

MATERIAL SPECIFICATIONS CELL

TECHNICAL SPECIFICATION

LT AC SINGLE PHASE 5 – 30 AMPS STATIC ENERGY
METER WITH 6LOWPAN BASED INTERNAL LOW
POWER RADIO FREQUENCY CONNECTIVITY FOR
COMMUNICATION

TECHNICAL SPECIFICATION NO.
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1.00 SCOPE

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

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

2.00 APPLICABLE STANDARDS

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

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

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

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

3.00 SERVICE CONDITIONS

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

Environmental Conditions

- | | |
|---|-------|
| a) Maximum ambient temperature | 55° C |
| b) Maximum ambient temperature in shade | 45° C |

- | | |
|--|-----------------------|
| c) Minimum temperature of air in shade | 35° C |
| d) Maximum daily average temperature | 40° C |
| e) Maximum yearly weighted average temperature | 32° C |
| f) Relative Humidity | 10 to 100 % |
| g) Maximum Annual rainfall | 1,450 mm |
| h) Maximum wind pressure | 150 Kg/m ² |
| i) Maximum altitude above mean sea level | 1,000 meters |
| j) Isoceraunic level | 50 days/year |
| k) Seismic level (Horizontal acceleration) | 0.3 g |
| l) Climate: Moderately hot and humid tropical climate conducive to rust and fungus growth. | |

4.00 GENERAL TECHNICAL PARTICULARS

4.01 The meter shall bear ISI mark.

4.02 Class of Accuracy:

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

4.03 Current & Voltage Rating:

- 1) The current rating shall be 5-30 Amps.
- 2) Rated basic current (I_b) for LT Energy Meters shall be 5 Amps.
- 3) The maximum continuous current (I_{max}) shall be 600% of rated basic current, i.e. 30 Amps. Moreover the 5-30 Amps meters shall work accurately upto 150% of I_{max} , i.e. 45 Amps.
- 4) The Voltage Rating shall be 240 volts. The voltage range shall be (-) 40% to (+) 20% of rated voltage, i.e. 144 Volts to 288 Volts.

4.04 Temperature:

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

4.05 Power Factor:

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

4.06 Power Consumption:

- 1) Voltage Circuit:

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

2) Current Circuit:

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

4.07 Starting Current:

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

4.08 Frequency:

The rated frequency shall be 50 Hz with a tolerance of $\pm 5\%$.

5.00 CONSTRUCTION

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

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

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

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

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

5.06 Sealing provision shall be made against opening of the terminal cover and front cover. It is necessary to provide screws with two holes for

sealing purpose. The meter shall be pilfer-proof & tamper-proof. The provision shall be made on the Meter for at least two seals to be put by utility user.

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

5.08 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 ! "मी"जुळू ±६.६०,००० वू.०००"त प्रयत्न ` ल्यास †×० ०००
३००० वी० नोंद ०३०००० " "

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

5.10 REAL TIME INTERNAL CLOCK (RTC)

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

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

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

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

5.12 OUTPUT DEVICE

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

measurement of the meter on site by means of LED output. Resolution of the test shall be sufficient to enable the starting current test in less than 10 minutes and accuracy test at the lowest load shall be completed with desired accuracy within 5 minutes.

- 5.13 There shall be one CT in Neutral circuit and one shunt in phase circuit. The current whichever is measured as higher either by CT or shunt shall be used for processing / computing energy. The shunt shall be manganin based and e-beam welded for the construction purpose. The meter shall have CTs with magnetic shielding and same shall be tested separately prior to assembly.
- 5.14 PCB used in meter shall be made by Surface Mounting Technology.
- 5.15 The meter shall be capable to withstand phase to phase voltage (440 V) if applied between phase to neutral for minimum 5 min.
- 5.16 Power supply unit in the meter shall be transformer less to avoid magnetic influence.
- 5.17 Non specified display parameters in the meter shall be blocked. Display parameters in the meter shall not be accessible for reprogramming at site through any kind of communication.
- 5.18 Complete metering system & measurement shall not be affected by the external electromagnetic interference such as electrical discharge of cables and capacitors, harmonics, electrostatic discharges, external magnetic fields and DC current in AC supply etc. The Meter shall meet the requirement of CBIP Tech. report 88 (amended up to date) except 0.2 Tesla AC magnet test.
- 5.19 The accuracy of the meter and the measurement by meter shall not get influenced by injection of high frequency AC Voltage / chopped signal / DC signal and harmonics on the terminals of the meter.
- 5.20 The meter accuracy shall not be affected by magnetic field from all sides of the meter i.e. front, sides, top and bottom of the meter.
- 5.21 The meter shall record and display total energy including Harmonic energy.
- 5.22 The meter shall remain immune for the test of electromagnetic HF/RF defined under the test no. 4.0 for EMI/EMC of IS 13779:1999 amended up to date.
- 5.23 The meter shall remain immune for any higher signals than the present standards and MSEDCL technical specifications as indicated above.

