Eskom	Standard	Distribution & Transmission

Title: **SPECIFICATION FOR CELLULAR NETWORK MODEMS FOR REMOTE METERING**

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1. Introduction

This standard describes the minimum requirements for cellular network modems to be used for metering purposes.

2. Supporting clauses

2.1 Scope

2.1.1 Purpose

This document sets out the requirements for standalone cellular network modems for remote metering within Eskom.

2.1.2 Applicability

This document shall apply to Eskom Distribution and Transmission 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

[1] ISO 9001, Quality Management Systems.

[2] IEC 60529, Specification for degrees of protection provided by enclosures (IP code).

[3] SANS 60950-1, Information technology equipment safety.

[4] SANS 61000-4-5, Electromagnetic compatibility (EMC): Testing and measurement techniques – Surge immunity test.

2.2.2 Informative

[5] 32-9, Definition of Eskom Documents.

[6] 32-644, Eskom Documentation Management Standard.

[7] 240-75670959, Operating Manual of the Steering Committee of Technologies (SCOT).

2.3 Definitions

2.3.1 General

Definition	Description
Cellular Network modem	A device capable of transferring data via the Global Systems for Mobile Communications (GSM).
Mini-SIM	A SIM card sized 25x15x0.76 mm
SIM card	A Subscriber Identity Module (SIM) card is a smart card capable of storing information.

2.3.2 Disclosure classification

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

2.4 Abbreviations

Abbreviation	Description
APN	Access Point Name
CE	Conformité Européenne (European health and safety product label)
DAS	Data Acquisition System
GPRS	General Packet Radio Service
GSM	Global Systems for Mobile Communications
ICASA	Independent Communications Authority of South Africa
IEC	International Electro-technical Commission
IED	Intelligent Electronic Device
IP	Internet Protocol
LED	Light-emitting Diode
MSISDN	Mobile Station International Subscriber Directory Number
N/A	not applicable
PTM&C	Protection, Telecomms, Metering & Control
RF	Radio Frequency
SCOT	Steering Committee of Technologies
SIM	Subscriber Identity Module
SMA	Sub-miniature version A connector
SMS	Short Messaging Service
SSL	Secure Socket Layer
TCP/IP	Transmission Control Protocol/Internet Protocol suite
WAN	Wide-area network

2.5 Roles and responsibilities

The requirements stated in this document shall be used for issuing and evaluating tenders for metering modems.

2.6 Process for monitoring

The Metering and Measurements Study Committee shall ensure that this document is implemented.

2.7 Related/supporting documents

Not applicable.

3. Requirements

The modems shall be deployed at remote metering sites and shall be used for the remote retrieval of data from the electricity meters to the respective Data Acquisition Systems (DAS) or Head-End Systems (HES) utilizing cellular communication technology. It shall meet the following minimum requirements:

3.1 Transceiver

3.1.1 GSM module

The GSM module shall be CE approved.

3.1.2 Modems

Modems shall:

a) Be type approved by the Independent Communications Authority of South Africa (ICASA) for use in South Africa.

b) Be network approved by all South African network service providers.

c) As a minimum, be:

1) 4G capable, or

2) 4G NB-IOT enabled with 2G fallback.

d) At least support GPRS multi-class 10.

e) As a minimum, be dual band for use in the 900 MHz and 1 800 MHz frequency bands.

3.2 Network Communications

a) The modem shall act as a server and expose a pre-configured IP port on its WAN link that transparently connects the DAS to the meter.

b) The modem shall also be able to act as a client to enable connections initiated from an IED connected to the modem.

c) The modem shall support the Transmission Control Protocol/Internet Protocol suite (TCP/IP).

d) The modem shall support both even and non-parity types for serial communications.

e) The modem shall support hardware and software flow control.

