MATERIAL SPECIFICATIONS CELL

TECHNICAL SPECIFICATION

OF

SINGLE PHASE 5 – 30 AMPS STATIC ENERGY METER WITH 6LOWPAN LPRF FOR COMMUNICATION WITH 6LOWPAN RF DCU

INDEX

1.00 SCOPE

This specification covers the design, engineering, manufacture, assembly stage testing, inspection and testing before dispatch and supply of ISI marked LT AC 5 – 30 Amps Static LCD Energy Meters with Communication capability based on 6LoWPAN Internal Low Power Radio Frequency (LPRF) with two way communication to read the meter data suitable for measurement of Energy (kWh) in Single Phase, Two wire system of LT Consumers. This specification of single phase meters with 6LoWPAN RF DCU shall be applicable where newly 6LoWPAN RF meters are installed.

The meter shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation, in a manner acceptable to purchaser, who will interpret the meaning of drawings and specification and shall have the power to reject any work or material which, in his judgment is not in accordance therewith. The offered material shall be complete with all components necessary for their effective and trouble free operation. Such components shall be deemed to be within the scope of Bidder's supply irrespective of whether those are specifically brought out in these specifications and / or the commercial order or not.

2.00 APPLICABLE STANDARDS

IS: 13779 / 1999 (amended up to date) and other relevant IS specifications including CBIP Tech. report 88 amended up to date, CEA regulations & MERC guidelines with latest amendments.

IS: 15707 / 2006: Specification for Testing, evaluation, installation & maintenance of AC Electricity Meters-Code of Practice.

The specification given in this document supersedes the relevant clauses of IS: 13779 / 1999 (amended up to date) wherever applicable.

The equipment meeting with the requirements of other authoritative standards, which ensures equal or better quality than the standard mentioned above, also shall be considered. For conflict related with other parts of the specification, the order of priority shall be – (i) this technical specification, (ii) IS: 13779 / 1999 (amended up to date).

3.00 SERVICE CONDITIONS

The meters to be supplied against this specification shall be suitable for satisfactory continuous operation under the following tropical conditions:

Environmental Conditions

a) Maximum ambient temperature 55^0 C

b)	Maximum ambient temperature in shade	45^0 C
c)	Minimum temperature of air in shade	35^0 C
d)	Maximum daily average temperature	40^0 C
e)	Maximum yearly weighted average temperature	32^0 C
f)	Relative Humidity	10 to 100 %
g)	Maximum Annual rainfall	1,450 mm
h)	Maximum wind pressure	150 Kg/m^2
i)	Maximum altitude above mean sea level	1,000 meters
j)	Isoceraunic level	50 days/year
k)	Seismic level (Horizontal acceleration)	0.3 g

l) Climate: Moderately hot and humid tropical climate conducive to rust and fungus growth.

4.00 GENERAL TECHNICAL PARTICULARS

4.01 The meter shall bear ISI mark.

4.02 Class of Accuracy:

The class of accuracy of the Energy Meter shall be 1.0. The accuracy shall not drift with time.

4.03 Current & Voltage Rating**:**

1) The current rating shall be 5-30 Amps.

2) Rated basic current (I_b) for LT Energy Meters shall be 5 Amps.

3) The maximum continuous current (I_{max}) shall be 600% of rated basic current, i.e. 30 Amps. Moreover the 5-30 Amps meters shall work accurately upto 150% of I_{max}, i.e. 45 Amps.

4) The Voltage Rating shall be 240 volts. The voltage range shall be (-) 40% to (+) 20% of rated voltage, i.e. 144 Volts to 288 Volts.

4.04 Temperature:

The standard reference temperature for performance shall be 27° C. The mean temperature co-efficient shall not exceed 0.07%. Temperature rise shall be as per IS: 13779 / 1999 (amended up to date).

4.05 Power Factor:

The meter shall work for Zero to unity PF (All lag or lead).

4.06 Power Consumption:

1) Voltage Circuit:

The active & apparent power consumption in each voltage circuit including power supply of meter at reference voltage, reference temperature & frequency shall not exceed 2.0 Watt & 10 VA as per IS: 13779 / 1999 (amended upto date).

2) Current Circuit:

The apparent power taken by current circuit at basic current, reference frequency & reference temperature shall not exceed 4.0 VA as per IS: 13779 / 1999 (amended upto date).

4.07 Starting Current:

The meter shall start registering the energy at 0.2 % of basic current (Ib).

4.08 Frequency:

The rated frequency shall be 50 Hz with a tolerance of ± 5%.

5.00 CONSTRUCTION

5.01 The meter shall be projection type and dust and moisture proof. The meter base & cover shall be made out of unbreakable, high grade, fire resistant Polycarbonate material so as to give it tough and non-breakable qualities. The base shall be opaque and top cover shall be transparent. The meter body shall be type tested for IP 51 degree of protection as per IS: 12063 against ingress of dust, moisture & vermin.

5.02 Moulded terminal block for current and voltage connections conforming to IS: 13779 / 1999 (amended up to date) to meet the requirement of terminal connection arrangement shall be provided. The termination arrangement shall be provided with an extended transparent terminal cover as per clause number 6.5.2 of IS: 13779 and shall be sealable independently to prevent unauthorized tampering. Proper size of grooves shall be provided at bottom of this terminal cover for incoming and outgoing service wires.

5.03 The terminal block, the terminal cover and the meter case shall ensure reasonable safety against the spread of fire. They shall not be ignited by thermal overload of live parts in contact with them.

5.04 All insulating materials used in the construction of the meter shall be substantially non-hygroscopic, non ageing and of tested quality.

5.05 All parts that are likely to develop corrosion under normal working condition shall be effectively protected against corrosion by suitable method to achieve durable results.

5.06 Sealing provision shall be made against opening of the terminal cover and front cover. It is necessary to provide screws with two holes for sealing purpose. The meter shall be pilfer-proof & tamper-proof. The

provision shall be made on the Meter for at least two seals to be put by utility user.

5.07 The opaque base and transparent top cover shall be ultra-sonically welded (continuous welding) so that once the meter is manufactured and tested at factory, it shall not be possible to open the cover at site except the terminal cover. The Manufacturer shall put at least one seal on meter body before dispatch. The thickness of material for meter body shall be 2 mm minimum.

A sticker label containing warning notice in Marathi language which is to be stick up on meters front cover or printed on meter name plate with easily readable font size not less than 10 in red colour, which reads "सावधान ! मीटरला फेरफार करण्याचा प्रयत्न केल्यास अधिकतम वेगाने वीज नोंदणी होणार."

5.08 The meter shall be completely factory sealed except the terminal block cover.

5.09 **REAL TIME INTERNAL CLOCK (RTC)**

The real time quartz clock shall be used in the meter for maintaining time (IST) and calendar. The RTC shall be pre-programmed for 30 Years Day / date without any necessity for correction. The time accuracy shall be as per provisions of CBIP Tech Report 88. Facility for adjustment of real time shall be provided through DCU with proper security.

The clock day / date setting and synchronization shall only be possible through password / Key code command from DCU or Meter testing work bench and this shall need password enabling for meter.

The RTC shall have long life (10 Years) Non rechargeable battery. The RTC battery & the battery for display in case of power failure shall be separate.

5.10 A push button shall be provided for scrolling the parameters in Alternate Display (On Demand) mode.

5.11 **OUTPUT DEVICE**

Energy Meter shall have test output, accessible from the front, and be capable of being monitored with suitable testing equipment while in operation at site. The operation indicator must be visible from front. The test output device shall be provided in the form of blinking LED or other similar devices like blinking LCD. The pulse rate of output device which is Pulse / kWh (meter constant) shall be indelibly provided on the nameplate. It shall be possible to check the accuracy of active energy measurement of the meter on site by means of LED output. Resolution of the test shall be sufficient to enable the starting current test in less than

10 minutes and accuracy test at the lowest load shall be completed with desired accuracy within 5 minutes.

5.12 There shall be one CT in Neutral circuit and one shunt in phase circuit. The current whichever is measured as higher either by CT or shunt shall be used for processing / computing energy. The shunt shall be manganin based and e-beam welded for the construction purpose. The meter shall have CTs with magnetic shielding and same shall be tested separately prior to assembly.

5.13 PCB used in meter shall be made by Surface Mounting Technology.

5.14 The meter shall be capable to withstand phase to phase voltage (440 V) if applied between phase to neutral for minimum 5 min.

5.15 Power supply unit in the meter shall be transformer less to avoid magnetic influence.

5.16 Non specified display parameters in the meter shall be blocked. Display parameters in the meter shall not be accessible for reprogramming at site through any kind of communication.

5.17 Complete metering system & measurement shall not be affected by the external electromagnetic interference such as electrical discharge of cables and capacitors, harmonics, electrostatic discharges, external magnetic fields and DC current in AC supply etc. The Meter shall meet the requirement of CBIP Tech. report 88 (amended up to date) except 0.2 Tesla AC magnet test.

5.18 The accuracy of the meter and the measurement by meter shall not get influenced by injection of high frequency AC Voltage / chopped signal / DC signal and harmonics on the terminals of the meter.

5.19 The meter accuracy shall not be affected by magnetic field from all sides of the meter i.e. front, sides, top and bottom of the meter.

5.20 The meter shall record and display total energy including Harmonic energy.

5.21 The meter shall remain immune for the test of electromagnetic HF/RF defined under the test no. 4.0 for EMI/EMC of IS 13779:1999 amended up to date.

5.22 The meter shall remain immune for any higher signals than the present standards and MSEDCL technical specifications as indicated above.

5.23 The communication of energy meters shall not be affected considering the above feature state in the clause 5.22 & 5.23.

5.24 Self Diagnostic Features.

(a) The meter shall display unsatisfactory functioning or nonfunctioning of Real Time Clock battery as "Battery Fail".

(b) All display segments: "LCD Test" display shall be provided for this purpose.

5.25 The watch dog provided shall invariably protect the hanging of microprocessor during such type of tampering devices.

5.26 Wireless / Cable less design:

The meter PCB shall be wireless to avoid improper soldering & loose connection / contact. The meter PCB material shall be glass epoxy, fire resistance grade FR4, with minimum thickness of 1.6 mm. Its should be framed by A class vendor.

5.27 **COMMUNICATION CAPABILITY**

The meter shall have wireless communication with DCU, for downloading all types of data from the meter. Meter shall support 6LoWPAN based on Internal Low Power Radio Frequency (LPRF) technology on frequency band sub-1GHz. Download should be possible though **optical port** in case of power failure. The baud rate while downloading data through optical port should be 9600. Bidder should implement their own protocol using attributes defined in annexure-VI for data downloading through optical port.

5.28.1 **6LoWPAN BASED INTERNAL LOW POWER RADIO FREQUENCY (LPRF)**

The 6LoWPAN based Internal Low Power Radio Frequency (LPRF) shall be capable to read the meter from a distance of minimum one hundred (100) meter with line of sight radius without obstructions, from the meter. Longer communication range is preferred.

The Meter & DCU shall be based on 6LoWPAN networking on sub-1 GHz (865-867 MHz) with protocol enclosed herewith as Annexure V & VI for Interoperability with following settings:

1. Device shall be capable of being 6LoWPAN 'root' device. Default device type at factory defaults should be 'router' and state is 'not joined'.

2. Default PAN id shall be 0xFFFF.

3. Radio device shall have 128 bits addressing (as per IPv6 and Annexure-V.)

4. The radio shall be programmed with 16 byte security key (128 bit encryption). The value for sample = 'MSEDCL' (This value is only for samples and actual value will be informed to successful bidder.)

5. The baud rate for radio to meter UART shall be 9,600 bps.

6. Over the air baud rate shall be 50 kbps.

7. Following Commissioning attributes must be supported:

   i. PAN ID

   ii. Channel (0 -9)

   iii. Device Type (1- Root, 2-Router)

   iv. IPv6 Prefix (as per IPv6 Specifications)

   v. AES key – 16 Bytes Hex

   vi. Commission state (0- un-commissioned, 1- commissioned)

   vii. DAG ID – 16 Byte (as per IPv6 specifications)

   viii. Router List

8. The DCU shall be capable of commissioning a meter network node as either a 6LoWPAN 'root' or 'router' as appropriate.

9. The DCU shall be capable of joining a metering network as a Router / end device to download data.

The frequency range of LPRF equipment shall be approved frequency range from Government of India, Ministry of Communications and Information Technology (Wireless Planning and Coordination Wing) New Delhi notification vide G.S.R. 45 (E), dtd. 28th January, 2005, i.e. the frequency band of 865 – 867 MHz. The meter shall use license free frequency band for communication so that license for use of LPRF equipment to read energy meter at site is not required. The required license, if any, for use of LPRF equipment to read energy meter at the site shall not be under the scope of purchaser. The necessary support shall be provided by the tenderer. Accordingly, Bidder shall submit ETA (Equipment Type Approval) for RF Module, issued by WPC Wing (Wireless planning and co-ordination wing) of Ministry of Communications and Information Technology, Govt. of India.

The meters with Internal Low Power Radio Frequency (LPRF) technology shall have two way communication to read the meter data. However, data could only be downloaded from meter to DCU, but no command regarding data alteration in the meter and data retrieval from meter to DCU shall be possible in any case. The LPRF module of the meter shall have no physical access from outside the meter. It shall not be possible to tamper the data stored in meter and DCU even after getting the password of the software. It shall be locked at the time of manufacturing.

MAHAVITARAN
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TECHNICAL SPECIFICATION OF SINGLE PHASE 5-30 AMPS WITH 6LOWPAN RF DCU

Adequate tamper proofing shall be provided to disallow any change of such auto recorded reading by any means. Meter shall not be accessible for reprogramming at site through any kind of communication for any alteration in the factory settings. Download should be possible through optical port in case of power failure.

5.28 The meter shall be supplied with battery back up feature for displaying the parameters during power OFF condition. Battery life shall be minimum ten years.

Separate push button shall be provided for activation of battery during power OFF condition. Alternatively, push button provided for displaying alternate mode (On Demand Mode) parameters shall also be acceptable for activation of battery during power OFF condition.

After activating the battery during power OFF condition, the meter shall display all Default Display (Auto Scrolling Mode) parameters only once, after which the battery shall switch OFF automatically. The battery shall be locked after 3 operations during one power OFF cycle.

5.29 The accuracy of the meter shall not be affected with the application of abnormal voltage / frequency generating device such as spark discharge of approximately 35 KV. The meter shall be tested by feeding the output of this device to meter in any of the following manner for 10 minutes:

a) On any of the phases or neutral terminals

b) On any connecting wires of the meter (Voltage discharge with 0-10 mm spark gap)

c) At any place in load circuit

d) Anywhere on meter body

The accuracy of meter shall be checked before and after the application of above device.

5.30 The data stored in the meters shall not be lost in the event of power failure. The meter shall have Non Volatile Memory (NVM), which does not need any battery backup.

The NVM shall have a minimum retention period of 10 years.

5.31 Reverse reading lock of main KWh reading is to be incorporated with necessary software modification if required additionally.

6.00 ENCLOSURE OF METER

As per Annexure – III

7.00 TOD TIMING

There shall be provision for at least 6 (Six) TOD time zones for energy and demand. The number and timings of these TOD time Zones shall be programmable. At present the time zones shall be programmed as below.

Zone A (TZ1): 00=00 Hrs. to 06=00 Hrs. and 22=00 Hrs. to 24=00 Hrs

Zone B (TZ2): 06=00 Hrs. to 09=00 Hrs. and 12=00 Hrs. to 18=00 Hrs

Zone C (TZ3): 09=00 Hrs. to 12=00 Hrs.

Zone D (TZ4): 18=00 Hrs. to 22=00 Hrs.

8.00 MAXIMUM DEMAND INTEGRETION PERIOD

The maximum demand integration period shall be set at 30 minute real time based as per requirement.

9.00 MD RESET

It shall be possible to reset MD by the following options:

a) Communication driven reset through hand held terminal (HHT)/Data concentrator Unit (DCU).

b) The meter shall Auto reset kVA MD at 24.00 Hrs. of last day of the month and this value shall be stored in the memory along with the cumulative kWh reading. No push button shall be provided for MD reset.

10.00 ANTI TAMPER FEATURES

The meter shall detect and register the energy correctly only in forward direction under any one or combination of following tamper conditions:

10.01 Reversal of phase & neutral.

10.02 Reversal of line and load terminals.

10.03 Load through local Earth.

10.04 The meter shall work accurately without earth.

10.05 Where neutral is disconnected from the load side or from the supply side or both, the load and supply side, the meter shall record the energy proportionate to the current drawn through the meter (minimum 30 % Ib) at reference voltage and unity Power Factor. ± 5% error in recording is admissible.

All the above tampers shall be verified at basic current at reference voltage.

The potential link shall not be provided on terminal block outside the main meter cover.

Visual indication as per clause no. 14.10 (c) shall be provided to show tamper conditions stated above.

10.06 The meter shall be immune to the magnetic field (AC / DC / Permanent) up to 0.2 Tesla (except 0.2 Tesla AC). Under influence of any magnetic field (AC / DC / Permanent) more than 0.2 Tesla, if the accuracy of the meter gets affected, then the same shall be recorded as magnetic tamper event with date & time stamping and the meter shall record energy considering maximum value current (Imax) at reference voltage & unity power factor.

