Fixed*Linx*™

Advanced Metering Infrastructure (AMI)

Specification

MM AMI105

MASTER METER

FixedLinx AMI is an advanced meter infrastructure providing a data rich communications platform between metered endpoints and the utility. Data flow is structured around three principal areas; Data Source *(metered endpoints that provide meter data)*, Data Acquisition *(the components responsible for collecting and communicating the data)*, and Data Control *(the software-based processing and control of data).*

Within this simple architecture there are five key components; 3G endpoints, Booster, Repeater, Concentrator, and MasterLinx Enterprise Management System Software.

DATA SOURCE

3G ENDPOINT

Coverage

Endpoints shall operate utilizing the 3G technology platform, provide universal connectivity solutions to incorporate third-party meter brands, and be made available for water, gas, and electricity utility meter platforms.

Endpoints shall be available for additional meter brands in the form of a programmable universal register that replaces the original register and retrofits a meter's bayonet mounting when available. 3G Endpoints shall provide for an external universal transceiver to retrofit existing encoder registers and provide additional connectivity to any meter with pulse output (competitor brands, magnetic, propeller, differential pressure, ultrasonic, etc.)

3G endpoints shall fully support parallel Mobile AMR (drive-by meter reading) and Fixed Network platforms. One data platform shall not preclude the concurrent usage of the other. A true hybrid approach shall be available to ensure maximum data collection flexibility dependent upon utility-specific environmental factors.

Data Transmission

3G shall operate within the unlicensed 902-928 MHz ISM band and comply with FCC Part 15. No license shall be required for any part of the 3G system. 3G endpoints shall utilize Direct Sequence Spread Spectrum (DS) modulation. Data shall be transmitted continuously every 11 seconds. To ensure additional communication options, the transceiver must employ a background wide band / narrow band (WB/NB) signal that transmits every 5 minutes available for cost-effective future communication requirements.

Data Integrity

The system must provide safeguards for field data; Accuracy (ensuring meter reads, ID numbers, and other data are always correct) and Data Security (ensuring transmissions of meter reading and customer data cannot be intercepted or accessed by unauthorized parties), and Data Integrity (endpoints must ensure against loss of data and provide for an algorithmic based design to rebuild any instance of corrupted data).

Data Logging

Integral data logging that supports a minimum 4,000 data points shall be available across all endpoints, not require any physical contact for data collection, and shall provide for user-defined scalable customization of TBR (Time Between Reads). Water endpoints shall ensure a smart battery management design and provide auto-activation of the RF transmission once in service.

Product Design

All 3G endpoints shall be housed in an IP-68 rated enclosure to ensure viability in all weather conditions. Water endpoints shall provide integral 3G technology within the register that contains the batteries, antenna, transceiver electronics, and encoder module Integral data logging that supports a minimum 4,000 data points shall be available across all endpoints, not require any physical contact for data collection, and shall provide for user-defined scalable customization of TBR (Time Between Reads).

Water endpoints shall ensure a smart battery management design and provide auto-activation of the RF transmission once in service. Housing shall be stainless steel, tempered glass, with a wrap around elastomer gasket and be vacuum pressurized to ensure complete absence on moisture at the time of manufacture. An additional external epoxy sealant shall be provided for maximum safeguard against vapor transfer. Labeling shall be present with manufacturer's name, model number, identification number, and required FCC labeling.

The endpoint shall operate without wires or connections between the meter and transceiver.

External Transceiver Unit. Non-integrated or wired MIUs are acceptable for commercial meters or to provide connectivity to meter brands other than the brand proposed. Dimensions should measure 5"x3"x1.5". The MIUs shall be housed within a high density UV-inhibiting ABS polymer enclosure. Electronics shall be encased within an electrostatic gel that eliminates moisture intrusion. The unit shall be battery operated using two 3.6volt Lithium Thionyl Chloride batteries for long operational life of minimum10 years and warranted for a total of 20. External or wired MIUs must include input/output connections and date of manufacture.

Programming

Each endpoint shall have a unique, non-programmable permanent ID number. Registers with integral 3G shall be ground shipped programmed and initialized. However, the endpoint must be capable of two-way communication for field programming or resetting specific alarm codes. Programming must be accomplished without removing the endpoint from a pit, basement or wall application. Under most conditions programming shall be possible from within utility service vehicle.

Enhanced Meter Data

Leak Detection — Endpoints shall continuously monitor water consumption through the meter and shall specifically indicate possible leaks as alarm flags whenever the meter has detected continuous flow within a 24 hour period. To protect against false errors and ongoing alarms once leak issues have been cleared, after a continuous 3 hour period of no flow, alarm code will automatically reset.

Tamper Detection — Endpoints shall contain tamper detection circuitry and software, which identifies magnetic tamper as alarm flags, or for external transceivers, whenever the external wires have been cut or disconnected.

