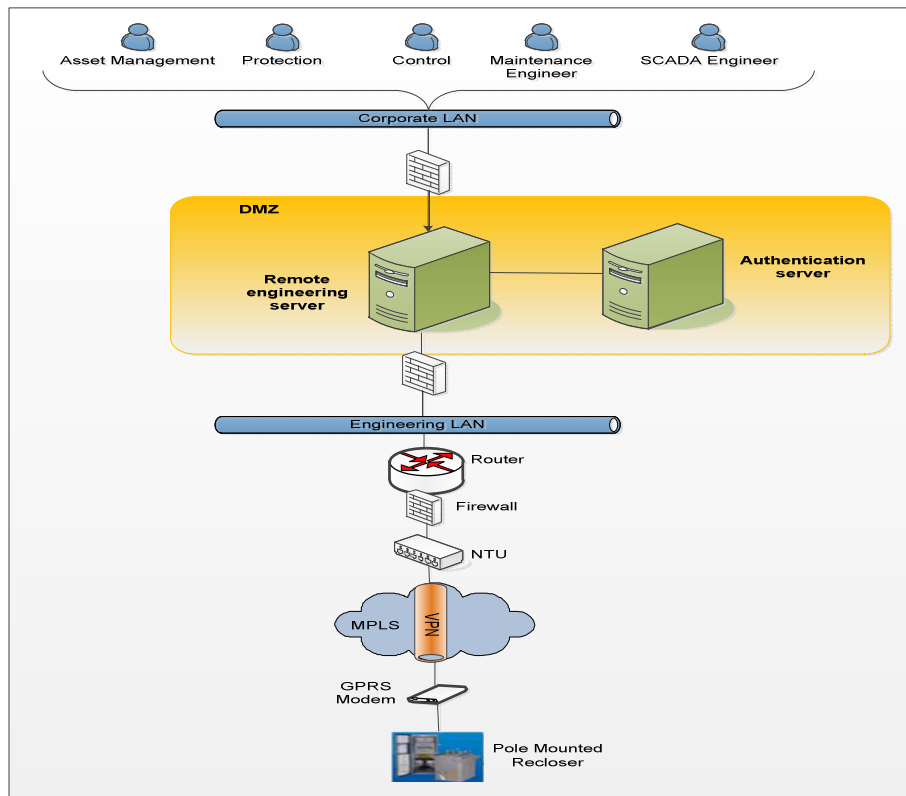


Figure 1: Example of a secure remote access system using VPN tunneling

Requirement ID	Network security	Mandatory/ Preferred/ Optional	Priority [High/ Med/Low]	Description
3.13.1	The modem shall support the authentication and encryption of the link using SSL	M	M	One of the major concerns in Operation Technology (OT) systems is cyber security. It shall be possible to encrypted communication between the end device and remote access system using SSL with at least 128bit Advanced Encryption Standard (AES).

Requirement ID	Network security	Mandatory/ Preferred/ Optional	Priority [High/ Med/Low]	Description
3.13.2	The modem should preferably support other methods that can be used for link encryption, such as PPTP, L2TP, IPsec and TLS	P	H	The modem should preferably support other methods that can be used to encrypt the communication link such as IPsec, PPTP, L2TP and TLS, in addition to the SSL support.
3.13.3	The modem shall have configurable firewall	M	H	The shall accept connections and make connections to a configurable list of IPs or source and destination ports, and not just accept connections from any IP or port unless configured so.

### 3.14 Network Management

With the increase in deployment of modems, Eskom has necessitated the remote monitoring and management of modem networks to minimize the down time on sites critical to the electricity network. SNMP is a network management protocol used to monitor network devices for conditions that warrant administrative attention.