3.3 Network Settings

a) The modem shall be able to be configured with the following minimum set of parameters to enable it to automatically connect to a private Access Point Name (APN):

1) The name of the APN

2) A username and password

3) A default allocated port number for access via the DAS system. This port number shall be user-configurable.

b) In addition, the modem shall offer the following minimum set of parameters for client mode:

1) Destination IP address

2) Destination port number

3.4 Identity Modules

a) The supplier shall offer Chip SIM Modems that allows for more than one service providers' chip SIMs to avoid the devices being network-locked to a single network.

b) In addition, the Chip SIM modems shall also have an externally accessible push-push mini-SIM card slot to cater for any MNO external SIM.

c) The supplier shall state the full dual SIM functionality of the modem.

d) Dual SIM capable modems shall be able to automatically select a service provider network when in client mode and or server mode.

e) The automatic switching capability shall be configurable and shall as default be disabled to allow the user to activate dual SIM capability.

f) It shall be possible to activate the modem's dual SIM capability both locally or remotely when more than one service providers SIMs are activated.

g) The modem shall have the functionality to start up automatically on the activated SIM.

h) The modem shall offer a mechanism to ensure that the standby SIM for dual SIM modems is not deactivated by the network due to inactivity. The supplier shall state how this is achieved.

i) The modem shall offer a mechanism to avoid network flapping whereby the modem jumps between networks when dual SIM capability is activated. The supplier shall state how this is achieved.

3.5 Firmware

a) The modem's firmware shall be stored in non–volatile flash memory.

b) The modem's firmware shall be remotely upgradeable via the cellular network by Eskom field staff and/or the supplier. The supplier shall provide Eskom with the necessary information and software to do so.

c) The supplier shall provide a detailed firmware revision history every time a new release is made. Any modifications and enhancements shall be clearly specified and the impact thereof explained.

d) Any firmware fault (bugs) fixes shall be supplied to Eskom free of charge. Any bugs discovered in a firmware version used by Eskom, by either the supplier, or other customers, shall immediately be brought to Eskom's attention.

e) The suppliers shall specify how version control of firmware will be handled over a period of at least 10 years.

3.6 User Indication

a) All physical status indications shall be clearly visible on the front of the cellular modem. A combination of indicators can be used for any of the indications provided, but it shall also be unambiguous and easily identifiable. Light-emitting Diode (LED) indication is preferred.

b) The following status indications are a minimum requirement:

1) Indication of the various cellular network mode statuses; example distinguishing between NB-IOT, 2G, 4G, etc.

2) Indication of when cellular communication is established.

3) Data transmit indication.

4) Data receive indication.

c) The supplier shall specify any other indications that are provided.

3.7 Diagnostics

a) 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 and at least perform or offer the following:

1) A cold restart if no communication has taken place in a 36 h period.

2) A cold restart if the modem loses cellular network authentication for more than 10 min when dual SIM capability is deactivated. Where dual SIM capability is enabled, the modem shall restart once the 2nd SIM also fails to authenticate to the cellular network after 10 minutes.

3) The cold restart functionality if remotely activated, for example through an SMS.

It is preferred that the above time periods are the default periods and that these periods are configurable.

b) The Radio Frequency (RF) output circuitry shall be protected against inadvertent open or short circuiting of the antenna or coaxial cable, and shall be of the self-restoring type.

c) The modem shall be able to remotely and through communicating via a computer or tool provide its received cellular network signal strength indication. The supplier shall specify how this is done.

d) Modems shall offer Telnet as an IP configuration service as a minimum. Preference shall be given to modems that offer an embedded web server for configuration and remote management.

e) It shall also be possible to remotely configure modems through SMS, terminal or any other software that will be provided by the modem supplier free of charge.

f) The supplier shall provide details of any additional diagnostics features.

3.8 Modem Security

a) The modem shall preferably support the authentication and encryption of the network link using Secure Socket Layer (SSL) or equivalent.

b) The modem shall preferably support access control lists to only allow for connections to and from selected users (IP's).

c) The supplier shall state which other security features are supported and how it is implemented.

3.9 Power Supply

a) The modem shall have a power supply which shall be able to operate from 110 V ac and from a 230 V ac supply. The modems that shall also operate from an 110V and 220V dc supply. The modem shall be able to operate with any deviation in voltage from these values to at least ± 15% without affecting its performance negatively.

b) Both Internal and external power supplies are acceptable, but where an external power supply is offered, it shall be DIN rail mountable.

c) The external power supply ingress protection (IP) rating shall be IP51 or better.

d) The power supply shall at least comply with the following specifications:

1) SANS 60950-1 - Information technology equipment standard

2) SANS 61000-4-5 – Electromagnetic compatibility (EMC) Part 4-5: Testing and measurements techniques – Surge immunity test

3.10 Modem Enclosure

a) The modem enclosure shall be manufactured of a durable high-impact flame-retardant plastic or metal extrusion or moulding.

b) The modem casing must have a minimum ingress protection rating of IP51 as specified in [2] IEC 60529. This means the enclosure must be dust-proof and be able to protect its contents from dripping water.

c) Regarding physical dimensions, the supplier shall specify actual outer dimensions of the modem enclosure. The dimensions shall not exceed height 180 mm x width 110 mm x depth 80 mm.

d) Modems shall be DIN-rail mountable or have a suitable mounting solution which will allow it to be securely mounted onto a flat surface. The mounting method of modems inside meter panels shall be such that visual indications are not obscured and all electrical connectors are easily accessible. DIN-rail mountable modems are preferred.

