MATERIAL SPECIFICATIONS CELL

TECHNICAL SPECIFICATION

LT AC THREE PHASE, FOUR WIRE 10 - 40 AMPS STATIC ENERGY METER WITH 6LOWPAN LPRF 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, Three Phase, Four wire, 10 - 40 Amps Static TOD Tri – vector 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 Active Energy (kWh), Reactive Energy(kVArh Lag and kVArhLead separately)and kVA MD in three phase, four wire balanced / unbalanced loads of LT residential and commercial consumers. This specification of three 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 QUALIFYING REQUIREMENTS

2.01 Offers of only original manufacturers of LT AC Static Energy Meter shall be accepted against the Tender.

2.02 The following qualifying requirement shall be fulfilled by the bidders / manufacturers.

(a) The bidder / manufacturer shall have turnover of `80.00 Crores during any one of the last three financial years.

(b) The bidder / manufacturer shall have supplied 12.5 Lakhs static meters during the last three financial years.

(c) The bidder / manufacturer shall have minimum experience of three years of supply or manufacturing for static meter upto the end of the last financial year.

2.03 The offers of Indian subsidiary company, whose parent company is located abroad fulfilling the qualifying requirements, shall be considered provided the Indian participant subsidiary company fulfils the minimum experience of three years of supply or manufacturing for static energy meter upto the end of the last financial year. However, the conditions of

turnover of `80.00 Crores during any one of the last three financial years and supply of minimum quantity of 12.50 Lakhs static energy meter during last three financial years can be fulfilled by the parent company located in abroad on behalf of their Indian subsidiary company. The parent company shall furnish undertaking for accepting responsibility for supplying quality meter as per specifications and execution of the contract on behalf of its India based subsidiary unit who has participated in the tender in Annexure - U-I.

2.04 In case of offers of foreign bidders / manufacturers, they shall fulfill Qualifying Requirement as per Sr. No. 2.02 (a) and 2.02 (b) above.

2.05 **MINIMUM TESTING FACILITIES:**

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). In addition, this facility shall produce Test Reports for each and every meter. The list of testing equipments shall be enclosed. The manufacturer shall have the necessary minimum testing facilities for carrying out the following tests:

a) Insulation resistance measurement

b) No load condition

c) Starting current test

d) Accuracy requirement

e) Power consumption in voltage circuit

f) Repeatability of error

g) Glow Wire Testing facility.

h) Transportation test – as per specification

i) Tamper conditions - as per specification.

j) LPRF Communication Connectivity Test as per specification.

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

2.06 **METER SOFTWARE**

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

2.07 Notwithstanding anything stated herein under, the Purchaser reserves the right to assess the capacity and capability of the bidder to execute

the work, shall the circumstances warrant such assessment in the overall interest of the Purchaser.

3.00 STANDARDS TO WHICH METERS SHALL COMPLY:

IS: 13779 / 1999 amended upto date and other relevant IS specifications including CBIP Tech report 88 amended upto date,

CEA regulations and 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 upto date.

The Common Meter Reading Instrument (CMRI) shall conform to following relevant standards.

a) CBIP Tech. Report 88 (amended upto date)

b) IS: 13779 / 1999: Specification for AC Static Watt-hour meters class 1 and 2.

c) IEC 687 / 1992: Alternating Current Static Watt-hour meters for active energy Class 0.5S and 0.2S.

d) IEC 1036 / 1996: Alternating Current Static Watt-hour meters for active energy (Class 1 and 2)

e) IEC 529: Degree of protection provided by enclosures.

f) IS: 12063 / 1987: amended upto date: Classification of degrees of protection provided by enclosures of electrical equipment.

g) IS: 9000/1979: Basic environmental testing procedures for electronic and electrical items.

h) IEC 1000: Electromagnetic compatibility.

i) IEC 1000-4-2/1995: Electrostatic discharge immunity test.

j) CISPAR 22: Limits and method of measurement of radio disturbance characteristics of information technology equipment.

k) IEC 1000-4-3/1995: Radiated radio frequency electromagnetic field immunity test.

4.00 SERVICE CONDITIONS:

As per IS: 13779 / 1999 (amended upto date), the meter to perform satisfactorily under Non - Air Conditioned environment (within stipulations of IS).

Meter body shall conform to IP 51 degree of protection. For outdoor use, meter shall be installed in sealed enclosure conforming to IP 55.

The meter shall be suitably designed for satisfactory operation under the hot and hazardous tropical climate conditions and shall be dust and vermin proof. All the parts and surface, which are subject to corrosion, shall either be made of such material or shall be provided with such protective finish, which provided suitable protection to them from any injurious effect of excessive humidity.

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

Environmental Conditions

a) Maximum ambient temperature 55^0C

b) Maximum ambient temperature in shade 45^0C

c) Minimum temperature of air in shade 35^0C

d) Maximum daily average temperature 40^0C

e) Maximum yearly weighted average temperature 32^0C

f) Relative Humidity 10 to 95 %

g) Maximum Annual rainfall 1450 mm

h) Maximum wind pressure 150 kg/m^2

i) Maximum altitude above mean sea level 1000 meter

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.

5.00 GENERAL TECHNICAL REQUIREMENTS:

1	TYPE	LT AC three phase, four Wire Static TOD Tri-Vector Energy Meter with communication capability based on Internal Low Power Radio Frequency (LPRF) suitable for three phase, four wire balanced / unbalanced loads of LT

		Consumers.
2	ACCURACY CLASS	1.0 (FOR ACTIVE AND REACTIVE ENERGY)
3	CURRENT RATING	10 – 40 Amps
4	RATED BASIC CURRENT (Ib)	10 Amps per phase
5	MAXIMUM CONTINUOUS CURRENT (Imax)	4 times (400 %) of Ib. The meter shall work accurately at 150% of Imax.
6	STARTING CURRENT	0.2% of Ib.
7	SHORT TIME CURRENT	As per IS 13779 / 1999.
8	RATED VOLTAGE	3 x 240 Volts Ph-N
9	VOLTAGE RANGE	+ 20 % to – 40 % of rated voltage.
10	TEMPERATURE	The standard reference temperature for performance shall be 27^0C. The mean temperature co-efficient shall not exceed 0.07%.
11	FREQUENCY	50 Hz ± 5%
12	POWER FACTOR	Power Factor range: Zero Lag to unity to Zero Lead to unity Avg. P.F = $\frac{\text{Total(kWh)}}{\text{Total (kVAh)}}$ $kVAh = \sqrt{(Kwh)^2 + (RKVAhlag + RKVAhlead)^2}$
13	POWER CONSUMPTION	(i) The active and apparent power consumption in each voltage circuit at reference voltage, reference temperature and reference frequency shall not exceed 1.5 W and 10 VA. (ii) The apparent power taken by each current circuit, at basic current Ib, reference frequency and reference temperature shall not exceed 4 VA.

14	DESIGN	Meter shall be designed with application specific integrated circuit (ASIC) or micro controller; shall have no moving parts; electronic components shall be assembled on printed circuit board using surface mounting technology; factory calibration using high accuracy (0.1 class) software based test bench.
15	POWER SUPPLY	SMPS (Switched Mode Power Supply)
16	ISI MARK	The meter so supplied must bear ISI Mark.

6.00 CONSTRUCTIONAL REQUIREMENT / METER COVER & SEALING ARRANGEMENT

6.01 GENERAL MECHANICAL REQUIREMENT

The meter shall be designed and constructed in such a way as to avoid introducing any danger in normal use and under normal conditions, so as to ensure especially:

(a) personal safety against electric shock:

(b) personal safety against effects of excessive temperature;

(c) protection against spread of fire;

(d) protection against penetration of solid objects, dust and water in the meter.

6.02 All parts, which are subject to corrosion under normal working conditions, shall be protected effectively against corrosion by suitable method to achieve durable results. Any protective coating shall not be liable to damage by ordinary handling nor damage due to exposure to air, under normal working conditions. The electrical connections shall be such as to prevent any opening of the circuit under normal conditions of use as specified in the standard, including any overload conditions specified in the standard. The construction of the meter shall be such as to minimize the risks of short-circuiting of the insulation between live parts and accessible conducting parts due to accidental loosening or unscrewing of the wiring, screws, etc. The meter shall not produce appreciable noise in use.

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

6.04 The meter shall be projection type and shall be 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. Meter base shall be opaque and meter top cover shall be transparent. The meter cover shall be secured to base by means of sealable unidirectional captive screws. The meter body shall be type tested for IP51 degree of protection as per IS 12063 against ingress of dust, moisture & vermin but without suction in the meter.

6.05 **METER CASE**

6.05.01 The poly carbonate body of the meter shall conform to IS: 11731 (FV-2 category) besides meeting the test requirement of heat deflection test as per ISO 75, glow wire test as per the IS: 11000 (Part 2/Sec-1) 1984 or IEC-60695-2-12, Ball pressure test as per IEC-60695-10-2 and Flammability Test as per UL 94 or as per IS 11731(Part-2) 1986.

6.05.02 The base and cover shall be ultra-sonically welded (continuous welding) so that once the meters are manufactured and tested at factory; it shall not be possible to open the cover at site except the terminal cover. The thickness of material for meter cover and base shall be 2 mm (minimum).

6.06 **TERMINALS & TERMINAL BLOCK**

6.06.01 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 with an extended transparent terminal cover as per clause number 6.5.2 of IS: 13779 / 1999 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.

6.06.02 The terminal cover shall be extended transparent type and shall enclose the actual terminals, the conductor fixing screws and unless otherwise specified, a suitable length of external conductors and their insulation.

6.06.03 The fixing screws used on the terminal cover for fixing and sealing in terminal cover shall be held captive in the terminal cover.

6.06.04 When the meter is mounted, no access to the terminals shall be possible without breaking seals(s) of the terminal cover.

6.07 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.

6.08 The meter shall be completely factory sealed except the terminal block cover. The provision shall be made on the meter for at least two

seals to be put by utility user. The Terminal cover shall be transparent with one side hinge with sealing arrangement

6.09 **RESISTANCE TO HEAT AND FIRE**

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.

6.10 **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. The pulse rate of output device (separate blinking LED must be provided for each parameter) which is Pulse / kWh andPulse / kVArh(meter constant) shall be indelibly provided on the nameplate. It shall be possible to check the accuracy of active energy and reactive 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.

6.11 The meter accuracy shall not be affected by magnetic field (AC / DC / Permanent) upto 0.2 Tesla on all the sides of meter, i.e. front, sides, top and bottom of the meter as per CBIP Technical Report 88 with latest amendments. Under influence of any magnetic field (AC / DC / Permanent) above 0.2 Tesla, if the accuracy of the meter gets affected, then the meter shall record energy considering Imax and reference voltage at unity power factor.