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

5.25 Self Diagnostic Features.

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

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

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

5.27 Wireless / Cable less design:

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

5.28 **COMMUNICATION CAPABILITY**

The meter shall have wireless communication with HHT, 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. HHT shall support dual band operations i) Zigbee based 2.4 GHz ii) 6LoWPAN based sub-1 GHz. HHT shall be capable to download, commission Zigbee based and 6LoWPAN based LPRF meters. Download should be possible though **optical port** in case of power failure. The baud rate while downloading data through optical port should be 9600. Bidder should implement their own protocol using attributes defined in annexure-VI for data downloading through optical port.

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

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

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

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

2. Default PAN id shall be 0xFFFF.
3. Radio device shall have 128 bits addressing (as per IPv6 and Annexure-V.)
4. The radio shall be programmed with 16 byte security key (128 bit encryption). The value for sample = 'MSEDCL' (This value is only for samples and actual value will be informed to successful bidder.)
5. The baud rate for radio to meter UART shall be 9,600 bps.
6. Over the air baud rate shall be 50 kbps.
7. Following Commissioning attributes must be supported:
 - i. PAN ID
 - ii. Channel (0 -9)
 - iii. Device Type (1- Root, 2-Router)
 - iv. IPv6 Prefix (as per IPv6 Specifications)
 - v. AES key – 16 Bytes Hex
 - vi. Commission state (0- un-commissioned, 1- commissioned)
 - vii. DAG ID – 16 Byte (as per IPv6 specifications)
 - viii. Router List
8. The HHT shall be capable of commissioning a meter network node as either a 6LoWPAN 'root' or 'router' as appropriate.
9. The HHT shall be capable of joining a metering network as a Router / end device to download data.

5.28.2 ZIGBEE BASED INTERNAL LOW POWER RADIO FREQUENCY (LPRF)

The Zigbee based Internal Low Power Radio Frequency (LPRF) shall be capable to read the meter from a distance of minimum thirty (30) meter radius with obstructions from the meter. Longer communication range is preferred. However, no pre - installation programming or post installation programming shall be required for this purpose.

The HHT shall be based on Open ZigBee - 2007 PRO with Smart energy profile protocol enclosed herewith as Annexure V & VI for Interoperability with following settings:

1. PAN id shall be 123 (This id is only for samples and actual id will be informed to successful bidder.)

2. Radio device shall have 64 bits addressing (as per IEEE.802.15.4 standard.)
3. The radio shall be programmed with 16 byte security key (128 bit encryption). The value for sample = 'MSEDCL' (This value is only for samples and actual value will be informed to successful bidder.)
4. The baud rate for radio to meter UART shall be 9,600 bps.
5. Over the air baud rate shall be 250 kbps.
6. Meter Serial Number shall be mapped with 64 bit MAC address of the radio.
7. The sample metering cluster 0x0702 to be implemented as open protocol as per Annexure V & VI.
8. The meter network RF device shall be a combo device.
9. The HHT shall be a combo device.
10. The HHT shall be capable of commissioning a meter network node as either a coordinator or router as appropriate.
11. The HHT shall be capable of joining a metering network as a Router / end device to download data.
12. The profile used shall be 0xBF0D.
13. Source and Destination Device End Point 0x08
14. Channel Mask 0x03FFF800 (not support the last channel number 26 in the band)
15. Time attribute to be supported as per Annexure IV.
16. Following Commissioning attributes must be supported:
 - i. Preconfigured Link Key
 - ii. Channel Mask
 - iii. Startup control
 - iv. Extended PAN ID
17. Following cluster support need to be present in Zigbee module:
 - i. Basic Cluster 0x0000
 - ii. Commissioning Cluster 0x0015
 - iii. MSEDCL Cluster 0xFC00

The bidder shall submit Zigbee compliance certificate for radio modules used in the HHT. Likewise, the certificate of PICS (Protocol

Implementation & Conformance Statement) in regards Manufacturer Specific Cluster from Zigbee Alliance Official Test House shall be submitted.

