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FOREWORD

Recommendations for corrections, additions or deletions should be addressed to the:

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INTRODUCTION

City Power wants to expand and upgrade its telecommunication network by adding modern digitized multiplexing equipment and replace the old multiplexers with new ones that are smart grid ready. Additional substation networks for plant condition monitoring and control are planned to be integrated to the telecommunications

1. SCOPE OF WORK

The scope entails the design, supply and installation, commissioning and maintenance as well as monitoring and support of the multiplexer equipment. City Power requires maintenance and support of all multiplexers and related equipment, to maintain the highest quality of service. We require specialized technical skills at affordable cost structures to execute the maintenance requirements.

2. NORMATIVE REFERENCES

The following standards contain provisions that, through reference in the text, constitute requirements of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below.

IEC 61850, *Communication Networks and Systems in Substations.*

IEC 60870-6, *Telecommunication control Equipment and Systems.*

NRS 037 Tlecontrol Protocols

ISO/IEC 2710:2005, Information technology — Security techniques — Information security management systems — Requirements

IEEE Std 1379™, *Recommended Practice for Data Communications between Intelligent Electronic Devices IED and Remote Terminal Units RTU's in a Substation*.

IEEE Std 1613™, *Standard Environmental and Testing Requirements for Communications Networking Devices Installed in Electric Power Substations*.

IEEE Std 1615™*, Recommended Practice for Network Communication in Electric Power Substations.*

IEEE Std 1646™, *Standard Communication Delivery Time Performance Requirements for Electric Power Substation Automation.*

IEEE Std C37.115™, *Standard Test Method for Use in the Evaluation of Message Communications between Intelligent Electronic Devices in an Integrated Substation Protection, Control, and Data Acquisition System.*

SANS 60300-3-16:2010: *Dependability management – Application guide – Guidelines for specification of maintenance support services*

ISO 9001: *Quality Systems - Model for Quality Assurance In Design, Development, Production, Installation and Servicing*

OHSAS 18001: *Occupational Health and Safety Management System*

CP_TSSPEC_214 *REV2 Specification for protective relays*

CP_TSSPEC_210 *Specification for digital multiplexer equipment*

CP_TSSPEC_204 *Specification for HDD fiber*

CP_TSSPEC_109 ADSS with fiber

CP_TSSPEC_060 Specification for OPGW optical fiber

3. ABBREVIATIONS

The definitions and abbreviations in the above documents shall apply to this document.

FOX615	ABB multiplexers
STM	ITU-T fiber optic network transmission standard. (synchronous Transport Module)
E1	E1 is a digital transmission link with a total transmit and receive rate of 2.048 Mbps (2048000 bits per second).
IP	Internet Protocol
Qos	Quality of supply
NMS	Network Management Centre
SCADA	Supervisory control and Data Acquisition
RTU	Remote terminal Unit
IED	Intelligent Electronic device
BOQ	Bill of Quantities
AC/DC	Alternating current
DC	Direct Current
ITU-T	International telecommunications union
SDH	Synchronous Digital Hierarchy
Mbps	Megabits Per second

4. GENERAL REQUIREMENTS

The current backbone network consists of FOX615 multiplexer equipment installed at major substations and strategic sites. The equipment is linked by single mode fibre optic cables to form multiple network rings. The network is extended to minor substations and remote sites by copper cables.

The current network provides STM1, 4 and 16, E1, Serial, Ethernet interfaces for applications such as SCADA, Protection systems (differential and impedance), QoS meters, Load Management, substation telephones, IP connectivity for video surveillance and remote access for substations. The suppliers shall provide technical support on system and equipment queries for the duration of the contract.

The Contractor shall conform to the requirements and provide all the equipment as required and detailed in this document. It should be noted that preliminary design information and bill of quantities (BOQ) shall form part of the BID document. The Contractor shall verify the design data during the site surveys and detail engineering also finalize the BOQ as required for ultimate design and system performance.

The Contractor's proposal shall address all functional and performance requirements within this document; including the required information and supporting documentation. The designs and site surveys shall be used to determine and high light the need for additional items and requirements that are not mentioned in this document.

The Contractor shall provide such additional items and services such that a viable and fully functional communication equipment system is implemented, that meets or exceeds the capacity, and performance requirements specified. Such materials and services shall be considered to be within the scope of the contract. The Bidders shall identify and include all such additional items and services in their proposal.

All equipment provided shall be designed to interface with existing equipment and shall be capable of supporting all present requirements and spare capacity requirements. The communication equipment shall be designed and provisioned for expansions and reconfigurations without impairing normal operation, including adding and removing of circuits. The offered items shall be designed to operate in a substation environment.