10.07 In the event the meter is forcibly opened, even by 2 to 4 mm variation of the meter cover, same shall be recorded as tamper event with date & time stamping and the meter shall continuously display that the cover has been tampered. It is suggested that the manufacturer shall develop their software such that there shall be some time delay for activation of this tamper feature and during that period only the meter cover shall be fitted. After the meter cover is fitted, it shall get activated immediately without any delay. The delay in activation of software shall be for one instance only.

10.08 The meter shall remain immune for the test of electromagnetic HF/RF defined under the test no. 4.0 for EMI/EMC of IS 13779:1999 amended up to date. The meter shall remain immune for any higher signals than the present standards and MSEDCL technical specifications.

11.00 DISPLAY OF MEASURED VALUES

11.01 The display shall be permanently backlit LCD, visible from the front of the meter. The display shall be electronic and when the meter is not energized, the electronic display need not be visible.

11.02 **MINIMUM CHARACTER SIZE**

The energy display shall be minimum 5 digits. The height of the display characters for the principal parameters values shall not be less than 5 mm. The size of digit shall be minimum 9x5 mm.

11.03 The principal unit for the measured values shall be the kilowatt hour (kWh) and the maximum demand in kW (kW MD) along with the time.

11.04 The decimal units shall not be displayed for cumulative kWh in auto scroll mode. However it shall be displayed in push button mode for high resolution display for testing.

11.05 The meter shall be pre-programmed for following details.

Voltage: 240 V

Integration period for kW MD shall be of 30 minutes real time based.

The meter shall auto reset kW maximum demand (kW MD) at 2400 Hrs. of last day of each calendar month and this value shall be stored in the memory along with the cumulative kWh reading.

No reset push button shall be provided.

The Default Display (Auto scrolling mode) shall switch to Alternate Display (On Demand Display Mode) after pressing the push button continuously for 5 seconds.

The Alternate Display shall switch over to Default Display if the push button is not operated for 15 seconds.

11.06   MEASURING PARAMETERS

A) DEFAULT DISPLAY (AUTO SCROLLING MODE)

All the following parameters shall be available in Default Display (Auto Scrolling Mode).

1) Active Energy (kWh)

B) ALTERNATE DISPLAY (ON DEMAND DISPLAY MODE) THROUGH PUSH BUTTON

The following parameters shall be available in Alternate Display (On demand Display Mode) and shall be displayed for 6 secs.

- Sr. No. of meter

- LCD test

- Real time & date

- High resolution reading of kWh with 2 decimal digits.

- Cumulative Active Energy (kWh) for each calendar month for previous twelve months with display of month.

- Maximum demand (kWMD) in a calendar month for previous twelve months with date & time.

- Magnetic tamper event with date / time: This shall be displayed as per the requirement of clause no. 10.06.

- Tamper event of meter cover open with date & time as per clause no. 10.07. The meter shall display the tamper name of "C - OPEn" with date & time in auto scroll mode along with other parameters.

- Tamper event of Electronic noise tamper of Electronic noise with date & time as per clause no. 10.08. The meter shall display the tamper " EI /EC tP" with date & time in auto scroll mode along with other parameters.

The separate slot with 10 no. occurrence of Electronic noise tamper along with date and time stamp shall be provided.

Active cumulative energy (kWh) shall be displayed for 20 seconds & all other parameters shall be displayed for minimum 6 seconds including LCD check

➢ PAN ID of meter.

The meter shall have a non-volatile (NVM) memory so that the registered parameters shall not be affected by the loss of power.

12.00 DEMONSTRATION

The purchaser reserves the right to ask for the demonstration of the equipment offered at the purchaser's place free of cost.

13.00 BILLING HISTORY & LOAD SURVEY

13.01 BILLING HISTORY

The meter shall have sufficient non-volatile memory for recording history of billing parameters (Cumulative kWh at the time of reset and kW MD) for last 12 months.

13.02 LOAD SURVEY PARAMETERS

The load survey parameters shall be kWh, kW MD, Voltage & Current.

The logging interval for load survey shall be 30 minutes. Load survey data shall be logged for last 45 days on non time based basis, i.e. if there is no power for more than 24 hours, the day shall not be recorded. Whenever meter is taken out and brought to laboratory, the load survey data shall be retained for the period of actual use of meter. This load survey data can be retrieved as and when desired and load profiles shall be viewed graphically / analytically with the help of meter application software. The meter application software shall be capable of exporting / transmitting these data for analysis to other user software in spreadsheet format.

14.00 DATA CONCETRATOR UNIT (DCU)

• **Functional Requirements of DCU**

14.01 DCU shall have in-built 6LoWPAN LPRF module for communication with 6LoWPAN LPRF meters installed in the field and communication module for communication with HES.

14.02 DCU should pull data i.e. download billing, bill history, tampers, load survey for 45 days from meters at pre-configured intervals (15 minutes/30 minutes/hourly etc.) and push this data to the HES.

14.03   It should also support the HES in pulling meter data from LPRF meters on demand. The data acquisition (Push/Pull) frequency shall be programmable.

14.04   DCU shall be capable to prioritize control commands.

14.05   DCU shall be able to configure the communication with underlying RF meter nodes. DCU shall be able to discover and join RF meters available in multiple PANs at programmed intervals.

14.06   DCU shall have store and forward feature i.e. meter data downloaded from LPRF meters should be saved in the internal memory and the same shall be pushed to Head End System (HES) at configured intervals.

14.07   DCU shall continuously check for events in the meters connected, at configured intervals. DCU shall push events like tamper, power off etc. to HES immediately on occurrence/receipt from meters.

14.08   DCU shall support on demand read and ping of individual/group of meters.

14.09   DCU shall able to store meter data of minimum 500 RF meters for at least 7 days on the internal storage.

1.01   DCU shall support network size of 100 or more meters per DCU.

14.10   DCU shall be able to acquire and send data to HES for full capacity i.e. at least for 500 RF meters to ensure the performance level. Full capacity of DCU is required to be indicated in the offer.

14.11   **Commissioning and decommissioning of meters:** DCU shall able to commission the un-commissioned RF meters to any existing PAN or new PAN, with appropriate parameters required for commissioning. It is possible to commission single RF meter or group of RF meters. Also DCU shall able to decommission individual meter or group of meters in PAN.

14.12   **Monitoring of RF Networks:** DCU shall regularly monitor the health of PANs available. If any RF network is not downloaded continuously for 24 hours, DCU should inform such PANs to HES.

14.13   **Configuration of DCU**: DCU should support remote configuration through HES. The network & consumer details of PANs surrounding DCU shall be configured in DCU remotely through HES. APN details for SIM cards inserted in DCU should be configured automatically or through HES.

14.14   DCU shall ensure a secure communication to HES.

14.15 DCU shall periodically monitor meter reads/downstream commands and shall retry and reconnect in case of failed events/reads.

14.16 DCU shall maintain latest communication logs for communication between DCU & meters, DCU & HES.

14.17 **Outage notification**: In the event of an outage, the DCU should use the battery backup and should be able to notify the outage event with date and time of Occurrence and restoration to HES.

14.18 After power interruption, on restoration of power supply, DCU shall establish communication with underlying devices as well as upstream application automatically.

14.19 **Remote firmware upgrade:** The DCU shall support remote firmware upgrades & remote configuration from HES. Configuration of programmable parameters of RF meters shall be done through HES.

HARDWARE REQUIREMENTS OF DCU

14.20 **Power Supply**

   i) DCU should work with Single phase and Three Phase A.C. power supply with 50Hz, 240V (-40% to 30%) between phase and neutral.

   ii) In case of outage between one or two phases, DCU should be powered through healthy phase.

   iii) DCU should capable of withstanding surges and voltage spikes of 6kV as per IEC-61000-4-5 standards. Required certificates issued by any Govt. Body/NABL accredited lab is to be produced in this regard

14.21 **Battery Backup**

   i) DCU should have battery backup of minimum 5 Hours for normal meter reading, to push tamper event, carry out on demand reading and the network health status / connectivity continuity & check. DCU should have the suitable feature to send power outage and restoration message to the HES.

   ii) The battery shall have a guaranteed life of 10 years.

   iii) Super capacitor will not be accepted

14.22 **Real Time Clock**

DCU should have in-built real time clock with separate battery backup. The battery shall have a guaranteed life of 10 years. It shall have self-diagnostic feature for RTC, memory, battery, communication module, etc. Synchronization of RTC with HES should be supported

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14.23 Mechanical Specifications

i) Enclosure/box of DCU shall be weatherproof, dustproof and constructed for outdoor installation on polls.

ii) All parts of DCU should be resisted against mechanical stroke and shake during the transportation.

iii) DCU shall be compliant to IP55 degree of protection. Required certificates issued by any Govt. Body/NABL accredited lab is to be produced in this regard.

iv) Suitable mounting provision shall be provided with mounting brackets.

v) Provision for security sealing shall be provided and in case the gasket of the cover is used for protection against moisture, dust and insects, the gasket shall be made of weather and aging resistant material

14.24 Interfaces

DCU should be provided with following interfaces.

i) RS232/USB or Bluetooth ports: DCU should have RS232/USB port or Bluetooth for debug purpose. Appropriate sealing provision should be provided for sealing of such port.

ii) SIM Interface: SIM interface should be a 3 V Interface in accordance with GSM 11.12 phase 2 with a retractable SIM cardholder, which should be fully inserted inside the DCU. The holder opening should have a sliding cover with provision for sealing after placing of the SIM card. Or Push fit type SIM cardholder which is suitably covered and sealable is also acceptable. The DCU shall accept the standard SIM Card. It should be possible to insert SIM card in DCU, externally.

iii) DCU should have external SMA Antenna connector. Antenna can be connected externally with this connector if required.

14.25 Internal Storage

DCU shall have sufficient memory to store meter data (including billing data, bill history, tamper events and load survey for 45 days) of minimum 500 RF meters for at least 7 days

14.26 Communication module

i) DCU should have internal intelligent communication module which is capable for bi-directional communication between DCU and Head End System (HES).

ii) The communication module should be 4G and also have facility to fall back to 2G/3G networks, where 4G network is not available. This module support both Data and SMS transmission.

iii) This module should support both push and pull features. This module should send the requests/commands received from HES to

LPRF modules. Also meter data downloaded should be pushed to HES at regular intervals. Events like tamper, power off etc. should be pushed to HES immediately after occurrence and restoration. Push/Pull frequency of module should be configurable.

iv) It should be possible to reset this module remotely through HES

14.27 6LoWPAN Module

i) DCU should have internal Low Power Radio Frequency (LPRF) module based MSEDCL protocol given in technical specifications of LPRF meters, working on 865-867MHz frequency.

ii) Over the air baud rate of module should be 50 Kbps.

iii) This module should able to communicate with 6LoWPAN based LPRF meters of various makes installed in the field. This module should able to join the multiple PANs and download meter data i.e. billing data, bill history, tampers and load survey data from RF meters at programmed interval or on demand i.e. after receiving command from HES.

iv) This module should able to commission RF meters if required.

v) ETA (Equipment Type Approval) for 6LoWPAN RF Module, issued by WPC Wing (Wireless planning and co-ordination wing) of Ministry of Communications and Information Technology, Govt. of India should be submitted by the bidder

14.28 Operational indicators

DCU should have separate six no. of LED indicators for transmitting data (Tx) for LPRF module, receiving data (Rx) from LPRF module, Power ON to indicate Power on position, carrier detects to indicate the availability of signal at the place of installation, transmit data (Tx) for GSM/GPRS module, received data (Rx) for GSM/GPRS module

14.29 Web Based Data Collection System/Head End System

i) Agency has to install its own data collection software on MSEDCL cloud and the same is to be integrated with MSEDCL MDAS by the bidder.

ii) The main objective of data collection software is to acquire meter data from DCUs automatically avoiding any human intervention and monitor parameters acquired from meters.

iii) The data collection software should be developed on open platform based on distributed architecture for scalability without degradation of performance.

iv) The data collection software should have provision to configure and monitor all the DCUs and network details for RF meters installed in the field.

v) The data collection software should monitor the DCU health such power on status of DCU and no. of RF Meters connected to DCU etc.

vi) This software should have following functionalities:

(a) It should be possible to login to data collection system with valid credentials by designated employees of MSEDCL.

(b) It should be possible to view the meter data i.e. billing, bill history, tamper and load survey data downloaded by DCUs. Also it should be possible to export this data in any file formats such as Text/Excel/Pdf etc. as per requirement of MSEDCL.

(c) It should be possible to generate bill string as per MSEDCL requirements.

(d) DCU should support push and pull mode for data collection. Event data for events (mentioned in tamper present status flags) shall always be pushed by DCU as and when events read by DCU. Also, meter data shall be pushed by DCU at configured intervals.

(e) DCU Configuration: It should be possible to configure the DCU for network details and communication parameters such as APN details, remotely through data collection software or over the air.

(f) The system should be able to generate all exception reports as per MSEDCL requirement. e.g. Event wise list of meters, List of non-communicating RF meters, List of non-communicating DCUs along with reason for non-communication. The DCU health report and report for no. of RF meters connected to DCU shall be generated daily. These reports should be exported to any file formats such text/excel/pdf etc.

(g) The system should be able to generate all exception reports as per MSEDCL requirement. e.g. Event wise list of meters, List of non-communicating RF meters, List of non-communicating DCUs along with reason for non-communication. These reports should be exported to any file formats such text/excel/pdf etc.

(h) There should be provision to download the RF network details for RF Meters configured in DCU.

(i) Dashboard should be provided for summary of readings downloaded by DCUs, status of DCUs along with location details. Dash boards should have filtering capability that will enable end users to dynamically filter the data in their dash board based upon criteria such as office level, PC, DCU Number etc.

(j) The agency shall integrate Data collection software with MSEDCL MDAS using web services/APIs, within one month, after award of contract

14.30 **Warranty**

DCU should have minimum 5 years warranty from date of supply.

- ## **Repeater/Gateway Specifications**
- ## **Functional Requirements of Repeater/Gateway**

14.31 Repeater/Gateway shall have in-built 6LoWPAN LPRF module for communication with 6LoWPAN LPRF meters installed in the field and communication module for communication with DCU.

14.32 Repeater/Gateway should pull data i.e. download billing, bill history, tampers, load survey for 45 days from meters at pre-configured intervals (15 minutes/30 minutes/hourly etc.) and push this data to the DCU.

14.33 It should also support the HES in pulling meter data from LPRF meters on demand. The data acquisition (Push/Pull) frequency shall be programmable.

14.34 Repeater/Gateway shall be capable to prioritize control commands.

14.35 Repeater/Gateway shall be able to configure the communication with underlying RF meter nodes. DCU shall be able to discover and join RF meters available in multiple PANs at programmed intervals.

14.36 Repeater/Gateway shall continuously check for events in the meters connected, at configured intervals. Repeater/Gateway shall push events like tamper, power off etc. to DCU immediately on occurrence/receipt from meters.

14.37 Repeater/Gateway shall support on demand read and ping of individual/group of meters.

14.38 Repeater/Gateway shall support network size of 100 or more meters per Repeater/Gateway.

14.39 **Commissioning and decommissioning of meters:** Repeater/Gateway shall able to commission the un-commissioned RF meters to any existing PAN or new PAN, with appropriate parameters required for commissioning. It is possible to commission single RF meter or group of RF meters. Also Repeater/Gateway shall able to decommission individual meter or group of meters in PAN.

14.40 **Monitoring of RF Networks:** Repeater/Gateway shall regularly monitor the health of PANs available. If any RF network is not

downloaded continuously for 24 hours, Repeater/Gateway should inform such PANs to HES.

14.41 **Configuration of Repeater/Gateway**: Repeater/Gateway should support remote configuration through HES. The network & consumer details of PANs surrounding Repeater/Gateway shall be configured in Repeater/Gateway remotely through HES.

14.42 Repeater/Gateway shall ensure a secure communication to HES.

14.43 Repeater/Gateway shall periodically monitor meter reads/downstream commands and shall retry and reconnect in case of failed events/reads.

14.44 **Remote firmware upgrade:** Repeater/Gateway shall support remote firmware upgrades & remote configuration from HES. Configuration of programmable parameters of RF meters shall be done through HES.

Technical Specifications of Repeater/Gateway
Hardware requirements:

14.45 **Power Supply :**

- Repeater/Gateway should work with Single phase and Three Phase A.C. power supply with 50Hz, 240V (-40% to 30%) between phase and neutral.
- In case of outage between one or two phases, Repeater/Gateway should be powered through healthy phase.
- Repeater/Gateway should capable of withstanding surges and voltage spikes of 6kV as per IEC-61000-4-5 standards. Required certificates issued by any Govt. Body/NABL accredited lab is to be produced in this regard.

14.46 **Mechanical Specifications :**

- Enclosure/box of Repeater/Gateway shall be weatherproof, dustproof and constructed for outdoor installation on polls.
- All parts of Repeater/Gateway should be resisted against mechanical stroke and shake during the transportation.
- Repeater/Gateway shall be compliant to IP55 degree of protection. Required certificates issued by any Govt. Body/NABL accredited lab is to be produced in this regard.
- Suitable mounting provision shall be provided with mounting brackets.
- Provision for security sealing shall be provided and in case the gasket of the cover is used for protection against moisture, dust and insects, the gasket shall be made of weather and aging resistant material.
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14.47 **Interfaces :**

Repeater/Gateway should be provided with following interfaces.

i) RS232/USB or Bluetooth ports: Repeater/Gateway should have RS232/USB port or Bluetooth for debug purpose. Appropriate sealing provision should be provided for sealing of such port.