Theft — Endpoints shall specifically indicate as alarm flags whenever there is an unusual amount of reverse flow through the meter, possibly indicating theft, backflow conditions, or improper installation.

Zero Consumption — there shall be software-derived notification of an extended absence of zero consumption possibly indicating vacated service, or theft.

DATA ACQUISITION

3G BOOSTER

Booster shall provide for technology migration from Drive-by AMR to Fixed Network AMI while preserving concurrent reading options to ensure a true hybrid data acquisition platform and secondary read platform. Each Booster shall interface with a minimum 2 metered endpoints.

Transmission Technology

Booster shall be comprised of dual transceivers; a primary unit that communicates with the 3G equipped meter and a secondary high gain transceiver to communicate with a network of Repeaters. Booster shall be capable of simultaneous communication with two endpoints. Both transceivers shall operate in the unlicensed 902-928MHz ISM bandwidth and conform to FCC Part 15 rules.

Data Resolution

Primary transceiver auto-syncs with the 3G endpoint and learns the precise timing of the endpoint's 11 second data transmission. At minimum, every 15 minutes the primary transceiver shall briefly activate and acquire transmitted meter data. Battery life is optimized resulting from this signal synchronization. Primary transceiver modulates both direct sequence spread spectrum (DS) and Wide Band / Narrow Band to ensure complete backwards and forwards compatibility with all installed endpoints.

The Booster stores it's acquired 15 minute interval meter data and then retransmits this accumulated data package through its high gain transceiver every 4 hours when communicating with a single endpoint, or every 6 hours when communicating with dual endpoints. Booster's high gain transceiver communicates using Frequency Hopping Spread Spectrum technology at 1 watt of power to ensure at typical minimum 1 mile transmission distance, free of interference or data corruption.

Transmission Integrity

Booster shall transmit across three sequential channels to further enhance communication integrity by mitigating deliberate hacking and/or data interception, data corruption, and persistent data interference. A proprietary algorithm governs data flow between the Booster and

Repeater and ensures accurate multi-channel data transmission.

Product Design

Interactive communication between the Booster and endpoint shall be without wires or connections. Two designs shall be available to address either meter pit lid placement for meters located beneath ground level, or wall mounted unit to address meters located indoors. Unit shall conform to IP-68 standards for environmental protection. Transceiver housing shall be of UV mitigating polymer ABS and provide internal electrostatic gel for encasement of electronics to ensure complete protection against moisture intrusion. Low profile antenna design shall not exceed 0.485 inches for pit mounted antennas, and wall mounted transceivers shall not exceed 1.25 inches.

Programming & Setup

Booster is activated by the swipe of a magnetic and shall provide an audible feedback to confirm activation. Booster shall employ advanced algorithm-based endpoint synchronization that assigns the Booster to the two nearest 3G endpoints. User-defined programming capability must be provided to manually override automatic endpoint pairing, modify the high gain transceiver transmission cycle and control other performance parameters.

Booster shall further provide synchronization between transceiver and the endpoints so that the Booster learns the specific timing of endpoint data transmission to minimize the duration that the transceiver is activated during 3G data acquisition. Booster must be capable of programming remotely without direct physical contact.

Battery

Booster shall utilize two 3.6volt Lithium Thionyl Chloride batteries for long operational life of minimum 10 years. Battery life shall be warranted for 20 years with full battery replacement coverage for 10 years, and an additional 10 years of prorated replacement protection. Smart power management must be implemented to mitigate premature battery failure or unnecessary current drain, such as optimizing transmission duration mention in previous section.

FIXED*LINX* REPEATER

Repeaters form a network of data collection points which transmit information acquired from Boosters and directly from in-range 3G endpoints back to the utility's data Concentrator.

Coverage

Repeater shall be capable of 2 way real time communication between the Repeater and Utility. Remote network diagnostics must be enabled between utility and Repeaters. Communications must comply with all FCC requirements and remain free of FCC license requirements.

Repeater shall support 360 degree data collection and shall be designed so that a maximum 1 Repeater is typically required per 4 square mile in a typical deployment. Repeater must be to acquire data directly from local in-range 3G endpoints and simultaneously from Boosters. Each Repeater shall process a minimum 1,000,000 meter reads per 24 hour period. Cost-effective 'black hole' solutions shall be available to address trouble spots that limit specific Booster's ability to reach the Repeater.

Transmission

Repeater shall utilize redundant transceiver modules capable of collecting incoming field data simultaneously across multiple frequency channels. The Repeater shall provide a modular, open architecture communication design utilizing flexible TCP/IP connectivity options to ensure the most technology appropriate solution for communicating data back to the Concentrator. Ethernet, WIFI, WiMAX, Cellular GPRS, Fiber Optic networks and DSL technologies must be able to interface with the Repeater.