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 2.4GHz and 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 HHT, but no command regarding data alteration in the meter and data retrieval from meter to HHT 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 HHT 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. Download should be possible through optical port in case of power failure.

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

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

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

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

- a) On any of the phases or neutral terminals
- b) On any connecting wires of the meter (Voltage discharge with 0-10 mm spark gap)
- c) At any place in load circuit
- d) Anywhere on meter body

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

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

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

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

6.00 ENCLOSURE OF METER

As per Annexure – III

7.00 TOD TIMING

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

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

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

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

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

8.00 MAXIMUM DEMAND INTEGRATION PERIOD

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

9.00 MD RESET

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

- a) Communication driven reset through hand held terminal (HHT).

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

10.00 ANTI TAMPER FEATURES

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

- 10.01 Reversal of phase & neutral.
- 10.02 Reversal of line and load terminals.
- 10.03 Load through local Earth.
- 10.04 The meter shall work accurately without earth.
- 10.05 Where neutral is disconnected from the load side or from the supply side or both, the load and supply side, the meter shall record the energy proportionate to the current drawn through the meter (minimum 30 % Ib) at reference voltage and unity Power Factor. $\pm 5\%$ error in recording is admissible.

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

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

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

- 10.06 The meter shall be immune to the magnetic field (AC / DC / Permanent) up to 0.2 Tesla (except 0.2 Tesla AC). Under influence of any magnetic field (AC / DC / Permanent) more than 0.2 Tesla, if the accuracy of the meter gets affected, then the same shall be recorded as magnetic tamper event with date & time stamping and the meter shall record energy considering maximum value current (Imax) at reference voltage & unity power factor.
- 10.07 In the event the meter is forcibly opened, even by 2 to 4 mm variation of the meter cover, same shall be recorded as tamper event with date & time stamping and the meter shall continuously display that the cover has been tampered. It is suggested that the manufacturer shall develop their software such that there shall be some time delay for activation of this tamper feature and during that period only the meter cover shall be fitted. After the meter cover is fitted, it shall get activated immediately

without any delay. The delay in activation of software shall be for one instance only.

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

11.00 DISPLAY OF MEASURED VALUES

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

11.02 MINIMUM CHARACTER SIZE

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

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

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

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

Voltage: 240 V

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

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

No reset push button shall be provided.

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

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

11.06 MEASURING PARAMETERS

A) DEFAULT DISPLAY (AUTO SCROLLING MODE)

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

1) Active Energy (kWh)

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

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

- Sr. No. of meter
- LCD test
- Real time & date
- High resolution reading of kWh with 2 decimal digits.
- Cumulative Active Energy (kWh) for each calendar month for previous twelve months with display of month.
- Maximum demand (kWMD) in a calendar month for previous twelve months with date & time.
- Magnetic tamper event with date / time: This shall be displayed as per the requirement of clause no. 10.06.
- Tamper event of meter cover open with date & time as per clause no. 10.07. The meter shall display the tamper name of "C - OPEN" with date & time in auto scroll mode along with other parameters.
- Tamper event of Electronic noise tamper of Electronic noise with date & time as per clause no. 10.08. The meter shall display the tamper "EI /EC tP" with date & time in auto scroll mode along with other parameters.

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

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

- PAN ID of meter.

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

12.00 DEMONSTRATION

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

13.00 BILLING HISTORY & LOAD SURVEY

13.01 BILLING HISTORY

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

13.02 LOAD SURVEY PARAMETERS

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

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

14.00 COMPUTER SOFTWARE

14.01 For efficient and speedy recovery of data downloaded through HHT on base computer, licensed copies of base computer software shall be supplied free of cost.

14.02 This BCS software shall be password protected.

14.03 The computer software shall be "Windows" based of latest version & user friendly & shall support all versions of "Windows". Also whenever there is new upgrade version operating system is released, the computer software compatible to that version should be provided within 3 months free of cost.

14.04 The data transfer from meter to HHT & from HHT to laptop computer or PC shall be highly reliable and fraud proof.

No editing shall be possible on base computer as well as on HHT by any means.

14.05 This software shall be used at number of places up to Division / Sub Division level. Hence as many copies of base computer software as required up to Division / Sub Division level shall be provided by supplier.

