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CELLULAR-BASED  
COMMUNICATIONS**

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## **1. Introduction**

Eskom Distribution has extensive medium voltage (MV) electricity distribution networks that cover vast geographical areas of South Africa. In order to improve the reliability and restoration time of these networks Eskom Distribution has installed large numbers of auto-reclosers, voltage regulators and Fault Path Indicators (FPI) on these networks. As part of Distribution's smart grid and network visibility improvement strategies it is a requirement to be able to remotely monitor, control and manage these devices. Most of the installed devices are already remotely monitored and controlled from Distribution's Supervisory Control and Data Acquisition (SCADA) Master Stations.

Since Eskom's own Ultra High Frequency (UHF) area radio network did not reach all these devices, a *cellular-based telecommunications* solution was developed and piloted, culminating in 2005 in the first revision of this User Requirement Specification (URS). This *cellular-based telecommunications* solution for SCADA/Telecontrol has proved its worth since then. The packet switched data capabilities of this service also enabled simultaneous connections for other services such as remote engineering access and engineering data retrieval not possible with the analogue UHF radio technology or the first generation digital UHF radio technology. This *cellular-based communications* service has also made it possible to provide communications to small line-mounted and low power devices such as the FPIs, which are too small and too power constrained to accommodate the UHF radio.

For the above reasons, Eskom continues to require a secure, high availability, end-to-end *cellular-based communications* solution for SCADA/Telecontrol.

The current solution is a complete, single vendor, end-to-end system encompassing every aspect of the required service. Recent developments have highlighted the commercial risks of the current solution. This has prompted a rethink of the architecture of the system in order to reduce these risks. These changes involve the migration of as many critical components as possible under Eskom's direct control and the use of perpetual licenses in order to ensure continued critical system functionality even when commercial difficulties arise.

The above changes are captured in this revision of the URS together with a number of other changes aimed at simplifying requirements while limiting the loss of features and functionality currently enjoyed. Other key risk reduction philosophies are the requirement of support for the large installed base of Field Routers and requiring field-proven, off-the-shelf solutions as far as possible, with development kept to a minimum.

## **2. Supporting Clauses**

### **2.1 Scope**

This document contains the User Requirement Specification for a system that facilitates communications between Eskom Distribution's SCADA/Telecontrol Master Stations and both serial (RS232) and Ethernet SCADA/Telecontrol devices using public *Cellular-based communications* networks. The requirement is for Telecontrol communications and for remote engineering access.

This URS covers the functional, operational and performance requirements, as well as the environmental conditions in which it is required to perform. Due to the strong service element of the required solution, service level requirements are also captured in this document and these service level requirements will be included in the tender requirements via the appropriate contract mechanism.

#### **2.1.1 Purpose**

The purpose of this URS is to specify Eskom Distribution's requirements for an end-to-end *Cellular-based communication* solution for SCADA/Telecontrol, remote engineering access and related services.

#### **2.1.2 Applicability**

This document shall apply throughout the Eskom Distribution Division.

## 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] [240-103994742](#): Cellular Network Connectivity Strategy
- [2] IEC 60529, edition 2.1, February 2001: Degrees of protection provided by enclosures (IP code).
- [3] SANS (CISPR / IEC 6100-6-3), 1<sup>st</sup> edition, February 1999: Electromagnetic compatibility – Generic emission standard – Part 3: Emission standard for residential, commercial and light-industrial environments.
- [4] SANS 301489-7 / SABS ETSI EN 301489-7:2000 – Electromagnetic compatibility and Radio spectrum matters (ERM) – Electromagnetic Compatibility (EMC) standard for radio equipment and services Part 7: Specific conditions for mobile and portable radio and ancillary equipment of digital cellular radio telecommunications systems (GSM and DCS)
- [5] ETSI EN 300 607-1 V9.0.0: Digital cellular telecommunications system (Phase 2+); Mobile Station (MS) conformance standard; Part 1: Conformance standard (GSM 11.10-1)
- [6] ETSI EN 300 910 V8.4.1: Digital cellular telecommunications system (Phase 2+); Radio transmission and reception
- [7] IEEE 1815 (2012), IEEE Standard for Electric Power Systems Communication – Distributed Network Protocol, IEEE.
- [8] DNP3 IED Certification Procedure Subset Level 2, DNP3 User Group
- [9] DNP3 Specification Volume 8 Appendix 1 –Device Profile, DNP3 User Group
- [10] All applicable published DNP3 Technical Bulletins to date of the enquiry, DNP3 User Group
- [11] [240-55410927](#): Cyber Security Standard for Operational Technology
- [12] [240-64038621](#): Remote Device Communication Standard For Data Retrieval And Remote Access

### 2.2.2 Informative

- [13] [240-89529746](#): Technology Roadmap for Distribution Automation
- [14] [240-79747329](#): Standard for Business Continuity Management
- [15] [240-57855742](#): Secure remote access system standard specification for field IEDs.

## 2.3 Definitions

### 2.3.1 General

Definition	Description
Availability	Availability refers to the percentage of time (measured over a predefined period e.g. one month), that the applicable service is functional. This service is deemed to be available when communication transactions are successfully completed between the Communications Controller and the Field Router. Availability can be expressed mathematically as follows; $\frac{\text{Serviceuptime}}{\text{Reportingperiod}} \times 100\%$

Definition	Description
<b>Bit Error Rate (BER)</b>	A telecoms performance parameter that indicates the ratio of the number of received erroneous bits over the total number of bits transmitted. BER is usually expressed as a coefficient and a power of 10, e.g. 1 error in 1000 bits is expressed as $1 \times 10^{-3}$ .
<b>Block Error Rate (BLER)</b>	It is the receiver measurement used in conformance testing of GPRS/EGPRS mobiles. Retransmission is done for the blocks that are received in error. BLER is the ratio of received erroneous blocks to the total number of data blocks transmitted.
<b>Communications Controller (CC)</b>	<p>A device that resides at the Eskom Control Centre and provides the interface between the SCADA Master Station (and other systems) and the Cellular-based telecommunications infrastructure. Its primary functions are:</p> <ol style="list-style-type: none"> <li>1) intelligent serial port server services (the encapsulation of serial Telecontrol protocol messages into IP messages based on the Telecontrol protocol message address and the corresponding decapsulation of IP messages into the Telecontrol protocol message and routing to the appropriate serial port)</li> <li>2) the high availability routing service that ensures that messages are routed to the APN which the remote device's active SIM is connected</li> <li>3) transparent message routing between central engineering and configuration servers and remote devices</li> <li>4) It also provides other services such as Field Router configuration management, message logging and communication management etc.</li> </ol> <p><b>Unless otherwise stated the term Communications Controller or its abbreviation CC shall include all SP-provided aspects of the solution residing at Eskom's Control Centre.</b></p>
<b>Data latency</b>	<p>The time it takes for 1 bit of data to be transmitted and received across an established communications link. It is measured from the time the data enters the data port on the transmitting device to the time that data exits the data port on the receiving device.</p> <p>NOTE: Due to the nature of the transported DNP3 data, this test will be conducted between the serial ports of the Communications Controller and a Field Router using the shortest available DNP3 message and setting the RS232 port speeds to maximum. Both directions will be measured.</p>
<b>End-to-end</b>	In the context of this URS, the term "end-to-end" means the total communications solution from the SCADA Master Station front-end serial ports to the (a) serial port of remote terminal units and (b) the Cellular engine inside FPIs and other sensors with built-in Cellular capabilities. The end-to-end solution shall make use of both the Eskom-provided APNs and their links back to the Dx Control Centre.
<b>GSM-based communications</b>	In the context of this URS, this term includes newer mobile cellular communications standards such as UMTS and LTE.
<b>Perpetual licence</b>	A perpetual licence is the 'traditional' model used to purchase software where one pays for the software licence up-front and receives the right to use it indefinitely. Implementation services would be a separate charge as would a support contract, which would be renewable annually.