Adequate measures shall be taken to provide protection against rodents, contaminants, pollutants, water and moisture; lightning and short circuit, vibration and electro-magnetic interference etc. The Bidders are advised to visit sites (at their own expense), prior to the submission of a proposal, and make surveys and assessments as deemed necessary for proposal submission.

The successful bidder (Contractor) is required to visit all sites, accompanied by the project engineer. The site visits after contract award shall include all necessary surveys to allow the contractor to perform the design and implementation functions. The Contractor shall provide the site survey schedule to City Power well in advance. The site survey schedule shall be finalized in consultation with City Power.

The following shall be considered for this project:

A. Digital Multiplexer Equipment along with suitable optical line interfaces & tributary cards, as specified in the Bill of Quantities and Specification for Digital Multiplexer Equipment.

B. Network Management System (NMS) configurations; all cabling, wiring, digital distribution frame patch panels;

C. Integration with the existing telecommunication platforms and City Power's systems, including SCADA, Protection, Load Management and Telephony systems

D. Maintenance and support of the supplied multiplexer equipment. Thereafter installation support shall be a minimum of 12 months for all workmanship, and a minimum of 5 years' warranty for all major equipment used.

4.1 The survey report shall include at least the following items:

a) Proposed layout of Equipment in the existing rooms and buildings;

b) Proposed routing of power, earthing, signal cables and patch cords etc.

c) Confirmation of adequacy of space and AC/DC Power supply requirements;

d) Identification of facility modifications if required and

e) Identify all additional items required for integration for each site.

4.2 General Responsibilities and Obligations

This section describes the general responsibilities and obligations of the Contractor and City Power.

4.2.1 Implementation Plan

The Contractor's technical proposal shall include a project implementation plan and schedule. The implementation plan shall include the activities of both the Contractor and City Power, showing all key milestones and clearly identifying the nature of all information and project support expected from City Power. The detailed implementation plan shall be finalized by both the Contractor and City Power following award of the contract.

4.2.2 Contractor's Responsibilities and Obligations

The Contractor shall be responsible for all cables and wiring associated with the equipment provided, both inside and outside buildings in accordance with technical requirements. The Contractor shall also be responsible for determining the adequacy of the local power source for the equipment and for wiring to it, with adequate circuit protective breakers. In addition, the Contractor shall be responsible for shielding equipment and cabling to eliminate potential interference to or from the equipment, and for earthing all equipment cabinets.

Contractor's obligations shall include, but are not limited to, the following:

4.2.2.1 Site visits, and surveys, necessary to identify and provide all equipment needed for the implementation of the network.

4.2.2.2 Equipment Engineering and design specific to each location including review of, and conformance with local environmental and earthing considerations.

4.2.2.3 Overall integration of offered multiplexer equipment's/subsystem with existing user equipment's such as SCADA, Protection, Load Management and Telephony systems.

4.2.2.4 All cabling, wiring including supply, laying and termination of the cables. Distribution frames required for full interconnectivity and proper operation of the telecommunications network.

4.2.2.5 Installation and integration of network management software, hardware and firmware.

4.2.2.6 Project management, project scheduling, including periodic project reports documenting progress, review meeting during the contract period.

4.2.2.7 Engineering and technical assistance during the contract and warranty period.

4.2.2.8 Implement all minor civil works and identify any major civil works i.e. expansion or construction of rooms, trenches necessary for installation of proposed equipment and provide the details of such work to City Power.

4.2.2.9 Factory and site testing of all hardware, software, and firmware provided.

4.2.2.10 Provide documented evidence of satisfactory performance tests to City Power.

4.2.2.11 Provide a Quality Assurance Plan, ensuring City Power access to the manufacturing process when required.

4.2.2.12 Training of City Power personnel on multiplexer and network management implementation throughout the entire project.

4.2.2.13 Hardware, software, and firmware maintenance, debugging, and support of the equipment through final acceptance, and maintenance on all new equipment throughout the warranty period of twelve months, with an extended warranty as an option.

4.2.2.14 Availability of service, spare and expansion parts of the supplied multiplexer equipment for the designed life of the equipment. This requires the availability of spares and replacement units to be available for 15 years, or the specified life of the equipment.

4.2.2.15 Provide details of all license requirements for the digital multiplexer equipment and the network management system.

4.2.2.16 Complete end to end testing of all installations to successfully prove all functions such Telephony, SCADA, Protection and Security Systems.

4.2.3 City Power Responsibilities and Obligations

City Power will provide the following items and services as part of this Project:

4.2.3.1 Overall supervision of the project

4.2.3.2 Review and approval of the Contractor's designs, drawings, and recommendations.

4.2.3.3 Communication network configuration data, including:
- a.) Channel assignments for voice and data
- b.) Interconnection drawings for existing equipment
- c.) Review and approval of test procedures.