6.12 The meter shall have CTs with magnetic shielding and same shall be tested separately prior to assembly.

6.13 In meter, Power supply unit shall be micro control type (transformer less to avoid magnetic influence) instead of providing conventional transformer and then conversion to avoid magnetic influence.

6.14 **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 non - rechargeable and shall be pre-programmed for 30 Years Day / date without any necessity for correction. The maximum drift shall not exceed +/- 300 Seconds per year. Facility for adjustment of real time shall be provided through CMRI with proper security.

The clock day / date setting and synchronization shall only be possible through password / Key code command from CMRI or Meter testing

work bench and this shall need password enabling for meter.

The RTC battery & the battery for display in case of power failure shall be separate.

6.15 Non-specified display parameters in the meter shall be blocked and same shall not be accessible for reprogramming at site through any kind of communication

6.16 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 requirements of CBIP Tech-report 88 (amended up to date).

6.17 A push button shall be provided for high resolution reading with two decimal digits / alternate mode of display as brought out elsewhere in this specification.

6.18 **SELF DIAGNOSTIC FEATURES**:

(a) The meter shall keep log in its memory for unsatisfactory / non - functioning of Real Time Clock battery.

(b) LCD Test display shall be provided for checking of all display Segments.

6.19 The meter shall have facility to read the default display parameters during power supply failure. An internal maintenance free battery (Ni-mh or Li-ion or NI CD) of long life of 10 years shall be provided for the same. A suitable Push Button arrangement for activation of battery shall be provided. 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 parameters only once, after which the battery shall switch OFF automatically. The battery shall be locked after 3 successive operations during one power OFF cycle. As soon as the supply is resumed to meter, the battery shall automatically come to normal.

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

6.21 The meter shall also be capable to withstand and shall not get damaged if phase to phase voltage is applied between phases to neutral for 5 minutes.

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

6.23 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-V for data downloading through optical port.

6.23.01 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 IV & V 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 = '0000000000MSEDCL'(ASCII) (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 (0-8)
   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. 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. Tamper proof arrangement shall be made to get such a reading even at the time of power failure. Meter shall support communication through Optical port in the event of Power failure, through battery.

6.24 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.

6.25 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. 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.

6.26 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.

6.27 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.

6.28 Wire / cable less design: The meter PCB shall be wireless to avoid improper soldering & loose connection / contact.

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

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.”

7.00 TOD TIMINGS

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”: - 00:00 Hrs. to 06:00 Hrs. and 22:00 Hrs. to 24:00 Hrs.

Zone "B": - 06:00 Hrs. to 09:00 Hrs. and 12:00 Hrs. to 18:00 Hrs.

Zone "C": - 09:00 Hrs. to 12:00 Hrs.

Zone "D": - 18:00 Hrs. to 22:00 Hrs.

8.00 DEMAND PERIOD

The maximum demand integration period shall be set at 30 minutes sliding window method (Sub Integration period of 10 minutes) and can be set at 15 minutes programmable (Sub Integration period of 5 minutes), if required in future.

9.00 MD RESET:

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

a) Communication driven reset through Data Concentrator Unit (DCU).

b) Auto reset at 24:00 hrs at the end of each billing cycle: Automatic reset at the end of certain predefined period (say, end of the month). No push button shall be provided for MD reset.

10.00 ANTI TAMPER FEATURES

The meter shall detect and correctly register energy in forward direction under following tamper conditions.

10.01 Change of phase sequence:

The meter accuracy shall not be affected by change of phase sequence. It shall maintain the desired accuracy in case of reversal of phase sequence.

10.02 Reversal of line and load terminals:

Even on interchanging the load and line wires, the meter shall register correct energy passing through the meter.

10.03 Drawing of current through local Earth:

The meter shall register accurate energy even if load is drawn partially or fully through a local earth.

10.04 The three phase meter shall continue to work even without neutral.

10.05 The three phase meter shall work in absence of any two phases i.e. it shall work on any one phase wire and neutral, to record relevant energy.

10.06 The meter shall work without earth.

10.07 The potential link shall not be provided.

10.08 Visual indication shall be provided to safeguard against wrong connections to the meter terminals.

10.09 The meter accuracy shall not be affected by external AC / DC / permanent magnetic field upto 0.2 Tesla as per CBIP Technical Report 88 with latest amendments. If the meter gets affected under influence of any magnetic field (AC / DC / Permanent) above 0.2 Tesla, then the same shall be recorded as magnetic tamper event with date & time stamping and the meter shall record energy considering Imax and reference voltage at unity power factor.

11.00 TAMPER EVENTS:

The meter shall work satisfactorily under presence of various influencing conditions like External Magnetic Field, Electromagnetic Field, Radio Frequency Interference, harmonic Distortion, Voltage / Frequency Fluctuations and electromagnetic High Frequency Fields etc.

The detection of the tamper event shall be registered in the tamper event register. The no. of times the tampering has been done shall also be registered in the meter. It is the responsibility of the meter manufacturer not to use manufacturer specific codes where standard codes are available.

The meter shall have features to detect the occurrence and restoration of the following abnormal events.

11.01 **Missing potential and potential imbalance:**

The meter shall be capable of detecting and recording occurrence and restoration with date and time the cases of potential failure and low potential, which could happen due to disconnection of potential leads (one or two) with phase identification. Meter shall also detect and log cases of voltage unbalance (10% or more for 5 Minutes.) Higher of the 3 phase voltages shall be considered as reference for this purpose.

11.02 **Current unbalance**:

The meter shall be capable of detecting and recording occurrence and restoration with date and time of current unbalance (30% or more for 15 minutes) with phase identification. Higher of the 3 phase currents shall be considered as reference for this purpose.

11.03 **Current Reversal**:

The meter shall be capable of detecting and recording occurrence and restoration with date and time of reversal of current with phase identification for persistence time of 5 minutes. It shall also possess a current reversal counter.

11.04 **Current circuit short**:

The meter shall be capable of detecting and recording occurrences and

restoration of shorting of any one or two phases of current, with date & time of occurrence and restoration with phase identification.

11.05 **High Neutral Current. (CT bypass):**

The meter shall be capable of recording incidences of excess neutral current (if it is in excess 30% of Ib for more than 5 minutes.) The meter shall record the total duration of the above abnormalities, time and date of their occurrences and restorations with snapshot of instantaneous electrical conditions viz. System Voltages, Phase Currents & System PF.

11.06 **Power ON / OFF:**

The meter shall be capable to record power ON/OFF events in the meter memory. All potential failure shall record as power off event. The meter shall keep records for the minimum 256 events in the meter memory for retrieval by authorized personnel. (Occurrence + Restoration with date & time).

For above abnormal conditions, the recording of events shall be on FIFO basis. The unrestored events shall be recorded separately and shall not be deleted till they get recovered (permissible upto 3 months). It shall be possible to retrieve the abnormal event data through the meter RF port with the help of DCU& downloaded the same to the base computer. All the information shall be made available in simple & easy to understand format**.**

11.07 In the event the meter is forcibly opened, even by 2 to 4 mm variation of the meter cover, same should be recorded as tamper event with date & time stamping and the meter should continuously display that the cover has been tampered. It is suggested that the manufacturer should develop their software such that there will be some time delay for activation of this tamper feature and during that period only the meter cover should be fitted. The delay in activation of software shall be for one instance only. After the meter cover is fitted, it shall get activated immediately with out any delay.

12.00 DISPLAY OF MEASURED VALUES

12.01 The meter shall have minimum 5 digits (with ± indication), parameter identifier, permanently backlit Liquid Crystal Display (LCD) with wide viewing angle and shall be 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. The size of digit shall be minimum 10x5 mm. The decimal units shall not be displayed in auto scroll mode. However it shall be displayed in push button mode for high resolution display for testing. LCD shall be suitable for temperature withstand of 70^0 C. Adequate back up arrangement for storing of energy registered at

the time of power interruption shall be provided.

In case of multiple values presented by single display, it shall be possible to display the contents of all relevant memories. When displaying the memory, the identification of each parameter applied shall be possible. The principle unit for measured values shall be the kilowatt-hour (kWh) for active energy, kVArh for reactive energy &kVAh for apparent energy.

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

(a) P. T. Ratio: 415 V

(b) MD Integration Period: 30 Minutes real time based.

(c) The meter shall Auto reset kVAMD at 24.00 Hrs. of last day of the month and this value shall be stored in the memory along with the cumulative kWh and cumulative kVAh reading.

(d) No MD reset push button shall be provided.

(e) Average power factor with 2 decimal digits shall be displayed.

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

(g) The meter display shall return to Default Display Mode if the "On Demand" Push Button is not operated for 15 sec.

(h) The array of data to be retained inside the meter memory shall be for the last 60 days for a capture period of 30 minutes. The load survey data shall be first in first out basis (FIFO).

(i) The sequence of display of various instantaneous electrical parameters in auto scroll & On Demand mode shall be as below. Display other than specified below shall be blocked. The scroll period for auto scroll, if any, shall be 9 sec.

(A)	**Default Display**
1.	LCD Test
2.	Meter Sr. No.
3.	Real Time Clock – Date & Time
4.	Cumulative Energy – kWh
5.	Cumulative Energy – kWh - TOD Zone A (TZ1)

6.	Cumulative Energy – kWh - TOD Zone B (TZ2)
7.	Cumulative Energy – kWh - TOD Zone C (TZ3)
8.	Cumulative Energy – kWh - TOD Zone D (TZ4)
9.	Cumulative Energy – kVArh - Lag
10.	Cumulative Energy – kVArh - Lag- TOD Zone A (TZ1)
11.	Cumulative Energy – kVArh - Lag- TOD Zone B (TZ2)
12.	Cumulative Energy – kVArh - Lag- TOD Zone C (TZ3)
13.	Cumulative Energy – kVArh - Lag- TOD Zone D (TZ4)
14.	Cumulative Energy –kVArh - Lead
15.	Cumulative Energy – kVArh - Lead- TOD Zone A (TZ1)
16.	Cumulative Energy – kVArh - Lead- TOD Zone B (TZ2)
17.	Cumulative Energy – kVArh - Lead- TOD Zone C (TZ3)
18.	Cumulative Energy – kVArh - Lead- TOD Zone D (TZ4)
19.	Cumulative Energy – kVAh
20.	Cumulative Energy – kVAh - TOD Zone A (TZ1)
21.	Cumulative Energy – kVAh - TOD Zone B (TZ2)
22.	Cumulative Energy – kVAh - TOD Zone C (TZ3)
23.	Cumulative Energy – kVAh – TOD Zone D (TZ4)
24.	Current MD – kVA with occurance date & time
25.	MD - kVA – TOD Zone A (TZ1) with occurance date & time
26.	MD - kVA – TOD Zone B (TZ2) with occurance date & time
27.	MD - kVA – TOD Zone C (TZ3) with occurance date & time
28.	MD - kVA – TOD Zone D (TZ4) with occurance date & time
29.	Number of MD – kVA reset