Definition	Description
<b>RS232</b>	The common name for a popular serial communications interface. RS232 was first introduced in 1960 by the Electronic Industries Association (EIA) as a Recommended Standard. The latest version of the standard is TIA-232-F (R2012)
<b>Solution Provider (SP)</b>	The entity that will provide the solution defined within this document.
<b>Unsolicited mode</b>	Unsolicited mode is the communication mode where remote devices initiate messages without the need for the Master Station to initiate communication. This mode is distinct from solicited mode (polled) where RTUs only respond under the control of the Master Station.

### 2.3.2 Disclosure Classification

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

## 2.4 Abbreviations

Abbreviation	Description
<b>3G</b>	Third Generation GSM technology
<b>APN</b>	Access Point Name
<b>BER</b>	Bit Error Rate
<b>BLER</b>	Block Error Rate
<b>CC</b>	Communications Controller
<b>CSD</b>	Circuit Switched Data
<b>DCE</b>	Data Communications Equipment
<b>DNP</b>	Distributed Network Protocol
<b>DTE</b>	Data Terminal Equipment
<b>Dx</b>	(Eskom) Distribution
<b>EADS</b>	Engineering And Data Server
<b>EDGE</b>	Enhanced Data for Global Evolution
<b>EGSM</b>	Extended GSM
<b>EIA</b>	Electronic Industry Association
<b>ETSI</b>	European Telecommunications Standards Institute
<b>FPI</b>	Fault Path Indicator
<b>GPRS</b>	General Packet Radio Services
<b>GSM</b>	Global System for Mobile Communications
<b>GUI</b>	Graphical User Interface
<b>ICASA</b>	Independent Communications Authority of South Africa
<b>IEC</b>	International Electrotechnical Commission
<b>kbps</b>	kilobits per second
<b>LCD</b>	Liquid Crystal Display

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Abbreviation	Description
LED	Light Emitting Diode
LTE	Long Term Evolution
MMA	Month Moving Average
MNO	Mobile Network Operator (e.g. Vodacom and MTN)
RF	Radio Frequency
RSSI	Received Signal Strength Indication
RTU	Remote Terminal Unit
SCADA	Supervisory Control and Data Acquisition (aka Telecontrol)
SIM	Subscriber Identity Module
SLA	Service Level Agreement
SMS	Short Message Service
SP	Solution Provider
TCP	Transport Control Protocol
TIA	Telecommunication Industry Association
UDP	User Datagram Protocol
UMTS	Universal Mobile Telecommunications System
VPN	Virtual Private Network
YTD	Year To Date

## **2.5 Roles and Responsibilities**

The roles and responsibilities are defined in the relevant Process Control Manuals.

## **2.6 Process for Monitoring**

The process for monitoring is defined in the relevant Process Control Manual.

## **2.7 Related/Supporting Documents**

See Informative References section 2.2.2 above.

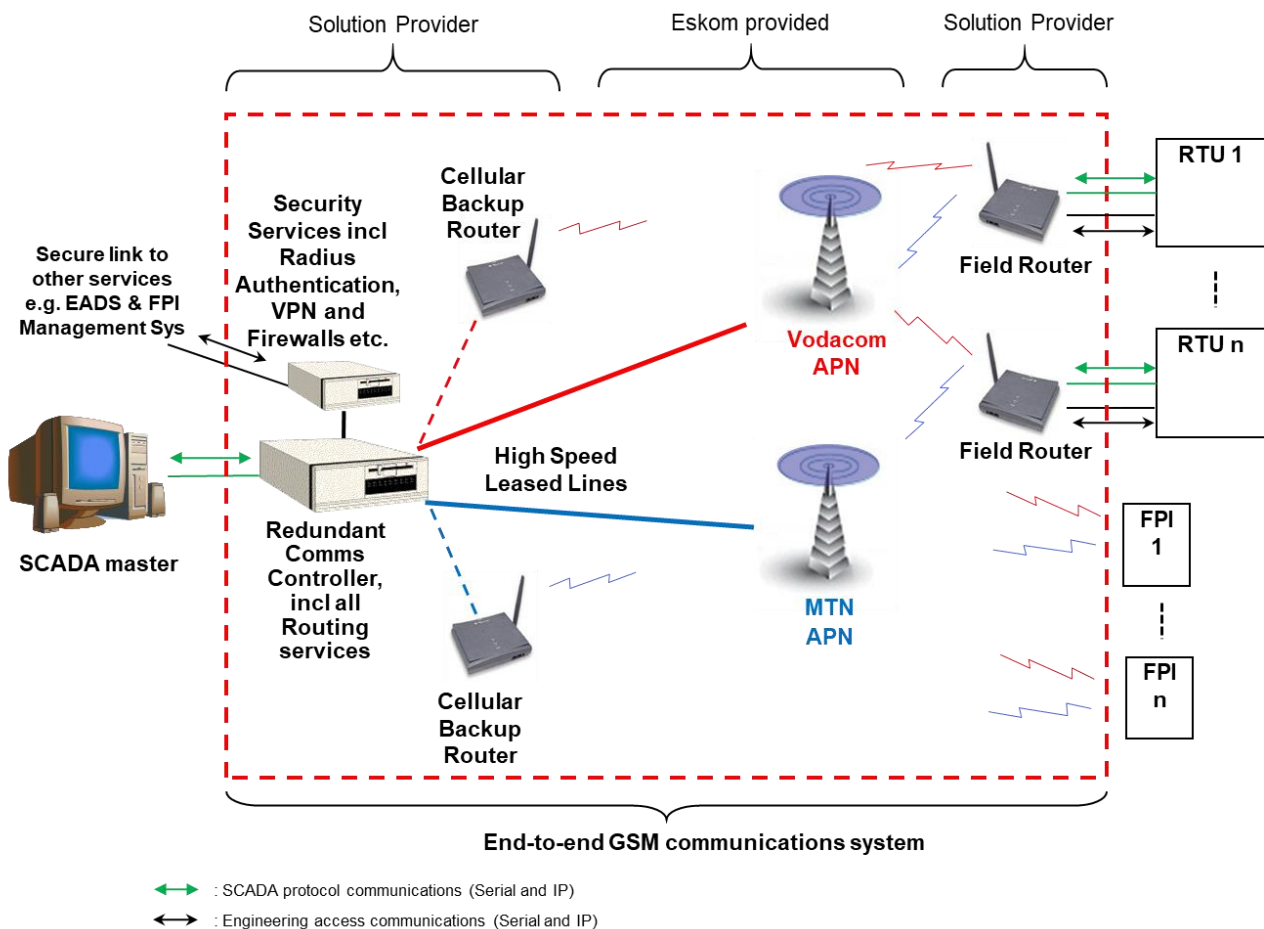
## **3. Requirements**

### **3.1 High-level Service Description**

- The end-to-end cellular communications system will consist of the logical components within the red dotted lines as indicated in Figure 1. Eskom will provide the two APNs (per Dx Control Centre) and the leased lines between each of the APNs and their respective Control Centres, while all the other components required by this URS shall be provided by the Solution Provider (SP).
- High availability is an essential requirement of the solution hence the redundant Communications Controller (CC), the cellular backup to the high-speed leased lines, the two APNs on different networks and the dual SIM capability of the Cellular Field Routers as indicated in Figure 1.
- Each of the six Eskom Distribution (Dx) Control Centres shall have their own instance of the system depicted in Figure 1.