14.48 **Communication Module :**

- Repeater/Gateway should have internal communication module for communication with DCU.
- This module should send the requests/commands received from DCU to LPRF modules. Also meter data downloaded should be pushed to DCU at regular intervals. Events like tamper, power off etc. should be pushed to DCU immediately after occurrence and restoration. Push/Pull frequency of module should be configurable.

14.49 **6LoWPAN Module :**

- Repeater/Gateway should have internal Low Power Radio Frequency (LPRF) module based MSEDCL protocol given in technical specifications of LPRF meters, working on 865-867MHz frequency.
- Over the air baud rate of module should be 50 Kbps.
- This module should able to communicate with 6LoWPAN based LPRF meters of various makes installed in the field. This module should able to join the multiple PANs and download meter data i.e. billing data, bill history, tampers and load survey data from RF meters at programmed interval or on demand i.e. after receiving command from HES/DCU.
- This module should able to commission RF meters if required.
- ETA (Equipment Type Approval) for 6LoWPAN RF Module, issued by WPC Wing (Wireless planning and co-ordination wing) of Ministry of Communications and Information Technology, Govt. of India should be submitted by the bidder

14.50 **Operational indicators :**

- Repeater/Gateway should have at least one LED indicators for Power ON to indicate Power on position.

14.51 **Warranty:**

Repeater/Gateway should have minimum 5 years warranty from date of supply.

15.00 **METERING PROTOCOL**

As per Annexure V & VI.

16.00 CONNECTION DIAGRAM AND TERMINAL MARKINGS

The connection diagram of the meter shall be clearly shown on inside portion of the terminal cover and shall be of permanent nature.

Meter terminals shall also be marked and this marking shall appear in the above diagram. **Stickers of any kind shall not be accepted.**

17.00 NAME PLATE AND MARKING

Meter shall have a purple colored name plate clearly visible, effectively secured against removal and indelibly and distinctly marked with all essential particulars as per relevant standards. The manufacturer's meter constant shall be marked on the Name Plate.

In addition to the requirement as per IS, following shall be marked on the Name Plate.

Purchase Order No.

Month and Year of manufacture

Name of purchaser: MSEDCL

Guarantee: Five Years

ISI mark

Communication Capability: 6LoWPAN LPRF

The meter Serial No. shall be Bar Coded along with Numeric No. The size of Bar Code shall not be less than 20x5 mm. Stickers in any case shall not be accepted.

A sticker label containing warning notice in Marathi language which is to be stick up on meters front cover or printed on meter name plate with easily readable font size not less than 10 in red colour, which reads as

"सावधान ! मीटरला फेरफार करण्याचा प्रयत्न केल्यास अधिकतम वेगाने वीज नोंदणी होणार."

18.00 TESTS

18.01 TYPE TESTS

Meter shall be fully type tested as per IS: 13779 / 1999 (amended up to date) and external AC (except 0.2 T AC magnet) / DC magnetic influence tests as per CBIP Tech-Report 88 with latest amendments. The Type Test Reports shall clearly indicate the constructional features of the type tested meters. Separate Type Test Reports for each offered type of meters shall be submitted. IP55 degree of protection test for DCU shall be submitted before commencement of supply. All the Type Tests shall have been carried out from Laboratories which are third party accredited by the National Board of Testing and Calibration Laboratories (NABL) of

Govt. of India such as CPRI, Bangalore / Bhopal, ERDA Vadodara, to prove that the meters meet the requirements of the specification.

Type Test Reports conducted in manufacturers own laboratory and certified by testing institute shall not be acceptable.

Type test reports shall be submitted along with offer. The purchaser reserves the right to demand repetition of some or all the type tests in presence of purchaser's representative at purchaser's cost.

Additional acceptance test except transportation test shall be submitted before commencement of supply and shall be get approved by C.E.(MMC).

18.02 Meters shall pass all the acceptance and routine tests as laid down in IS: 13779 / 1999 (amended up to date) and also additional acceptance tests as prescribed in this specification. (3 to 8 meters from a lot more than 1,000 shall be sealed randomly in the factory and shall be tested for tamper events).

18.03 **ADDITIONAL ACCEPTANCE TESTS**

The following additional tests shall be carried out in addition to the acceptance tests specified in IS: 13779 / 1999 (amended up to date).

A) **Transportation Test**

At least 50% of the samples of the meters be tested for error at Imax, Ib and 5% Ib at unity power factor and 50% Imax and 10% Ib at 0.5 lagging Power Factor besides checking them for starting current. The meter shall be tested with meter cover duly tightened and sealed properly.

After recording these errors, the meters be put in their normal packing and transported for at least 50 km in any transport vehicle such as pick up van, Jeep, etc. on uneven rural roads and then re-tested at all these loads after the transportation.

The variation in errors recorded before and after transportation shall not exceed 1% at higher loads and 1.5% at low loads.

Transportation test will be carried out at the time of quality testing at NABL Lab.

B) **Other Acceptance Tests**

   i) The meter shall withstand continuously for a period of at least 5 minutes at a voltage of 440 V between phase and neutral without damage / problems,

TECHNICAL SPECIFICATION OF SINGLE PHASE 5-30 AMPS WITH 6LOWPAN RF DCU

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ii) Tamper conditions as stated in this specification,

iii) Glow wire testing for polycarbonate material.

iv) Power consumption tests,

v) Verification of data transfer / downloading via RF port as per technical specifications, The data verification will be carried out at communication testing lab of IT Section of MSEDCL at corporate office. During the testing in communication testing laboratory, protocol implemented in the meter will be verified. If meter protocol is as per Clause No. 15 then further testing will be carried out. Draft testing parameters are given in Annexure-XI

vi) The meter shall comply all the tests for external AC / DC (except 0.2 Tesla AC magnet test) magnetic field as per CBIP Tech Report 88 with latest amendments.

Moreover, the magnetic influence test for permanent magnet of 0.5 Tesla for a minimum period of 15 minutes shall be carried out by putting the magnet on the meter body.

If the accuracy of the meter gets affected during the test, then the same shall be recorded as magnetic tamper event with date & time stamping and the meter shall record energy considering maximum value current (I_{max}) and reference voltage at unity power factor.

After removal of magnet, meter shall be subjected to accuracy test as per IS 13779 / 1999 (amended up to date).

No deviation in error is allowed in the class index as per IS: 13779 / 1999 (amended up to date) & this specification.

vii) The meter shall remain immune for the test of electromagnetic HF/RF defined under the test no. 4.0 for EMI/EMC of IS 13779:1999 amended up to date. The meter shall remain immune for any higher signals than the present standards and MSEDCL Technical specifications.

viii) The meter shall withstand impulse voltage at 10 kV

ix) Jammer test for sample meters shall be carried out for immunity at MSEDCL's Testing Division.

The test 19.03.B (i) to (v) shall be carried out at factory for each inspected lot at the time of pre-dispatch inspection.

The tests 19.03.B (vi), (vii) & (viii) shall be carried out on one sample from first lot as per procedure laid down in IS: 13779 / 1999 (amended up to date) and CBIP Tech. Report 88 in Third party NABL LAB.

The test report shall be got approved from Chief Engineer, MSEDCL, Testing & Quality Control Cell, 5th Floor, Prakashgad, Bandra (E), Mumbai – 400 051 before commencement of supply.

18.04 **LIMITS OF ERROR**

Limits of variation in percentage error due to change in voltage shall not exceed the values given in the following table:

Sr. No.	Influence quantities	current Value	Power factor	Limits of variation in % error for class 1 meters
a)	Voltage variation – 15% to +10%	I_b I_b	1 0.5 lag	0.7 1.0
b)	Voltage variation – 40% & + 20%	I_b I_b	1 0.5 lag	1.1 1.5

i) The meters shall be tested at (-) 15% and at (-) 40% of reference voltage as well as (+) 10% and (+) 20% of reference voltage and shall record energy within limits of variation indicated above. However the meter shall continue to register energy up to 50% of the rated voltage.

ii) For other influence quantities like frequency variation the limits of variation in percentage error shall be as per IS: 13779 / 1999 (amended up to date).

19.00 GUARANTEED TECHNICAL PARTICULARS

The tenderer shall furnish the particulars giving specific required details of Meter in schedule `A' attached. The offers without the details in Schedule 'A' stands rejected.

20.00 PRE DESPATCH INSPECTIONS

All Acceptance Tests and Inspection shall be carried out at the place of manufacturer unless otherwise specially agreed upon by the manufacturer and purchaser at the time of purchase. The manufacturer shall offer to the inspector representing the purchaser, all the reasonable facilities, free of charge, for inspection and testing, to satisfy him that the material is being supplied in accordance with this specification. The Company's representative / Engineer attending the above testing shall carry out testing on suitable number of meters as per sampling procedure laid down in IS: 13779 / 1999 (amended up to date) and additional acceptance test as per this specification and issue test certificate approval to the manufacturer and give clearance for dispatch. All the meters offered for inspection shall be in sealed condition. The

seals of sample meters taken for testing & inspection shall be break open & resealed after inspection. The first lot of meter may be jointly inspected by the Executive Engineer, Testing Division and the Executive Engineer, Inspection Wing.

21.00 INSPECTION AFTER RECEIPT AT STORES (Random Sample Testing)

For carrying out Random Sample Testing (RST), the sample meters shall be drawn from any one of the stores against inspected lot and same shall be tested at respective Testing and Quality Assurance Units at Aurangabad, Bhandup, Kolhapur, Nagpur, Nashik and Pune. Sample meters shall be drawn as per Annex H of IS: 13779 / 1999 (amended upto date). Sample meters shall be tested by MSEDCL Testing Engineer in presence of supplier's representative jointly for (i) Starting Current, (ii) Limits of error, (iii) Repeatability of error, (iv) No Load Test as per IS: 13779/1999 (amended upto date), (v) Tamper conditions as per technical specifications and (vi) Data downloading time as per specifications.

The 5 days advanced intimation shall be given to the supplier and if the supplier fails to attend the joint inspection on the date informed, the testing shall be carried out by our Testing Engineer in absence of supplier's representative. If the meters failed in above Random Sample Testing, the lot shall be rejected.

22.00 GUARANTEE

The meter & DCU shall be guaranteed for the period of five years from the date of commissioning or five and half year from the date of dispatch whichever is earlier.

23.00 PACKING

23.01 The meters shall be suitably packed in order to avoid damage during transit or handling. Each meter may be suitably packed in the first instance to prevent ingress of moisture and dust and then placed in a cushioned carton of a suitable material to prevent damage due to shocks during transit. The lid of the carton may be suitably sealed. A suitable number of sealed cartons may be packed in a case of adequate strength with extra cushioning. The cases may then be properly sealed against accidental opening in transit. The packing cases may be marked to indicate the fragile nature of the contents.

23.02 The following information shall be furnished with the consignment:

- ➢ Name of the consignee.
- ➢ Details of consignment.
- ➢ Destination.

➢ Total weight of the consignment.

➢ Sign showing upper / lower side of the crate.

➢ Sign showing fragility of the material.

➢ Handling and unpacking instructions.

➢ Bill of Material indicating contents of each package and spare material.

24.00 TENDER SAMPLE

Tenderer are required to submit 15 (Fifteen) nos. of sample meters and 1 (One) no. each of sample DCU & repeater/gateway of offered type and 2 (Two) Nos. of meter enclosures as per technical specifications along with the DCU data collection software & documentation to Executive Engineer (Store Management) in the office of the Chief Engineer, MSEDCL, Material Management Cell, 1st Floor, Prakashgad, Bandra (E), Mumbai – 400 051 on or before the time & date stipulated for submission of offer for testing the sample meters in third party NABL Lab like ERDA, CPRI, CIPET, ERTL and testing the offered API, checksum logic & documentation by our IT Department as per technical specifications for testing TOD tariff protocol & interoperability, etc. The offer of those eligible bidders shall only be considered if the sample passes the tests at NABL Lab as well as necessary certification from our IT Department for the offered API, TOD tariff protocol & interoperability, etc. The results of NABL Lab and the certification from IT Department shall not be disputed and shall be binding on the bidder. The required information such as Manufacturer's Name or Trade Name, Sr. No., ISI Certification No., API specification No. etc. shall be provided on inner/outer portion of sample meters being submitted along with the offer.

Out of these, two samples shall be without ultrasonic welding to confirm constructional features.

25.00 QUALITY CONTROL

25.01 The purchaser has a right to send a team of experienced engineers for assessing the capability of the firm for manufacturing and testing of meters as per this specification. The team shall be given all assistance and co-operation for inspection and testing at the bidder's works.

25.02 The meters supplied shall give service for a long period with out drifting from the original calibration & performance must be near to zero percent failure.

26.00 MINIMUM TESTING FACILITIES

26.01 Manufacturer shall posses fully computerized Meter Test Bench System for carrying out routine and acceptance Tests as per IS: 13779/1999

(amended up to date). Test Reports for each and every meter shall be generated. The list of testing equipments shall be enclosed.

The manufacturer shall have the necessary minimum testing facilities for carrying out the following tests:

(i) Insulation resistance measurement,

(ii) No load condition,

(iii) Starting current,

(iv) Accuracy requirement,

(v) Power consumption,

(vi) Repeatability of error,

(vii) Transportation test – as per clause no. 19.03.A,

(viii) Tamper conditions - as per clause no. 10.00,

(ix) LPRF communication connectivity Test as per clause no. 5.23.

(x) The manufacturer shall have duly calibrated RSS meter of class 0.1 or better accuracy.

(xi) The manufacturer shall have Glow Wire Testing facility.

(xii) The bidder shall have fully automatic Test Bench having in-built constant voltage, current and frequency source with facility to select various loads automatically and print the errors directly.

26.02 **Meter Software**

The Bidders shall have to get appraised & obtain CMMI – Level III within one year from the date of letter of award.

27.00 MANUFACTURING ACTIVITIES

The manufacturer shall submit the list of plant and machinery along with the offer.

i) Meter shall be manufactured using SMT (Surface Mount Technology) components and by deploying automatic SMT pick and place machine and reflow solder process. The loops/wired joints must be avoided on PCB. Further, the Bidder shall own or have assured access (through hire, lease or sub-contract, documentary proof shall be attached with the offer) of above facilities.

ii) Quality shall be ensured at the following stages:

> At PCB manufacturing stage, each Board shall be subjected to computerized bare board testing.

> At insertion stage, all components shall undergo computerized testing for conforming to design parameters and orientation.

> Complete assembled and soldered PCB shall undergo functional testing using Automatic Test Equipments (ATEs).

> Important: - Prior to final testing and calibration, all meters shall be subjected to ageing test (i.e. Meters shall be kept in heating chamber for 72 hours at 55°C temperature at full load current. After 72 hours, meters shall work satisfactory) to eliminate infant mortality.

iii) The calibration of meters shall be done in-house on a computerized testing bench having stabilized power supply.

iv) The bidders shall submit the list of all (imported as well as indigenous) components to be used in meter, separately along with the offer. List of makes of components is attached herewith as a guide line (Annexure II).

v) Bought out items:

A detailed list of bought out items which are used in the manufacturing of the meter shall be furnished indicating the name of firms from whom these items are procured. The bidder shall also give the details of quality assurance procedures followed by him in respect of the bought out items.

vi) List of Plant and Machinery used for production of energy meters.

Sr. No.	List of Plant and Machinery used for Energy meter Production	
1	Fully automatic testing Bench with ICT for testing link less meters	Routine Testing and Calibration of Meters
2	Semi automatic testing Bench with MSVT	Routine Testing and Calibration of Meters
3	IR Tester	Insulation testing
4	HV Tester	Insulation testing
5	Error calculators	Error testing
6	Long duration Running test set ups	Reliability Testing
7	Reference Meters class 0.1 accuracy	Error calculation

8	Ultrasonic welding Machines	Welding of meters
9	Automatic Pick and Place Machines	Automatic placing of SMT components
10	Solder Paste Printing Machine	SMT soldering
11	Soldering Furnace IR reflow	SMT soldering
12	PCB Scanner	For testing of PCBs
13	ATE functional tester	For testing of Components
14	Programmers and Program Loaders	Chip Programming Tools
15	CAD PCB designing setups	PCB designing
16	Furnace IR type for Hybrid Micro Circuits	resistance network and HMC manufacturing
17	Laser Trimming Machines	trimming of resistances for higher accuracy measurement
18	Wave Soldering Machines	Wave soldering of PCBs
19	Humidity Chamber	Accelerated testing for Life cycle
20	Dry Heat Test Chamber	Accelerated testing for Life cycle
21	Thermal Shock Chamber	Accelerated testing for Life cycle
22	PRO E-Mechanical Design Stations	Mechanical CAD stations
23	Spark Erosion Tool fabricating Machine	Tool fabrication and Die manufacturing
24	CNC wire Cut Tool Fabrication machine	Tool fabrication and Die manufacturing
25	Injection Moulding Machine	Moulding of plastic parts

ANNEXURE I
Quality Assurance Plan

A) The bidder shall invariably furnish the following information along with his bid, failing which his bid shall be liable for rejection. Information shall be separately given for individual type of material offered.

   i) Statement giving list of important raw materials, names of sub - suppliers for the raw materials, list of standards according to which the raw materials are tested. List of tests normally carried out on raw materials in presence of Bidder's representative, copies of test certificates,

   ii) Information and copies of test certificates as in (i) above in respect of bought out accessories,

   iii) List of manufacturing facilities available,

   iv) Level of automation achieved and list of areas where manual processing exists,

   v) List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections,

   vi) List of testing equipments available with the bidder for final testing of equipment specified and test plan limitation, if any, vis-à-vis, the type, special acceptance and routine tests specified in the relevant standards. These limitations shall be very clearly bought out in schedule of deviation from specified test requirements.