30.	Rising MD with elapsed time
31.	Three Phase Power Factor – PF
32.	Cumulative Tamper Count
33.	Meter Cover Opening –Occurance with date and time.
(B)	**On – Demand Display (Alternate Display)**
1.	Meter Sr. No.
2.	Last date & time of MD - kVA reset
3.	Current – I_R
4.	Current – I_Y
5.	Current – I_B
6.	Voltage – V_R
7.	Voltage – V_Y
8.	Voltage – V_B
9.	Signed Power Factor – R Phase
10.	Signed Power Factor – Y Phase
11.	Signed Power Factor – B Phase
12.	Frequency
13.	High resolution kWh (for calibration)
14.	High resolution kVArh Lag(for calibration)
15.	High resolution kVArh Lead(for calibration)
16.	High resolution kVAh (for calibration)
17.	Rising MD with elapsed time (for calibration/testing)
18.	M1 MD - kVA – TOD Zone A (TZ1) with occurance date & time
19.	M1 MD - kVA –TOD Zone B (TZ2) with occurance date & time

20.	M1 MD - kVA – TOD Zone C (TZ3) with occurance date & time
21.	M1 MD - kVA – TOD Zone D (TZ4) with occurance date & time
22.	M2 MD - kVA – TOD Zone A (TZ1) with occurance date & time
23.	M2 MD - kVA –TOD Zone B (TZ2) with occurance date & time
24.	M2 MD - kVA – TOD Zone C (TZ3) with occurance date & time
25.	M2 MD - kVA – TOD Zone D (TZ4) with occurance date & time
26.	Last Tamper Event with date and time.
27.	PAN ID of meter
28.	Voltage – V_R (Instantaneous)
29.	Voltage – V_Y (Instantaneous)
30.	Voltage – V_B (Instantaneous)
31.	Current – I_R (Instantaneous)
32.	Current – I_Y (Instantaneous)
33.	Current – I_B (Instantaneous)
34.	Active Power- kW-R phase (Instantaneous)
35.	Active Power- kW-Y phase (Instantaneous)
36.	Active Power- kW-B phase (Instantaneous)
37.	Reactive Power- kVAr- R phase (Instantaneous)
38.	Reactive Power- kVAr- Y phase (Instantaneous)
39.	Reactive Power- kVAr- B phase (Instantaneous)
40.	Apparent Power- kVA- R phase (Instantaneous)
41.	Apparent Power- kVA- Y phase (Instantaneous)
42.	Apparent Power- kVA- B phase (Instantaneous)
43.	Frequency (Instantaneous)

44.	Phase Sequence (Instantaneous)

13.00 DEMONSTRATION

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

14.00 BILLING DATA, BILLING HISTORY & LOAD SURVEY

14.01 BILLING DATA

Billing parameters shall be downloaded as per table below.

(1)	Cumulative Energy –kWh
(2)	Cumulative Energy –kWh-TOD Zone A (TZ1)
(3)	Cumulative Energy –kWh-TOD Zone B (TZ2)
(4)	Cumulative Energy –kWh-TOD Zone C (TZ3)
(5)	Cumulative Energy –kWh-TOD Zone D (TZ4)
(6)	Maximum Demand- MD kVA with occurrence date & time
(7)	MD kVA- TOD Zone A (TZ1) with occurrence date & time
(8)	MD kVA- TOD Zone B (TZ2) with occurrence date & time
(9)	MD kVA- TOD Zone C (TZ3) with occurrence date & time
(10)	MD kVA- TOD Zone D (TZ4) with occurrence date & time
(11)	Cumulative Energy –kVAh
(12)	Cumulative Energy –kVAh-TOD Zone A (TZ1)
(13)	Cumulative Energy –kVAh-TOD Zone B (TZ2)
(14)	Cumulative Energy –kVAh-TOD Zone C (TZ3)
(15)	Cumulative Energy –kVAh-TOD Zone D (TZ4)
(16)	Cumulative Energy –kVArh (Lag)
(17)	Cumulative Energy –kVArh (Lead)
(18)	Voltage – V_{RN}

(19)	Voltage – V_{YN}
(20)	Voltage – V_{BN}
(21)	Current - I_R
(22)	Current – I_Y
(23)	Current – I_B

14.02 **BILLING HISTORY**

The meter shall have sufficient non-volatile memory for recording history of billing parameters (Cumulative kWh Total, Cumulative kVAh Total, Cumulative kVArh (Lag), Cumulative kVArh (Lead) at the time of reset and kVAMD) for last 12 months.

14.03 **LOAD SURVEY**

The logging interval for load survey shall be 30 minutes. Load survey data shall be logged for last 60 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.

Sr. No.	**Parameters**
1.	Real Time Clock – Date & Time
2.	Current - I_R
3.	Current – I_Y
4.	Current – I_B
5.	Voltage – V_{RN}
6.	Voltage – V_{YN}
7.	Voltage – V_{BN}
8.	Block Energy – kWh
9.	Block Energy – kVArh – lag

10.	Block Energy – kVArh – lead
11.	Block Energy – kVAh

15.00 Data Concentrator Unit (DCU)

FUNCTIONAL REQUIREMENTS OF DCU

15.01 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.

15.02 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.

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

15.04 DCU shall be capable to prioritize control commands.

15.05 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.

15.06 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.

15.07 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.

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

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

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

15.11 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.

15.12 **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.

15.13 **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.

15.14 **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.

15.15 DCU shall ensure a secure communication to HES.

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

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

15.18 **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.

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

15.20 **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

15.21 **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

15.22 **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

15.23 **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

15.24 **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

15.25 **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

15.26 **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.

15.27 **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

15.28 **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

15.29 **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

15.30 **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

15.31 **Warranty**

DCU should have minimum 5 years warranty from date of supply

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

15.32 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.

15.33 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.

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

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

15.36 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.

15.37 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.

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

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

15.40 **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.

15.41 **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.

15.42 **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.

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

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

15.45 **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:

15.46 **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.

15.47 **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.

15.48 **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.

15.49 **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.

15.50 **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.

15.51 **Operational indicators :**

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

15.52 **Warranty:**

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

16.00 COMMUNICATION PROTOCOL

As per Annexure –IV & V.

17.00 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. The diagram & terminal marking on sticker will not be allowed.

18.00 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. Meter Serial Number shall be Bar Coded along with numeric number. The size of bar coded number shall not be less than 35x7 mm. The manufacturer's meter constant shall be marked on the name plate. Meter serial number & bar code on sticker will not be allowed. In addition to the requirement as per IS, following shall be marked on the name plate.

a) Purchase order No & date

b) Month and Year of manufacture

c) Name of purchaser, i.e. MSEDCL

d) Guarantee Five Years

e) ISI mark

f) Communication capability: 6LoWPAN LPRF. The character height of the same shall be minimum 3 mm in capital letters.

g) 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."

19.00 TESTS:

19.01 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 as 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).

19.02 The meter 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 will be sealed randomly in the factory and will be tested for tamper events).

19.03 **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 meter 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. This test shall be conducted on ready to install meter i.e. meter cover ultrasonically welded & sealed. After recording these errors, the meter 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 loads below Ib.

(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.

ii. Meter shall be tested for tamper conditions as stated in this specification.

iii. Glow wire testing for poly-carbonate body.

iv. Power consumption tests shall be carried out.

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.shall be allowed. If meter protocol is as per Clause No. 17 then further testing will be carried out. Draft testing parameters are given in Annexure-X.Being the first tender for 3 phase 6LowPAN RF Meter, firmware and software up gradation of sample meters without opening meter cover, is allowed during evaluation, if required.

vi. The meter shall comply all the tests for external AC / DC magnetic field as per CBIP Tech Report 88 with latest amendments. Moreover, the magnetic influence test for permanent magnet of 0.5 T for minimum period of 15 minutes shall be carried out by putting the magnet on the meter body. If, during the test, 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 Imax and reference voltage at unity power factor in all the three phases. 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 withstand impulse voltage at 10 kV.

viii. 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 as indicated above.

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

The test 20.03 (b) (i) to (v) shall be carried out at factory for each inspected lot at the time of pre dispatch inspection.

The tests 20.03 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 (with latest amendments) in NABL LAB. The test report shall be got approved from Chief Engineer, MSEDCL, Testing & Quality Control, (MSC) 1st Floor, Prakashgad, Bandra (East), Mumbai – 400 051 before

commencement of supply

Jammer test for sample meters shall be carried out at MSEDCL's Testing Division

(c) **Limits of error:**

(i) 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	Value of current (Balanced, unless otherwise stated	Power factor	Limits of variation in % error for class 1 meter
(a)	Voltage variation between – 15% to +10%	Ib	1 0.5 lag	0.7 1.0
(b)	Voltage variation between – 40%, + 20% and + 10%	Ib	1 0.5 lag	1.1 1.5

(ii) The meter 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.

(iii) For other influence quantities like frequency variation, voltage unbalance etc. the limits of variation in percentage error will be as per IS: 13779 / 1999. (Amended up to date).

20.00 GUARANTEED TECHNICAL PARTICULARS:

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

21.00 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 MSEDCL's representative / Engineer attending the above testing will carry out testing on suitable number of meter 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. The meter shall be sealed after inspection at works.

The first lot of meter may be jointly inspected by the Executive Engineer, Testing Division and the Executive Engineer, (Inspection Wing).

22.00 JOINT INSPECTION AFTER RECEIPT AT STORES (Random Sample Testing):

For carrying out Random Sample Testing (RST), the sample meters & CMRI shall be drawn from any one of the stores against inspected lot and same shall be tested at any of the Testing and Quality Assurance Units at Aurangabad, Bhandup, Kolhapur, Nagpur, Nashik and Pune.

Sample meters shall be drawn as per Annex H (Recommended Sampling Plan) 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.

23.00 GUARANTEE:

The meter and CMRI 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. The equipments found defective within above guarantee period shall he replaced / repaired by the supplier free of cost, within one month of receipt of intimation. If defective equipments are not replaced / repaired within the specified period as above, the MSEDCL shall recover an equivalent amount plus 15% supervision charges from any of the bills of the supplier.

24.00 PACKING:

24.01 The meters & CMRIs shall be suitably packed in order to avoid damage or disturbance during transit or handling. Each meter & CMRI 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, if considered necessary. 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.