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**Figure 1: Logical components of Cellular-based communication system (per Dx master)**

- d) There are typically between 16 and 64 RS232 ports on each SCADA Master Station serving GPRS and about 50 to 100 RTUs grouped onto each SCADA Master serial port. The solution shall enable the communication of DNP3 serial messages from these RS232 ports over the cellular network.
- e) The Dx SCADA/Telecontrol Master Station and most of the Telecontrol Remote Terminal Units (RTUs) and Fault Path Indicators (FPIs) communicate using the DNP3 serial Telecontrol protocol, principally via RS232 ports.
- f) The Dx SCADA/Telecontrol Master and some of the Telecontrol RTUs communicate using DNP/IP, via Ethernet ports; therefore the solution shall enable the communication of DNP/IP between the SCADA Master and field devices.
- g) In addition to the SCADA/Telecontrol communications requirements, there is also an important requirement to provide other communications services to the field devices such as remote engineering access. The remote engineering access servers are distinct from the SCADA Master therefore the solution shall make provision for providing secure access by other servers such as the Engineering and Data Server (EADS) and the FPI Management server to this cellular communications service.
- h) The two SIMs in the field devices each have their own IP address but the various Master Stations (e.g. SCADA Master and EADS) only provide for a single IP address per device, therefore the solution shall have the capability to route between this single Master Station IP address and whichever IP address on the field device is active. This routing between IP addresses shall take place at the Dx Control Centre i.e. on Eskom premises.

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- i) This communication solution unavoidably exposes critical Eskom infrastructure to external companies therefore, every reasonable security measure shall be taken by the SP to safeguard this solution from cyber security threats.

## **3.2 Communication System Requirements**

### **3.2.1 System Components**

- a) The solution shall be a complete system encompassing all the necessary elements to achieve the required end-to-end functionality detailed in this specification (in concert with the Eskom-provided APNs and associated leased lines).
- b) The SP shall provide a functional diagram of their solution, which shows how the various logical functions translate into system components and how they are networked together.
- c) The SP shall provide a functional diagram of their solution, with a brief explanation of the functions performed by each component.
- d) The SP shall provide a functional diagram of their solution, which shows all security components and explains how cyber security requirements will be met.
- e) Service continuity is a priority therefore a seamless transition from the existing system is an essential requirement. The installed base of Field Routers and other devices e.g. FPIs cannot be replaced therefore the solution shall be capable of providing DNP3 communications to the installed base of Field Routers and FPIs from the first day. Demonstrating this capability shall be a pre-condition of tender award.

### **3.2.2 Functional Requirements**

- a) In the outbound direction from SCADA Master to field device, the Communications Controller (CC) shall obtain the DNP3 destination address from the protocol message received from the SCADA Master. Using a preconfigured address table, the CC will determine the IP address/es of the field device associated with that DNP3 address and will encapsulate the DNP3 message into an IP packet using the active IP address. When this IP packet arrives at the Field Router, it will be decapsulated from the IP packet and sent to the appropriate serial port of the Field Router for transmission to the connected RTU's serial port.
- b) In the inbound direction from field device to SCADA Master, the Field Router shall encapsulate the DNP3 message in an IP packet with the configured SCADA Master IP address. When this IP packet arrives at the CC, the DNP3 message will be decapsulated from the IP packet and sent by the CC (using the predefined address table) to the appropriate serial port of the SCADA Master.
- c) For field devices that have built-in cellular communications and serial server capabilities e.g. FPIs, items a) and b) above shall be achieved without the need for a Field Router, as shown in Figure 1.
- d) The solution shall ensure that protocol messages are given correctly to the destination device (RTU or SCADA Master). Here "correctly" means that the DNP3 datalink frames are given to the destination device in the correct order and with no inter-octet gaps within the DNP3 datalink frames.
- e) The solution shall cater for all valid DNP3 datalink frame sizes.
- f) The solution shall provide support for the DNP3 broadcast address mechanism as detailed in the DNP3 Specification [7]. The scope of the broadcast shall be limited to the devices on the SCADA Master port that initiated the DNP3 broadcast. The SP shall detail all APN setup/configuration requirements to achieve DNP3 broadcasting. This functionality shall be provided and included in the product pricing and if this functionality is not part of the SP's standard product, a period of up to 6 months will be allowed to develop this functionality.
- g) The solution shall provide "always-on" communications between the SCADA Master Station and the field devices. "Always-on" refers to a situation where SCADA data can be sent/ received at any time from either end, and where the maximum data latency from end-to-end in either direction is less than 8 seconds (see Data Latency definition).

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- h) The solution shall provide support for both TCP (Transport Control Protocol) and UDP (User Datagram Protocol) over the cellular network.
  - i) The solution shall be capable of handling simultaneous communications sessions between the SCADA Master and all the connected field devices. The Service Provider (SP) shall state all constraints or limits that apply to the number of simultaneous connections.
  - j) The solution shall transmit data between the SCADA Master and the field devices in the quickest and most reliable way possible.
  - k) Retrying protocol messages is strictly reserved for the SCADA/Telecontrol end devices therefore the CC and Remote Router shall not resend protocol messages. This does not apply to TCP/IP mechanisms nevertheless the IP time-to-live parameter shall be made available to limit how long protocol messages can live in the network.
  - l) In addition to providing the means to transport DNP3 messages to/from field devices, the solution is also required to provide the means to transport engineering access communications between field devices and their respective engineering access server (e.g. the Engineering And Data Server (EADS) and the FPI Management System) as indicated in Figure 1.
  - m) The solution shall continuously monitor the state of the CC and shall automatically fail over to the backup CC if the main CC fails.
  - n) The CC shall constantly monitor communications with active SIMs in the field, to correctly route outbound messages to the active SIM (SIM switching is under the control of the field devices and not the CC as indicated in the item below).
  - o) The Field Router shall continuously monitor the state of the connection between the active SIM and the rest of the system and shall automatically fail over to the secondary SIM (for dual SIM devices) if the communications fail (see section 3.4.7 Field Router Configuration and Diagnostics for details).
  - p) The solution shall support at least 3G and preferably LTE for the Cellular Backup Routers
  - q) The SCADA Master and the RTU interfaces are almost exclusively RS232 at present; however Eskom is introducing the use of Ethernet connections to cater for devices that can communicate directly with the SCADA Master using DNP/IP. These DNP/IP connections do not require the encapsulation and decapsulation services detailed above but the solution shall still provide the leased-line, APN and SIM redundancy capabilities listed above for these direct DNP/IP communications.
  - r) The use of Ethernet and DNP/IP introduces cyber risks that do not exist when using RS232 interfaces. The solution shall provide the appropriate firewalls and other security measures to ensure the Confidentiality, Integrity and Availability of the system and of the Eskom assets connected to it and of all transmitted messages (see Cyber Security section for details). The SP shall describe all security measures provided.
  - s) The solution shall allow Eskom-approved third-party Field Routers and other devices/sensors that have integrated cellular comms to communicate to the SCADA Master through the system.
  - t) The solution shall enable the transparent transport of IP services from any of the other non-SCADA services such as the Engineering and Data Server (EADS) and the FPI Management System etc. to any remote device i.e. devices/sensors with integrated cellular comms or via the Ethernet port of a Field Router.
  - u) The solution shall provide for a secure interface for the “other services” as described in t) above and as indicated in Figure 1.
  - v) The solution shall utilise Internet Assigned Numbers Authority (IANA) approved port numbers for DNP3 and DNP/IP etc.