B) The successful bidder shall within 30 days of placement of order, submit following information to the purchaser.

   i) List of raw materials as well as bought out accessories and the names of sub - suppliers selected from those furnished along with offers.

   ii) Type test certificates of the raw materials and bought out accessories if required by the purchaser.

   iii) Quality assurance plan (QAP) with hold points for purchaser's inspection. The quality assurance plant and purchasers hold points shall be discussed between the purchaser and bidder before the QAP is finalized.

C) The contractor shall operate systems which implement the following:

   i) Hold point: A stage in the material procurement or workmanship process beyond which work shall not proceed without the documental approval of designated individuals organizations. The purchaser's written approval is

TECHNICAL SPECIFICATION OF SINGLE PHASE 5-30 AMPS WITH 6LOWPAN RF DCU

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required to authorize work to progress beyond the hold points indicated in quality assurance plans.

ii) Notification point: A stage in the material procurement or workmanship process for which advance notice of the activity is required to facilitate witness. If the purchaser does not attend after receiving documented notification in accordance with the agreed procedures and with the correct period of notice, then the work may proceed.

D) The successful bidder shall submit the routine test certificates of bought out accessories and central excise passes for raw material at the time of routine testing if required by the purchaser and ensure that Quality Assurance program of the contractor shall consist of the quality systems and quality plans with the following details.

i) The structure of the organization.

> The duties and responsibilities assigned to staff ensuring quality of work.

> The system for purchasing taking delivery and verification of material.

> The system for ensuring quality workmanship.

> The system for retention of records.

> The arrangement for contractor's internal auditing.

> A list of administration and work procedures required to achieve and verify contractor's quality requirements.

These procedures shall be made readily available to the project manager for inspection on request.

ii) Quality Plans:

> An outline of the proposed work and programme sequence.

> The structure of the contractor's organization for the contract.

> The duties and responsibilities assigned to staff ensuring quality of work.

> Hold and notification points.

> Submission of engineering documents required by the specification.

> The inspection of materials and components on receipt.

> Reference to the contractor's work procedures appropriate to each activity.

> Inspection during fabrication / construction.

> Final inspection and test.

ANNEXURE II

COMPONENT SPECIFICATION

Sr. No.	Component function	Requirement	Makes
1	Measurement or computing chips	The measurement or computing chips used in the Meter shall be with the Surface mount type.	**USA:** Analog Devices, Cyrus Logic, Atmel, Philips, Teridian. Dallas, ST, Texas Instruments, Motorola, Maxim, National Semiconductors, Freescale, Onsemiconductors **Germany:** Siemens. **South Africa:** SAMES. **Japan:** NEC, Toshiba, Renasas, Hitachi. **Austria:** AMS **Holland:** Philips (N X P) **Taiwan:** Prolific
2	Memory chips	The memory chips shall not be affected by external parameters like sparking, high voltage spikes or electrostatic discharges. Meter shall have non volatile memory (NVM). No other type of memory shall be used for data recording and programming. (The life of the NVM is highest) There shall be security isolation between metering circuit, communication circuit, and power circuit.	**USA:** Atmel, Teridian, National Semiconductors, Philips, Texas Instruments, ST, Microchip, Spanson (Fujitsu), Ramtron **Japan:** Hitachi, Renasas **Germany:** Siemens

| 3 | Display modules | a) The display modules shall be well protected from the external UV radiations.

b) The display visibility shall be sufficient to read the Meter mounted at height of 0.5 meter as well as at the height of 2 meters (refer 3.2 d for viewing angle).

c) The construction of the modules shall be such that the displayed quantity shall not disturbed with the life of display (PIN Type).

d) It shall be trans-reflective HTN (HTN – Hyper Twisted Nematic (120°)) or STN (STN – Super Twisted Nematic (160°)) type industrial grade with extended temperature range. HTN – Hyper Twisted Nematic (120°)

STN – Super Twisted Nematic (160°) | **Singapore:** E-smart, Bonafied Technologies, Display Tech,

Korea: Advantek, Jebon, Union Display Inc.,

Japan: Hitachi, Sony, L&G.

Malaysia: Crystal Clear Technology.

China: Success, Tianma |
| 4 | Electronic components | The active & passive components shall be of the surface mount type & are to be handled & soldered by the state of art assembly processes. | **USA:** National Semiconductors, Atmel, Philips, Texas Instruments, BC Component Analog devices, ST, Maxim, Kemet Onsemiconductors, Freescale, Intersil, Raltron, Fairchild, Muruta, Agilent, AVX, Abracon, Sipex, Diode Inc., |

			Honeywell, Power Integration, Fox, Roham
			Japan: Hitachi, Oki, AVZ or Ricon, Toshiba, Epson, Kemet, Alps, Muruta, TDK, Sanyo, Samsung
			India: Keltron, Incap, VEPL, PEC, RMC, Gujarat Polyavx, Prismatic, MFR Electronic components Pvt. Ltd., Cermet
			Korea: Samsung
			Japan: Panasonic
			Germany: Vishay, Epcos, Diotech, Kemet, Infineon
			India- CTR
			Taiwan: Yageo
5	Battery	Only non rechargeable battery shall be used for RTC as well as display in absence of Power since the life & Reliability of these are better than the rechargeable batteries.	**USA:** Maxell, Renata **Japan:** Panasonic, Sony, Mitsubishi, Sanyo **Germany:** Varta **France:** Saft **Korea:** Tekcell, Vitzrocell

MAHAVITARAN

TECHNICAL SPECIFICATION OF SINGLE PHASE 5-30 AMPS WITH 6LOWPAN RF DCU

ANNEXURE III
TECHNICAL SPECIFICATION OF SINGLE PHASE POLYCARBONATE METER BOX
TECHNICAL SPECIFICATION NO. CE/MMC/MSC-II/MTR BOX,

1.00 SCOPE:

This specification covers design, manufacturing, testing and supply of fully transparent poly-carbonate Meter Box suitable for Single phase Static Energy meter. The meter box shall be suitable for wall mounting and indoor or outdoor application.

2.00 SERVICE CONDITION:

The meter box to be supplied against this specification shall be suitable for satisfactory continuous operation under following service conditions.

(i)	Max. ambient temperature	50^0C
(ii)	Max. relative humidity	100%
(iii)	Max. annual rainfall	1450 mm
(iv)	Max. wind pressure	150 Kg./ m^2
(v)	Max. altitude above mean sea level	1000 meters
(vi)	Seismic level (Horizontal acceleration)	0.3 g
(vii)	Ref. Ambient temperature for temperature rise	50^0C
(viii)	Climatic condition: Moderately hot & humid tropical climate conducive to rust and fungus growth	

3.00 APPLICABLE STANDARDS:

Unless otherwise modified in this specification the meter box shall be generally conform to IS: 14772/2000 & IS 14434:1998 for polycarbonate material (amended up to date).

4.00 DESIGN AND CONSTRUCTION:

4.01 The meter box shall be so constructed as to have roof tapering down on both sides for easy flow of rain water and box shall be totally transparent poly-carbonate material natural white colour and having good workmanship.

4.02 The meter box shall be made of anti corrosive, dust proof, weather proof, unbreakable, scratch resistant, water proof, ultra violet stabilized and flame retardant high grade poly-carbonate material having good dielectric and mechanical strength.

4.03 The box material must be UV stabilized to ensure that the base and cover does not get 'Yellow' over a period of time. The surface appearance of part must be smooth, non porous and homogeneous, free of ripples, defects and marks. No fillers or fibers shall be visible at any

place.

4.04 (a) The meter box shall be made from Poly-carbonate as per IS: 14772 / 2000 and as per requirement of this specification.

(b) The wall thickness of meter box shall be minimum 3 mm on load bearing side and cover shall be 2 mm.

4.05 The internal dimensions of meter box shall be such that there shall be minimum 60 mm clearance at the bottom, 40 mm clearance on three sides, 25 mm clearance on front and 10 mm clearance from back of the meter.

4.06 The meter box shall not change in colour, shape, size, dimension when subjected to 200 hours on UV ageing test. Also it shall be capable of withstanding temperature of boiling water for five minutes continuously without distortion or softening.

4.07 The cover shall be made overlapping type having collars on all four sides. The cover of the box shall be provided with semi circular / circular gasket of sufficient size to completely fit in the grooves of the base. The gasket shall be made of neoprene rubber or equivalent good quality rubber.

4.08 The cover shall be made overlapping type having collars on all four sides. The cover of meter box shall have 4 nos. of non-detachable self-locking push fit type arrangement. It shall have suitable non-detachable fitting to base such that if pushed once inside, the cover shall rest on the base of box in such a way that any access from outside to the meter is not possible. The locking (press fit) knob shall get completely contained in the locking hub inside the meter box. The locking hub shall be closed at its base.

4.09 Meter box shall confirm IP-51.

4.10 The meter base support inside the box shall be raised by about 10 mm in the box for easy wiring. While fixing the meter, the meter screws shall not protrude outside.

4.11 Suitable circular holes shall be provided at the bottom of the box for inlet and outlet cables with glands of 6 or 8 mm size made of brass or poly-carbonate material for the cable securely fixed to the bottom of the box on both sides by chuck nuts with rubber grommet. All the screws and washers shall be properly zinc plated.

4.12 For fixing the box to wall or wooden board 4 nos. key holes of min. 5 mm diameter shall be provided at the four corners of meter box. The meter is to be installed in the box and the box in assembled condition shall have provision to fix it to pole or a wall. The 4 nos. screws of size 5 mm

diameter and 37.5 mm long with suitable washers shall be provided with each meter box.

4.13 The tolerance permissible on the various dimensions of the meter box shall be ±3%.

4.14 The surface appearance of part must be smooth, non porous and homogeneous, free of ripples, defects and marks. No fillers or fibers shall be visible at any place.

4.15 No optical port shall be on enclosure. Optical port shall be on meter body.

5.00 TESTS:

The meter box shall have been successfully type tested as per IS: 14772 / 2000 from NABL Accredited independent testing laboratories such as CPRI/ERDA. The type test report shall clearly indicate the constructional features of the type tested meter box. The tenderer shall also furnish certificate from laboratories where type test carried out. The requisite test facility available in house for that particular test shall be approved by NABL. The type tests conducted in manufacturer's own laboratory and certified by testing institute shall not be acceptable. The tenderer shall also furnish the particulars giving specific required details of meter box in schedule 'A' attached (As per Guaranteed Technical Particulars uploaded on e - Tendering site). The offers without the details in schedule 'A' and Type Test reports stands rejected.

A) Following tests shall be conducted on meter cover confirming to IS:14772/2000 and IS:14434/1998 as mentioned below:

Sr. No.	Test	Reference Standard
1.	Material Identification of Cover (poly carbonate)	IS:14434/1998
2.	Marking, Dimension & Construction	IS:14772 / 2000
3.	Protection against electric shock	IS:14772 / 2000
4.	Provision for earthing	IS:14772 / 2000
5.	Resistance to ageing, humid conditions, Ingress of solid objects and to harmful ingress of water	IS:14772 / 2000
6.	Mechanical strength	IS:14772 / 2000
7.	Resistance to heat/ Ball Pressure Test	IS:14772 / 2000
8.	Resistance of insulating material to abnormal heat and fire	IS:14772 / 2000
9.	Resistance to Tracking	IS:14772 / 2000
10.	Flammability (V2)	UL 94 or IS: 11731 (Part. II)

11.	Self extinguishing	IS: 4249/1967
12.	Heat deflection temperature	ISO 75
13.	Glow Wire Test	IS: 11000 (Part 2/ Sec-1) or IEC –60695-2-12
14.	Water Absorption	IS:5133 (Part-II)-1969
15.	Light Transmission (Transparency) for Cover	ASTM D 1003
16.	UV Ageing Test for 200 Hours	ASTM G53 (9.3)

6.00 TESTING AND MANUFACTURING FACILITIES

6.01 The manufacturer shall have necessary machinery for production of polycarbonate meter box.

6.02 The manufacturer shall have in house testing facilities for carrying out following tests:

Sr. No.	Test Details	Reference standard
1.	Flammability (V2)	UL 94 or IS: 11731 (Pt. II)
2.	Heat deflection temp. at (min. 150°C) 0.45 SUB MPA Load	ISO 75
3.	Glow wire test	IEC–695–2-1 or IS: 11000 (Pt 2/sec.1)
4.	Ball pressure test	IEC: 335
5.	Water absorption	IS: 14772
6.	Mechanical Strength	IS: 14772
7.	Marking Dimensions and construction	IS: 14772
8.	Spirit burner test	IS: 4249

7.00 DRAWING /SAMPLE:

The detailed dimensional drawing showing clearly the dimensions and material for meter box and its constructional features shall be invariably furnished with the offer. Two samples of meter box as per the specifications shall be submitted along with offer. The offer would be rejected, if meter box samples are not accompanied.

8.00 MARKING / EMBOSSING:

The following information shall be clearly and indelibly embossed (not

printed) on the cover of the meter box except Sr. No. which may be indelibly printed with inkjet printing on the base and cover of the meter box. The meter box Sr. No. shall be same as that of the meter Sr. No. fitted inside the meter box.

(i) Purchase order number and date.

(ii) Year and month of manufacture.

(iii) Purchaser's name: MSEDCL

(iv) Guarantee 5.5 Years.

(v) Sign of danger.

(vi) Code name of manufacturer

(vii) Meter box Sr. No. [Printed on both the base and cover of meter box]

9.00 PACKING:

The meter box shall be suitably packed in corrugated boxes in order to avoid damage during transit or handling.

10.00 GUARANTEE:

The supplier shall have to give 5.5 years guarantee of meter box from date of supply to MSEDCL.

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TECHNICAL SPECIFICATION OF SINGLE PHASE 5-30 AMPS WITH 6LOWPAN RF DCU

ANNEXURE - IV

MAKE CODE OF METERS

Make Code	Description
002	ANDHRA PRADESH ELECTRIC EQUIPMENT COR. LTD.
003	A.E.G.
004	BARODA ELECTRIC METERS LTD., VALLABH VIDYANAGAR
006	CHAMBERLAIN & HOOKHAM LTD.
008	DASS HITACHI PVT. LTD., NEW DELHI
010	ELECTRIC CONSTRUCTION & EQUIPMENT CO., SONEPAT
014	ELECTRICAL INSTRUMENTS MFG.CO.LTD. AHMEDABAD
015	HAVELLS ELECTRICALS
016	INDIA METERS LIMITED, MADRAS
018	INDUSTRIAL METERS PRIVATE LIMITED
020	JAIPUR METERS & ELECTRICALS LIMITED, JAIPUR
022	LANDIES & GYR LIMITED
024	MALIK METERS PRIVATE LIMITED, BOMBAY
026	METERS & INSTRUMENTS PVT. LTD., NEW DELHI
028	RADIO & ELECTRICALS MFG.CO.LTD., BANGALORE
030	SIMCO METERS LIMITED, TIRUCHIRAPALLI
034	UNITED ELECTRICAL INDUSTRIES LTD.,CALCUTTA
035	VOLTAS
036	AEC COMPANY
038	ARON
039	ALLIED ENGGINEERING WORKS LTD.
040	BUXLELS
041	DELHI CONTROL DEVICES PVT. LTD.

042	C.R.E. WOD CO. PVT. LTD.
043	GENUS INNOVATION LTD.
044	CONTIMENTS
045	NAINA POWER PVT. LTD.
046	GANG & CO. LTD., BUDAPEST
048	KRIZIC
050	SIEMENS
052	SCLUMBER
053	L & T
054	Datapro
055	Secure
056	DUKE ARNIES
057	A.B.B
058	ROLEX
059	L&G
061	ELYMER
062	AVENER
063	ELSTER METERING
064	ACCURATE
065	GENUS
066	CAPITAL POWER SYSTEMS PVT LTD
067	VAN ELECTRO DEVICES PVT LTD
068	GEC ALSTHOM INDIA LTD
069	GILBERT ELECTRICALS AND ELECTRONICS PVT LTD
070	KEI ELECTRICALS PVT LTD

071	MODEN INSTUMENTS PVT LTD
072	POWERTEC METERS
074	EMCO
075	HIMACHAL ENERGY
076	HPL
078	SHENZEN
079	SEMICONDUCTOR COMPLEX LTD
080	LOTUS WIRES AND CABLES
081	OMNI AGATE SYSTEM
082	PALMOHAN
083	SYNERGY
084	RC ENERGY METERING PVT. LTD
086	MOTWANI MANUFACTURE
087	MODERN INSTRUMENTS PVT LTD
088	AVON METERS
089	KELTRON COUNTERS LTD
091	TERANA INFOTECK
092	NATIONAL TELECOM
093	TTL LTD
094	TOWERS AND TRANSFORMERS
095	ESPRITE SWITCHGEAR PVT LTD
096	BENTEX ELECTRICALS
097	BHARAT HEAVY ELECTRICAL LTD
098	FLASH

Technical Specification No. CE/T-QC/MSC-II/SP/LPRF/ DATE: 20.03.2020

ANNEXURE V

MSEDCL 6LOWPAN PROTOCOL

Introduction

MSEDCL has previously deployed LPRF meters based on ZigBee Smart Energy 1.0 profile operating in 2.4GHz – 2.485GHz, with an MSEDCL specific profile used for data collection. These meters were primarily deployed in Urban areas of Mumbai, Pune and Nashik zones. Going forward, LPRF meters are sought to be deployed in rural, Rurban and Urban areas.