3.11 Modem Markings

a) The modem's manufacturing name, model type and year of manufacturing shall be clearly visible on the front of the modem.

b) The serial number of the modem, which shall relate to the manufacturing name, year of manufacture, model and its unique identification number, shall be displayed on the front of the modem in the form of text and a barcode. The barcode shall be generated using the code 128 symbology.

c) All external connectors, test points, switches and status indications shall be clearly and indelibly marked.

d) The network service provider name and the Chip SIM serial number of modems shall be clearly and indelibly marked.

3.12 External Connections

a) Modems shall have a female SMA connector.

b) The RF connector shall have a non-reactive impedance of 50 Ω.

c) The modem shall as a minimum have an RS485 serial communication data port, preferably through an RJ12 or RJ45 connector.

d) Modems shall offer a second communication port that can act as both a data or diagnostic port which could be either a RS485 or Ethernet port.

e) Any cables required for communications between the modem and Eskom approved meters shall be supplied to Eskom on request.

f) The communication speed of the serial link shall be selectable from 2 400 bps to a maximum of at least 57 600 bps.

g) The supplier shall provide full details of any additional connectors the modem may have.

h) The primary power connections for modems shall be done through screw terminals, which shall have adequate insulating properties, mechanical strength and a secure mechanism to prevent inadvertent disconnection. Terminals shall also be protected against accidental short-circuiting. The protective earth terminal that forms part of the modem base shall be located adjacent to the power supply screw terminals, and shall be electrically bonded to the accessible metal parts of the modem. The clearances and creepage distances between any terminal of a circuit and earth shall not be less than 3,0 mm and 3,2 mm respectively.

3.13 Environmental Operating Conditions

a) The equipment will be mounted in substations and pole-mounted enclosures where it will be subjected to harsh environmental conditions. The equipment shall operate without malfunction and shall meet all the required specifications within the following environmental limits:

1) Ambient temperature: -10 °C to +55 °C.

2) Electric field strength: up to 10 V/m.

4. Tests

4.1 Type Tests

The supplier shall indicate the level of type tests that have been performed on the equipment offered to Eskom. All certificates and the type test results shall be in English and must be submitted as part of the offer. Eskom will evaluate the test information supplied and may elect to verify some of the test results.

4.2 Functional Tests

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 performance in Eskom's operating environment.

5. Product Support

Eskom may require the supplier to offer technical after-sales support. The minimum level of service required is described in the following paragraphs. However, the supplier shall provide full details about the level of service that can be provided in each of the following categories:

5.1 Technical Support

Dedicated local expertise to support all modems or parts thereof offered by the supplier shall be available telephonically as a minimum during office hours.

5.2 Training

Training shall be provided on request for Eskom staff to enable them to configure, install, maintain and operate the product and related systems offered. The formal assessments of attendees shall be preferred.

6. Documentation

6.1 Drawings

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.

6.2 Instruction Manuals

All types of 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. AT command sets should also be included in the manual.

7. Authorization

This document has been seen and accepted by:

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8. Revisions

Date	Rev.	Compiler	Remarks
June 2024	5	RR Brooks	• Added Requirements for 2 GSM module options • Amended requirements for Dual SIM functionality • Removed power down delay requirement • Added IP rating for external PS • Standardised on RS485 interface for communication/diagnostic ports • Removed requirements for input/output contacts
Jan 2019	4	RR Brooks	• Included Client mode requirements • Added Output Contact requirements
August 2013	3	RR Brooks	• Removed antenna requirements
March 2012	2	RR Brooks	• Applicability changed to Tx and Dx • Added Chip SIM requirements
March 2011	1	RR Brooks	• Added requirements on Network settings
Feb 2009	0	RR Brooks	New Document

9. Development team

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

- RR Brooks
- HPD Groenewald

10. Acknowledgements

Not applicable.