### 3.2.3 Communication through the Cellular Network

- a) The solution shall utilise the Eskom provided APNs via the associated leased lines (primary routes).
- b) The solution shall provide a secondary route to the APNs via high-speed Cellular Backup Routers.
- c) Switching between the primary and secondary routes shall be automatic.
- d) User controlled switching between the two routes shall also be provided.
- e) It is preferred that the data messages are secured across the entire communication link from the Dx Control Centre to the Field Router. The SP shall describe their proposal/s to achieve this while still providing backward compatibility to the current installed base that has limited, if any, support for encryption etc.
- f) The SP shall ensure that any chip-SIMs fitted in devices they provide, can be provisioned on Eskom's APNs.

### 3.2.4 System Performance

The solution shall meet the performance criteria stated in the following table. The definitions are listed below the table:

Table 1: Performance criteria

Clause	Description	Note	Criteria
a)	System capacity <u>per CC</u> – the number of simultaneous connections without affecting data rate & latency.	Initial	>2000
		After 5 years	>4000
b)	System Availability (Control Centre based portion)	12 MMA	≥99.99%
c)	Maximum Data Latency on an idle channel	Master to RTU	≤ 8 s
d)	Average Data Latency	Master to RTU	≤ 2 s

- a) System capacity – The number of simultaneous connections that the system can handle while still meeting the other performance criteria of the system. This is for the initial system size and a predicted future growth.
- b) Average Yearly System Availability: This is the 12-month moving average availability of the solution from the interface to the SCADA Master to the interface to the APNs.
- c) Maximum Data Latency (see Definitions table) on an idle channel: The data latency when data from the SCADA Master or RTU is transmitted over a connection in an idle state. The SP shall provide full details and shall indicate how this latency could be kept to a minimum.
- d) Average Data Latency (see Definitions table): The average data latency of all transmissions. The SP shall supply full details and shall indicate how data latency could be minimised.

## 3.3 Communications Controller

### 3.3.1 Routing

- a) The Communications Controller (CC) shall encapsulate all serial (non-routable) protocol messages from the SCADA Master into the correct IP packet for routing to the correct RTU and shall decapsulate all protocol messages received from the RTU network and route them to the appropriate serial port of the SCADA Master as described in section 3.2.2 Functional Requirements
- b) To perform the required routing the CC shall maintain an appropriate user-configurable routing table or database.
- c) The CC shall provide the same encapsulation and decapsulation service for engineering access communications between the EADS and RTUs with serial configuration ports.

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- d) The CC shall have the ability to disable/enable engineering access communications globally and on a per device basis. This functionality shall be provided and included in the product pricing and if this functionality is not part of the SP's standard product, a period of up to 6 months will be allowed to develop this functionality.

### **3.3.2 CC Interface to Eskom's SCADA Master Station**

- a) The CC shall have the capability to support up to 64 RS232 ports that connect to the SCADA Master station.
- b) Each RS232 port shall have a minimum bandwidth capability of 57600 bps.
- c) The CC shall have the capability to support at least two Ethernet ports to connect to the SCADA Master station. The SP shall state the maximum Ethernet port capacity.

### **3.3.3 Communications Statistics**

- a) The CC shall keep track of all TCP/IP connections made to/from each field device.
- b) The CC shall track successful as well as unsuccessful connections, and record the reasons for connections that were not successful. This information shall be held in a database for analysis.
- c) It shall be possible to monitor and analyse communication data in real time.
- d) The CC shall record the amount of data sent to and sent from the SCADA Master facing side of the CC, per RTU. This information shall be stored in a database in ten-minute intervals.
- e) The user shall be able to configure the CC to raise an alarm (via email) when any RTU exceeds a user-defined amount of data over a rolling 60-minute period so that RTUs with an abnormally high data usage can be quickly identified. It is preferred that this alarm can also be sent via SMS.
- f) The CC shall record the amount of data sent to each APN and received from each APN. This information shall be recorded in a database in one-minute intervals.

### **3.3.4 Database Management**

- a) The CC shall timestamp and log all protocol data transactions in a message transaction database.
- b) The CC shall have the facility to display the protocol transaction database for the purposes of analysing the protocol messages.
- c) The CC shall provide the facility to filter displayed messages for one or more RTUs.
- d) In addition to the RTU filter, the CC shall provide the facility to filter displayed messages for a user-specified period.
- e) The CC shall have the ability to export the filtered protocol messages in a suitable delimited format that can be read by Microsoft Excel.
- a) The CC shall manage all database sizes (i.e. message transaction, data usage and RTU data), by automatically archiving all data older than a user configurable period. These archive files shall reside on the CC.
- b) The SP shall indicate the name and type of the database/s used by the CC. An open database that does not require additional software licences is preferred.
- c) The CC shall automatically back up its databases periodically. The back up frequency shall be user configurable.
- d) It shall be possible to create user initiated backups of the CC database to a PC or other external media.
- e) It shall be possible to configure the CC to automatically back up all data to a PC or backup device to ensure availability of data in the case of a hard drive crash.
- f) It shall be possible to restore any corrupted database from an uncorrupted backup database.

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- g) Relevant database security shall be applied. The SP shall provide details of the security measures that will be adopted.

### **3.3.5 Remote Data Retrieval from and Configuration of the Field Router**

- a) The CC shall have a Graphical User Interface (GUI) that enables the user to connect to any Field Router via the cellular network (i.e. over-the-air) to retrieve the diagnostic information described in section 3.4.7 j).
- b) It shall be possible to configure the CC to automatically retrieve all, or selected diagnostic information from Field Routers. The user shall be able to specify the interrogation frequency.
- c) The CC shall store the latest remotely retrieved diagnostic information in a database, and shall display this latest information, together with time and date when retrieved, when the diagnostic application is opened.
- d) The CC shall store the configuration parameters of all Field Routers in a database. The configuration files shall be in an open, non-proprietary format.
- e) The CC shall be able to remotely update or reconfigure the parameters of any Field Router via the data connection to the Field Router (i.e. over-the-air). The SP shall indicate if there are additional means of communication that can be used for this feature such as SMS etc.
- f) The CC shall be able to verify the remotely retrieved firmware version of each Field Router against a predefined version number. If any of the devices have an older version of firmware it shall be flagged by the application software.
- g) It shall be possible for an authorised user to remotely upgrade the firmware of any Field Router over-the-air from an authorised device/server. All new versions of Field Router software shall be updated this way. The SP shall provide details of the security measures.
- h) This over-the-air firmware upgrade feature shall be failsafe in that the Field Router shall automatically revert to the previous firmware version if an over-the-air upgrade attempt does not complete successfully.
- i) The CC shall have a feature to automatically update all user identified remote devices with new firmware received from the SP. The CC shall keep track of devices updated, and devices that still need to be updated.
- j) The CC shall be able to perform a reset of a selected Field Router over-the-air, on demand. This reset shall be as close to a power off/on condition as possible. The SP to provide details.

### **3.3.6 Alarming**

- a) The CC shall generate an alarm/error report for:
- 1) Any Field Router errors/failures
  - 2) Field Routers that fail to respond to valid data sent to it
  - 3) Connection errors
  - 4) Database errors
  - 5) RTUs with high data usage as per 3.4.2 e)
  - 6) Field Routers that have moved outside their geo-fenced area as per 3.4.3 c)
  - 7) The SP shall describe any other alarm/error that relates to the operation of the system
- b) The user shall be able to configure the alarm reporting, including the priority of each type of alarm, and the frequency of alarm reporting.
- c) The system shall have a user configurable feature to automatically notify one or more users about alarms by means of SMS and/or email.