Requirement ID	Network connection and setting	Mandatory/ Preferred/ Optional	Priority [High/ Med/Low]	Description
3.14.1	The modem shall support SNMPv1	M	H	SNMP version 1 is the initial implementation of the SNMP protocol. It enables the monitoring of the system objects and interfaces, such as device health, device temperature and interfaces
3.14.2	The modem should preferably support SNMPv2c or SNMPv3	P	M	For improved SNMP performance and security features SNMPv2c or SNMPv3 is preferred. SNMPv2c and SNMPv3 have the GetBulkRequest as an alternative to iterative GetNextRequests used in SNMPv1 for retrieving large amounts data in a single request.
3.14.3	The modem should preferably be supplied with a RF MIB	P	M	Preference will be given to devices that have an RF MIB to enable the monitoring of modem location, mobile cell tower information, mobile packet service, network signal strength, number of PPP bytes sent and received, etc.
3.14.4	The supplier shall supply all SNMP MIBS to ESKOM without any additional cost	P	M	To enable Eskom to evaluate and test the devices SNMP implementation, the shall supply all SNMP MIBS to Eskom without any additional cost

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**3.15 Self-diagnostics**

Requirement ID	Self-diagnostic requirements	Mandatory/ Preferred/ Optional	Priority [High/ Med/Low]
3.15.1	The modem shall have a hardware and software watchdog timer. These timers shall perform their own internal diagnostics that shall operate independently from each other.	P	H

**3.16 Configuration and diagnostic tools**

Requirement ID	Configuration and Diagnostic requirements	Mandatory/ Preferred/ Optional	Priority [High/ Med/Low]	Description
3.16.1	The modem shall be configurable using a Web Browser	M	H	The modem shall IP remote management and configuration services over a web service
3.16.2	Should additional tools or software be required for the modem's configuration and to perform diagnostic, these tools shall be supplied to Eskom without any additional costs.	M	H	If a separate software application is also required for configuration and to perform diagnostic on the modem, the software or engineering tool shall be supplied to Eskom inclusive in the device's price. The vendor shall allow Eskom to freely distribute and use such software within its divisions.

**3.17 Device security**

Requirement ID	Device Security requirements	Mandatory/ Preferred/ Optional	Priority [High/ Med/Low]
3.17.1	The modem shall be password protected to prevent unauthorized connections and configuration changes.	M	H
3.17.2	Modems that offer added security features, such as methods to encrypt the communication link and restrict access to the modem's configuration files will be given preference. The supplier shall state which security features are supported and how they are implemented	P	M

### 3.18 Firmware

Requirement ID	Firmware requirement	Mandatory/ Preferred/ Optional	Priority [High/ Med/Low]	Description
3.18.1	The modem's firmware shall be stored in non-volatile flash memory.	M	H	Non-volatile storage meaning that the modem's memory shall retain stored information even when power has been lost.
3.18.2	The modem's firmware shall be remotely upgradeable	M	M	Using a mechanism that will be advised by the supplier, the modem should allow firmware changes to be done remotely
3.18.3	The modem should preferably have a firmware fail-safe feature	P	M	The modem should preferably have a fail-safe feature to revert back to the old firmware version after a pre-defined period of time should a firmware upgrade fail
3.18.4	The firmware supplied to Eskom shall have preconfigured APN settings which will be supplied by Eskom	M	M	To enable plug and play capability the APN details will be supplied by Eskom to the supplier and shall be added onto the modem's firmware

### 3.19 Functional Testing

Requirement ID	Functional test requirements	Mandatory/ Preferred/ Optional	Priority [High/ Med/Low]	Description
3.19.1	On request the supplier shall supply Eskom with a test product	M	H	As part of the product approval process, Eskom intends to perform functional tests on the product offered to ensure compatibility with existing systems, as well as to verify the product's functionality.

### 3.20 Product support

Requirement ID	Product support requirements	Mandatory/ Preferred/ Optional	Priority [High/ Med/Low]	Description
3.20.1	Preference will be given to suppliers that offer product support for the longest duration	P	H	The supplier shall provide full details about the level of service that can be provided and the anticipated period that product support will be available for.

**3.21 Technical support**

Requirement ID	Technical support requirement	Mandatory/ Preferred/ Optional	Priority [High/ Med/Low]
3.21.1	The supplier shall as a minimum offer telephonic support during office hours.	M	M

**3.22 Fault Repairs**

Requirement ID	Fault Repairs requirement	Mandatory/ Preferred/ Optional	Priority [High/ Med/Low]
3.22.1	The supplier is required to repair and return faulty modems within a period of three weeks of less	M	M

**3.23 Training**

Requirement ID	Training requirement	Mandatory/ Preferred/ Optional	Priority [High/ Med/Low]
3.23.1	Training shall be provided on request for Eskom staff to enable them to configure, install, maintain and operate the product	M	M
3.23.2	The formal assessment of training attendees is preferred.	P	M