14.06 BCS software shall have the facility to import consumer master data from MSEDCL billing system to BCS. Format is as follows:

Field	Data Type	Length
Billing Unit (BU)	Variable character	4
Processing Cycle (PC)	Number	2
Meter Route (MR)	Variable character	2
Route	Variable character	4
Sequence	Variable character	4
Consumer Number	Variable character	12
Consumer Name	Variable character	50
Consumer Address	Variable character	50
Meter Serial Number	Variable character	8
Meter Make Code	Variable character	3
Distribution Transformer Centre (DTC) code	Variable character	7
Bill Month (YYMM)	Variable character	4
Current reading	Variable character	6
Average consumption	Variable character	6
Meter Phase	Variable character	2
Meter Type (Zigbee/6LoWPAN)	Variable character	15

- 14.07 Import / Export shall happen on any USB port of PC / Laptop.
- 14.08 Every report shall have the facility to print/export as text, pdf.
- 14.09 Exporting of meter number from BCS to HHT shall be selective on meter number or group of meters of particular MR-Route-Sequence or DTC code.
- 14.10 The software shall have capability to convert all the data into ASCII format as per MSEDCL requirement as below.

a) Billing Data Format

- (i) Reading captured from RF meters shall be submitted in one line per meter reading in following format for billing.

Parameter	Length	Position	Remark
Record Type	4 Char	01-04	RF01 / RF03 / IR01 / IR03 (Refer table of Record Types)
Consumer Number	12 chars	05-16	Left Padded with zeros (0)
Make Code	5 chars	17-21	As given in Annexure-IV
Meter ID(Serial No)	8 chars	22-29	Left Padded with zeros (0)
Current Reading date	8 chars	30-37	DDMMYYYY format
Current kWh reading	8 chars	38-45	Left Padded with zeros (0)
Current KW MD	4 chars	46-49	Left Padded with zeros (0) with decimal part if any
Current KW MD date	8 chars	50-57	DDMMYYYY format
Current KW MD time	4 chars	58-61	HHMM format

(ii) Last Line in bill string (Meter Reading) file, will be the check sum logic output as follows:

- Character 1 to 4 (4 characters): will be (RFT1 /RFT3 /IRT1 /IRT3). (Refer table of record types)
- Character 5 to 12 (8 characters): Count of Meter Serial Number, left padding by 0.
- Character 13 to 28 (16 characters): Sum of kWh of all above meters. Total length will be 16, left padding with 0.
- Character 29 to 36 (8 characters): Sum of KW MD, total length will be 8, left padding with 0.
- Character 37 to 61 (25 characters): All zeros.

(iii) Table of Record Type

Source	Type	Record Type	Prefix Required
RF	Single Phase	Data	RF01
RF	Single Phase	Control Record	RFT1
RF	3-Phase	Data	RF03
RF	3-Phase	Control Record	RFT3
IR	Single Phase	Data	IR01
IR	Single Phase	Control Record	IRT1
IR	3-Phase	Data	IR03
IR	3-Phase	Control Record	IRT3
AMR	Three Phase	Data	AMR1

b) Load Survey

As per clause no. 13.02 above

c) Tamper Data

S.N.	Name of Tamper Event as per Clause No. 10.00	Occurance date & time	Restoration date & time
1]	Reversal of phase & neutral & Reversal of Line and Load terminals.		
2]	Load through local Earth		
3]	Neutral Disconnected		
4]	Magnetic Tamper		
5]	EMI / EMC Tamper		
6]	Meter cover Open with date & time	Only occurrence	
7]	Power ON-OFF events		
For tampers in Sr. no.1 to 5, maximum 10 nos. of each tamper events shall be registered by meter and each latest tamper shall be displayed by meter on FIFO basis. For tamper sr. no. (7) 256 events shall be registered.			

- 14.11 BCS shall maintain the audit log for connection and disconnection of HHT to BCS. The BCS shall have the option of downloading audit log.
- 14.12 BCS shall maintain the downloaded meter data including energy parameters, billing history, tampers, TOD data and load profile data.
- 14.13 BCS shall store the data to database in encrypted format. Encryption used shall be provided free of cost to MSEDCL.
- 14.14 BCS shall generate following exceptional reports
- List of newly downloaded meters i.e. Meters not available in consumer master uploaded in HHT initially, but reading present in HHT.
 - List of Meters not downloaded i.e. Meter number available in consumer master uploaded in HHT, but reading not present in HHT.
- 14.15 Meter manufacturer shall provide API / Exe file with documentation for downloading the data from the meter along with the sample meter.
- 14.16 Checksum logic shall also be provided for the downloaded data along with the sample meter.