24.02 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 Materials indicating contents of each package & spare material

25.00 TENDER SAMPLE

Tenderer are required to submit 15 (Fifteen) nos. of sample meters and 1 (one) DCU & repeater/gateway along with the data collection software & documentation of offered type as per technical specifications 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, etc. by our IT Department as per technical specifications.

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 / protocol. The results of NABL Lab and the certification from IT Department for offered API / protocol 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.

26.00 QUALITY CONTROL

The purchaser has a right to send a team of experienced engineers for assessing the capability of the firm for manufacturing and testing of

meter as per this specification.

The team shall be given all assistance and cooperation for inspection and testing at the bidder's work.

27.00 MANUFACTURING ACTIVITIES

27.01 Meters shall be manufactured using latest and 'state of the art' technology and methods prevalent in electronics industry. The meter shall be made from high accuracy and reliable surface mount technology (SMT) components. All inward flow of major components and sub assembly parts (CT, PT, RTCs/Crystal, LCDs, LEDs, power circuit electronic components etc.) shall have batch and source identification. Multilayer 'PCB' assembly with 'PTH' (Plated through Hole) using surface mounted component shall have adequate track clearance for power circuits. SMT component shall be assembled using automatic 'pick-and-place' machines, Reflow Soldering oven, for stabilized setting of the components on 'PCB'. For soldered PCBs, cleaning and washing of cards, after wave soldering process is to be carried out as a standard practice. Assembly line of the manufacturing system shall have provision for testing of sub-assembled cards. Manual placing of components and soldering, to be minimized to items, which cannot be handled by automatic machine. Handling of 'PCB' with ICs/C-MOS components, to be restricted to bare minimum and precautions to prevent 'ESD' failure to be provided. Complete assembled and soldered PCB should undergo functional testing using computerized Automatic Test Equipment.

Test points should be provided to check the performance of each block / stage of the meter circuitry. RTC shall be synchronized with NPL time at the time of manufacture. Meters testing at intermediate and final stage shall be carried out with testing instruments, duly calibrated with reference standard, with traceability of source and date.

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

27.03 Meter shall be manufactured using SMT (Surface Mount Technology) components and by deploying automatic SMT pick and place machine and reflow solder process.

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.

27.04 The calibration of meter shall be done in-house.

27.05 Quality shall be ensured at the following stages.

27.05.01 At PCB manufacturing stage, each Board shall be subjected to

computerized bare board testing.

27.05.02 At insertion stage, all components shall under go computerized testing for conforming to design parameter and orientation.

27.05.03 Complete assembled and soldered PCB shall under go functional testing using Automatic Test Equipments (ATEs).

27.05.04 Prior to final testing and calibration, all meter shall be subjected to ageing test (i.e. Meter will be kept in ovens for 72 hours at 55 deg C temperature & at full load current. After 72 hours meter shall work satisfactory) to eliminate infant mortality.

27.06 The bidders shall submit the list of all imported and indigenous components separately used in meter along with the offer.

27.07 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.

27.08 List of Plant and Machinery used for production of energy meter:

SN	List of Plant and Machinery used for Energy meter Production	
1	Fully automatic testing Bench with ICT for testing link less meter	Routine Testing and Calibration of Meter
2	Semi automatic testing Bench with MSVT	Routine Testing and Calibration of Meter
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 Meter Class 0.1 accuracy	Error calculation
8	Ultrasonic welding Machines	Welding of meter
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	CNC Milling Machine for composite tool fabrication	Tool fabrication and Die manufacturing
26	Injection Moulding Machine	Moulding of plastic parts
27	Vibration testing Machine	Vibration testing of Meter
28	Glow Wire Test machine	Testing of Plastic Material

29	Fast transient burst testing setup	Type testing of Meter
30	Short term over Current testing setup	Type testing of Meter
31	Magnetic and other tamper testing setups	Tamper Testing
32	Impulse Voltage Testing Setup	Type testing of Meter
33	Composite Environmental testing chambers	Type testing of Meter

28.00 QUALITY ASSURANCE PLAN:

28.01 The tenderer shall invariably furnish QAP as specified in Annexure - I along with his offer the QAP adopted by him in the process of manufacturing.

28.02 Precautions taken for ensuring uses of quality raw material and subcomponents shall be stated in QAP.

29.00 COMPONENT SPECIFICATION:

As per Annexure - II enclosed.

30.00 SCHEDULES:

The tenderer shall fill in the following schedules, which are part and partial of the tender specification and offer. If the schedules are not submitted duly filled in with the offer, the offer shall be liable for rejection.

Schedule 'A' .... Guaranteed technical particulars. (As per GTP uploaded on e - tendering site)

The discrepancies if any between the specification and the catalogs and / or literatures submitted as part of the offer by the bidders, the same shall not be considered and representations in this regard shall not be entertained.

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 test 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 equipment available with the bidder for final testing of equipment specified and test plan limitation. If any, vis-a-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 required to authorise 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 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 by contractor for internal auditing.

A list of administration and work procedures required to achieve and verify contract's quality requirements 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

SN	Component Function	Requirement	Makes & Origin
1.	Current Transformers	The Meters shall be with the current transformers as measuring elements. The current transformer shall withstand for the clauses under 5 & 9 of IS: 13779 / 1999	
2.	Measurement or computing chips	The measurement or computing chips used in the Meter shall be with the Surface mount type along with the ASICs.	USA: Teridian, Analog Devices, Cyrus Logic, Atmel, Philips, Dallas, ST, Motorola, Texas Instruments, Maxim, Freescale, National Semiconductor, Onsemiconductors. Germany: Siemens. South Africa: SAMES. Japan: NEC, Toshiba, Renasas, Hitachi. Austria: AMS. Holland: Philips (N X P) Taiwan: Prolific
3.	Memory chips	Memory chips shall not be affected by external parameters like sparking, high voltage spikes or electrostatic discharges. Meter shall have nonvolatile 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: Teridian, Atmel, Philips, ST, National Semiconductors, Texas Instruments, Microchip, Spason (Fujitsu), Ramtron. Japan: Hitachi, Renasas. Germany: Siemens

4.	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 a 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 disturb with the life of display (PIN Type). d) It shall be Tran-reflective HTN or STN type industrial grade with extended temperature range.	Singapore: Bonafied Technologies, Displaytech, E-smart Korea: Advantek, Jebon, Union Display Inc. Hong Kong: Genda China: Success, Truly,Tianma Japan: Hitachi, Sony, L & G. Malaysia: Crystal Clear Technology.
5.	Communication Modules	Communication modules shall be compatible for the two ports (one for optical port for communication with meter reading instruments & the other for the hardwired RS-232 port to communicate with various modems for AMR)	USA: Agilent, HP, Fairchild, National Semiconductors, Optonica. Holland: Philips. Korea: Phillips. Japan: Hitachi. Taiwan: Ligitek
6.	Optical port	Optical port shall be used to transfer the meter data to meter reading instrument. The mechanical construction of the port shall be such to facilitate the data transfer easily.	USA: HP, National Semiconductors, Maxim. Holland: Philips. Korea: Phillips. Japan: Hitachi Taiwan: Ligitek, Everlight Germany: Osram
7.	Power supply	The power supply shall be with the Capabilities as per the relevant standards. The power supply unit of the meter shall not be affected in	SMPS Type

		case the maximum voltage of the system appears to the terminals due to faults or due to wrong connections. It shall not also be affected by magnet	
8.	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: Atmel, National Semiconductors, BC Component, Philips, Texas Instruments, Analog Devices. ST, Onsemiconductors, Maxim, Muruta, Kemet, Freescale, AVX, Intersil, Raltron, Fox, Fairchild, Agilent, Abracon, Diode Inc., Honeywell, Sipex Power Integration, R-ohm. Japan: Hitachi, Oki, AVZ, Ricon, Toshiba, Epson, Kemet, Alps, Muruta, TDK, Sanyo, Samsung. India: RMC, VEPL, KELTRON, Incap, PEC, Cermet, Gujarat Polyavx, Prismatic, MFR Electronic Components Pvt. Ltd., CTR. Korea: Samsung Japan: Panasonic Germany: Kemet, Vishay, Epcos, Diotech, Infineon. Taiwan: Yageo
9.	Mechanical parts	a) The internal electrical components shall be of electrolytic copper & shall be protected from corrosion, rust	

		etc. b) The other mechanical components shall be protected from rust, corrosion etc. by suitable plating / painting methods.	
10.	Battery	Maintenance free battery (Ni-mh or Li-ion) of long life of 10 years. 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: Varta, Tedirun, Sanyo or National, Maxell, Renata. Japan: Panasonic, Sony, Mitsubishi. France: Saft. Korea: Tekcell. Germany: Varta.
11.	RTC & Micro controller.	The accuracy of RTC shall be as per relevant IEC / IS standards.	USA: ST, Teridian, Philips, Dallas, Atmel, Motorola, Microchip. Japan: NEC, Oki, Epson.
12.	P.C.B.	Glass Epoxy, fire resistance grade FR4, with minimum thickness 1.6 mm.	

ANNEXURE - III

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
023	LINKWELL TELESYSTEMS, HYDERABAD
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