**3.24 Documentation**

Requirement ID	Documentation requirement	Mandatory/ Preferred/ Optional	Priority [High/ Med/Low]
3.24.1	The following drawings shall be supplied as part of the instruction manuals: a) Outline dimensions and mounting details of each item. b) Block schematics showing the functional components of the equipment. c) Functional diagrams showing the operation of the equipment. d) Component layout diagrams. e) Circuit and wiring diagrams. f) Details of the terminals and terminal connectors.	M	M
3.24.2	All modems shall be supplied with instruction manuals that shall be detailed enough to enable Eskom staff to install, maintain, test, configure and use each component.	M	M

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### 3.25 Warranty

Requirement ID	Warranty requirement	Mandatory/ Preferred/ Optional	Priority [High/ Med/Low]
3.25.1	The Tenderer shall submit the warranty period in years for any product related defects.	M	M

## 4. Authorization

This document has been seen and accepted by:

Name and surname	Designation
M Sukhnandan	Telecontrol SC Chairperson
Marius v Rensburg	Senior Manager – TX
Paul Grobler	Chief Engineer - TX
Sikelela Mkhabela	Senior Manager - DX
Prudence Madiba	Senior Manager – GX
Corrie Vermeulen	Senior Manager - Eskom Telecommunications
Sean Maritz	Senior Manager - GIT
Alex Stramrood	Senior Manager - Safety Risk Management

## 5. Revisions

Date	Rev.	Compiler	Remarks
Oct 2014	1	E.Luwaca	First issue.

## 6. Development team

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

- Colin Charles                      Power Delivery - Standards and Implementation
- Emmanuel Luwaca                Western OU – Network Engineering and design control plant
- Jason Hector                        PTM&C Control and Automation
- Ziyaad Gydien                      Telecomms SC Chairperson

## Annex A– Impact assessment

(Normative)

Impact assessment form to be completed for all documents

### A.1 Guidelines

- All comments must be completed.
- Motivate why items are N/A (not applicable)
- Indicate actions to be taken, persons or organisations responsible for actions and deadline for action.
- Change control committees to discuss the impact assessment, and if necessary give feedback to the compiler of any omissions or errors.

### A.2 Critical points

**A.2.1** Importance of this document. E.g. is implementation required due to safety deficiencies, statutory requirements, technology changes, document revisions, improved service quality, improved service performance, and optimised costs.

**Comment:** Optimised costs

**A.2.2** If the document to be released impacts on statutory or legal compliance - this need to be very clearly stated and so highlighted.

**Comment:** No

**A.2.3** Impact on stock holding and depletion of existing stock prior to switch over.

**Comment:** N/A

**A.2.4** When will new stock be available?

**Comment:** When required

**A.2.5** Has the interchangeability of the product or item been verified - i.e. when it fails is a straight swap possible with a competitor's product?

**Comment:** Yes, various manufacturers available

**A.2.6** Identify and provide details of other critical (items required for the successful implementation of this document) points to be considered in the implementation of this document.

**Comment:** None

**A.2.7** Provide details of any comments made by the Regions regarding the implementation of this document.

**Comment:** None currently

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### A.3 Implementation timeframe

A.3.1 Time period for implementation of requirements.

**Comment:** Regions to implement according to their own time frame

A.3.2 Deadline for changeover to new item and personnel to be informed of DX wide change-over.

**Comment:** N/A

### A.4 Buyers Guide and Power Office

A.4.1 Does the Buyers Guide or Buyers List need updating?

**Comment:** Yes, although this will happen at a later stage.

A.4.2 What Buyer's Guides or items have been created?

**Comment:** Not applicable – see above.

A.4.3 List all assembly drawing changes that have been revised in conjunction with this document.

**Comment:** N/A

A.4.4 If the implementation of this document requires assessment by CAP, provide details under A.5 below

A.4.5 Which Power Office packages have been created, modified or removed?

**Comment:** None

### A.5 CAP / LAP Pre-Qualification Process related impacts

A.5.1 Is an ad-hoc re-evaluation of all currently accepted suppliers required as a result of implementation of this document?