- 14.17 Checksum checking Exe / API shall also be given for validating downloaded meter data as well as generated XML file with sample meter.
- 14.18 It shall be possible to upload the HHT data to any PC having HHT software. A consumer based data uploading facility is required so that HHT shall upload data only in that PC which has the concerned consumers' data. The consumer number + meter number + make code shall be the key for creating consumers' files or overwriting consumers' files in PC.
- 14.19 The BCS software shall create one single file for the uploaded data, e.g. if HHT contains the meter readings of 2,000 consumer meters and the said data is uploaded to BCS, then the BCS shall create a single file containing separate records for each consumer meter reading. Also there shall be a provision to give filenames while creating the file.
- 14.20 Bidder has to provide any new additional reports from BCS software, if required by MSEDCL in future and the same shall be made available free of cost.
- 14.21 The meter manufacturer shall have to depute Hardware and Software Engineers on call basis who shall have thorough knowledge of meter hardware / software used for downloading and converting so as to discuss the problems, if any, or new development in the hardware / software with Chief General Manager (IT) / Chief Engineer, MM Cell, MSEDCL, Prakashgad, Bandra (E), Mumbai - 400 051 without any additional charge.
- 14.22 The meter sample with HHT shall be tested by our IT department for the protocol implemented and time required for downloading the data as confirmed by the bidder.
- 14.23 BCS shall support all current operating system versions and shall provide new version of BCS wherever the new version of operating system released.
- 14.24 As and when the meter manufacturer releases new or latest or advanced versions of meter hardware / firmware / software, the same shall be made available to purchaser immediately on the release date free of cost. The latest version shall support all existing hardware / meters in the field.

15.00 GPRS ENABLED HAND HELD TERMINAL (HHT)

- 15.01 HHT shall have in-built RF module and in-built GSM / GPRS Modem compatible with 3G, 4G. No separate / external attachment will be accepted.

- 15.02 RF module in HHT should support dual band operations- the ZigBee based 2.4GHz operation and 6LoWPAN based sub-1GHz operation.
- 15.03 HHT shall facilitate Manual band selection through keypad.
- 15.04 SIM slot of HHT shall have provision for sealing.
- 15.05 Modem in HHT shall be self-configurable.
- 15.06 In Built Modem should have following communication capabilities :
- Modem should be Dual Band modem capable of operating at 900 and 1800 MHz GSM transmission.
 - Modem should support both Data and SMS transmission. It should have both GSM and GPRS/EDGE features.
- 15.07 RF HHT shall download meter data through RF port and the downloaded data shall be stored in HHT and transferred to MSEDCL MDAS (Head End system) through GPRS channel/USB.
- 15.08 Application in HHT shall be password protected and HHT should have common menu structure as given in Annexure-VIII.
- 15.09 After power on the HHT, HHT program version should be displayed and by default it shall be in Meter Reading mode.
- 15.10 The HHT shall possess a specific Serial No. which cannot be changed. Every HHT shall be properly labeled with serial number / tender number / program name / program version.
- 15.11 HHT shall download the data of all the meters, irrespective of meter serial number present in HHT. It shall show listed (meter serial number available in HHT) and not listed meters whose data has been downloaded.
- 15.12 HHT shall show the following statistic of meters:
- (a) Total No. of Meters for reading in HHT.
 - (b) Total No. of meter readings downloaded in HHT (excluding the new meters),
 - (c) No. of new meters downloaded in HHT. (Meter Numbers not available in Job)
 - (d) No. of Meters not downloaded in HHT.
- 15.13 HHT shall have the option to check the reading status (Downloaded or Not Downloaded) for any particular meter.
- 15.14 HHT shall not accept any external file other than BCS.