ANNEXURE IV

MSEDCL 6LOWPAN PROTOCOL

Introduction

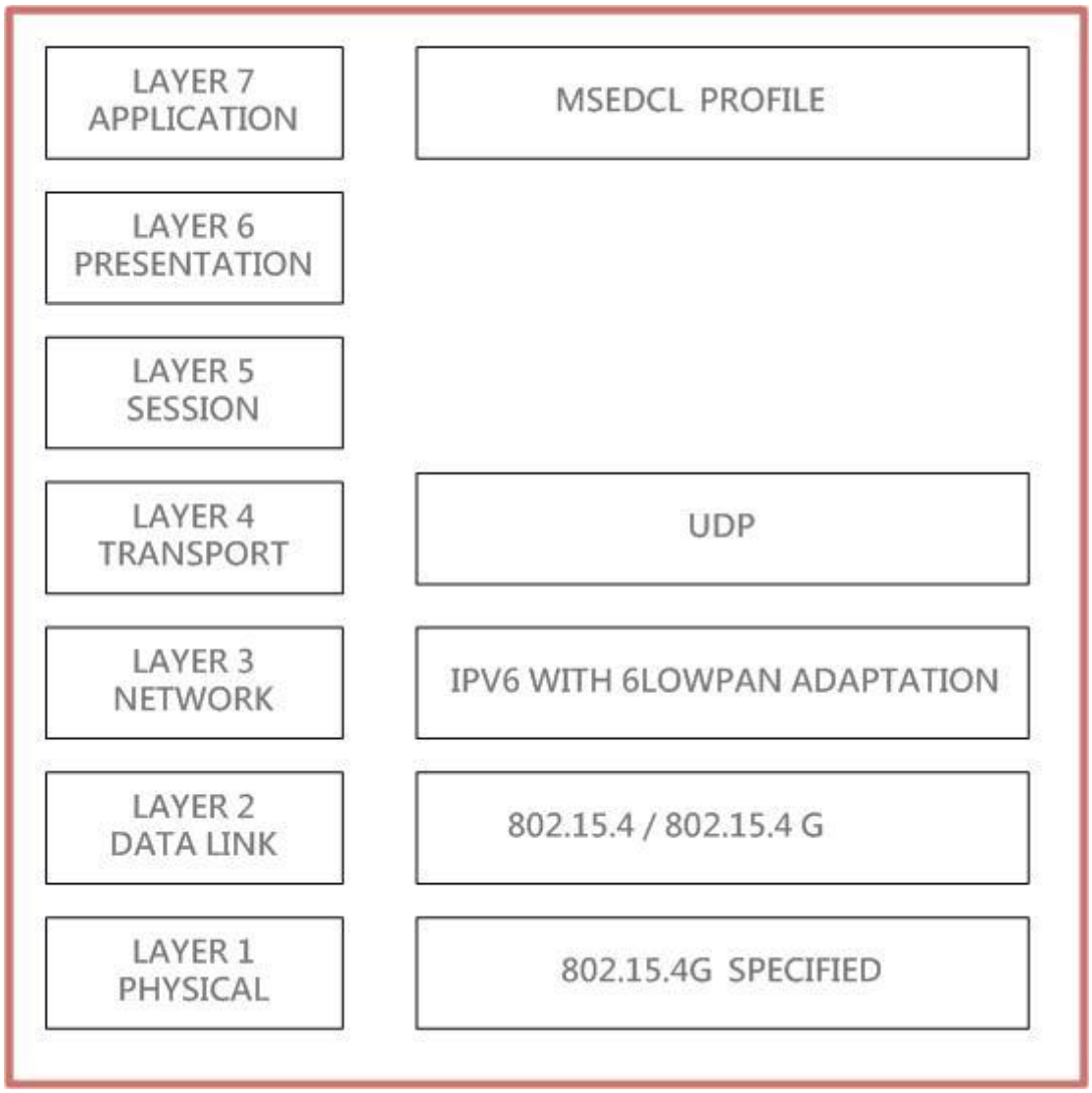
MSEDCL has previously deployed LPRF meters based on ZigBee Smart Energy 1.0 profile operating in 2.4GHz – 2.485GHz, with an MSEDCL specific profile used for data collection. These meters were primarily deployed in Urban areas of Mumbai, Pune and Nashik zones.

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.

Protocol Overview

The protocol stack layers are as given below:



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 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 :0x000000000000000000004D534544434C

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. 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.

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 8
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 Frame Type	1- byte Sequence no	1- byte Command ID	1-byte Attribute count	1- byte Attribute ID1	Attribute ID1 value	1- byte Attribute ID'n	Attribute ID'n value

Example :

|00 | 02 |00 |05| 00 |12 34 | 01 | 02 | 02|01|03 | CC CCCCCCCCCCCCCC| 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 CCCCCCCCCCCCCC : 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 CCCCCCCCCCCC |

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

00: Read Status of attribute ID3

01: Device Type

03 : Attribute ID 4 – IPv6 prefix value

00: Read Status of attribute ID4

CC CCCCCCCCCCCCCC : IPv6 prefix value

Router List write Request:

1-byte Frame	1-byte Sequence	1-byte Command	1-byte Attribute	1-byte Attribute	1–byte Add	1-byte Routers	4-byte Router	- -	4-byte Router

Type	no	ID	count	ID	/Remove	count	Address 1	--	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 Failed 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 Sequence no	1-byte Command 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 application should change the values for fields “count of routers” & “index” accordingly.

Example:

To download router list of 35 devices, 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 – V

RF METERING PROTOCOL - THREE PHASE RF METER

Protocol Version 2.1

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.

2. Introduction

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

3. 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	Cumulative Apparent Energy
0x0A	Time zone wise Cumulative Apparent Energy
0x0B	Cumulative Reactive Energy
0x0C	Time zone wise Cumulative Reactive Energy
0x0D-0xff	Reserved

3.1. 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
0x004	Meter Phase	Unsigned 8 bit Integer	1 bytes	Read Only	M
0x005	Vendor ID	Unsigned 8 bit Integer	1byte	Read only	M
0x06	Tamper Present Status	Unsigned 32 bit Integer	4 bytes	Read Only	M
0x09	Instantaneous	Unsigned	2 bytes	Read	M

	Voltage (R Phase)	16 bit Integer		Only	
0x0A	Instantaneous Voltage (Y Phase)	Unsigned 16 bit Integer	2 bytes	Read Only	M
0x0B	Instantaneous Voltage (B Phase)	Unsigned 16 bit Integer	2 bytes	Read Only	M
0x0C	Instantaneous Current (R Phase)	Unsigned 16 bit Integer	2 bytes	Read Only	M
0x0D	Instantaneous Current (Y Phase)	Unsigned 16 bit Integer	2 bytes	Read Only	M
0x0E	Instantaneous Current (B Phase)	Unsigned 16 bit Integer	2 bytes	Read Only	M

3.1.1. Serial Number Attribute

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

3.1.2. Make Code Attribute

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

3.1.3. Meter Time

This attribute returns the time currently seen in the meter.

3.1.4. Protocol Version

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

3.1.5. Meter Phase

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

3.1.6. Vendor ID

This attribute returns the vendor ID of the supplier set in the meter.

3.1.7. 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. Once the tamper specific bit is set to 1 after occurrence of tamper, this bit should not be set to 0 after restoration of that tamper. The meter reading software shall check the tamper present and download related tamper information as specified in the document. Bits corresponding to tampers not applicable for three phase meters shall be always set to 0.

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
Missing Potential	7	N
Current Imbalance	8	N
Current Reversal	9	N
Current Short Circuit	10	N
High Neutral Current	11	N
Potential Imbalance	12	N
Reserved	13	-

Reserved	-	-
Reserved	32	-

3.1.8. Instantaneous Voltage (Phase wise)

This attribute returns phase wise voltage values. Voltage should be measured with no decimal values.

3.1.9. Instantaneous Current (Phase wise)

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

3.2. 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

3.2.1. 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.

3.2.2. 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.

3.3. 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 Demand of Current Month 1	Unsigned 16-bit integer	0x0000 – 0xffff	Read only	M
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	Unsigned 16-bit integer	0x0000 – 0xffff	Read only	M

	Month 3				
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	UTC Time	4 bytes	Read only	M

	Month 7 Timestamp				
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 Month 11 Timestamp	UTC Time	4 bytes	Read only	M
0x18	Maximum Demand of	Unsigned 16-bit	0x0000 – 0xffff	Read only	M

	Current Month 12	integer			
0x19	Maximum Demand of Current Month 12 Timestamp	UTC Time	4 bytes	Read only	M

3.3.1. 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 kVA 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 KVA. Invalid values are given as 0xffff.

3.3.2. 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.

3.3.3. 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 kVA 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 kVA. Invalid values are given as 0xffff.

3.3.4. 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.

3.4. 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	Latest 10 Tamper Events – Missing Potential	Structure	11 bytes	ReadOnly	M
0x10 - 0x19 0x0a – 0x0F 0x1a – 0x1f	Reserved				
0x20 – 0x29	Latest 10 tamper Events – Current Imbalance	Structure	11 bytes	ReadOnly	M
0x30 – 0x39 0x2a – 0x2f 0x3a – 0x3f	Reserved				
0x40 – 0x49	Latest 10 Tamper Events – Current Reversal Start (0x4x) and Stop (0x5x) times	Structure	11 bytes	ReadOnly	M
0x50 – 0x59 0x4a –	Reserved				

0x4f 0x5a – 0x5f					
0x60 - 0x69	Latest 10 tamper events – Current Short circuit	Structure	11 bytes	ReadOnly	M
0x70 – 0x79 0x6a – 0x6f 0x7a – 0x7f	Reserved				
0x80	Meter Cover Open	UTC Time	11 bytes	ReadOnly	M
0x90 – 0x99	Latest 10 Tamper events – High Neutral Current	Structure	11 bytes	ReadOnly	M
0xa0 – 0xa9 0x9a – 9f 0xaa – 0xaf	Reserved				
0xb0 – 0xb9	Latest 10 Tamper events – Potential imbalance	Structure	11 bytes	ReadOnly	M
0xc0 – 0xc9 0xba – 0xbf 0xca – 0xcf	Reserved				
0xd0 – 0xd9	Latest 10 Tamper events – Magnetic	Structure	11 bytes	ReadOnly	M

	Tamper				
0xe0 - 0xe9 0xda – 0xdf 0xea – 0xef	Reserved				

Single tamper record will be structure consisting of the following fields.

Field name	**Type**
Phase	Unsigned 8 bit integer (1 byte)
Occurrence date	UTC time (4 bytes)
Restoration date	UTC time (4 bytes)

In structure data type 2 bytes are reserved to indicate number of elements in structure. Total data length is 11 bytes

3.4.1. 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 attribute should return phase on which event is occurred and restored and time stamp for occurrence and restoration of event. The values for phase should be as below.

Type of phase	Value
No phase	0x00
R Phase	0x01
Y Phase	0x02
B Phase	0x03

The application layer frame format of response to download two events of potential missing should be as below.

|00|08|00 FC|0D BF|08|00|18|02|0E|00 03|00|4C|03|00|20|01|E2| 80 EF 9A 22 |E2|E0 62 9A 22|

00 - Frame control

08 – Destination end point

00 FC – Cluster ID

0D BF – Profile ID

08 – Source end point

00 - APS counter

18 - Frame control

02 – Sequence Number

0E-Command identifier (Read attributes structured)

00 03 – Attribute ID to download tamper

00 – Status Success

4C – Data Type (Structure)

03 00 – Number of Attributes in Structure

20|01| E2| 80 EF 9A 22 |E2|E0 62 9A 22– is tamper data

20|01 Attribute 1 phase on which tamper occurred/restored

20 – Data Type (Unsigned 8-bitinteger)

01 – R phase on which tamper occurred/restored.

| E2| 80 EF 9A 22 | Tamper Occurrencetimestamp

E2- Data type (UTCTime)

80 EF 9A 22 – Data Value (Occurrence timestamp)

| E2| E0 62 9A 22 | Tamper Restorationtimestamp

E2- Data type (UTCTime)

E0 62 9A 22 – Data Value (Restoration timestamp)

3.4.2. Meter Cover Open

This attribute shall return phase and timestamp for the last time the meter coverwas opened. As phase is not applicable for this tamper,

value for phase should be returned as 0x00 An invalid event i.e. restoration timestamp is encoded as 0xE2ffffffff .Total response should be given as0x2000E280EF9A22E2FFFFFF.