### **3.3.7 CC Hardware**

- a) The CC shall be supplied by the SP as a “black box” even if use is made of computer hardware.
- b) The quality of all CC hardware shall be in line with server grade hardware.
- c) It is preferred that the hardware is off-the-shelf equipment with components that are readily available and well supported.
- d) The CC hardware shall be 19-inch rack-mountable.
- e) It shall be possible to physically separate the CC and its Graphical User Interface (GUI) to enable Eskom Dx staff to configure the CC from a different physical location (on the same LAN).
- f) The CC shall have industry standard interfaces that can connect to external machines and media devices e.g. USB, Ethernet and RS232.

### **3.3.8 CC Firmware and Software**

- a) The CC firmware and software shall be fully capable of performing all the functionality specified in this specification.
- b) The CC firmware and software licenses shall be perpetual licences with a 12-month warranty period.
- c) Maintenance and support of the CC firmware and software shall be catered for via an optional maintenance and support contract. The cost for this annual contract shall be provided in the Price Schedule.
- d) The CC GUI shall be user friendly and menu driven, and comprehensive help files shall be provided. Only basic training should be required to configure the CC.
- e) The SP shall provide a list of all software and other licences used by the offered solution so that Eskom can determine if any of Eskom’s many enterprise licence agreements could be used to save costs.
- f) Take out pricing shall be provided for each licence listed in e) above.

### **3.3.9 CC Graphical User Interface (GUI)**

- a) All current communications connections to the Cellular network including source and destination addresses shall be displayed.
- b) All current protocol messages shall be displayed in Hexadecimal format, including the source address and destination address (in ASCII), and the time and date (in ASCII) of the transaction.
- c) Each transaction shall have a unique transaction ID.
- d) The GUI shall indicate the status of each transaction e.g. pending, failed, completed etc.
- e) The user shall be able to configure the amount of information displayed by the application, and shall be able to filter on any field to view selected information, e.g. DNP3 addresses.
- f) The user shall be able to interrupt the automatic scrolling of data in order to manually scroll through the data.
- g) A period of up to 6 months will be allowed to develop any of the functionality described in items a) through f) which is not part of the SP’s standard product.

### **3.3.10 CC Reliability**

- a) All applications and services necessary for the operation of the service shall start automatically from a cold and a warm restart.
- b) The CC shall have full redundancy such that any failure of the CC shall be automatically resolved.
- c) The automatic changeover shall restore full service in less than 30 seconds.

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- d) When a failure causes a CC changeover, this event shall be clearly displayed, alarmed and logged.
- e) The SP shall provide details of all single points of failure in the offered solution and details of all manual interventions that would be required to get the system working again following the failure of each of these single points.
- f) Eskom intends to have Disaster Recovery (DR) sites for the Dx Control Centres. There is a need for this Cellular communications solution to be easily and quickly available at the DR site. The SP shall provide details of how this easy and quick total service changeover can be achieved.

### **3.3.11 CC Mounting Requirements**

- a) The CC shall be 19-inch rack-mountable.
- b) All required Human Interface Devices such as keyboards and trackballs etc. shall be provided with an ergonomic 19-inch rack-mountable sliding tray.
- c) Any visual display units required by the CC shall be 19-inch rack-mountable.

### **3.3.12 CC Power Supply**

- a) The CC should preferably have a dual power supply unit to improve availability.
- b) The CC shall operate from an Eskom provided 50 Hz uninterruptible power supply with a voltage of 230 V +/- 10%.

### **3.3.13 CC Environmental Operating Parameters**

- a) The CC will be installed in a computer room. The CC shall be able to operate in a computer room environment.

### **3.3.14 CC Cyber Security**

- a) Network activity logging shall be enabled and shall contain sufficient information to support reviewing that ensures accountability of users and enables traceability.
- b) The use of shared user names shall not be allowed.
- c) No duplicate User IDs shall be allowed.
- d) All user accounts shall require new passwords at least every 60 days.
- e) User passwords shall be encrypted when transmitted over any network and when stored.
- f) Any user accounts shall be locked for one hour after three (3) unsuccessful login attempts within a 1-hour period. This event shall be alarmed.
- g) No outbound access to the internet shall be allowed from any part of this solution except through the secure interface provided for EADS and the FPI management system etc.
- h) The SP and Eskom shall sign each other's Non Disclosure Agreement.

## **3.4 Cellular Field Router Requirements**

The Cellular Field Router shall meet the following requirements:

### **3.4.1 Field Router Transceiver**

- a) The Field Router shall be fully compliant with the GSM Phase 2+ standard or higher [5][6].
- b) The Field Router shall be dual band for use in the 900 and 1800 MHz bands.
- c) The Field Router shall be a class A or class B
- d) The Field Router shall support GPRS and EDGE to multi-slot class 12 or higher.

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- e) The Field Router shall support 3G.
- f) The receiver, when in a stationary position, shall have a BER performance better than  $1 \times 10^{-4}$  for an RF receive level of -82 dBm into the RF connector of the Field Router.
- g) The SP shall indicate the maximum usable sensitivity level, i.e. the RF receive level at which the Block Error Rate (BLER) is 10%.
- h) The SP shall provide data on the Field Router's BER versus Receive Signal Strength Indication (RSSI).
- i) The SP shall provide data on the RSSI level versus receive power (in dBm) at the antenna connector.
- j) The RF output circuitry shall be protected against inadvertent open- or short-circuiting of the antenna or co-axial cable, and shall be of the self-restoring type.

#### **3.4.2 Field Router Clock**

- a) The Field Router shall be equipped with an accurate and stable internal clock, preferably a real-time clock.
- b) The Field Router internal clock shall be synchronised via the cellular network time service (if a GPS receiver is fitted then GPS time should be used).
- c) The SP shall provide details of the expected clock accuracy when set using the cellular network time.

#### **3.4.3 Field Router GPS Receiver**

- a) The Field Router shall be equipped with a GPS receiver.
- b) The GPS receiver shall be capable of determining the location of the Field Router to within 20 m.
- c) The Field Router shall have a geo-fencing feature which will disable the data ports should the device be moved more than 200 m from the location stored at commissioning time. Communications with the CC shall not be blocked by this feature. This feature need only check the Field Router's location on power up and then once a day.
- d) The GPS receiver shall be used to keep the clock accurate to within 1 millisecond or better.
- e) Should GPS time be unavailable for any reason the Field Router shall keep its clock accurate using the time provided by the cellular network.
- f) All of the GPS functionality shall be provided and included in the product pricing, however if this functionality is not part of the SP's standard product, a period of up to 6 months will be allowed to develop this functionality. The SP shall provide all relevant details.

#### **3.4.4 Field Router SIM Cards**

- a) The Field Router shall have slots for either two plastic SIM cards, or two chip-SIMs (Vodacom and MTN), or have one plastic SIM and one chip-SIM (Vodacom or MTN).
- b) The SP shall implement all available measures to prevent unauthorised and fraudulent use of the SIM cards in Field Routers supplied by the SP.
- c) Details of all security features embedded in the Field Router shall be provided.

#### **3.4.5 Field Router Hardware and Firmware**

- a) The Field Router hardware shall have enough processing capacity to perform all the functionality specified in this specification with extra capacity for reasonable feature upgrades.
- b) The Field Router shall have a hardware watchdog to reboot the device, should its software lock up.
- c) The Field Router shall have a means to detect if the device is being physically tampered with.
- d) The Field Router firmware shall be stored in non-volatile Flash memory.