4.2.3.4 Participation in and approval of factory and site acceptance tests where testing is required.

4.2.3.5 Review and approval of training plans.

4.2.3.6 Providing support and access to facilities at the sites.

4.2.3.7 Coordination of the Contractor's activities with concerned City Power departments.

4.2.3.8 Applicable Standards as mentioned on the attached digital multiplexer specification document in Annexure C and the offered equipment shall conform to these standards.

4.3 System Support and Maintenance

4.3.1 Support and Maintenance

Support and maintenance shall include the following services:

a) On-site and Remote Support
b) Integration of services;
c) Equipment tests, fault finding and repairs;
d) Configurations and wiring
e) Network Management System Maintenance;
f) Preventative system maintenance;
g) Hardware Repair;
h) Software Upgrade.
i) System Upgrade;
j) System Maintenance;
k) Network and Equipment documentation.
l) Management of operating data (routing data)

The contractor shall be responsible for the support and maintenance of existing and newly implemented multiplexer systems for a period of 3 years. For newly installed devices, support and maintenance will only be effective after the warranty period has ended. All works shall take place during City Power normal working hours and outside working hours including weekends and public holidays.

4.3.2 Support Centre

The Service Provider shall provide the Support Centre which shall be a single point of contact for the resolution of system problems. Support requests shall be submitted by phone or email. The Service Provider shall respond to all support requests as to 2.4.7. The Support Centre shall be available for support requests on Monday to Friday from 08.00 in the morning to 17.00 in the afternoon. (each “Business Day”); and after hours including weekends and public holidays.

The Support Centre shall be responsible to perform the following functions:

a) Document all logged requests and issue a reference number for each incident.
b) Track, monitor and manage the resolution of incidents from the initial support request to resolution.
c) Perform problem diagnosis.
d) Answer queries regarding failures and performance of the system.
e) Access the system remotely for diagnosis and correction of problems.
f) Contact the City Power Representative at regular intervals to provide status and/or resolution of problems.

4.3.3 CITY POWER shall be responsible for the 1st line support as follows:

a) City power shall respond to end user queries regarding the usage or performance of the system.
b) City Power shall resolve system problems with support from the Service Provider where necessary.
c) City Power shall swap defective hardware components using spare parts.
d) City power shall handover complex system problems to the service provider through the Support Centre.
e) City Power shall file a request with the Support Centre for software and hardware maintenance.
f) City Power shall inform the Service Provider of all information related to the encountered software or hardware problem.

4.3.4 On-Site Support

The Service Provider shall provide On-site support as and when required.

4.3.5 Hardware Repair

a) The Service Provider shall repair defective hardware components that City Power offers for repair within a time frame of maximum 3 weeks from receipt of hardware.
b) Repair of defective hardware components shall cover the repair of parts/equipment and labor costs for returning into service of those parts/equipment.

4.3.6 System Maintenance

a) The Service Provider shall perform routine maintenance.
b) Routine maintenance shall include once per month on-site visits for a minimum of four hours.
c) The Service Provider shall check the general status of the system.
d) The Service Provider shall test the performance of the equipment against the relevant equipment specifications.
e) The Service Provider shall review applications and system logs.
f) The Service Provider shall, check and update patch levels when necessary.
g) The Service Provider shall resolve system alarms and fix/ repair any issues that may be found.

Table1: Incident Management

Priority	Description	Condition
1	Critical	Total System Failure 50% (Port capacity) or higher System Failure, Primary timing source failure 2 or more RTU circuit failure 2 or more protection circuits failure 2 or more security links failure 2 or more ripple control links failure 1 or more ICT links failure
2	High	20% up to 49% (Port capacity) System Failure. 1 RTU circuit failure 1 Protection link failure 1 security link failure 1 ripple control link failure
3	Medium	< 5 Telephone circuit failure
4	Low	All other failures not included in Categories 1,2 and 3
5	Configuration and Programming	Includes all configurations and minor ad hoc programming

Table2: Response Time:

Priority	Acknowledgement	Response Time	Feedback	Maximum time to repair
1	30 minutes	30 minutes	On site	4 hours
2	30 minutes	1 hour	On site	5 hours
3	30 minutes	2 hours	On site	6 hours
4	30 minutes	6 hours	On site	12 hours
5	30 minutes	2 hours	On site	48 hours

5. TESTS

5.1 General

All equipment shall be subjected to the test listed below as a regulatory requirement. City power's employee or an authorized representative shall witness the test where required..