3.5. 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	Latest 10 Tamper Events – ESD Tamper	Structure	11 bytes	Read only	M
0x10-0x19	Reserved				

This attribute represents ESD tamper events on the meter. The attribute shall return phase on which event is occurred and restored and time stamp for occurrence and restoration of event. If the meter is immune then response should be given as 0x2000E2ffffffffE2ffffffff.

3.6. 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	Unsigned 32- bit	0x00000000 -0xffffffff	Read only	M

	Energy	integer			

3.6.1. 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.

3.7. 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 16- bit integer	0x0000-0xffff	Read only	M
0x03	TZ2 Maximum Demand Timestamp	UTC Time	4 bytes	Read only	M
0x04	TZ3 Maximum Demand	Unsigned 16- bit integer	0x0000-0xffff	Read only	M
0x05	TZ3 Maximum Demand	UTC Time	4 bytes	Read only	M

	Timestamp				
0x06	TZ4 Maximum Demand	Unsigned 16- bit integer	0x0000-0xffff	Read only	M
0x07	TZ4 Maximum Demand Timestamp	UTC Time	4 bytes	Read only	M

3.7.1. 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 0.1kVA 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 kVA. Invalid values are given as 0xffff.

3.7.2. 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.

3.8. 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	32 bytes	Read Only	M

Load profile shall be maintained for the previous 60 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
kVArh (Lag)	Unsigned 32 bit integer
kVArh (Lead)	Unsigned 32 bit integer
kVAh	Unsigned 32 bit integer
Voltage - V_{RN}	Unsigned 16 bit integer
Voltage - V_{YN}	Unsigned 16 bit integer
Voltage – V_{BN}	Unsigned 16 bit integer
Current - I_R	Unsigned 16 bit integer
Current - I_Y	Unsigned 16 bit integer
Current – I_B	Unsigned 16 bit integer

Unsigned 32 bit integer values should be divided by 10 in order to convert unsigned integer representation to true decimal value.

The voltage value will be the measured voltage with no decimal values.

The current will be in multiples of 10mA.

For example, 1.540A will be represented as 154

60 A will be represented as 6000.

3.9. 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.

3.10. Cumulative Apparent Energy Attribute Set (0x09XX)

This attributes that are used in the Cumulative Apparent Energy Attribute set are summarized in the below table.

Identifier	Name	Type	Range	Access	Mandatory / Optional
0x00	Cumulative Apparent Energy	Unsigned 32-bit integer	0x00000000 – 0xffffffff	Read only	M
0x01 - 0x0C	Cumulative Apparent Energy of Previous Month1-12	Unsigned 32-bit integer	0x00000000 – 0xffffffff	Read only	M

3.10.1. Cumulative Apparent Energy

These attributes give the current cumulative apparent energy value for the meter. The value is a fixed point value of 0.1 kVAh 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 kVAh.

3.10.2. Cumulative Apparent 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 kVAh 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 kVAh.

3.11. Time Zone wise Apparent Energy Attributes Set (0x0AXX)

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

Identifier	Name	Type	Range	Access	Mandatory

					/ Optional
0x00	TZ1 Apparent Energy	Unsigned 32- bit integer	0x00000000 -0xffffffff	Read only	M
0x01	TZ2 Apparent Energy	Unsigned 32- bit integer	0x00000000 -0xffffffff	Read only	M
0x02	TZ3 Apparent Energy	Unsigned 32- bit integer	0x00000000 -0xffffffff	Read only	M
0x03	TZ4 Apparent Energy	Unsigned 32- bit integer	0x00000000 -0xffffffff	Read only	M

3.11.1. Time zone wise Apparent Energy

These attributes give the time zone wise current cumulative apparent energy value for the meter. The value is a fixed point value of 0.1 kVAh 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 kVAh.

3.12. Cumulative Reactive Energy Attribute Set (0x0BXX)

This attributes that are used in the Cumulative Reactive Energy Attribute set are summarized in the below table.

Identifier	**Name**	**Type**	**Range**	**Access**	**Mandatory / Optional**
0x00	Cumulative Reactive Energy(Lag) Current month	Unsigned 32-bit integer	0x00000000 – 0xffffffff	Read only	M
0x01	Cumulative Reactive Energy(Lead) Current month	Unsigned 32-bit integer	0x00000000 – 0xffffffff	Read only	M
0x02	Cumulative Reactive	Unsigned 32-bit	0x00000000 – 0xffffffff	Read only	M

	Energy(Lag) Previous month1	integer			
0x03	Cumulative Reactive Energy(Lead) Previous month 1	Unsigned 32-bit integer	0x00000000 – 0xffffffff	Read only	M
0x04	Cumulative Reactive Energy(Lag) Previous month2	Unsigned 32-bit integer	0x00000000 – 0xffffffff	Read only	M
0x05	Cumulative Reactive Energy(Lead) Previous month 2	Unsigned 32-bit integer	0x00000000 – 0xffffffff	Read only	M
0x06	Cumulative Reactive Energy(Lag) Previous month3	Unsigned 32-bit integer	0x00000000 – 0xffffffff	Read only	M
0x07	Cumulative Reactive Energy(Lead) Previous month 3	Unsigned 32-bit integer	0x00000000 – 0xffffffff	Read only	M
0x08	Cumulative Reactive Energy(Lag) Previous month 4	Unsigned 32-bit integer	0x00000000 – 0xffffffff	Read only	M
0x09	Cumulative Reactive Energy(Lead) Previous month 4	Unsigned 32-bit integer	0x00000000 – 0xffffffff	Read only	M
0x0a	Cumulative Reactive Energy(Lag) Previous	Unsigned 32-bit integer	0x00000000 – 0xffffffff	Read only	M

	month 5				
0x0b	Cumulative Reactive Energy(Lead) Previous month 5	Unsigned 32-bit integer	0x00000000 – 0xffffffff	Read only	M
0x0c	Cumulative Reactive Energy(Lag) Previous month 6	Unsigned 32-bit integer	0x00000000 – 0xffffffff	Read only	M
0x0d	Cumulative Reactive Energy(Lead) Previous month 6	Unsigned 32-bit integer	0x00000000 – 0xffffffff	Read only	M
0x0e	Cumulative Reactive Energy(Lag) Previous month 7	Unsigned 32-bit integer	0x00000000 – 0xffffffff	Read only	M
0x0f	Cumulative Reactive Energy(Lead) Previous month 7	Unsigned 32-bit integer	0x00000000 – 0xffffffff	Read only	M
0x10	Cumulative Reactive Energy(Lag) Previous month 8	Unsigned 32-bit integer	0x00000000 – 0xffffffff	Read only	M
0x11	Cumulative Reactive Energy(Lead) Previous month 8	Unsigned 32-bit integer	0x00000000 – 0xffffffff	Read only	M
0x12	Cumulative Reactive Energy(Lag) Previous month 9	Unsigned 32-bit integer	0x00000000 – 0xffffffff	Read only	M
0x13	Cumulative	Unsigned	0x00000000	Read	M

	Reactive Energy(Lead) Previous month 9	32-bit integer	– 0xffffffff	only	
0x14	Cumulative Reactive Energy(Lag) Previous month 10	Unsigned 32-bit integer	0x00000000 – 0xffffffff	Read only	M
0x15	Cumulative Reactive Energy(Lead) Previous month 10	Unsigned 32-bit integer	0x00000000 – 0xffffffff	Read only	M
0x16	Cumulative Reactive Energy(Lag) Previous month 11	Unsigned 32-bit integer	0x00000000 – 0xffffffff	Read only	M
0x17	Cumulative Reactive Energy(Lead) Previous month 11	Unsigned 32-bit integer	0x00000000 – 0xffffffff	Read only	M
0x18	Cumulative Reactive Energy(Lag) Previous month 12	Unsigned 32-bit integer	0x00000000 – 0xffffffff	Read only	M
0x19	Cumulative Reactive Energy(Lead) Previous month 12	Unsigned 32-bit integer	0x00000000 – 0xffffffff	Read only	M

3.12.1. Cumulative Reactive Energy (Lag/Lead)

These attributes give the current& historic months cumulative reactive energy (Lag/Lead) value for the meter. The value is a fixed point value of 0.1 kVArh 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 kVArh.

3.13. Time Zone wise Reactive Energy Attributes Set (0x0CXX)

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

Identifier	Name	Type	Range	Access	Mandatory / Optional
0x00	TZ1 Reactive Energy(Lead)	Unsigned 32- bit integer	0x00000000 -0xffffffff	Read only	M
0x01	TZ1 Reactive Energy(Lag)	Unsigned 32- bit integer	0x00000000 -0xffffffff	Read only	M
0x02	TZ2 Reactive Energy(Lead)	Unsigned 32- bit integer	0x00000000 -0xffffffff	Read only	M
0x03	TZ2 Reactive Energy(Lag)	Unsigned 32- bit integer	0x00000000 -0xffffffff	Read only	M
0x04	TZ3 Reactive Energy(Lead)	Unsigned 32- bit integer	0x00000000 -0xffffffff	Read only	M
0x05	TZ3 Reactive Energy(Lag)	Unsigned 32- bit integer	0x00000000 -0xffffffff	Read only	M
0x06	TZ4 Reactive Energy(Lead)	Unsigned 32- bit integer	0x00000000 -0xffffffff	Read only	M
0x07	TZ4 Reactive Energy(Lag)	Unsigned 32- bit integer	0x00000000 -0xffffffff	Read only	M

3.13.1. Time zone wise Reactive Energy

These attributes give the time zone wise current cumulative reactive energy value for the meter. The value is a fixed point value of 0.1 kVArh 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 kVArh.

Note: For any attribute other than attributes defined in this annexure, meter should give response as 'Unsupported attribute' with attribute status as '0x86'. The application layer frame format of response for Unsupported attribute 0x 0D 00should be as below.

|00|08|00FC|0DBF|08|00|18|02|01|000D|86|

00 - Frame control

08 – Destination end point

00 FC – Cluster ID

0D BF – Profile ID

08 – Source end point

00 - APS counter

18 - Frame control

02 – Sequence Number

01-Command identifier (Read attributes response)

0D 00 – Attribute ID

86 – Status (Unsupported attribute)

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).
5) Set MD integration period

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 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.

The DCU 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 DCU.
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

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.
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.

5) Protocol sequence for settingMD integration & sub integration period in the meter.