Product Design

Repeater shall have minimal footprint to support mounting on existing utility infrastructure such as power poles, elevated buildings, or water towers. Repeaters shall optimally collect data between 60' – 100' elevation. Antennas with excessive height are not allowed. Where existing infrastructure does not support an elevated installation, Repeater must be capable of mounting on commercially available cost-effective towers.

Repeaters shall be powered by 120 VAC and provide ability to incorporate future optional solar power. Repeaters shall employ uninterruptable power supply (UPS) to ensure device

remains operational for minimum 15 minutes after power loss.

Unit shall be constructed of lightweight metal case consistent with IP-68 and NEMA 4 environmental ratings. Structure must allow for atmospheric changes without damage to internal electronics. Internal electronic components shall be cleanly mounted using a modular grid and interconnected with a smart wiring harness structure. Structure must mitigate effects of nearby lightening strikes and protect components against static electricity discharge.

DATA CONTROL

CONCENTRATOR

Coverage

The Concentrator shall provide preliminary processing of raw meter data and integrate data into the Meter Data Management (MDM) software. The Fixed Network system shall not require more than a single Concentrator unit.

Concentrator shall provide data recovery and address error codes arising from data corruption in the field. Cyclical Redundancy Check (CRC) algorithms shall be employed to effectively verify and solve any occurrence of data corruption. Concentrator shall support 2way communication between the Utility, Concentrator and Repeater.

The Concentrator shall utilize distributed processing to provide temporary data storage with 90 days data redundancy to safeguard against IP loss. Concentrator shall push data through to the internet for access by the utility every hour. Frequency of this data transmission shall be user-defined and range from minimum 15 minute interval to once per 24 hour period.

The Concentrator shall utilize an Intel Quad-Core chipset with minimum 2 Giga Byte (GB) Internal RAM, and a 250 GB Hard Drive expandable to 1 Terra Byte (TB).

METER DATA MANAGEMENT (MDM)

Coverage

The Fixed Network system manufacturer shall provide Meter Data Management (MDM) system software and database applications as an integral solution component. The manufacture shall provide software and database hosting in a secure Data Center. Optionally, should the utility choose to host the software and database in their facility, the manufacture shall recommend minimum hardware and software requirements.

Meter data shall be stored in a Microsoft SQL Server Database or equivalent, and vendor shall be Microsoft certified.

MDM software system architecture shall be scalable and developed on a platform that takes full advantage of multi-core processors, multiple processor computers and parallel data processing.

The MDM software shall be a full featured, browser based, with an intuitive graphical user interface providing current meter data, customer and service address information to utility employees. The modular structure of the software shall allow for future components not specific to meter reading but beneficial to utilities such as integral general ledger or a full financial software suite. Bidders shall provide sample reports and user interface screens available for meter data management.

The MDM software shall produce meter data in tabular, chart, report, PDF, and CSV (comma separated values) formats and provide automated daily emails or file transfers of daily meter readings, alarms and problem meters.

The utility currently uses other systems in day to day operations like customer billing and service orders. The MDM system shall provide the means to transfer data to and from these systems. The manufacture will be required to demonstrate the MDM system can produce a meter reading text file compatible with the current billing system reading import function.

The MDM software shall provide a geospatial display of meter locations positioned using latitude and longitude coordinates provided by the utility.

The MDM system shall provide a consumer login web site where utility customers can view the same consumption information available to utility employees. The system shall

also provide individual customer email notifications for system generated alerts and higher than normal usage.

The MDM system shall include advanced methods of flagging and notifications for possible leaks with individual meters and groups of meters commonly referred to as DMA or District Metered Area. At a minimum the system must provide alerts for High/low/zero/negative consumption, Leak Detection, Magnetic Tamper, Battery Condition and Backflow.

Data Center Hosting

To ensure maximum protection of remotely stored data, facility shall have at minimum the following;

The Data Center shall be built above a 100 year flood plain.

The Data Center security shall include biometric finger scanner, PIN and photo badge for access.

The Data Center shall provide continuous, monitored video surveillance 24 hours day, 365 days a year.

The Data Center shall provide environmental controls and redundancy using a power grid which is internally redundant and double end fed, power generator with minimum two megawatt capacity and minimum 1,500 gallon on-site fuel storage. A minimum of three 625 KVA UPS (uninterruptable power source) systems shall be provided by the Data Center.

Temperature and humidity shall be controlled with redundant HVAC units. Water intrusion and high humidity detection systems shall be located under Data Center flooring.

The Data Center shall provide overhead and under floor fire suppression and detection systems with two fire suppression zones per suite with overhead and under floor delivery. No wet pipe fire suppression systems within the Data Center space shall be allowed.

The Data Center shall provide redundant Tier 1 Internet access using connections to multiple carrier networks.