5.2 Factory Acceptance Test (FAT)

After the Contractor is satisfied with the correct functioning of the prototype equipment, City Power shall be notified in writing. Within a two (2) week period from the date of this letter, and then City Power and the Contractor shall agree upon a date when formal factory acceptance testing shall commence. The testing shall then be carried out in accordance with the FAT procedure.

In the event of any equipment malfunctioning, City Power may elect to restart the complete test procedure from the beginning. City Power shall also carry out an unstructured testing program (Free-Form-Tests), at its discretion, on the Contractor's premises for duration of two (2) weeks. The Contractor shall, at no extra charge to City Power, correct any errors detected. This two week period

shall not include the time taken to repair any faults. After City Power has satisfied itself that the system has passed the prescribed tests, the prototype units shall be officially handed over to City Power.

5.3 Site acceptance Test (SAT)

After delivery of the production unit to a City Power selected site, the Contractor assisted by City Power shall install the equipment in a substation in accordance with City Power's standards. City Power must be informed in writing of the completion of the installation. Within a three (3) week period or less, the SAT shall commence. These formal tests shall be defined in the SAT procedure. In the event of an error being detected, City Power may elect to restart the SAT.

For a period of one (1) month after the successful completion of the formal SAT the equipment shall undergo random testing while being subjected to a soak test. In the event of any non-conformance being detected the Contractor shall be required to commence the correction of the errors within a 48-hour period. Only on completion of the correction procedure shall the one-month test and soak test period commence.

Depending on the nature of the fault, City Power may at its sole discretion elect to restart the SAT. During this SAT the Contractor shall make available at no extra charge to City Power, the relevant hardware, software and/or system specialist.

6. DOCUMENTATION

The Contractor shall submit following documents during detailed engineering:

a) Data Requirement sheets;

b) Link Budget calculations;

c) Bill of Quantity including mandatory spares;

d) Previous Type test reports;

e) Factory Test report and results;

f) Manuals for all equipment;

g) Schematic drawings;

h) Numbering, Marking, labeling document;

i) Synchronization plan;

j) Test schedule;

k) Training manual;

l) Configuration diagram;

m) Transportation & handling Procedure;

n) Installation Manuals;

o) Maintenance Manuals.

7. MARKING AND LABELLING

7.1 The following information shall appear in legible and indelible marking on the outside of the control and monitoring system:

7.2 The manufacturer's name or trademark;

7.3 Year of manufacturing

7.4 Serial number for tracking

8. TRAINING

8.1 The suppliers shall provide comprehensive training courses in a language that will be understandable to all City Power personnel.

8.2 The training shall include the following;

a) System overview and operations guide shall provide an overall understanding of the system and its capabilities and limitations. In addition, system configuration must be covered in such a way that the user shall understand how to construct a system from the building blocks to meet his/her requirements.

b) System configuration and system maintenance training: This training shall include computer system operation, hardware maintenance, computer Contractor software and relevant operating system aspects.

c) Detailed system training on all hardware and software aspects: It is intended that any person attending this course shall be in a position to maintain the system down to printed circuit board and/or component level.

8.3 All aspects of the training shall be supplemented with periods of practical training; this shall apply to all courses and be implemented where applicable.

8.4 The Service Provider shall also be required to provide training to City Power technical resources on the system when enhanced features and functionality becomes available as the system is upgraded.

8.5 The tenderer shall quote separately as an option the cost of subsequent training courses.

9. QUALITY MANAGEMENT

A Quality Management Plan/System shall be set up in order to assure the quality of the cable fault location machine during design, development, production and servicing. Guidance on the requirements for a quality management system may be found in the following standards: ISO 9001:2015. The details shall be subject to agreement between the City Power and Supplier/Contractor.

10. HEALTH AND SAFETY

A Health and Safety Plan/System shall be set up in order to ensure proper management and compliance of the cable fault location machine during installation, operation, maintenance, and decommissioning phase/s. Guidance on the requirements of a Health and Safety Plan/System may be found in OHSAS 18001:2007 standards. This is to ensure that the asset/service conforms to standard operating procedures and City Power SHERQ Policy. The details shall be subject to agreement between City Power and the Supplier/Contractor.

11. ENVIRONMENTAL MANAGEMENT

An Environmental Management Plan/System shall be set up in order to ensure the proper environmental management and compliance of the cable fault location machine during its entire life cycle (i.e. during design, development, production, installation, operation and maintenance, decommissioning as well as Rehabilitation, Recycling or Disposal phase/s). Guidance on the requirements for an environmental management plan/system may be found in ISO 14001:2015 standards. The details shall be subject to agreement between City Power and the Supplier. This is to ensure that the asset created conforms to environmental standards and City Power SHERQ Policy

Annexure A - Bibliography

None

Annex B - Revision information

DATE	REV. NO.	NOTES
FEBRUARY 2019	0	First issue