**Comment:** No

A.5.2 If NO, provide motivation for issuing this specification before Acceptance Cycle Expiry date.

**Comment:** Technology changes. A business need exists to evaluate and approve GPRS modems

A.5.3 Are ALL suppliers (currently accepted per LAP), aware of the nature of changes contained in this document?

**Comment:** No, will be done during implementation

**A.5.4** Is implementation of the provisions of this document required during the current supplier qualification period?

**Comment:** No.

**A.5.5** If Yes to A.5.4, what date has been set for all currently accepted suppliers to comply fully?

**Comment:** N/A

**A.5.6** If Yes to A.5.4, have all currently accepted suppliers been sent a prior formal notification informing them of Eskom's expectations, including the implementation date deadline?

**Comment:** N/A

**A.5.7** Can the changes made, potentially impact upon the purchase price of the material/equipment?

**Comment:** Yes

**A.5.8** Material group(s) affected by specification: (Refer to Pre-Qualification invitation schedule for list of material groups)

**Comment:** GPRS Modems.

## **A.6 Training or communication**

**A.6.1** Is training required?

**Comment:** Yes

**A.6.2** State the level of training required to implement this document. (E.g. awareness training, practical / on job, module, etc.)

**Comment:** Both awareness and practical training will be required.

**A.6.3** State designations of personnel that will require training.

**Comment:** Dx: Telecontrol, NEDCP and SCADA Engineers/Technicians

**A.6.4** Is the training material available? Identify person responsible for the development of training material.

**Comment:** No, this will form part of the tender.

**A.6.5** If applicable, provide details of training that will take place. (E.G. sponsor, costs, trainer, schedule of training, course material availability, training in erection / use of new equipment, maintenance training, etc).

**Comment:** Courses to be scheduled with suppliers after the tender process

**A.6.6** Was Technical Training Section consulted regarding module development process?

**Comment:** No, not required

**A.6.7** State communications channels to be used to inform target audience.

**Comment:** Various.

## **A.7 Special tools, equipment, software**

**A.7.1** What special tools, equipment, software, etc. will need to be purchased by the Region to effectively implement?

**Comment:** The configuration tools required for this equipment will be supplied as part of the product.

**A.7.2** Are stock numbers available for the new equipment?

**Comment:** Yes, general numbers

**A.7.3** What will be the cost of these special tools, equipment, software?

**Comment:** N/A

## **A.8 Finances**

**A.8.1** What total costs would the Regions be required to incur in implementing this document? Identify all cost activities associated with implementation, e.g. labour, training, tooling, stock, obsolescence.

**Comment:** All procurement costs will be obtained through each respective project where this solution will be implemented.

**Impact assessment completed by:**

**Name:** E. Luwaca

**Designation:** Eskom Distribution WCOU

## Annex B: Schedule A: Schedule of technical compliance

Schedule A provides technical details against tendered equipment/Tenderer's statement of compliance or non-compliance. Some of the information requested in this schedule may be provided on separate sheets of paper.

Clause No	Description	Eskom's Minimum Technical Requirements	Supplier's Statements Of Compliance
3	<b>Requirements</b>		
3.2	<b>EMC, EMI immunity and radiation</b>		
3.2.1	IEEE Standard 1613	Specify	
3.2.2	IEC TS 61000-6-5	Specify	
3.2.3	IEC 61850-3	Specify	
3.3	<b>Operational and storage temperature</b>		
3.3.1	Operating temperature of -10°C to 60°C	Comply	
3.3.2	Storage temperature of -20°C to 85°C	Specify	
3.4	<b>Modem enclosure protection</b>		
3.4.1	IP51 rating as per SANS 60529	Comply	
3.4.2	Modem dimensions	Specify	
3.4.3	The dimensions should preferably not exceed height 180 mm x width 110 mm x depth 80 mm	Specify	
3.4.4	The Modem shall be DIN-rail mountable or have a 19 inch rack mounting solution.	Comply	
3.4.5	The mounting method of the modem shall be such that visual indications are not obscured and all electrical connectors are easily accessible	Comply	
3.5	<b>Power supply</b>		
3.5.1	The modem shall operate reliably from an input voltage ranging from 5 to 32 Volts DC, in addition to a 230 Volt AC supply input.	Comply	
3.5.2	The modem should preferably operate reliably from an input voltage ranging from 5 to 110 Volts DC, in addition to a 230 Volt AC supply input.	Specify	