The new meters shall support LPRF data downloading based on 6lowpan networking on sub 1 GHz. The principal driver is the enhanced range that is expected out of a sub 1GHz implementation. At the same time, some of the learning from previous deployments is factored in. This document specifies the complete data downloading protocol(s) that need to be implemented; where relevant, references are made to standard documents – RFCs and IEEE standards; where appropriate, desired protocols are fully defined in the documents.

NOTE:

1. Any changes in communication protocol if required shall be incorporated subsequently.

Protocol Overview
The protocol stack layers are as given below:

LAYER 7 APPLICATION	MSEDCL PROFILE
LAYER 6 PRESENTATION	
LAYER 5 SESSION	
LAYER 4 TRANSPORT	UDP
LAYER 3 NETWORK	IPV6 WITH 6LOWPAN ADAPTATION
LAYER 2 DATA LINK	802.15.4 / 802.15.4 G
LAYER 1 PHYSICAL	802.15.4G SPECIFIED
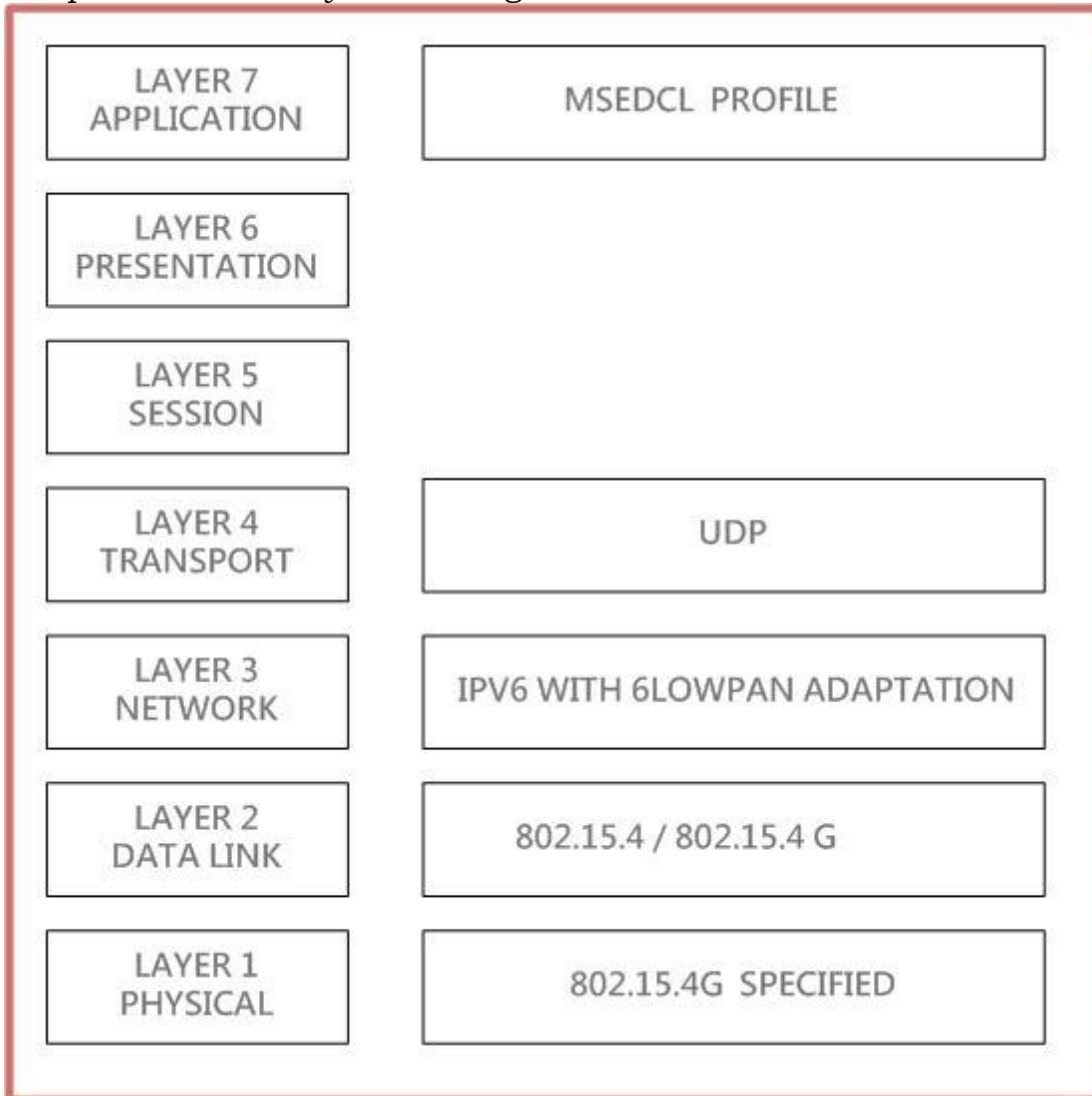
Each of the layers is explained in separate sections in the document.

APPLICATION LAYER

This protocol is the same protocol as used in the ZigBee implementation of LPRF metering previously at MSEDCL. The protocol is implemented as a series of attribute IDs as included in the Annexure-VI of this document.

TRANSPORT LAYER

All metering devices shall implement UDP protocol as defined in relevant RFC's. Meter data shall be available for reading on UDP port 61616. The meter shall implement an UDP server on this port to respond to data acquisition commands from HHU / DCU. Port no 61616 for meter data downloads and critical parameter communication. However, 61618 will be used for network parameters setting and commissioning as specified.

However, other than root assignment, commissioning is not usually required. The root assignment process is illustrated in the section no. 5.2

NETWORK LAYER

IPv6

IPv6 has to be implemented in the meters as detailed in RFC2460 and derivative/companion documents. The network proposed to be implemented will be an isolated 6lowpan network.

ICMPv6

Internet Control Message Protocol (ICMPv6) for the Internet Protocol Version 6 (IPv6) Specification, as defined in RFC4443 needs to be implemented. The devices must support ICMPv6 Error messages, Echo Reply and Echo Request messages.

Addressing

IPv6 addresses are 16x8 bit addresses. In the proposed network, this must be constructed out of a combination of 8 byte IPv6 prefix for the most significant 8 byte and the 8 byte MAC address of the node. The IPv6 address should be constructed based on RFC4862, with the following considerations:

8 byte IPv6 prefix, shall be assigned two different address for both Local & Global Address. "FE 80 00 00 00 00 00 00" will used for Local Addresses and the prefix for global addresses shall be allotted later.

All UDP communication has to be based on Global IPv6 address. The Initial handshaking (DIS/DIO /DAO) will use the local link address.

8 byte MAC address, this will consist of:
5 most significant bytes containing organizationally unique identifier (OUI) purchased from IEEE
The last three significant bytes shall be mapped to the serial number of the energy meter.

MESH AND ROUTING

RPL protocol is used for routing of data. This protocol is specified in RFC 6550 and its companion RFCs 6551 – 6554 and RFC 6719. MRHOF will be used. Transit information including parent option will be included in the DAO messages. Hop by hop option is mandatory in all UDP packets.

ADAPTATION LAYER

The Adaptation layer is 6lowpan. This is an adaptation of IPv6 packets onto the underlying Lossy Low power Network (LLN). The RFCs / standards are written keeping IEEE 802.15.4g MAC standards, expecting 128 octet packet sizes over the air. The relevant RFCs are 4944, 6282.

MAC LAYER

The MAC layer is a derivative of IEEE 802.15.4G specification in terms of MAC Layer headers and usage of IEEE headers. The packet & protocol options, protocol specified commands will be as follows.
MAC layer under 6lowpan is essentially a link layer broadcast protocol. While the 802.15.4G defines multiple packet types, the MAC_DATA_PACKET type suffices for the 6lowpan packet exchange. Further, nodes must respond with BEACON packets in response to BEACON_REQUEST messages. Link layer acknowledgements should be disabled.

NOTE: All MAC packets will be preceded by a 4-byte preamble (0x55, 0x55, 0x55, 0x55), followed by a 2-byte Sync word (0x90, 0x4E) followed by 2-byte frame control (Phy A & Phy B bytes in 802.15.4G). Nodes are required to transmit using 2 byte CRC.

4-byte preamble	2-byte sync word	2 byte Phy frame control	MAC Protocol data unit

MAC DATA PACKET
This MAC packet type is used for all 6lowpan communication messages. The packet will have the following structure(s) for different 6lowpan use cases.

Point to point application data communication

2byte Frame control	1 byte sequence number	2 byte destination PAN	8 byte Destination MAC address	8 byte Source MAC address	Security Header	Payload Data	2 byte FCS

Local broadcast as used in a DIO message (for example)
MHR to be coded as follows :

2byte Frame control	1 byte sequence number	2 byte destination PAN	2 byte Destination address (0xFFFF)	8 byte Source MAC address	Security Header	Payload Data	2 byte FCS

MAC packet format for Beacon Request

Frame control (2bytes)	Sequence number (1byte)	Destination PAN (2bytes)	Destination Address (2bytes)	Command identifier (0x07) (1 byte)	FCS (2 bytes)

MAC packet format for Beacon Messages

Frame control (2 bytes)	Sequence number (1 byte)	Source PANID (2 bytes)	Source Address (8 bytes)	Superframe specification (2 bytes)	GTS field (1byte)	Pending Addresses Fields (1 byte)	FCS (2 bytes)

Super Frame Specification: 0xCFFF
GTS Fields: 0x00
Pending Addresses Fields: 0x00
All the above fields should be ignored in MAC header processing by receiving nodes.

PHY LAYER

The Phy layer specifications are derived from 802.15.4g specification and it is mandatory to use IEEE802.15.4g phy mode #1. The standard is not applicable to Indian context & constraints (as per WPC specifications).

Therefore, suitable adaptation has been made here and should be implemented as follows:

Frequency Band: 865-867 Mhz

Channel Spacing: 200 KHz

Number of Channels: 9

Channel Centre Frequencies (MHz): ChanCenterFreq = ChanCenterFreq 0 + NumChan · ChanSpacing

Where, ChanCenterFreq 0 = 865.125 MHz

Data rate: 50 kbps

Modulation: Filtered 2FSK (2GFSK)

Modulation Index: 1.0

Preamble: 0x55555555

Sync word: 0x904E

Default Channel Center Frequency: 865.525 MHz (Channel #2)

Frequency Deviation: 25 kHz

SECURITY

All the data transmission in network must be encrypted. This implementation will use AES-CCM-32 encryption using 128 bit security key (Key will be provided by MSEDCL). AES key should be programmable over the air (protocol as defined in section 6).

Implicit key shall be used and Encryption & decryption keys will same.

FACTORY DEFAULT NETWORK PARAMETERS

Frequency / Channel: 0x02

Device type: Router

Device State: Not joined

PAN: 0xFFFF

Default Encryption Key : 0000000000MSEDCL

Prefix: 0xFFFF000000000000 (0xFFFF::)

MAC address: As defined in section 2.3.3

Theory of Operation – network formation and commissioning

Description:

On power on, if the router is in a commissioned state, shall issue the DIS message (Reference: RFC6550) once every minute, with a 20% random jitter. Network joins happen on the basis of DIO, DAO and ICMP echo-request and ICMP echo-reply messages. The network shall be a storing mode network, with each node capable of hosting routes of 200 children. The timing of transmission of DIO messages shall follow trickle algorithm specification as specified under RFC 6206.

Subsequent to a network join, a node shall transmit DIO messages at 4s, 8s, 16s, 32s, 64s, 128s, 256s, 512s and 1024s with a 10% random jitter. Subsequent to this, DIO messages shall be transmitted every 1024s with

random jitter, till a global repair command is received at which time the trickle timer shall be reset.

If the device is not in a commissioned state, it should be a router in factory default network parameters. In this state, it shall be issuing a IEEE 802.15.4G MAC BEACON REQUEST packet, once every 1 minute with a 20% random jitter.

On the basis of MAC BEACON packets received, the device then makes a list of available PANs, and initiates the 6lowpan network join procedure in each of those PANs. When a meter tries to join different PAN IDs, the maximum time needed to wait in DIS state is 3 DIS periods. There is no MAC join procedure.

6lowpan network join procedure is the standard 6lowpan RPL join process as defined in RFC6550. A minute after the DAO, the new node shall send a ping-request to the root node; if the node does not receive a ping-reply within 10 attempts of ping requests, each issued a minute (with random jitter) apart, the new node shall detach itself from the parent and restart the join procedure on the next discovered PAN.

Once a ping response from the root is received, the router device saves the network parameters for future and marks itself as commissioned. No DIO messages shall be transmitted by this node prior to this state.

Specifying a root node.

All the devices in the network should be capable of being 6lowpan root devices, though factory defaults set them to be routers. One of the (centrally located) nodes shall be identified and configured as a ROOT by DCU/HHT. ROOT assignment involves setting the target Short PAN, channel, device type, IPv6 Prefix, AES key. Information to be further given will include the list of devices to be allowed into the network. The ROOT shall respond to ping requests to those devices that are in this list.

Data Concentrator Unit (DCU) should join the network as ROOT while commissioning of meters. Though DCU act as ROOT, reply to ping-requests should not be given by DCU

COMMISSIONING PROTOCOL
UDP payload with 61616

1-byte Frame Type	1 - byte Sequence no	1 - byte Command ID	1 - byte Attribute count	1 - byte Attribute ID	Attribute ID value [Optional]

Frame Type Details

Frame Type	Description
0x00	Read / Write commission request
0x01	Restart command request
0x02	Read / Write commission response
0x03	Restart command response
0x04 to 0xFF	Reserved

Command Identifier details

Command Identifier	Description
0x00	Commission Write command Request
0x01	Commission Write command Response
0x02	Commission Read command Request
0x03	Commission Read command Response
0x04 to 0xFF	Reserved

List of Commission Attributes

Attribute ID Name	Attribute ID	Attribute Length	Range
PAN ID	0x00	2	0 to 0xFFFF
Channel	0X01	1	O to 9
Device Type	0x02	1	1 – Root 2 - Router
IPv6 Prefix	0x03	8	As per IPv6 specifications
AES Key	0X04	16	Hex 16 bytes
Commission State	0X18	1	0 – Un-commissioned 1 – Commissioned
DAG ID	0x19	16	As per IPv6 specifications
Router List	0x1A	N/A	List of 4 byte IPv6 address with the first 12 byte elided.
Number of routers	0x1B	3	Count of routers added in the ROOT.
Other ID values	Reserved		

Note 1: Attribute PAN ID, channel, Device type, IPv6 Prefix, AES key are mandatory while commissioning ROOT device.
Note 2: Restart command should be sent after writing all attributes in Note 1. If restart command is received before writing all attributes in Note 1, response to restart command should be failure.

Note 3: Attributes 'commission state', 'DAG ID', 'Number of routers' should be read only. DAG ID should be IPv6 address of ROOT device which is combination of IPv6 prefix & MAC address.

Packet Structure of request to write commissioning attributes :

1-byte	1-	1- byte	1-byte	1- byte	Attrib	1- byte	Attribute

Frame Type	byte Sequence no	Command ID	Attribute count	Attribute ID1	ute ID1 value	Attribute ID'n	ID'n value

Example :

|00 | 02 |00 |05| 00 |12 34 | 01 | 02 | 02|01|03 | CC CC CC CC CC CC CC CC| 04 |00 00 00 00 00 00 00 00 00 00 4D 53 45 44 43 4C |

00 : Frame type Commissioning Read/Write
02 : Sequence Number
00 : Command ID – Commissioning Write request
05 : Attribute Count
00 : Attribute ID 1 – Short PAN ID
12 34 : Short PAN ID value
01 : Attribute ID 2 – Channel
02 : Channel Value
02: Attribute ID 3 – Device Type
01: Device type value
03 : Attribute ID 4 – IPv6 prefix
CC CC CC CC CC CC CC CC : IPv6 prefix value
04 : Attribute ID 4 – AES Key
00 00 00 00 00 00 00 00 00 00 4D 53 45 44 43 4C : AES key 16 byte value

Commissioning packet response (Success):

1-byte Frame Type	1- byte Sequence no	1- byte Command ID	Status Field

Example
| 02 | 02 | 01 | 00 |
02 : Frame type – Commission Read/write Response
02 : Sequence Number
01 : Command ID   Commission Write command Response
Value : 0x00 Success, non zero is failure

Note 4:
Command ID success is indicated by status code as zero. Failure shall be indicated with failed attribute and status. Fail Attribute Status is one for failure.