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- e) The Field Router shall send regular “heartbeat” transmissions as a means for the CC to confirm that communications is still active. The length of these “heartbeat” transmissions shall be kept as short as possible to allow for frequent transmissions without major impact on the data usage.
  - f) The period of these “heartbeat” messages shall be user configurable. It shall be possible to set this parameter in the range 1 to 10 minutes in steps of 1 minute or less.
  - g) The Field Router shall also send periodic “device status” transmissions as a means for the CC to monitor the device status of each Field Router.
  - h) The SP shall indicate the recommended set of device parameters reported in the “device status” message.
  - i) The period of these “device status” messages shall be user configurable. It shall be possible to set this parameter in the range 10 to 99 minutes in steps of 1 minute or less.
  - j) Both the “heartbeat” and the “device status” message formats shall be open and non-proprietary.
  - k) The destination IP address for the “heartbeat” and “device status” messages shall be user configurable.
  - l) Changes to parameter settings and the downloading of firmware shall be restricted to authorised sources only, e.g. the CC.
  - m) The SP 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 explained.
  - n) Any firmware bug fixes discovered during the warranty period shall be made available free of charge within a period of 8 weeks after the problem has been formally communicated to the SP.
  - o) Any bugs discovered by either the SP or any other customer, in a firmware version used by Eskom, shall be brought to Eskom’s attention as soon as possible.
  - p) Future revisions of Field Router firmware shall be made available to Eskom at no additional cost for a minimum period of 5 years after the delivery of the last Field Router of that model.
  - q) The SP shall indicate how version control of firmware will be handled over a period of at least 10 years following contract award.

#### **3.4.6 Field Router User Interface**

- a) The following Field Router status indications are a minimum requirement:
  - 1) Power supply on/healthy
  - 2) Cellular communications OK/status
  - 3) Cellular data transmission occurring
  - 4) Cellular data reception occurring
  - 5) The SP shall indicate any other indications that are provided.
- b) The physical status indications shall be clearly visible on the front of the Field Router. Indications shall also be unambiguous and easily identifiable.
- c) Details of the available physical status indications shall be provided by the SP, including the method of indication (e.g. LCD or LED etc.).

#### **3.4.7 Field Router Configuration and Diagnostics**

- a) The Field Router shall have the facility for the user to set which SIM is the secondary SIM.
- b) The Field Router shall cutover to the secondary SIM (if enabled) when the cellular network signal is lost or falls below an acceptable level for a user configurable period.

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- c) This acceptable signal level parameter shall be settable. SP to provide details of acceptable signal ranges.
  - d) The signal lost period parameter described above shall be settable in minutes in the range 0 (disabled) to at least 30.
  - e) The Field Router shall continuously monitor the state of the TCP/IP connection between the active SIM and the CC and shall automatically fail over to the secondary SIM (if enabled) if the CC connection is lost (and cannot be re-established) for a user configurable period. This "connection lost" parameter shall be set in minutes in the range 0 (disabled) to at least 60.
  - f) A mechanism shall be provided to prevent the secondary SIM (if fitted) from being inactive for so long that it is disabled by the Mobile Network Operator. The SP shall provide details.
  - g) The Field Router shall perform its own internal diagnostics and report any errors to the CC, including all resets. The format of these reports shall be open and not proprietary. Open formats such as Syslog or SNMP are preferable.
  - h) The config/diagnostic interface shall be securely available in both of the following ways:
    - 1) Locally via a dedicated config/diagnostics port
    - 2) Remotely via the Cellular connection (properly secured)
  - i) The SP shall provide details of how each of the above config/diagnostic interfaces is achieved.
  - j) The following device information shall be available via the above config/diagnostic interfaces:
    - 1) Field Router Serial number and module type
    - 2) Firmware version
    - 3) Device uptime (since last restart/reset)
    - 4) GSM module IMEI
    - 5) Received Signal Strength Indication of the active SIM.
    - 6) Cell tower information of the active SIM.
    - 7) Timing Advance of the Cell tower (or equivalent indication).
    - 8) GPS co-ordinates (in decimal degrees format compatible with Google Earth)
  - k) The SP shall provide details of any additional status information that is or can be provided.
  - l) Should Field Router configuration/diagnostics, via the local port, require a software tool rather than a browser, the Field Router configuration software shall at least be compatible with Microsoft Windows™ 10 (32 and 64 bit). Future support for the next Microsoft Windows™ OS version shall be required within 1 year of a formal request from Eskom (should browser configuration not be available).
  - m) The SP shall indicate the terms and conditions related to the distribution of any config/diagnostics software.
  - n) The config/diagnostics GUI shall be user friendly and menu driven and comprehensive help files shall be provided.
  - o) For browser-based config/diagnostics, support for Internet Explorer 11 (64 bit) shall be provided as a minimum. The SP shall indicate all other browsers that are supported.
  - p) For browser-based config/diagnostics, browser security shall be applied and there shall be no use of vulnerable services.
  - q) It shall be possible to upload the configuration from a Field Router via each of the config/diagnostics connection options and save the configuration to a file.
  - r) It shall be possible to download a configuration file to a Field Router via each of the config/diagnostics connection options.

### **3.4.8 Field Router Power Supply**

- a) The Field Router shall operate at a nominal DC voltage of 12 V. The Field Router shall operate reliably from an input voltage range of 8 to 16 V DC without any external equipment.
- b) The SP shall provide a solution for powering the Field Router from each of the following sources;
  - 1) 50 V DC (+/- 10%)
  - 2) 110 V DC (+/- 10%)
  - 3) 230 V AC (+/- 10%)
- c) The maximum DC power consumption of the Field Router across the supply voltage range of 8 to 16 V should be (without GPS module and with no comms ports connected):
  - 1) Standby/Idle mode – 0.90 W
  - 2) Receive mode – 1.40 W
  - 3) Transmit mode – 1.80 W
  - 4) The SP shall provide a comprehensive test report indicating the average and peak power consumption in each of the above operating modes, and for various typical combinations of comms ports connected.
- d) The SP shall indicate the operation of any power saving techniques or modes, and the consumption savings achieved by such techniques.
- e) The SP shall indicate if and how the power saving mode affects the transmission and reception of data, and the typical delay when changing from power save mode to normal operating mode.
- f) Reverse polarity protection: The DC power input of the Field Router shall have suitable protection against inadvertent reverse polarity connections. Self-restoring protection is preferred but protection by means of a SP supplied fuse is acceptable, provided that the fuse can be accessed without opening the enclosure. The SP shall indicate the type of protection offered.

### **3.4.9 Field Router Enclosure**

- a) The Field Router enclosure shall be manufactured of a durable high impact plastic or metal extrusion.
- b) The Field Router casing shall have a minimum IP rating of IP51 (IEC 60529 [1]). This means the enclosure shall be dust proof and be able to protect its contents from dripping water.
- c) The Field Router enclosure (including all external connectors and wiring) shall be suitably screened to prevent electromagnetic radiation produced by the Field Router from interfering with the operation of any adjacent electronic equipment, i.e. it shall conform to SANS/IEC 6100-6-3 [3].
- d) Physical dimensions: The dimensions shall not exceed 160 x 100 x 40 mm.
- e) The SP shall indicate actual outer dimensions of the Field Router enclosure.
- f) Field Router mounting: To enable mounting inside an equipment cabinet, the Field Router enclosure shall have suitable mounting holes/lugs that allow it to be securely mounted onto a flat metal surface, or alternatively be provided with a suitable mounting bracket assembly.
- g) The mounting method shall be such that visual indications are not obscured and all electrical connectors are easily accessible. The SP shall provide full details.

### **3.4.10 Field Router Markings**

- a) The model and serial number of the Field Router shall be clearly visible and not subject to fading over time.
- b) All external connectors, test points, switches and status indications shall be clearly and permanently marked.