Packet 1:

Attribute ID: 0x0000
Attribute type: string type
Attribute length: 6 – 20 bytes
Description: password.
Attribute ID: 0x0007
Attribute type: 8 bit unsigned integer.
The values for this attribute should be as below.

Value	Description
0x00	This value used to set MD integration period of 30 minutes & sub-integration period of 10 minutes
0x01	This value used to set MD integration period of 15 minutes & sub-integration period of 5 minutes

Attribute Description: This command will set MD integration period& sub integration period in the meter.

Application layer frame formats for response given by meter after setting of critical parameters should be as below.

i. **If critical parameter setting is successful**

If critical parameter setting is successful, following response should be given by meter.

|00|08|01 FC|0DBF|08|00|18|02|04|00|

00 - Frame control

08 – Destination end point

01FC – Cluster ID

0D BF – Profile ID

08 – Source end point

00 - APS counter

18 - Frame control

02 – Sequence Number

04-Command identifier (Write attributes response)

00 – Status (Critical parameter setting successful)

ii. **If critical parameter setting is not successful**

If the critical parameter setting is failed due to wrong meter password, following response should be given by meter.

|00|08|01FC|0DBF|08|00|18|02|04|7E|00 00|

00 - Frame control

08 – Destination end point

01FC – Cluster ID

0D BF – Profile ID

08 – Source end point

00 - APS counter

18 - Frame control

02 – Sequence Number

04- Command identifier (Write attributes response)

7E – Status (Critical parameter setting not successful due to wrong password)

00 00 – Attribute ID due to which critical parameter setting is failed.

if meter password is correct and still critical parameter setting is failed, following response should be given by meter.

|00|08|01 FC|0D BF|08|00|18|02|04|01|06 00|

00 - Frame control

08 – Destination end point

01 FC – Cluster ID

0D BF – Profile ID

08 – Source end point

00 - APS counter

18 - Frame control

02 – Sequence Number

04- Command identifier (Write attributes response)

01 – Status (Meter password is correct still critical parameter setting not successful due to attribute given next)

00 06 – Attribute ID for which critical parameter setting is failed.

ANNEXURE - VI

Draft Testing Template

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

Test Parameter	Test Result / Observations
Manual	
1. Meter Manual	
2. DCU Manual	
Meter	
3. Make Code and Meter Serial Number	
4. Meter Phase (1 Ph / 3 Ph)	
5. TOD Meter (Yes / No)	
6. Meter RTC maintain time as per IST (Yes / No)	
7. PAN ID in Global Mode	
8. Link Key in Global Mode	
9. Communication Display on meter	
10. Meter status on meter display such as: Router/Edge Router	
11. Details of RF module in meter a. RF Module Vendor Name & ID b. IEEE Address of RF Module c. Chipset of RF Module	
12. Module Certification	
13. MSEDCL RF Protocol (as given in Tender document) is implemented in Meter (Yes / No)	

Overall Remark :

SCHEDULE 'A'

GUARANTEED TECHNICAL PARAMETERS

SR. NO.	PARAMETERS	GTP VALUES
1.0	MANUFACTURER'S / SUPPLIER'S NAME AND ADDRESS WITH WORKS ADDRESS	TO BE FILLED BY MANUFACTURER
2.0	MAKE & TYPE	TO BE FILLED BY MANUFACTURER
3.0	APPLICABLE STANDARD	IS 13779, CBIP 88
4.0	METER BEARS ISI MARK	YES
5.0	ACCURACY CLASS 1.00	1.00
6.0	RATED VOLTAGE RANGE	+ 20 % TO – 40 % OF RATED VOLTAGE.
7.0	RATED VOLTAGE	3 X 240 VOLTS PH-N
8.0	RATED BASIC CURRENT Ib	10 AMPS PER PHASE
9.0	MAXIMUM CURRENT	4 TIMES (400 %) OF IB
10.0	STARTING CURRENT	0.2% OF IB
11.0	FREQUENCY RANGE	50 HZ ± 5%
12.0	POWER SUPPLY	SMPS (SWITCHED MODE POWER SUPPLY)
13.0	POWER FACTOR	ZERO LAG TO UNITY TO ZERO LEAD TO UNITY

14.0	STANDARD REFERENCE TEMPERATURE FOR PERFORMANCE	27^{O}C
15.0	MEAN TEMPERATURE CO-EFFICIENT DOES NOT EXCEED	0.07%
16.0	TEMPERATURE RISE IS AS PER IS: 13779 / 1999	YES
17.0	OPAQUE METER BASE & TRANSPARENT TOP COVER MADE OF UNBREAKABLE, TOUGH, HIGH GRADE, FIRE RESISTANT POLYCARBONATE MATERIAL	YES
18.0	METER BODY TYPE TESTED FOR IP 51 DEGREE OF PROTECTION AS PER IS 12063	YES
19.0	MOULDED TERMINAL BLOCK CONFORMS TO IS: 13779 / 1999 (AMENDED UP TO DATE)	YES
20.0	EXTENDED TRANSPARENT TERMINAL COVER AS PER CLAUSE NUMBER 6.5.2 OF IS: 13779 / 1999 (AMENDED UP TO DATE) IS PROVIDED	YES
21.0	TRANSPARENT TERMINAL COVER IS SEALABLE INDEPENDENTLY	YES
22.0	PROPER SIZES OF GROOVES ARE PROVIDED AT BOTTOM OF TERMINAL COVER	YES
23.0	METER BASE & COVER ARE ULTRA-SONICALLY WELDED (CONTINUOUS WELDING)	
24.0	THICKNESS OF MATERIAL FOR METER 2 MM MINIMUM	2 MM MINIMUM
25.0	RTC PRE-PROGRAMMED FOR	30 YEARS DAY / DATE
26.0	TIME ACCURACY OF RTC AS PER CBIP TECH REPORT 88	YES

27.0	PROVISION TO PUT AT LEAST TWO SEALS BY UTILITY USER	YES
28.0	COMPLETE METERING SYSTEM & MEASUREMENT NOT AFFECTED BY EXTERNAL ELECTROMAGNETIC INTERFERENCE AS PER CL. NO. 6.16 OF TECH. SPECS.	YES
29.0	METER ACCURACY NOT AFFECTED BY AC / DC MAGNETIC FIELD UPTO 0.2 TESLA .	YES
30.0	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
31.0	METER RECORDS AND DISPLAYS TOTAL ENERGY INCLUDING HARMONIC ENERGY.	YES
32.0	METER DISPLAYS UNSATISFACTORY FUNCTIONING OR NONFUNCTIONING OF REAL TIME CLOCK BATTERY	YES
33.0	METER PCB IS WIRELESS	YES
34.0	BATTERY BACK UP WITH MINIMUM 10 YEARS LIFE IS PROVIDED	YES
35.0	METER WITHSTANDS PHASE TO PHASE VOLTAGE (440 V) IF APPLIED BETWEEN PHASE TO NEUTRAL FOR MINIMUM 5 MIN	YES
36.0	POWER SUPPLY UNIT IS TRANSFORMER LESS	YES
37.0	PUSH BUTTON PROVIDED FOR SCROLLING THE PARAMETERS IN ALTERNATE DISPLAY (ON DEMAND) MODE	YES
38.0	OPERATION INDICATOR PROVIDED IN THE FORM OF BLINKING LED / LCD	YES
39.0	METER CONSTANT INDELIBLY PROVIDED ON THE NAMEPLATE	YES
40.0	METER MANUFACTURED USING SMT	YES

41.0	TOD TIME ZONES PROVIDED	YES
42.0	ALL ANTI-TAMPER FEATURES AS PER CLAUSE 10.00 ARE PROVIDED	YES
43.0	UNDER INFLUENCE OF ANY MAGNETIC FIELD ABOVE 0.2 TESLA, IF THE ERRORS ARE BEYOND PERMISSIBLE LIMITS, METER RECORDS ENERGY CONSIDERING IMAX AND REFERENCE VOLTAGE AT UNITY POWER FACTOR	YES
44.0	LCD CHECK IS PROVIDED TO DISPLAY HEALTHINESS OF ALL SEGMENTS	YES
45.0	BACKLIT LCD TYPE DISPLAY IS PROVIDED	YES
46.0	MINIMUM NUMBER OF DIGITS FOR ENERGY DISPLAY PROVIDED	5 DIGITS
47.0	MINIMUM SIZE OF DIGITS	10X5 MM
48.0	DISPLAY PARAMETERS PREPROGRAMMED AT FACTORY AS PER CL. 12.00	YES
49.0	PERIOD FOR AUTO SCROLL.	9 SEC
50.0	POWER CONSUMPTION IN VOLTAGE CIRCUIT	SHALL NOT EXCEED 1.5 W AND 10 VA
51.0	POWER CONSUMPTION IN CURRENT CIRCUIT	SHALL NOT EXCEED 4 VA
52.0	CONVENTIONAL TRANSFORMER LESS POWER SUPPLY IS PROVIDED	YES
53.0	PUSH BUTTON IS PROVIDED FOR HIGH RESOLUTION READINGS OF DISPLAY WITH TWO DECIMAL POINTS	YES
54.0	PUSH BUTTON ARRANGEMENT FOR ACTIVATION OF BATTERY IS PROVIDED	YES
55.0	KVAMD PROVIDED	YES

56.0	INTEGRATION PERIOD OF KVAMD	30 MINUTES SLIDING WINDOW METHOD (SUB INTEGRATION PERIOD OF 10 MINUTES)
57.0	COMMUNICATION CAPABILITY AS PER CL. NO. 6.23 OF SPECIFICATION	YES
58.0	MAKE OF 6LOWPAN RF MODULE USED IN METER	TO BE FILLED BY MANUFACTURER
59.0	MAKE OF 6LOWPAN RF MODULE USED IN DCU	TO BE FILLED BY MANUFACTURER
60.0	ZIGBEE COMPLIANCE CERTIFICATE FOR RADIO MODULES USED IN METER & DCU IS SUBMITTED	YES
61.0	ZIGBEE COMPLIANCE CERTIFICATE NUMBER & DATE FOR RADIO MODULES	TO BE FILLED BY MANUFACTURER
62.0	CERTIFICATE OF PICS (PROTOCOL IMPLEMENTATION & CONFORMANCE STATEMENT) IN REGARDS MANUFACTURER SPECIFIC CLUSTER FROM ZIGBEE ALLIANCE OFFICIAL TEST HOUSE IS SUBMITTED.	YES
63.0	PICS CERTIFICATE NO. & DATE IN REGARDS MANUFACTURER SPECIFIC CLUSTER FROM ZIGBEE ALLIANCE OFFICIAL TEST HOUSE.	TO BE FILLED BY MANUFACTURER
64.0	COMPUTER SOFTWARE AS PER CLAUSE 15.00 OF TECHNICAL SPECIFICATION IS PROVIDED	YES
65.0	BASE COMPUTER SOFTWARE PROVIDED IS USER FRIENDLY & WINDOWS BASED & SUPPORTS ALL VERSIONS OF “WINDOWS”.	YES
66.0	BCS SUPPORTS ALL CURRENT OPERATING SYSTEM VERSIONS.	YES