Commissioning packet failure response :

1-byte Frame Type	1-byte Sequence no	1-byte Command ID	1-byte Status	1-byte Fail attribute ID	1-byte Fail Attribute Status

Example.
02 | 02 | 01 |01| 00| 01 |
02 : Frame type – Commission Read/write Response
02 : Sequence Number

01 : Command ID – Commission Write Response
01 : Status - failure
00: Fail Attribute ID 0x00 (PAN ID)
01: Status - Fail

Packet Structure for reading commissioning attributes :

1-byte Frame Type	1-byte Sequence no	1-byte Command ID	1-byte Attribute count	1- byte Attribute ID1	1- byte Attribute ID2	……… ……… ……… ………..	Attribute ID'n

Example :
|00 | 02 |02 |04| 00 |01 | 02 | 03 |

00 : Frame type Commissioning Read/Write
02 : Sequence Number
02 : Command ID – Commissioning Read request
04 : Attribute Count
00 : Attribute ID 1 – Short PAN ID
01 : Attribute ID 2 – Channel
02 : Attribute ID 3 – Device Type
03: Attribute ID4- IPv6 prefix value

Packet structure of response to the command to read commissioning attributes :

1-byte Frame Type	1-byte Sequence no	1- byte Command ID	1-byte Attribute count	1- byte Attribute ID1	**Attribute 1 read status**	Attribute 1 value	Attribute n ID	Attribute ID'n read status

|02 | 02 |03 |04| 00 |00|12 34 | 01 |00| 02 | 02 |00| 01|03 |00|CC CC CC CC CC CC CC CC |

02 : Frame type Commissioning Read/Write
02 : Sequence Number
03 : Command ID – Commissioning Read request
04 : Attribute Count
00 : Attribute ID 1 – Short PAN ID
00: Read Status of attribute ID1 : Value 0= success, non-zero value for failure.
12 34 : Short PAN ID value
01 : Attribute ID 2 – Channel
00: Read Status of attribute ID2
02 : Channel Value
02 : Attribute ID 3 – Device Type

MAHAVITARAN

TECHNICAL SPECIFICATION OF SINGLE PHASE 5-30 AMPS WITH 6LOWPAN RF DCU

00: Read Status of attribute ID3
01: Device Type
03 : Attribute ID 4 – IPv6 prefix value
00: Read Status of attribute ID4
CC CC CC CC CC CC CC CC : IPv6 prefix value

Router List write Request:

1-byte Frame Type	1-byte Sequence no	1-byte Command ID	1-byte Attribute count	1-byte Attribute ID	1–byte Add /Remove	1-byte Routers count	4-byte Router Address 1	- - -	4-byte Router Address n

| 00 | 02 | 00 | 01 | 1A | 00| 05 | 00 00 02 01 | 00 00 02 02 | 00 00 02 03 | 00 00 02 04 | 00 00 02 05 |

Note 5: Values for 1-byte add/remove field should be 00 for adding & 01 for removing router addresses.

Note 6: The router IPv6 addresses have their most significant 12 bytes elided. The 4-byte router addresses to be written into the ROOT device should be unique. In case of duplication of router addresses, response should be given as failure.

Example Router List write Response:

1-byte Frame Type	1-byte Sequence no	1-byte Command ID	Status

| 02 | 02 | 01 |00

Note 7:
Command ID zero for success, Failure with failed attribute and status, Fail Attribute Status one for failure.

1-byte Frame Type	1-byte Sequence no	1-byte Command ID	1-byte Fail attribute ID	1-byte Attribute Status

Example: | 02 | 02 |01|01|00|01|

Reading of list of routers added in Root device :

Before reading the router list, number of routers added in Root device should be downloaded using attribute 1B.

Packet structure of request to read number of routers added in ROOT :

The packet structure should be similar to commissioning packet read request.

Example:

|00 | 02 |02 |01| 1B|

00 : Frame type Commissioning Read/Write
02 : Sequence Number
02 : Command ID – Commissioning Read request
01 : Attribute Count
1B : Attribute ID 1 – Number of routers present in the Root device.

Depending upon the number of routers present in Root device, the request to read the router list should be formatted. The packet structure to read router list is as below.

Router List Read Request:

1-byte Frame Type	1-byte Seque nce no	1-byte Comma nd ID	1-byte Attribute count	1-byte Attribute ID	1-byte Routers count	1-byte Index

Example:
The command to download first 5 router addresses should be as below.
| 00 | 02 | 02 | 01 | 1A | 05 |00|

00 : Frame type Commissioning Read/Write
02 : Sequence Number
02 : Command ID – Commissioning Read request
01 : Attribute Count
1A : Attribute ID 1 –Router list added in the Root device.
05: Count of router addresses to be read.
00: Index- router addresses starting from 0th address

If the response to router list read command should not be sent in single packet, the router list should be downloaded in batches. DCU/DCU application should change the values for fields "count of routers" & "index" accordingly.

Example:
To download router list of 35 devices, DCU/DCU application may download the list of 20 devices first and in next batch remaining devices will be downloaded.

The commands given should be as below.

| 00 | 02 | 02 | 01 | 1A | 14 |00|

This command should return first 20 router addresses (0-19) starting from 0th address.

 | 00 | 02 | 02 | 01 | 1A | 0E |14|

This command should return remaining 15 router addresses (20-34) starting from 20th address.

Router List Read Response:

1-byte Frame Type	1-byte Sequence no	1-byte Command ID	1-byte Attribute count	1-byte Attribute ID	Read Status Attribute ID1	1-byte Routers count	4-byte Router Address 1	- - -	4-byte Router Address n

Example:
The response to command | 00 | 02 | 02 | 01 | 1A | 14 |00| should be

|02| 02| 03| 01| 1A| 00| 14| 00 01 32 01| 00 01 32 02| 00 01 32 03| 00 01 32 04| 00 01 32 05| 00 01 32 06| 00 01 32 07| 00 01 32 08| 00 01 32 09| 00 01 32 10| 00 01 32 11| 00 01 32 12| 00 01 32 13| 00 01 32 14| 00 01 32 15| 00 01 32 16| 00 01 32 17| 00 01 32 18| 00 01 32 19| 00 01 32 20|

02 : Frame type Read/Write commission response
02 : Sequence Number
03 : Command ID – Commissioning Read response
01 : Attribute Count
1A : Attribute ID 1 –Router list added in the Root device.
00 : Read status of attribute ID1. Value 0 for success, non-zero value for failure
14: count of router addresses sent
00 01 32 01: 1st router address
………………

Restart command:

1-byte Frame Type	1- byte Sequence no	2 - byte Delay restart value in seconds

Example   : |01 | 02| 00 0A |

Restart Response:

1-byte Frame Type	1- byte Sequence no	1 byte Status

Example : | 03 | 02 | 00 |

APPLICATION LAYER
Over the Air payload structure, data types information, profile ID, cluster ID, end point information should be the same as legacy ZigBee implementation.

ANNEXURE – VI

RF METERING PROTOCOL - SINGLE PHASE RF METER
Protocol Version 2.1

Scope and Purpose

This section specifies a single cluster, the Maharashtra State Electricity Distribution Company Limited (MSEDCL) cluster, which provides representation of data elements. It is in intention that multiple meter manufactures intending to provide product for Indian state of Maharashtra support the attributes listed below in its entirety.

Introduction

This document facilitates the representation and exchange of data elements and are to be supported by multiple meter manufacturers.

Attributes

For convenience, the attributes defined in this specification are arranged into sets of related attributes; each set can contain multiple attributes. Attribute identifiers are encoded such that the most significant byte specifies the attributes set and the least significant byte specifies the attribute within the set. The currently defined attribute sets are listed in the table below.

Attribute Set Identifier	Description
0x00	Meter Information
0x01	Cumulative Active Energy
0x02	Maximum Demand
0x03	Tamper Information (Set1)
0x04	Time zone wise Cumulative Active Energy
0x05	Time zone wise Maximum Demand
0x06	Load Profile
0x07	Power On/Off Events
0x08	Tamper Information (Set2)
0x09-0xff	Reserved

Meter Information Attribute Set (0x00XX)

The attributes that are used in the Meter Information attribute Set are summarized in the below table. Some of these attributes overlap with functionality provided on the Basic cluster. Information presented by these attributes should be mirrored on the Basic cluster.

Identifier	Name	Type	Range	Access	Mandatory / Optional
0x00	Serial Number	Character string	8 bytes	Read only	M
0x01	Make Code	Character string	5 bytes	Read only	M
0x02	Meter Time	UTC Time	4 bytes	Read only	M
0x03	Protocol Version	Unsigned 16 bit Integer	2 bytes	Read Only	M

0x04	Meter Phase	Unsigned 8 bit Integer	1 byte	Read Only	M
0x05	Vendor ID	Unsigned 8 bit Integer	1byte	Read only	M
0x06	Tamper Present Status	Unsigned 32 bit Integer	4 bytes	Read Only	M
0x07	Instantaneous Voltage	Unsigned 16 bit Integer	2 bytes	Read Only	M
0x08	Instantaneous Current	Unsigned 16 bit Integer	2 bytes	Read Only	M

Serial Number Attribute

This attribute is a character string representing the serial number of the meter.

Make Code Attribute

This attribute is a character string representing the make code of the meter.

Meter Time

This attribute returns the time currently seen in the meter.

Protocol Version

This attribute returns the protocol version seen in the meter. Protocol version is 2.1

Meter Phase

This attribute returns the meter type of the meter. 0x01 is for single phase and 0x03 for three phase

Vendor ID

This attribute returns the vendor ID of the RF module set in the meter.

Tamper Present Status

This attribute returns the time currently seen in the meter.

Tamper Present Status field shall have 32 bits bitmap indicating which tampers have occurred. When no tamper has occurred, the status shall be set as 0, else the specific tamper bit will be set to 1. The DCU program shall check the tamper present while downloading billing data and download related tamper information along with billing data as specified in the document.

Example : 0000 0000 0000 00000000 0000 0001 0101

Tamper Description	Bit Position	Tamper Present
Reversal of Phase and Neutral	1	Y
Load through Local Earth	2	N
Neutral Disconnect	3	Y
Magnetic Tamper	4	N
Meter Cover Open	5	Y
EMI/EMC Field Tamper	6	N
Reserved	7	N
Reserved	8	N
Reserved	-	-
Reserved	32	N

Bit No. 7 to bit no. 32 are reserved and should be always set to zero.

Instantaneous Voltage

This attribute returns instantaneous values of voltage. Voltage should be measured with no decimal values.

Instantaneous Current

This attribute returns instantaneous values of current. Current should be measured in multiple of 10mA.

Cumulative Active Energy Attribute Set (0x01XX)

This attributes that are used in the Cumulative Active Energy Attributes are summarized in the below table.

Identifier	Name	Type	Range	Access	Mandatory / Optional
0x00	Cumulative Active Energy	Unsigned 32-bit integer	0x00000000 – 0xffffffff	Read only	M
0x01 - 0x0C	Cumulative Active Energy of Previous Month 1-12	Unsigned 32-bit integer	0x00000000 – 0xffffffff	Read only	M

Cumulative Active Energy

These attributes give the current cumulative active energy value for the meter. The value is a fixed point value of 0.1 kWh encoded as an unsigned 32-bit integer. It should be divided by 10 in order to convert from the unsigned integer representation to the true decimal value in kWh.

Cumulative Active Energy of previous Months 1-12

These attributes give the historic consumption information for previous months. The value is a fixed point value of 0.1 kWh encoded as an unsigned 32-bit integer. It should be divided by 10 in order to convert from the unsigned integer representation to the true decimal value in kWh.

Maximum Demand Attribute set (0x02XX)

The attributes that are used in the Maximum Demand Attribute Set are summarized in the below table

Identifier	Name	Type	Range	Access	Mandatory / Optional
0x00	Maximum Demand of Current Month	Unsigned 16-bit integer	0x0000 – 0xffff	Read only	M
0x01	Maximum Demand of Current Month Timestamp	UTC Time	4 bytes	Read only	M
0x02	Maximum	Unsigned	0x0000 –	Read	M

	Demand of Current Month 1	16-bit integer	0xffff	only	
0x03	Maximum Demand of Current Month 1 Timestamp	UTC Time	4 bytes	Read only	M
0x04	Maximum Demand of Current Month 2	Unsigned 16-bit integer	0x0000 – 0xffff	Read only	M
0x05	Maximum Demand of Current Month 2 Timestamp	UTC Time	4 bytes	Read only	M
0x06	Maximum Demand of Current Month 3	Unsigned 16-bit integer	0x0000 – 0xffff	Read only	M
0x07	Maximum Demand of Current Month 3 Timestamp	UTC Time	4 bytes	Read only	M
0x08	Maximum Demand of Current Month 4	Unsigned 16-bit integer	0x0000 – 0xffff	Read only	M
0x09	Maximum Demand of Current Month 4 Timestamp	UTC Time	4 bytes	Read only	M
0x0a	Maximum Demand of Current Month 5	Unsigned 16-bit integer	0x0000 – 0xffff	Read only	M
0x0b	Maximum Demand of Current Month 5 Timestamp	UTC Time	4 bytes	Read only	M
0x0c	Maximum Demand of Current Month 6	Unsigned 16-bit integer	0x0000 – 0xffff	Read only	M

0x0d	Maximum Demand of Current Month 6 Timestamp	UTC Time	4 bytes	Read only	M
0x0e	Maximum Demand of Current Month 7	Unsigned 16-bit integer	0x0000 – 0xffff	Read only	M
0x0f	Maximum Demand of Current Month 7 Timestamp	UTC Time	4 bytes	Read only	M
0x10	Maximum Demand of Current Month 8	Unsigned 16-bit integer	0x0000 – 0xffff	Read only	M
0x11	Maximum Demand of Current Month 8 Timestamp	UTC Time	4 bytes	Read only	M
0x12	Maximum Demand of Current Month 9	Unsigned 16-bit integer	0x0000 – 0xffff	Read only	M
0x13	Maximum Demand of Current Month 9 Timestamp	UTC Time	4 bytes	Read only	M
0x14	Maximum Demand of Current Month 10	Unsigned 16-bit integer	0x0000 – 0xffff	Read only	M
0x15	Maximum Demand of Current Month 10 Timestamp	UTC Time	4 bytes	Read only	M
0x16	Maximum Demand of Current Month 11	Unsigned 16-bit integer	0x0000 – 0xffff	Read only	M
0x17	Maximum Demand of Current	UTC Time	4 bytes	Read only	M

	Month 11 Timestamp				
0x18	Maximum Demand of Current Month 12	Unsigned 16-bit integer	0x0000 – 0xffff	Read only	M
0x19	Maximum Demand of Current Month 12 Timestamp	UTC Time	4 bytes	Read only	M

Maximum Demand of Current Month

This attributes give the maximum demand for the current month. The value is a fixed point value of 0.1 kW encoded as an unsigned 16-bit integer. It should be divided by 10 in order to convert from the Unsigned integer representation to the true decimal value in KW. Invalid values are given as 0xffff.

Maximum Demand of current Month Timestamp

These attributes give a timestamp for when the maximum demand of the current month occurred. An invalid value is given as 0xffffffff.

Maximum Demand of Previous Months 1-12

These attributes give the historic maximum demand information for previous months. The value is a fixed value of 0.1 KW encoded as an unsigned 16-bit integer. It should be divided by 10 in order to convert from the unsigned integer representation to the true decimal value in KW. Invalid values are given as 0xffff.

Maximum Demand of previous Months Timestamp 1-12

These attributes give the timestamp for when the historic maximum demand occurred for previous months. An invalid value is given as 0xffffffff.

Tamper information Attribute Set1 (0x03XX)

The attributes that are used in the Tamper Attribute Set are summarized in the below table.

Identifier	Name	Type	Range	Access	Mandatory / Optional
0x00- 0x09 0x10- 0x19	Latest 10 Tamper Events – Reversal Phase and Neutral and Reversal of Line And Load Start (0x0X) and Stop (0x1X) times	UTC Time	4 bytes	Read only	M
0x0a – 0x0f 0x1a – 0x1f	Reserved				
0x20- 0x29	Latest 10	UTC	4 bytes	Read	M

0x30- 0x39	Tamper Events-Load Through Local Earth Start (0x2x) and Stop (0x3X) times	Time		only	
0x2a – 0x2f 0x3a – 0x3f	Reserved				
0x40 – 0x49 0x50 – 0x59	Latest 10 Tamper Events – Neutral Disconnected Start (0x04X) and Stop (0x5X) times	UTC Time	4 bytes	Read only	M
0x4a – 0x4f 0x5a – 0x5f	Reserved				
0x60-0x69 0x70-0x79	Latest 10 Tamper Events Magnetic Tamper Start (0x6X) and Stop (0x7X) times	UTC Time	4 bytes	Read only	M
0x6a-0x6f 0x7a-0x7f	Reserved				
0x80	Meter Cover Open	UTC Time	4 bytes	Read only	M

Latest 10 Tamper Event Attributes

These attributes represents tamper events on the meter. There are 10 events for each event type. Each incrementing attributes index corresponds to one event further in the past. The beginning of an event is stored on one attribute (x), the end of the event is stored in attribute (x+0x0010). An invalid event is encoded as 0xffffffff.

Meter Cover Open

This attribute shall return timestamp for the last time the meter cover was opened. An invalid event is encoded as 0xffffffff.

Tamper information Attribute Set2 (0x08XX)

The attributes that are used in the Tamper Attribute Set are summarized in the below table.

Identifier	Name	Type	Range	Access	Mandatory / Optional
0x00-0x09 0x10-0x19	Latest 10 Tamper	UTC Time	4 bytes	Read only	M

Events – ESD Tamper Start (0x0X) and Stop (0x1X) times					

This attribute represents ESD tamper events on the meter. If the meter is immune then response should be given as 0xffffffff.

Time Zone wise Active Energy Attributes Set (0x04XX)

The attributes that are used in the Time Zone wise Active Energy Attribute Set are summarized in the below table.

Identifier	Name	Type	Range	Access	Mandatory / Optional
0x00	TZ1 Active Energy	Unsigned 32- bit integer	0x00000000 -0xffffffff	Read only	M
0x01	TZ2 Active Energy	Unsigned 32- bit integer	0x00000000 -0xffffffff	Read only	M
0x02	TZ3 Active Energy	Unsigned 32- bit integer	0x00000000 -0xffffffff	Read only	M
0x03	TZ4 Active Energy	Unsigned 32- bit integer	0x00000000 -0xffffffff	Read only	M

Time zone wise Active Energy

These attributes give the time zone wise current cumulative active energy value for the meter. The value is a fixed point value of 0.1 kWh encoded as an unsigned 32-bit integer. It should be divided by 10 in order to convert from the unsigned integer representation to the true decimal value in kWh.