### **3.4.11 Field Router External Connectors**

- a) It is preferred that the RF connector is of the SMA or TNC type. The SP shall indicate the type of RF connector used.
- b) The RF connector shall be of a high quality and have a non-reactive impedance of 50 ohm.
- c) Good quality, industry standard 8-position 8-contact modular connectors ("RJ45" 8-pin connectors) shall be used for the data ports and interfaces.
- d) The RS232 data connectors shall have the standard TIA-561 pin configuration.
- e) The Field Router shall have at least two RS232 data ports to allow connection to current Eskom RTUs (one for DNP3 comms and one for remote configuration of the Eskom RTU).
- f) The Field Router shall have at least one Ethernet port to allow connection to devices/RTUs that are equipped with Ethernet ports.
- g) The Ethernet port shall be 100Base-Tx. Higher speeds may be provided but the Ethernet port shall be able to be configured as auto-sensing and fixed baud rate.
- h) The SP shall provide details of the connector type used for any local I/O capability.
- i) The SP shall indicate the connector to be used for programming, configuration and diagnostics.
- j) The power connector shall be specified to safely handle the maximum current consumption of the Field Router, and shall have a securing mechanism to prevent inadvertent disconnection.
- k) A power cable of minimum length 1 m and fitted with the correct connector for the above shall be supplied with the Field Router.
- l) The SP shall provide full details of any additional connectors with which the Field Router is equipped.
- m) It is not a requirement that the Field Router is supplied with an antenna or co-axial cable.

### **3.4.12 Field Router Environmental Operating Conditions**

- a) The Field Router shall be able to operate in harsh environmental conditions such as in substations and pole-mounted enclosures.
- b) The equipment shall operate without malfunction within the following environmental limits:
  - 1) Altitude : 0 to 3000 m above mean sea level
  - 2) Ambient temperatures : -15 to +60 °C
  - 3) Humidity : up to 90% non-condensing
  - 4) Barometric pressure : 75 to 106 kPa
  - 5) Electric field strength : up to 10 V/m

## **3.5 Concentrator Gateway/Virtual RTU**

The current GPRS solution includes a Concentrator Gateway/RTU that is mainly used to provide an interface between the installed base of GPRS FPIs and the SCADA Master. The Concentrator Gateway is also used for other purposes. This device provides the following services:

- It monitors the daily/weekly health reports of the FPIs and raises an alarm when an FPI fails to report in.
- It allows for the filtering out of any points that the FPIs report but which are not needed by the business.
- It allows for the creation of new virtual points that are a logical combination of points reported by the FPIs.
- It allows for the consolidation of points from many hundreds of FPIs to reduce the number of DNP3 addresses consumed by the FPIs.



- a) The solution shall provide a real or virtual Concentrator Gateway/RTU capable of communicating to the SCADA Master exactly like a real DNP3 level 3 RTU and that is able to act as a DNP3 Master Station to real DNP3 RTUs, in particular Eskom's installed base of FPIs.
- b) The Concentrator Gateway shall be able to communicate with any simple device e.g. sensor that communicates via GPRS or via SMS (text-based messages).
- c) The Concentrator Gateway shall be able to track/monitor the arrival of FPI/sensor health checks with a period of up to 10 days and generate an event on a derived DNP3 point should the FPI/sensor fail to report within the set period.
- d) The Concentrator Gateway shall be able to map a reduced set of points from the FPI/sensor through to the SCADA Master so that unwanted points can be filtered out.
- e) The Concentrator Gateway shall provide concentrator functionality that facilitates the concentration of many FPIs into a single virtual RTU with a single DNP3 address.
- f) All of the above Concentrator Gateway functionality shall be provided and included in the product pricing and if this functionality is not part of the SP's standard product, a period of up to 3 months will be allowed to develop this functionality. The SP shall provide all relevant details.

### **3.6 Value Added Services**

#### **3.6.1 Supply Contract**

The intention is to enter into a contract between Eskom Dx and the SP that governs the purchasing of the equipment offered by the SP. The SP shall provide the following information (costs to be provided in the applicable section of the price schedule);

- a) The cost of a Field Router (hardware and once-off perpetual licence).
- b) The cost of the redundant Communications Controller (CC) per Control Centre (hardware and once-off perpetual software licence).
- c) The cost of the Concentrator Gateway/Virtual RTU per Control Centre (hardware and once-off perpetual software licence).
- d) The cost of the Radius Server per Control Centre (hardware and once-off perpetual software licence).
- e) The cost per item of all other items required to fulfil this URS per Control Centre (hardware and once-off perpetual software licence).
- f) State any discounts that apply based on quantities.
- g) Any other costs and pertinent information not explicitly requested above.

#### **3.6.2 Services Contract**

The intention is to enter into a contract between Eskom Dx and the SP that governs the purchasing of the services offered by the SP. The SP shall provide the following information (costs to be provided in the applicable section of the price schedule);

- a) The list of services offered.
- b) The annual support and maintenance costs pertaining to each item of software.
- c) State what discounts will apply based on the quantity of Field Routers on contract.
- d) Costs to carry out repairs to a Field Router.
- e) Costs to carry out repairs to the CC equipment.
- f) Any other pertinent information not explicitly requested above.



### **3.6.3 Service Level Agreement**

A Service Level Agreement (SLA) shall be entered into between Eskom Dx and the SP. The services that shall be included in the SLA are listed below. The SP shall submit a proposed SLA that stipulates;

- a) The conditions that pertain to the supply of the Field Router such as delivery lead times, packaging, configuration of the Field Router, latest firmware versions etc.
- b) The warranties of the Field Router, CC and related equipment.
- c) The guarantee that all applicable source code shall be provided to Eskom in the event that the SP ceases to operate as a business or the product is discontinued.
- d) The maintenance support of the CC equipment. The SP shall state the extent of the technical support such as on-site support, remote support, hardware repairs, software debugging and upgrades, equipment configuration and turnaround times.
- e) The reports detailing repair work that will be produced and included with the returned repaired equipment.
- f) The detail of Call Centre support including operating times, contact details, procedure to log faults, reference numbers and escalation procedures.
- g) The process of when and how upgrades to Field Router firmware will take place.
- h) The commitment of the SP to exceed minimum performance levels as per the performance criteria stated in section 3.2.4.
- i) The details of monthly performance reports that will be produced and submitted to Eskom.
- j) The process of when and how upgrades to the CC software will take place.
- k) Any other pertinent information not explicitly requested above.