67.0	IMPORT / EXPORT OF DATA THROUGH BCS CAN BE THROUGH ANY USB PORT OF PC / LAPTOP.	YES
68.0	BCS SOFTWARE HAS CAPABILITY TO CONVERT ALL THE DATA INTO ASCII FORMAT AS PER MSEDCL REQUIREMENT.	YES
69.0	BCS MAINTAINS AUDIT LOG FOR CONNECTION AND DISCONNECTION OF DCU TO BCS.	YES
70.0	BCS HAS OPTION OF DOWNLOADING AUDIT LOG.	YES
71.0	BCS MAINTAINS DOWNLOADED BILLING HISTORY.	YES
72.0	BCS STORES DATA TO DATABASE IN ENCRYPTED FORMAT.	YES
73.0	BCS GENERATES EXCEPTIONAL REPORT OF NEW METERS (METERS NOT AVAILABLE IN DCU INITIALLY) READING.	YES
74.0	API / EXE FILE WITH DOCUMENTATION FOR DOWNLOADING DATA FROM METER ALONG WITH SAMPLE METER IS SUBMITTED.	YES
75.0	API RESIDING ON DCU IS GIVEN FREE OF COST WITH ALL ITS DOCUMENTATION AND TRAINING.	YES
76.0	TOTAL TIME TAKEN FOR DOWNLOADING ALL DATA FOR 60 DAYS	UP TO 26 MINUTES
77.0	DOWNLOADING TIME OF ONLY BILLING DATA AFTER JOINING THE NETWORK	IS LESS THAN 25 SECS
78.0	COMMISSIONING AND DEPLOYMENT DOCUMENT OF DCU IS AS PER ANNEXURE VI.	YES
79.0	RF MODULE IS INBUILT IN DCU.	YES

80.0	BY DEFAULT, AFTER STARTING DCU IS METER READING MODE.	YES
81.0	MEMORY OF DCU	256 MB MIN
82.0	DCU POSSESSES SPECIFIC SERIAL NO.	YES
83.0	DCU IS PROPERLY LABELED WITH SERIAL NUMBER / TENDER NUMBER / PROGRAM NAME / PROGRAM VERSION.	YES
84.0	TEST OPTION FOR CHECKING CONNECTIVITY BETWEEN DCU & METER PROVIDED.	YES
85.0	DCU IS BASED ON OPEN ZIGBEE – 2007 PRO WITH SMART ENERGY PROFILE PROTOCOL AND 6LOWPAN PROTOCOL FOR INTEROPERABILITY AS PER SETTINGS GIVEN IN CLAUSE 5.28 AND ANNEXURE V & VI OF THE SPECIFICATIONS.	YES
86.0	PROVISION FOR AUTO POWER SAVE ON DCU.	YES
87.0	BIDDER AGREES TO SUPPLY DCU IN THE RATIO OF 1:250 INCLUDING USER MANUAL, AA SIZE BATTERIES & A SET OF DIRECT COMMUNICATION CORDS	YES
88.0	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
89.0	METER SPECIFIC MRI PROGRAMS HAVE ABILITY TO USE DCU REAL TIME CLOCK TO TAG ALL TIME RELATED EVENTS.	YES
90.0	A REAL TIME CLOCK WITH A MINIMUM OF 15 DAYS BATTERY BACKUP WITH 30 YEAR CALENDAR IS PROVIDED IN DCU.	YES

91.0	TIME DRIFT OF THE RTC IN DCU DOES NOT EXCEED + / - 300 SECONDS PER YEAR.	+ / - 300 SECONDS PER YEAR
92.0	INDICATION FOR CONFIRMATION OF SUCCESSFUL DATA TRANSFER IS PROVIDED ON METER & DCU	YES
93.0	DCU DOES NOT ACCEPT ANY EXTERNAL FILE OTHER THAN BCS.	YES
94.0	DCU HAS AUDIT TRAIL LOG OF CONNECTION & DISCONNECTION OF DCU WITH BCS.	YES
95.0	USB PORT ARE PROVIDED ON DCU	YES
96.0	ONE CHORD OF MIN. 1 MTR LENGTH ARE PROVIDED WITH EACH DCU	YES
97.0	NECESSARY SOFTWARE CONFORMING TO THE ENCLOSED COMMUNICATION PROTOCOL, REQUIRED FOR DCU & BASE COMPUTER SYSTEM WITH NECESSARY SECURITY PROVISIONS IS SUPPLIED.	YES
98.0	DCU HAS OPTION TO CHECK READING STATUS (DOWNLOADED OR NOT DOWNLOADED) FOR ANY PARTICULAR METER.	YES
99.0	DCU INDICATES STATUS OF TOTAL CONSUMERS / METERS, NUMBER OF CONSUMERS / METERS READ AND BALANCE CONSUMERS / METERS.	YES
100.0	SEARCH FACILITY FOR THE BALANCE METERS PROVIDED ON DCU.	YES
101.0	DCU CAPABLE OF DOWNLOADING BILLING DATA OF AT LEAST 2,000 (TWO THOUSAND) METERS AT A TIME	YES

102.0	DCU SUPPLIED IS CAPABLE FOR DOWNLOADING DATA OF MULTIPLE DESIGNS & MAKE OF METERS	YES
103.0	DCU HAS FACILITY FOR RE-ENTERING METER SERIAL NUMBERS DIRECTLY FROM BASE COMPUTER SYSTEM	YES
104.0	DCU IS TYPE TESTED AS PER TECHNICAL SPECIFICATION	YES
105.0	TYPE TEST REPORT NO & DATE OF DCU	TO BE FILLED BY MANUFACTURER
106.0	METER IS TYPE TESTED	YES
107.0	TYPE TEST REPORT NUMBER & DATE OF METER	TO BE FILLED BY MANUFACTURER
108.0	GUARANTEE 5 YEARS FROM INSTALLATION OR FIVE & HALF YEARS FROM DATE OF DESPATCH	YES
109.0	IN HOUSE TESTING FACILITIES ARE AVAILABLE FOR (a) INSULATION RESISTANCE MEASUREMENT	YES
110.0	(b) NO LOAD CONDITION	YES
111.0	(c) STARTING CURRENT TEST	YES
112.0	(d) ACCURACY TEST REQUIREMENT	YES
113.0	(e) POWER CONSUMPTION	YES
114.0	(f) TRANSPORTATION TEST	YES
115.0	(g) FULLY COMPUTERISED METER TEST BENCH SYSTEM FOR CARRYING OUT ROUTINE AND ACCEPTANCE TEST IS AVAILABLE	YES

116.0	(h) MANUFACTURER HAS CALIBRATED STANDARD METER OF 0.1 CLASS ACCURACY	YES
117.0	(i) VERIFIACTION OF DATA DOWNLOADING AS PER RF PORT	YES
118.0	(j) GLOW WIRE TESTING	YES
119.0	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	YES
120.0	MANUFACTURING ACTIVITIES ARE AS PER CLAUSE 28.00	YES
121.0	QAP SUBMITTED AS PER ANNEXURE-I	YES
122.0	METER & DCU COMPLIES WITH ANNEXURE IV, V & VI OF TECHNICAL SPECIFICATION .	YES
123.0	PERMANENT NATURE CONNECTION DIAGRAM OF METER IS SHOWN ON INSIDE PORTION OF THE TERMINAL COVER.	YES
124.0	METER TERMINALS ARE MARKED AND THIS MARKING APPEARS IN THE ABOVE PERMANENT NATURE CONNECTION DIAGRAM.	YES
125.0	NAME PLATE & MARKING AS PER CLAUSE NO. 18.00	YES
126.0	(a) THE BIDDER/MANUFACTURER SHALL HAVE SUPPLIED 12.5 LAKHS STATIC METER DURING THE LAST THREE FINANCIAL YEARS.	YES

127.0	(b) THE BIDDER / MANUFACTURER SHALL HAVE MINIMUM EXPERIENCE OF THREE YEARS OF SUPPLY OR MANUFACTURING FOR STATIC METER UPTO THE END OF THE LAST FINANCIAL YEAR.	YES
128.0	SPARK DISCHARGE TEST AT 35 KV IS CARRIED OUT AS PER CLAUSE 6.26 OF TECHNICAL SPECIFICATION	YES
129.0	FURNISH PHYSICAL WATER ABSORPTION VALUE	TO BE FILLED BY MANUFACTURER
130.0	FURNISH THERMAL HDDT VALUE	TO BE FILLED BY MANUFACTURER
131.0	FURNISH FLAMMABILITY VALUE	TO BE FILLED BY MANUFACTURER
132.0	FLAMMABILITY V2	TO BE FILLED BY MANUFACTURER
133.0	GLOW WIRE TEST AT 650° C	YES
134.0	TENSILE STRENGTH	YES
135.0	FLEXURE STRENGTH	TO BE FILLED BY MANUFACTURER
136.0	MODULUS OF ELASTICITY	TO BE FILLED BY MANUFACTURER
137.0	IZOD IMPACT STRENGTH NOTCHED 23° C	TO BE FILLED BY MANUFACTURER
138.0	WHETHER 10 NOS. OF TENDER SAMPLE METERS ARE SUBMITTED ALONGWITH API SOFTWARE & DOCUMENTATION.	YES
139.0	AGEING TEST IS CARRIED OUT AS PER CLAUSE 29.04.04 OF TECHNICAL SPECIFICATION	YES
140.0	WHETHER THE FIRM IS SUBSIDIARY IF YES, WHETHER UNDERTAKING I.E. ANNEXURE-UI IS ENCLOSED	YES

141.0	ADDITIONAL INFORMATION REQUIRED IN CASE OF FOREIGN BIDDER / MANUFACTURER. 1. RATE OF CUSTOM DUTY	YES
142.0	2. OFFER SUBMITTED BY FOREIGN BIDDER / MANUFACTURER.	TO BE FILLED BY MANUFACTURER
143.0	3. WHETHER OFFER SUBMITTED THROUGH AUTHORIZED ASSIGNEE / NOMINEE.	TO BE FILLED BY MANUFACTURER
144.0	4. IN CASE OFFER SUBMITTED THROUGH AUTHORIZED ASSIGNEE/ NOMINEE, WHETHER ANNEXURE UII SUBMITTED	TO BE FILLED BY MANUFACTURER