Time Zone wise Maximum Demand Attribute Set (0x05XX)

The attribute that are used in the Time zone wise Maximum Demand Attribute Set are summarized in the below table

Identifier	Name	Type	Range	Access	Mandatory / Optional
0x00	TZ1 Maximum Demand	Unsigned 16-bit integer	0x0000- 0xffff	Read only	M
0x01	TZ1 Maximum Demand Timestamp	UTC Time	4 bytes	Read only	M
0x02	TZ2 Maximum Demand	Unsigned 32- bit integer	0x0000- 0xffff	Read only	M
0x03	TZ2 Maximum	UTC Time	4 bytes	Read only	M

	Demand Timestamp				
0x04	TZ3 Maximum Demand	Unsigned 32- bit integer	0x0000-0xffff	Read only	M
0x05	TZ3 Maximum Demand Timestamp	UTC Time	4 bytes	Read only	M
0x06	TZ4 Maximum Demand	Unsigned 32- bit integer	0x0000-0xffff	Read only	M
0x07	TZ4 Maximum Demand Timestamp	UTC Time	4 bytes	Read only	M

Time zone wise Maximum Demand

This attributes give the time zone wise maximum demand for the current month. The value is a fixed point value of 0.1kW encoded as an unsigned 16-bit integer. It should be divided by 10 in order to convert from the unsigned integration representation to the true decimal value in kW. Invalid values are given as 0xffff.

Time zone wise Maximum Demand Timestamp

These attributes give a timestamp for when the maximum demand of the corresponding time zone occurred. An Invalid value is given as 0xffffffff.

Load Profile Attributes Set (0x06XX)

Attribute Set ID 0x06, attribute ID 0x00 will be used to retrieve load survey data. The attribute ID 0x0600 should be followed by 2 byte index (0xXXXX) which shall be used to access the intervals. The most recent interval shall be accessed by index value 0x0000 and increasing values of index shall be used to access previous intervals.

Load Profile

Identifier	Index	Name	Type	Range	Access	Mandatory / Optional
0x00	0xXXXX	Load Survey	Set	14 bytes	Read only	M

Load profile shall be maintained for the previous 45 days on a power on basis. The values shall be integrated for 30 Minutes and the following parameters stored. The thirty minute record will be maintained as a record consisting of the following fields.

Field Name	Type
Interval Start Time	UTC time
kWH	Unsigned 32 bit integer
kWMD	Unsigned 16 bit integer

Voltage	Unsigned 16 bit integer
Current	Unsigned 16 bit integer

Note :
1. kWh & kW MD values should be divided by 10 in order to convert from the unsigned integer representation to the true decimal value.
2. The voltage value will be the measured voltage with no decimal values.
3. The current will be in multiples of 10mA. For example, 1.540A will be represented as 154. 60 A will be represented as 6000.

Power On/OFF events Attribute set (0x07XX)

Identifier	Name	Type	Range	Access	Mandatory / Optional
0x00 – 0xff	Power OFF /On events - Timestamp	UTC Time	4 bytes	ReadOnly	M

Power ON/OFF events, should always be made available with the first event always being a power OFF event and subsequent event in power ON. Thus all odd events should be always Power OFF event and all even events should be always Power ON events

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Part II : Setting Critical Parameters

The purpose of this document is to specify a protocol sequence for certain operations.

These operations involve setting critical parameters in the meters.

1) Change the password in the meter
2) Reset of Maximum Demand.
3) Set the number of TOD slots and their durations.
4) Set meter time (RTC).

For the aforementioned purposes, the following parameters and protocol sequences are specified.

Protocol Sequences.
1) Change of password in the meter.
The default password in the meter shall be the meter's serial number. The following packets shall be sent from the HHT/DCU to the meter.

Packet 1:
Attribute ID: 0x0000
Attribute type: String type
Attribute length: 6 – 20 bytes
Description: Old password.
Attribute ID: 0x0001
Attribute type: string type
Attribute length: 6 – 20 bytes
Description: New password.

Packet 2:
To be issued within 120 seconds of Packet 1:
Attribute ID: 0x0002
Attribute type: string type
Attribute length: 6 – 20 bytes
Description: New Password Reconfirm.

Response :
For success- 0x00
For failure- any non-zero value.

The HHU software should have front end display capability to take the necessary inputs, give prompts to users. Automatic extensions, forms, saves etc should not be implemented in HHU.

The meter shall reset the password on successful completion of sequence. If the reconfirm packet is not received in the timeout provided, the new password will be discarded and the old one retained. If the old password does not match, the password will not be changed.

2) Protocol sequence for reset MD.

Packet 1:
Attribute ID: 0x0000
Attribute type: string type
Attribute length: 6 – 20 bytes
Description: Password.
Attribute ID: 0x0004
Attribute type: No data type

Response :
For success- 0x00
For failure- any non-zero value.

3) Protocol sequence for TOD timeslot setting
Packet 1:
Attribute ID: 0x0000
Attribute type: string type
Attribute length: 6 – 20 bytes
Description: Password.
Attribute ID: 0x0005
Attribute type: Variable length array.

Response :
For success- 0x00
For failure- any non-zero value.

Attribute Description: The 0th element will be a 16 bit element consisting of the length of the array and the following elements will be of 8 bit unsigned integer type.
The number in the 0th element lists the number of time of day (TOD) slots. The following array elements will describe the number of hours in each slot.

4) Protocol sequence for setting time in the meter.
Packet 1:
Attribute ID: 0x0000
Attribute type: string type
Attribute length: 6 – 20 bytes
Description: password.
Attribute ID: 0x0006
Attribute type: UTC Time.
Description: This command will set the RTC time in the meter.

Response :
For success- 0x00
For failure- any non-zero value.

ANNEXURE - VII

Draft Testing Template

Following parameters will be verified in the communication testing laboratory of IT Department.

Test Parameter	Test Result / Observations
Manual	
1. BCS Installation Manual	
2. BCS Operational Manual	
3. HHU Software Operational Manual	
4. HHU Software Update Manual	
5. Meter Technical Manual	
6. HHU Technical Manual	
Meter	
7. Make Code and Meter Serial Number	
8. Meter Phase (1 Ph / 3 Ph)	
9. TOD Meter (Yes / No)	
10. Meter RTC maintain time as per IST (Yes / No)	
11. PAN ID in Global Mode	
12. Link Key in Global Mode	
13. Communication Display on meter	
14. Meter status on meter display such as: Router/Edge Router	
15. Details of RF module in meter a. RF Module Vendor Name & ID b. IEEE Address of RF Module c. Chipset of RF Module	
16. Module Certification details	
17. MSEDCL RF Protocol (as given in Tender document) is implemented in Meter (Yes / No)	
Further testing will be done only if meter is as per MSEDCL RF protocol	
18. Interoperability with different HHU	

Test Parameter	Test Result / Observations
BCS	
19. Operating System Version supported	
20. BCS User Name	
21. BCS Password	
22. Database	
23. BCS Software Version and display available in BCS	
24. BCS Database is Password Protected	
25. Importing Consumer Master xls file to BCS	
26. Number of consumers data loaded in BCS	
27. Exporting Consumer Meter details from BCS to HHU	
28. HHU data downloaded in BCS	

29. Bill string file generated as per MSEDCL format
    a. Bill string for 1ph Meters
    b. Bill string for 3ph Meters (TOD format)
    c. Control Total generated	

30. PAN Management (Manual / Auto)	

31. Reports available through BCS *
    A. Commissioning Report
    B. Meter Reading downloaded Statistics
    C. RTC Corrupted Report
    D. Consumer wise Tamper Report
    E. Consumer wise Load Survey Report
    F. Consumer wise TOD Report
    G. PAN wise coordinator and router Report	

32. Facility for Backup and Restoration of Database	
33. Option for clearing the HHU data in HHU	
34. Security while data transfer between HHU and BCS	

Test Parameter	Test Result / Observations
DCU	
35. DCU Serial Number	
36. DCU Make and model	
37. DCU Processor/Microcontroller Family	
38. RF Module to DCU is Internal	
39. DCU supports dual band operations i.e. Zigbee operations 2.4 GHz and 6LoWPAN operations on 865-867MHz	
40. DCU RF Module Details a. Make & Name of RF Module b. RF Module IEEE Address	
41. MSEDCL RF Protocol (as given in latest Tender document) is implemented in DCU (Yes / No)	

Technical Specification No. CE/T-QC/MSC-II/SP/LPRF/ DATE: 20.03.2020

42. Ports available on DCU (COM / USB etc.)	
43. Communication cable for DCU and PC (COM / USB Cable)	
44. Memory Capacity of DCU (MB)	
45. Maximum time for which DCU waits to receive response from meter, before retrying the same command (In milliseconds)	
46. Type and make of batteries present in DCU	
47. Hours of operations if batteries are fully charged	
48. Battery status is indicated in the form of bar-graph in DCU display (Yes/No)	
49. Low battery indication provided (Yes/No)	
50. Automatic cut-off time if DCU is not in operation	
51. Details of Type Tests	
52. DCU Operating System	
53. DCU Firmware / Kernel Version	
54. Details of database implemented in DCU	
55. DCU Password Protected (If Yes, Mention password)	
56. DCU Software Version and display available on HHU (Yes / No)	
57. Program starts automatically after power on	
58. Maximum Number of consumers data loaded in DCU	
59. Consumer details like number, name and address available in DCU data	

60. Modes of commissioning available in DCU
    a. Auto (Yes / No)
    b. Manual (Yes / No)	

61. Commissioning attributes sent by DCU while commissioning of meters (for Zigbee)
    a. Preconfigured Link Key (Yes / No)
    b. Channel Mask (Yes / No)
    c. Startup Control (Yes / No)
    d. Extended PAN ID (Yes / No)	

62. Commissioning attributes sent by DCU while commissioning of meters (for 6LoWPAN)
    a. PAN ID (Yes / No)
    b. Channel (Yes / No)
    c. Device Type (Yes / No)
    d. IPv6 Prefix (Yes / No)
    e. AES Key (Yes / No)
    f. Commission state (Yes / No)
    g. DAG ID (Yes / No)
    h. Router List (Yes / No)	

63. Indication of DCU after successful downloading of any	

TECHNICAL SPECIFICATION OF SINGLE PHASE 5-30 AMPS WITH 6LOWPAN RF DCU

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data from meter (e.g. Sound beep or message on DCU screen)	

64. Data stored in DCU is according to DCU common file format declared by MSEDCL
   a. BILL.MRI – For Billing Data
   b. KWH.MRI- For Bill History
   c. TPR.MRI- For Tamper Data
   d. LSD.MRI – For Load Survey Data	

65. DCU is having common menu structure declared by MSEDCL (Yes/No)	

66. Statistics of commissioning / readings downloaded in DCU
   a. Total meters uploaded in DCU for reading
   b. Total meter reading downloaded in DCU (excluding the new meters)
   c. No. of New meter reading downloaded in DCU
   d. No. of Meters not downloaded in DCU	

67. Settings of Critical Parameters like
   a. Change the password in the meter (Yes / No)
   b. Reset of Maximum Demand (Yes / No)
   c. Set the number of TOD slots and their durations (Yes / No)
   d. Set meter time (RTC) (Yes / No)	

68. Interoperability with different make of meters in setting of critical parameters (Yes/No)	

69. Data download options available in DCU
   a. Billing data
   b. Billing History
   c. Tampers
   d. Load Survey
   e. TOD
   f. All Data	

70. DCU download tamper present status along with billing data	
71. DCU download tamper data according to tamper present status along with billing data (Yes/No)	
72. Time (in seconds) required to capture Billing Data without tamper present status from Meter	
73. Time (in seconds) required to capture Billing Data along with tamper present status from Meter	
74. Total time (in seconds) required to download the complete data	
75. Average time required to commission a single meter (in sec.)	
76. Interoperability with different makes of Meters	

77. If Yes, List of meter make used for interoperability.	
78. Facility to update DCU software (Yes / No)	
79. DCU software updation is password protected	
80. DCU is having in-built GSM/GPRS Modem (Yes/No)	

* High Level Device Driver & GPRS functionality will be tested after testing of above parameters.*

Overall Remark :

SCHEDULE 'A'

GUARANTEED TECHNICAL PARAMETERS

ITEM NAME	LT AC SINGLE PHASE 5 – 30 AMPS. STATIC ENERGY METER WITH 6LOWPAN BASED INTERNAL LPRF AS COMMUNICATION CAPABILITY FOR INTEROPERABILITY	
SR. NO.	GUARANTTED TECHNICAL PARAMETERS	GTP VALUES
1.0	MAKE & TYPE	TO BE FILLED BY MANUFACTURER
2.0	APPLICABLE STANDARD	IS 13779, CBIP 88
3.0	ACCURACY CLASS 1.00	1.00
4.0	METER BEARS ISI MARK	YES
5.0	RATED VOLTAGE 240 V	240 V
6.0	VOLTAGE RANGE	RANGE (-) 40% TO (+) 20% OF RATED VOLTAGE
7.0	FREQUENCY	50 HZ +/- 5%
8.0	RATED BASIC CURRENT	5 AMPS
9.0	MAXIMUM CONTINUOUS CURRENT	30 AMP
10.0	STARTING CURRENT.	0.2 % OF IB
11.0	POWER CONSUMPTION IN VOLTAGE CIRCUIT 2 W & 10 VA	SHALLNOT EXCEED 2 W & 10 VA
12.0	POWER CONSUMPTION IN CURRENT CIRCUIT 4 VA	SHALLNOT EXCEED 4 VA
13.0	POWER FACTOR	ZERO TO UNITY (ALL LAG OR LEAD)

14.0	STANDARD REFERENCE TEMPERATURE FOR PERFORMANCE	27ºC
15.0	MEAN TEMPERATURE CO-EFFICIENT DOES NOT EXCEED	0.07%
16.0	TEMPERATURE RISE IS AS PER IS: 13779 / 1999 (AMENDED UP TO DATE)	YES
17.0	OPAQUE METER BASE & TRANSPARENT TOP COVER MADE OF UNBREAKABLE, TOUGH, HIGH GRADE, FIRE RESISTANT POLYCARBONATE MATERIAL	0.07%
18.0	METER BODY TYPE TESTED FOR IP 51 DEGREE OF PROTECTION AS PER IS 12063	0.07%
19.0	FURNISH PHYSICAL WATER ABSORPTION VALUE	TO BE FILLED BY MANUFACTURER
20.0	FURNISH THERMAL HDDT VALUE	TO BE FILLED BY MANUFACTURER
21.0	FLAMMABILITY V2	YES
22.0	FURNISH FLAMMABILITY VALUE	TO BE FILLED BY MANUFACTURER
23.0	GLOW WIRE TEST AT 650° C	TO BE FILLED BY MANUFACTURER
24.0	TENSILE STRENGTH	TO BE FILLED BY MANUFACTURER
25.0	FLEXURE STRENGTH	TO BE FILLED BY MANUFACTURER
26.0	MODULUS OF ELASTICITY	TO BE FILLED BY MANUFACTURER
27.0	IZOD IMPACT STRENGTH NOTCHED AT 23° C	TO BE FILLED BY MANUFACTURER
28.0	FURNISH PHYSICAL WATER ABSORPTION VALUE	TO BE FILLED BY MANUFACTURER
29.0	MOULDED TERMINAL BLOCK CONFORMS TO IS: 13779 / 1999 (AMENDED UP TO DATE)	YES

30.0	EXTENDED TRANSPARENT TERMINAL COVER AS PER CLAUSE NUMBER 6.5.2 OF IS: 13779 / 1999 (AMENDED UP TO DATE) IS PROVIDED	YES
31.0	TRANSPARENT TERMINAL COVER IS SEALABLE INDEPENDENTLY	YES
32.0	PROPER SIZES OF GROOVES ARE PROVIDED AT BOTTOM OF TERMINAL COVER	YES
33.0	METER BASE & COVER ARE ULTRA-SONICALLY WELDED (CONTINUOUS WELDING)	YES
34.0	THICKNESS OF MATERIAL	2 MM MINIMUM
35.0	RTC PRE-PROGRAMMED FOR	30 YEARS DAY / DATE
36.0	TIME ACCURACY OF RTC AS PER CBIP TECH REPORT 88	YES
37.0	PROVISION TO PUT AT LEAST TWO SEALS BY UTILITY USER	YES
38.0	PUSH BUTTON PROVIDED FOR SCROLLING THE PARAMETERS IN ALTERNATE DISPLAY (ON DEMAND) MODE	YES
39.0	OPERATION INDICATOR PROVIDED IN THE FORM OF BLINKING LED / LCD	YES
40.0	METER CONSTANT INDELIBLY PROVIDED ON THE NAMEPLATE	YES
41.0	METER ACCURACY DOES NOT GET AFFECTED BY MAGNETIC FIELD FROM ALL SIDES OF THE METER	YES
42.0	ONE CT IN NEUTRAL CIRCUIT AND ONE MANGANIN BASED, E-BEAM WELDED SHUNT IN PHASE CIRCUIT PROVIDED	YES