### **3.6.4 Billing and Reporting**

- a) The SP shall provide to each Control Centre a suitably detailed tax invoice, each month.
- b) The SP shall provide to each Control Centre a detailed bill as described below (in addition to the above invoice).
- c) The billing reports shall be presented in an unlocked MS Excel spreadsheet.
- d) All dates shall be in a Date format and not Text so that the date can be sorted or used in a formula.
- e) All IP addresses and MSISDNs shall be in General format that can be filtered and sorted.
- f) All data usage figures shall be in Number format so that usage figures can be summated etc.
- g) The billing report shall contain a list of all the SIMs active on the system during that billing period.
- h) The billing report shall contain at least the following information per SIM;
  - 1) SIM identifier
  - 2) APN of SIM
  - 3) Static IP address associated with each SIM/MSISDN
  - 4) Device identifier associated with the SIM as per CC table (DNP address or single virtual IP address used to link multiple SIM static IP addresses)
  - 5) Data usage as measured by the CC
- i) The billing report shall contain a list of all the Field Routers purchased by Eskom and assigned to that Control Centre. The billing report shall contain at least the following information per Field Router:
  - 1) Serial number

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- 2) The device status – Active or Not-active
- 3) Eskom Purchase order number for this device
- 4) MSISDN for each chip SIM within the device
- 5) Static IP address associated with each SIM/MSISDN
- 6) Data usage of each SIM as measured by the CC

### **3.7 Product Support**

Eskom requires the SP to offer technical after-sales support. The SP shall provide full details about the level of service that can be provided in each of the following categories:

#### **3.7.1 Training**

- a) The SP shall provide comprehensive training courses, in English, to enable Eskom to configure, install, program, operate and maintain the product and related systems offered.
- b) The following training course information shall be supplied:
  - 1) The location of the training centre
  - 2) The syllabus of each training course(s)
  - 3) The duration of each training course(s)
  - 4) Minimum entrance requirements for the course in terms of skill level
  - 5) The maximum and minimum number of delegates per course
  - 6) Budgetary costs per delegate for each course (state all assumptions)

#### **3.7.2 Technical Support and Fault Repair**

The SP shall provide the following:

- a) Business-hours telephonic support services as per Table 2: The SP shall provide costs for this service in the price schedule.
- b) After-hours telephonic support services as per Table 2: The SP shall provide costs for this service in the price schedule.
- c) On-site support during business hours. The SP shall provide labour, travel and subsistence rates for this service in the price schedule.
- d) Maintenance and updates of the CC databases by means of suitable scripts.
- e) Approval and release of any new Windows patches released by Microsoft® that Eskom needs to install on the CC.
- f) Disaster recovery of the CC databases shall be provided, with adequate measures to provide access to evidence as per the Eskom Cyber Security Standard for Operational Technology [11]

Repair services for the CC and Field Routers as per

g) Table 3.

**Table 2: Telephonic Support response times**

Response times to action telephonic assistance	Business hours	60 minutes
	Standby after hours	2 hours

**Table 3: Repair times**

Repair turnaround times excluding delivery.	CC equipment	2 days
	Field Router	5 days

### **3.7.3 Spares**

- a) The SP shall provide a detailed list of all items that can be purchased as spares. The cost per spare item shall be provided in the Price Schedule.
- b) The delivery lead-time for required spares shall be four weeks or less from the date of order.
- c) The SP shall provide a list of recommended spares.
- d) The SP shall indicate the period after model discontinuation for which spares will be available.

### **3.7.4 Documentation**

- a) Comprehensive support documentation shall be available for all equipment, hardware and software delivered.
- b) The documentation shall be in English.
- c) The SP shall indicate whether the documentation will be free issued, or whether it needs to be separately purchased, in which case the cost shall be provided in the Price Schedule.

## **3.8 Testing**

### **3.8.1 Type Testing**

- a) The Field Router shall be type approved by ICASA for use in South Africa.
- b) The SP shall indicate the level of all other type testing performed on the equipment and protocol drivers offered to Eskom. All certificates and type test results shall be submitted with the offer. Eskom will evaluate the test information supplied and may elect to verify some of the test results.

### **3.8.2 Functional Testing**

- a) 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. The SP shall make the product available for evaluation purposes on Eskom premises for a period not exceeding three months, after which time Eskom will return the product.

### **3.8.3 Test Equipment**

- a) The SP shall provide a list of any test equipment that is required to perform basic as well as comprehensive fault-finding on the communications system.
- b) All applicable test equipment shall operate from a 230V AC, 50 Hz supply or directly from the unit under test.

## **3.9 Additional Information to be provided**

- a) Company Information
- b) Name of the company
- c) Company address
- d) Date of establishment of the company

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- e) The company's staff complement in the following departments:
- 1) Management
  - 2) Administrative
  - 3) Hardware design and development
  - 4) Software design and development
  - 5) Drawing office
  - 6) Production
  - 7) Inspection and quality assurance
  - 8) Technical support
- f) The nature of resources in South Africa in terms of workshops, test facilities etc. shall be stated.

### **3.9.1 Product Information**

- a) A brief summary of the company's present range of equipment.
- b) Details of the warranty policy for the equipment offered to Eskom.
- c) Expected Mean Time Between Failures (MTBF) of all equipment offered, based on historical performance.

### **3.9.2 Customer References**

- a) The SP is encouraged to provide customer references, as well as the details of a contact person, who would be authorised and willing to share with Eskom, information regarding the product's application and performance.

## **4. Authorisation**

This document has been seen and accepted by:

<b>Name and surname</b>	<b>Designation</b>
Prudence Madiba	Senior Manager – GX Engineering
Lenah Mothata	Senior Manager – Grids
Barry Clayton	Chief Engineer – TX Secondary Plant, Work Planning and Centralised Services
Richard McCurrach	Senior Manager – TX IM (acting)
Maureen Mokone	Senior Manager – DX IM
Alison Maseko	Senior Manager – Eskom Telecommunications
Sikelela Mkhabela	Senior Manager – DX Network Operations
Mervin Mottian	Chair - Dx SCADA Managers Forum
Kgomotso Sethlapelo	Chair – SCOT Telecommunications Study Committee
Marlini Sukhnandan	Chair – SCOT Telecontrol Study Committee

**5. Revisions**

Date	Rev	Compiler	Remarks
June 2021	3	K F Brown	<p>Fixed minor grammatical errors and corrected the capacity figures in Table 1.</p> <p>Reworked the document to cater for the new architecture based around "Eskom-owned" APNs, removing all APN related service requirements.</p> <p>Removed the Advanced Field Router requirement and made other changes to simplify the requirements.</p> <p>Made the following updates after internal commenting;</p> <ul style="list-style-type: none"> <li>• Added DNP3 port numbers</li> <li>• Removed requirement to support Estel Variant</li> <li>• Changed most references to "GSM" to the more generic term "cellular", including in the doc name.</li> <li>• Added explicit requirement for support for DNP3 services to the installed base.</li> <li>• Added "High-level Service Description" section.</li> <li>• Added support for DNP3 broadcast (development).</li> <li>• Strengthened source code guarantee wording.</li> </ul>
May 2017	2	K F Brown	<p>Updated References, Definitions and Abbreviations</p> <p>Added section "Concentrator Gateway/Virtual RTU"</p> <p>Expanded section "Cyber Security"</p> <p>Updated Seen and Accepted list</p> <p>Improved alignment with Cellular Network Connectivity Strategy.</p> <p>Updated References, Definitions and Abbreviations</p> <p>Updated System Components to reflect redundancy needs.</p> <p>Added section "Comms through the Cellular Network"</p> <p>Added section "GPS Receiver"</p> <p>Added section "Embedded RTU"</p> <p>Added section "Cyber Security"</p> <p>Expanded "Value Added Services" section</p> <p>Removed detailed drawing requirements</p>
March 2015	1	M M J Thakadu	<p>Document number changed to 240-71630971.</p> <p>Document reformatted. No content change. This document supersedes document number DSP_34-1079.</p> <p>Authorisation table updated</p>

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Date	Rev	Compiler	Remarks
March 2009	0	M M J Thakadu	Periodic Revision. Document number changed to DSP_34-1079
Nov 2005	0	D. Gutschow, W vd Merwe	Original Document (DSP0004)

## **6. Development Team**

The following people were involved in the development of Rev 3 of this document:

- Rodney Westwood supplied the Value Added Services section.

## **7. Acknowledgements**

The following people (in alphabetical order) made contributions during the commenting phases of Rev 3:

- Jacques Schutte
- Lesiba Buthane
- Matthew Taljaard
- Michael Rawson
- Reginald Brooks
- Sanjiv Bandu
- Thuli Tladi
- William Woolley
- Wimpie van der Merwe