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Clause No	Description	Eskom's Minimum Technical Requirements	Supplier's Statements Of Compliance
3.5.3	The modem shall be able to operate with any deviation in voltage from the rated supply to at least ±15% without affecting its performance negatively	Comply	
3.5.4	The modem shall preferably have no external adapter for power converting	Specify	
3.5.5	Where an external power supply is offered, it shall be DIN-rail mountable	Comply	
3.5.6	The modems power supply shall offer surge protection, which must be specified	Specify	
3.5.7	The modems power supply should preferably conform to SANS 60950-1	Specify	
3.6	<b>Power supply connectors</b>		
3.6.1	Preference will be given to a modem with the power supply connectors using Phoenix, or Molex 5557-02R, type connectors	Specify	
3.7	<b>Antenna Connector</b>		
3.7.1	The modem is shall be supplied with a SMA Female panel mount antenna connector.	Comply	
3.7.2	The modem is shall be supplied with a have a non-reactive impedance of 50Ω RF connector	Comply	
3.8	<b>Antenna</b>		
3.8.1	The antenna should preferably be Omni-directional, weather-proof and suitable for easy outdoor mounting	Specify	
3.8.2	The antenna should preferably be terminated with a male SMA connector on the modem side.	Specify	
3.9	<b>Modem SIM card</b>		
3.9.1	The modem shall support two SIM cards	Comply	
3.9.2	The modem should preferably support two chipped SIM cards	Specify	
3.9.3	The modem shall have a fail over mechanism between the two SIM cards	Comply	
3.10	<b>Network connectivity</b>		

Clause No	Description	Eskom's Minimum Technical Requirements	Supplier's Statements Of Compliance
3.10.1	The modem's GSM module shall be CE approved and shall comply with the following standards: a) 3GPPP TS 51.010-1 b) ETSI EN 301 511 c) GCF-CC d) ETSI EN 301 489-1&7 e) SANS 60950-1	Comply	
3.10.2	The modem shall be type approved by ICASA for use in South Africa	Comply	
3.10.3	The modem shall be network approved by all South African network service providers utilised by Eskom	Comply	
3.10.4	The modem shall offer connectivity via EDGE	Comply	
3.10.5	The modem should preferably offer connectivity using 3G or higher	Specify	
3.11	<b>Communication ports</b>		
3.11.1	The modem shall have at least one serial port	Comply	
3.11.2	The modem should preferably have two serial ports	Specify	
3.11.3	Support RS232	Comply	
3.11.4	Support RS232/RS485 selectable per port	Specify	
3.11.5	The modem's communication serial ports should preferably be optically isolated and have surge protection as per SANS 61000-4 Class 3 standard.	Specify	
3.11.6	The modem's serial ports shall support the following data rates: 1200, 4800, 9600, 19200, 38400, 57600 and 115200	Comply	
3.11.7	The modem shall support the following framing options for data streams: a) One start bit b) One and two stop bits c) Even, odd and no parity	Comply	
3.11.8	The modem shall support control signalling for RS232 ports.	Comply	
3.11.9	The modem's serial ports shall have a Transmit and Receive light indications	Comply	
3.11.10	The modem shall have at least one standard RJ45 Ethernet port with support for both 10BaseTx and 100BaseTx.	Comply	

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Clause No	Description	Eskom's Minimum Technical Requirements	Supplier's Statements Of Compliance
3.11.11	The modem should preferably have more than one Ethernet port	Specify	
3.11.12	The modem shall be able to maintain multiple simultaneous socket connections	Comply	
3.11.13	The modem should preferably support a raw socket connection to a serial port	Specify	
3.11.14	The modem shall support active and passive connection. These settings should be configurable per serial port	Comply	
3.12	<b>Network communication</b>		
3.12.1	The modem shall support Ethernet as specified in the IEEE802.3 standard.	Comply	
3.12.2	As a minimum requirement the modem should support IPv4	Comply	
3.12.3	The modem shall support TCP	Comply	
3.12.4	The modem shall support UDP	Comply	
3.12.5	The modem shall support HTTP	Comply	
3.12.16	The modem should preferably support HTTPS	Specify	
3.12.7	The modem shall support SNMP	Comply	
3.12.8	The modem should preferably support SMS	Specify	
3.12.9	The modem shall support PPP	Comply	
3.12.10	The modem should preferably support FTP	Specify	
3.12.11	The modem should preferably support TELNET	Specify	
3.12.12	The modem should preferably support NAT	Specify	
3.12.13	The modem shall support port-forwarding	Comply	
3.12.14	The modem shall be capable of acting as VPN server	Specify	
3.12.15	The modem should preferably be capable of acting as both a VPN server and as VPN client	Specify	
3.12.16	The modem should preferably support SNTP version 4 both client and server	Specify	