43.0	METER WITHSTANDS PHASE TO PHASE VOLTAGE (440 V) IF APPLIED BETWEEN PHASE TO NEUTRAL FOR MINIMUM 5 MIN	YES
44.0	POWER SUPPLY UNIT IS TRANSFORMER LESS	YES
45.0	COMPLETE METERING SYSTEM & MEASUREMENT NOT AFFECTED BY EXTERNAL ELECTROMAGNETIC INTERFERENCE AS PER CL. NO. 6.16 OF TECH. SPECS.	YES
46.0	METER MEETS THE REQUIREMENT OF CBIP TECH. REPORT 88 (AMENDED UP TO DATE) EXCEPT 0.2 TESLA AC MAGNET TEST	YES
47.0	METER ACCURACY DOES NOT GET INFLUENCED BY INJECTION OF HIGH FREQUENCY AC VOLTAGE / CHOPPED SIGNAL / DC SIGNAL AND HARMONICS ON THE TERMINALS OF THE METER	YES
48.0	METER RECORDS AND DISPLAYS TOTAL ENERGY INCLUDING HARMONIC ENERGY.	YES
49.0	METER DISPLAYS UNSATISFACTORY FUNCTIONING OR NONFUNCTIONING OF REAL TIME CLOCK BATTERY	YES
50.0	METER PCB IS WIRELESS	YES
51.0	BATTERY BACK UP WITH MINIMUM 10 YEARS LIFE IS PROVIDED	YES
52.0	METER DISPLAYS DEFAULT PARAMETERS ONLY ONCE AFTER ACTIVATION OF BATTERY DURING POWER OFF CONDITION	YES
53.0	BATTERY GETS LOCKED AFTER 3 OPERATIONS DURING ONE POWER OFF CYCLE	YES

54.0	MAKE OF RF MODULE USED IN METER	TO BE FILLED BY MANUFACTURER
55.0	COMMUNICATION CAPABILITY OF THE METER IS AS PER 6LOW PAN LPRF TO READ METER FROM ONE HUNDRED (100) METER RADIUS WITHOUT OBSTRUCTIONS	YES
56.0	COMMUNICATION RANGE FURTHER INCREASED UPTO 5 HOPS THROUGH MESH NETWORKING	YES
57.0	35 KV SPARK DISCHARGE TEST OF IS CARRIED OUT	YES
58.0	METER MANUFACTURED USING SMT	YES
59.0	TOD TIME ZONES PROVIDED	YES
60.0	ALL ANTI-TAMPER FEATURES AS PER CLAUSE 10.00 ARE PROVIDED	YES
61.0	PERMANENT BACKLIT LCD TYPE DISPLAY IS PROVIDED	YES
62.0	MINIMUM NUMBER OF DIGITS FOR ENERGY DISPAY PROVIDED	5 DIGITS
63.0	MINIMUM SIZE OF DIGITS 9X5 MM	9X5 MM
64.0	ACTIVE CUMULATIVE ENERGY (KWH) IS DISPLAYED FOR 20 SECONDS	20 SECONDS
65.0	OTHER PARAMETERS THAN CUMULATIVE ENERGY AND ALTERNATE MODE PARAMETERS DISPLAYED FOR	MINIMUM 6 SECONDS
66.0	LCD CHECK IS PROVIDED TO DISPLAY HEALTHINESS OF ALL SEGMENTS	YES
67.0	KWMD PROVIDED	YES
68.0	MD INTEGRETION PERIOD	30 MINUTE

69.0	PROVISION TO RESET MD THROUGH HAND HELD TERMINAL (HHT)/DATA CONCENTRATOR UNIT (DCU) OR AUTO RESET AT 24:00 HRS AT THE END OF EACH BILLING CYCLE OR AT THE END OF CERTAIN PREDEFINED PERIOD (SAY, END OF THE MONTH) IS PROVIDED	YES
70.0	METER PRE-PROGRAMMED FOR (a) 240 V	YES
71.0	(b) INTEGRATION PERIOD 30 MIN OF KWMD	YES
72.0	(c) AUTO RESET KWMD AT 2400 HRS. OF LAST DAY OF EACH CALENDAR MONTH	YES
73.0	(d) NO RESET PUSH BUTTON PROVIDED	YES
74.0	(e) DEFAULT DISPLAY (AUTO SCROLLING MODE) SWITCHES TO ALTERNATE DISPLAY (ON DEMAND DISPLAY MODE) AFTER PRESSING PUSH BUTTON CONTINUOUSLY FOR 5 SECONDS	YES
75.0	(f) ALTERNATE DISPLAY SWITCHES OVER TO DEFAULT DISPLAY IF PUSH BUTTON IS NOT OPERATED FOR 15 SECONDS	YES
76.0	NON-VOLATILE MEMORY PROVIDED	YES
77.0	METERING PROTOCOL AS PER ANNEXURE V & VI.	YES
78.0	BASE COMPUTER SOFTWARE PROVIDED IS PASSWORD PROTECTED.	YES
79.0	BASE COMPUTER SOFTWARE PROVIDED IS USER FRIENDLY & WINDOWS BASED & SUPPORTS ALL VERSIONS OF "WINDOWS".	YES
80.0	BCS SUPPORTS ALL CURRENT OPERATING SYSTEM VERSIONS.	YES

81.0	IMPORT / EXPORT OF DATA THROUGH BCS CAN BE THROUGH ANY USB PORT OF PC / LAPTOP.	YES
82.0	BCS SOFTWARE HAS CAPABILITY TO CONVERT ALL THE DATA INTO ASCII FORMAT AS PER MSEDCL REQUIREMENT.	YES
83.0	BCS MAINTAINS AUDIT LOG FOR CONNECTION AND DISCONNECTION OF DCU TO BCS.	YES
84.0	BCS HAS OPTION OF DOWNLOADING AUDIT LOG.	YES
85.0	BCS MAINTAINS DOWNLOADED BILLING HISTORY.	YES
86.0	BCS STORES DATA TO DATABASE IN ENCRYPTED FORMAT.	YES
87.0	BCS GENERATES EXCEPTIONAL REPORT OF NEW METERS (METERS NOT AVAILABLE IN DCU INITIALLY) READING.	YES
88.0	API / EXE FILE WITH DOCUMENTATION FOR DOWNLOADING DATA FROM METER ALONG WITH SAMPLE METER IS SUBMITTED.	YES
89.0	CHECKSUM LOGIC IS SUBMITTED FOR DOWNLOADED DATA ALONG WITH SAMPLE METER.	YES
90.0	CHECKSUM CHECKING EXE / API IS GIVEN FOR VALIDATING DOWNLOADED METER DATA AS WELL AS GENERATED XML FILE WITH SAMPLE METER.	YES
91.0	API RESIDING ON DCU IS GIVEN FREE OF COST WITH ALL ITS DOCUMENTATION AND TRAINING.	YES
92.0	TOTAL TIME TAKEN FOR DOWNLOADING ALL DATA FOR 45 DAYS IS	10 TO 12 MINUTES

93.0	DOWNLOADING TIME OF ONLY BILLING DATA AFTER JOINING THR NETWORK	LESS THAN 10 SECS
94.0	COMMISSIONING AND DEPLOYMENT DOCUMENT OF DCU IS AS PER ANNEXURE VI.	YES
95.0	RF MODULE IS INBUILT IN DCU.	YES
96.0	MAKE OF RF MODULE USED IN DCU	TO BE FILLED BY MANUFACTURER
97.0	BY DEFAULT, AFTER STARTING DCU IS METER READING MODE.	YES
98.0	MEMORY OF DCU IS AS PER SPECIFICATIONS.	YES
99.0	DCU POSSESSES SPECIFIC SERIAL NO.	YES
100.0	DCU IS PROPERLY LABELED WITH SERIAL NUMBER / TENDER NUMBER / PROGRAM NAME / PROGRAM VERSION.	YES
101.0	DCU IS BASED ON OPEN ZIGBEE – 2007 PRO WITH SMART ENERGY PROFILE PROTOCOL AND 6LOWPAN PROTOCOL FOR INTEROPERABILITY AS PER SETTINGS GIVEN IN CLAUSE 5.23 AND ANNEXURE V & VI OF THE SPECIFICATIONS.	YES
102.0	PROVISION FOR AUTO POWER SAVE ON DCU.	YES
103.0	BIDDER AGREES TO SUPPLY DCU IN THE RATIO OF 1:1,000 INCLUDING USER MANUAL, AA SIZE BATTERIES & A SET OF DIRECT COMMUNICATION CORDS	YES

104.0	DCU CAPABLE FOR DOWNLOADING DATA OF MULTIPLE DESIGNS & MAKE OF METERS AS WELL AS FOR METERS ADDED IN NEXT 5 YEARS FOR THE COMMON COMMUNICATION PROTOCOL ATTACHED WITH THIS SPECIFICATION.	YES
105.0	METER SPECIFIC MRI PROGRAMS HAVE ABILITY TO USE DCU REAL TIME CLOCK TO TAG ALL TIME RELATED EVENTS.	YES
106.0	A REAL TIME CLOCK WITH A MINIMUM OF 15 DAYS BATTERY BACKUP WITH 30 YEAR CALENDAR IS PROVIDED IN DCU.	YES
107.0	TIME DRIFT OF THE RTC IN DCU DOES NOT EXCEED	+ / - 300 SECONDS PER YEAR.
108.0	INDICATION FOR CONFIRMATION OF SUCCESSFUL DATA TRANSFER IS PROVIDED ON METER & DCU	YES
109.0	DCU DOES NOT ACCEPT ANY EXTERNAL FILE OTHER THAN BCS.	YES
110.0	DCU HAS AUDIT TRAIL LOG OF CONNECTION & DISCONNECTION OF DCU WITH BCS.	YES
111.0	USB PORT ARE PROVIDED ON DCU	YES
112.0	TWO NOS. OF CHORDS OF MIN. 1 MTR LENGTH ARE PROVIDED WITH EACH DCU	YES
113.0	NECESSARY SOFTWARE CONFORMING TO THE ENCLOSED COMMUNICATION PROTOCOL, REQUIRED FOR DCU & BASE COMPUTER SYSTEM WITH NECESSARY SECURITY PROVISIONS IS SUPPLIED.	YES
114.0	DCU HAS OPTION TO CHECK READING STATUS (DOWNLOADED OR NOT DOWNLOADED) FOR ANY PARTICULAR METER.	YES

115.0	DCU INDICATES STATUS OF TOTAL CONSUMERS / METERS, NUMBER OF CONSUMERS / METERS READ AND BALANCE CONSUMERS / METERS.	YES
116.0	SEARCH FACILITY FOR THE BALANCE METERS PROVIDED ON DCU.	YES
117.0	DCU SUPPLIED IS CAPABLE FOR DOWNLOADING DATA OF MULTIPLE DESIGNS & MAKE OF METERS	YES
118.0	DCU HAS FACILITY FOR RE-ENTERING METER SERIAL NUMBERS DIRECTLY FROM BASE COMPUTER SYSTEM	YES
119.0	DCU IS TYPE TESTED AS PER TECHNICAL SPECIFICATION	YES
120.0	TYPE TEST REPORT NO & DATE OF DCU	TO BE FILLED BY MANUFACTURER
121.0	ZIGBEE COMPLIANCE CERTIFICATE FOR RADIO MODULES USED IN DCU IS SUBMITTED	YES
122.0	ZIGBEE COMPLIANCE CERTIFICATE NUMBER & DATE FOR RADIO MODULES IN DCU	TO BE FILLED BY MANUFACTURER
123.0	CERTIFICATE OF PICS (PROTOCOL IMPLEMENTATION & CONFORMANCE STATEMENT) IN REGARDS MANUFACTURER SPECIFIC CLUSTER FROM ZIGBEE ALLIANCE OFFICIAL TEST HOUSE IS SUBMITTED.	YES
124.0	PICS CERTIFICATE NO. & DATE IN REGARDS MANUFACTURER SPECIFIC CLUSTER FROM ZIGBEE ALLIANCE OFFICIAL TEST HOUSE.	TO BE FILLED BY MANUFACTURER
125.0	METER IS TYPE TESTED	YES
126.0	TYPE TEST REPORT NUMBER & DATE OF METER	TO BE FILLED BY MANUFACTURER

127.0	GUARANTEE 5 YEARS FROM INSTALLATION OR FIVE & HALF YEARS FROM DATE OF DESPATCH	YES
128.0	IN HOUSE TESTING FACILITIES ARE AVAILABLE FOR (g) INSULATION RESISTANCE MEASUREMENT	YES
129.0	(h) NO LOAD CONDITION	YES
130.0	(i) STARTING CURRENT TEST	YES
131.0	(j) ACCURACY TEST REQUIREMENT	YES
132.0	(k) POWER CONSUMPTION	YES
133.0	(l) TRANSPORTATION TEST	YES
134.0	(m) FULLY COMPUTERISED METER TEST BENCH SYSTEM FOR CARRYING OUT ROUTINE AND ACCEPTANCE TEST IS AVAILABLE	YES
135.0	(n) MANUFACTURER HAS CALIBRATED STANDARD METER OF 0.1 CLASS ACCURACY	YES
136.0	(o) VERIFIACTION OF DATA DOWNLOADING AS PER RF PORT	YES
137.0	(p) GLOW WIRE TESTING	YES
138.0	FURNISH PRINCIPLE OF OPERATION OF METER OUTLINING METHODS AND STAGES OF COMPUTATIONS OF VARIOUS PARAMETERS STARTING FROM INPUT VOLTAGE AND CURRENT SIGNALS INCLUDING SAMPLING RATE IF APPLICABLE	TO BE FILLED BY MANUFACTURER
139.0	MANUFACTURING ACTIVITIES ARE AS PER CLAUSE 28.00	YES
140.0	QAP SUBMITTED AS PER ANNEXURE-I	YES

141.0	AGEING TEST IS CARRIED OUT ON METER	YES
142.0	METER & DCU COMPLIES WITH ANNEXURE IV, V & VI OF TECHNICAL SPECIFICATION .	YES
143.0	PERMANENT NATURE CONNECTION DIAGRAM OF METER IS SHOWN ON INSIDE PORTION OF THE TERMINAL COVER.	YES
144.0	METER TERMINALS ARE MARKED AND THIS MARKING APPEARS IN THE ABOVE PERMANENT NATURE CONNECTION DIAGRAM.	YES
145.0	NAME PLATE & MARKING AS PER CLAUSE NO. 18.00	YES
146.0	**GTP FOR METER BOX**	
147.0	MANUFACTURER'S / SUPPLIER'S NAME AND ADDRESS WITH WORKS ADDRESS	TO BE FILLED BY MANUFACTURER
148.0	TRANSPARENT POLY-CARBONATE MATERIAL NATURAL WHITE COLOUR USED FOR BASE AND COVER OF METER BOX	YES
149.0	WALL THICKNESS OF METER BOX ON LOAD BEARING SIDE 3 MM	YES
150.0	THICKNESS OF SHEET OF COVER 2 MM	YES
151.0	LIFE EXPECTED IS 5.5 YEARS	YES
152.0	APPLICABLE IS: 14772 / 2000 (WITH LATEST AMENDMENT)	YES
153.0	FURNISH PHYSICAL WATER ABSORPTION VALUE	TO BE FILLED BY MANUFACTURER
154.0	FURNISH THERMAL HDDT VALUE	TO BE FILLED BY MANUFACTURER
155.0	FURNISH FLAMMABILITY VALUE	TO BE FILLED BY MANUFACTURER
156.0	FLAMMABILITY V2	YES

157.0	GLOW WIRE TEST AT 650° C	YES
158.0	TENSILE STRENGTH	TO BE FILLED BY MANUFACTURER
159.0	FLEXURE STRENGTH	TO BE FILLED BY MANUFACTURER
160.0	MODULUS OF ELASTICITY	TO BE FILLED BY MANUFACTURER
161.0	IZOD IMPACT STRENGTH NOTCHED AT 23° C	TO BE FILLED BY MANUFACTURER
162.0	DIMENSIONS OF BOX IN MM (LXBXH)	TO BE FILLED BY MANUFACTURER
163.0	MINIMUM CLEARANCE OF 40 MM FROM THREE SIDES OF METER	YES
164.0	MINIMUM CLEARANCE OF 25 MM FROM METER FRONT SIDE	YES
165.0	MINIMUM CLEARANCE OF 10 MM FROM BACK OF METER	YES
166.0	MINIMUM CLEARANCE OF 60 MM FROM BOTTOM OF METER	YES
167.0	WEIGHT OF COMPLETE BOX IN KGS	TO BE FILLED BY MANUFACTURER
168.0	METER BOX IS TYPE TESTED (YES/ NO)	BOOLEAN
169.0	TYPE TEST REPORT NOS.	TO BE FILLED BY MANUFACTURER
170.0	IN-HOUSE TESTING FACILITY AS PER CLAUSE NO. 6.0	YES
171.0	AS PER CLAUSE 4.6 OF ANNEXURE III, I.E. TECHNICAL SPECIFICATION FOR METER BOX, UV AGEING TEST IS CARRIED OUT	YES
172.0	WHETHER YOU AGREE TO SUPPLY METERS AS PER ANEXURE-D, I.E. TECHNICAL SPECIFICATIONS OF THE TENDER.	YES

173.0	WHETHER TYPE TEST REPORTS ALONGWITH COPY OF SAME IN TWO CDS ARE SUBMITTED	YES
174.0	WHETHER 15 NOS. OF TENDER SAMPLE METERS, TWO METER BOXES, ONE DCU, API SOFTWARE, BCS, CHECKSUM LOGIC & DOCUMENTATION ARE SUBMITTED ALONGWITH THE OFFER	YES