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Clause No	Description	Eskom's Minimum Technical Requirements	Supplier's Statements Of Compliance
3.12.17	The modem shall support SSL	Comply	
3.13	<b>Network security</b>		
3.13.1	The modem shall support the authentication and encryption of the link using SSL	Comply	
3.13.2	The modem should preferably support other methods that can be used for link encryption, such as PPTP, L2TP, IPsec and TLS	Specify	
3.13.3	The modem shall have configurable firewall	Comply	
3.14	<b>Network Management</b>		
3.14.1	The modem shall support SNMPv1	Comply	
3.14.2	The modem should preferably support SNMPv2c or SNMPv3	Specify	
3.14.3	As a preference the modem shall have an RF MIB	Specify	
3.14.4	The supplier should preferably supply all SNMP MIBS to ESKOM without any additional cost	Specify	
3.15	<b>Self-Diagnostics</b>		
3.15.1	The modem shall have a hardware and software watchdog timer.	Comply	
3.16	<b>Configuration and diagnostic tools</b>		
3.16.1	The modem shall be configured using a Web Browser	Comply	
3.16.2	Should additional tools or software be required for the modem's configuration and to perform diagnostic, these tools shall be supplied to Eskom without any additional costs.	Comply	
3.17	<b>Device Security</b>		
3.17.1	The modem shall be password protected from unauthorized connection and configuration.	Comply	
3.17.2	Modems that offer added security features, such as methods to encrypt the communication link and restrict access to the modem's configuration files will be given preference. The supplier shall state which security features are supported and how they are implemented	Specify	

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Clause No	Description	Eskom's Minimum Technical Requirements	Supplier's Statements Of Compliance
3.18	<b>Firmware</b>		
3.18.1	The modem's firmware shall be stored in non-volatile flash memory.	Specify	
3.18.2	The modem's firmware shall be remotely upgradeable	Comply	
3.18.3	The modem should preferably have a firmware fail-safe feature	Specify	
3.18.4	The firmware supplied to Eskom shall have preconfigured APN settings which will be supplied by Eskom	Comply	
3.19	<b>Functional Tests</b>		
3.19.1	On request the supplier shall supply Eskom with a test product	Comply	
3.20	<b>Product Support</b>		
3.20.1	Preference will be given to suppliers that offer product support for the longest duration	Specify	
3.21	<b>Technical Support</b>		
3.21.1	The supplier shall as a minimum offer telephonic support during office hours.	Comply	
3.22	<b>Fault Repairs</b>		
3.22.1	The supplier is required to repair and return faulty modems within a period of three weeks of less	Specify	
3.23	<b>Training</b>		
3.23.1	Training shall be provided on request for Eskom staff to enable them to configure, install, maintain and operate the product and related systems offered	Comply	
3.23.2	The formal assessments of attendees shall be preferred.	Specify	
3.24	<b>Documentation</b>		

Clause No	Description	Eskom's Minimum Technical Requirements	Supplier's Statements Of Compliance
3.24.1	The following types of drawings shall be supplied as part of the instruction manuals: Outline dimensions and mounting details of each item. Block schematics showing the functional components of the equipment. Functional diagrams showing the operation of the equipment. Component layout diagrams. Circuit and wiring diagrams. Details of the terminals and terminal connectors.	Comply	
3.24.2	All modems shall be supplied with instruction manuals that shall be detailed enough to enable Eskom staff to install, maintain, test, configure and use each item of equipment.	Comply	
3.25	<b>Warranty</b>		
3.25.1	The Tenderer shall submit the warranty period in years for any related product defects.	Comply	