- 15.15 HHT Data files shall be deleted / removed from HHT as per value of job download status as given below :
- i. Job Download Status = '0' and Clear HHT command is sent through BCS : Delete the .MRI files from HHT after confirmation from user.
 - ii. Job Download Status = '1' : No file in HHT should be deleted, even after receipt of clear HHT command from BCS.
 - iii. Job Download Status = '2' : While uploading new job from BCS to HHT, existing files in HHT shall be deleted. (BCS should issue clear HHT command before uploading new job to HHT).
 - iv. Refer job download status flag details in JOB.MRI file. (Annexure-IX)
- 15.16 API which will be residing on HHT will be given to MSEDCL free of cost with all its documentation and training. Without API, meter samples shall not be approved.
- 15.17 The meter samples with HHT shall be tested by our IT Department for the time required for downloading the data as confirmed by the bidder.
- 15.18 While downloading billing data, by default every time HHT should download tamper present status for tampers as per protocol given in Annexure-V & VI. If tamper is found, then HHT should download tamper data of tampers present along with billing data.
- 15.19 Downloading time of only Billing data, i.e. kWh and tamper data, if tampers present, shall be less than 10 secs (after joining the network) inclusive of handshaking.
- 15.20 The total time taken for downloading Billing, Tamper and Load Survey Data for 45 days shall be minimum 10 to 12 minutes.
- 15.21 Commissioning and Deployment document is as per Annexure V.
- 15.22 Memory of HHT shall be minimum 256 MB.
- 15.23 The HHT shall be based on open ZigBee - 2007 PRO with Smart energy profile protocol & 6LoWPAN for Interoperability with the settings given in clause 5.28 and Annexure V & VI of the specifications.
- 15.24 The bidder shall submit Zigbee, 6LoWPAN compliance certificate for radio modules used in the HHT. Likewise, the certificate of PICS (Protocol Implementation & Conformance Statement) in regards Manufacturer Specific Cluster from ZigBee, 6LoWPAN Alliance Official Test House shall be submitted.
- 15.25 The HHT shall be supplied free of cost in the ratio of one for each 1,000 Nos. meters supplied including user manual, AA size batteries and a set

of direct communication cords for data downloading to the Laptop or PC for each HHT.

There shall be a provision for AUTO POWER SAVE, which shall force the instrument in the power saving mode in case of no-activity within 5 minutes. The data shall not be lost in the event the batteries are drained or removed from the HHT.

- 15.26 File structure to upload / export the meter details from BCS to HHT is as follows:
- A) Meter Serial Number – 8 chars.
 - B) Meter Make Code – 3 chars.
 - C) Consumer Number – 12 chars.
 - D) Consumer Name – 50 chars.
 - E) Consumer Address – 50 chars.
- 15.27 HHT shall be capable to download following data individually after respective command to HHT.
- (a) Only Billing Data,
 - (b) Only Billing History,
 - (c) Only Tamper Data,
 - (d) Only TOD Data,
 - (e) Only Load Survey Data,
 - (f) All Data.
- 15.28 HHT shall be capable of downloading billing data of at least 2,000 (Two thousand) meters at a time. The HHT supplied shall be capable for downloading data of multiple designs and make of meters as well as for meters added in next 5 years for the common communication protocol attached herewith.
- 15.29 The meter specific MRI programs shall have the ability to use HHT real time clock to tag all time related events.
- 15.30 A real time clock shall be provided in the HHT. The clock shall have a minimum of 15 days battery backup with 30 year calendar. The time drift of the real time clock, considering all influencing quantities shall not exceed +/- 300 seconds per year.
- 15.31 After successful downloading of meter data to HHT, an indication on both, HHT and meter for confirmation of successful data transfer shall be provided for each set of data, viz. billing, load survey & tamper data.

- During this period, the energy recording in meter shall not be affected. Also Indication on Meter during downloading of data and on HHT appearance of message after successful downloading shall also be acceptable.
- 15.32 After downloading the data from meters, it shall be possible to create a single file for all records. The contents of this file shall not be editable.
- 15.33 Further, there shall be facility in HHT to provide the transfer of meter data to base computer through USB port only.
- 15.34 The interface for communication between HHT & Base computer shall be supplied free of cost. One chord of minimum length of 1 Mtr shall be provided with each HHT for downloading the data from HHT to base computer.
- 15.35 Necessary software conforming to the enclosed communication protocol, required for HHT and Base Computer System with necessary security provisions shall also be supplied free of cost.
- 15.36 The manufacturer / supplier shall modify the compatibility of HHT with the meter and the base computer system due to any change in language or any other reasons at their own cost within guarantee period.
- 15.37 The HHT shall have facility for re-entering the meter serial numbers directly from base computer system so that once these meters are read and the data is uploaded on base computer system, the serial numbers of existing meters could be deleted from the HHT and the meter serial numbers of other meters can be entered in the HHT.
- 15.38 While exporting the fresh (new) meter data from BCS to HHT, there shall have the option for downloading or deleting the existing (old) data present in HHT. Before deleting the data from HHT ask (prompt) (Yes/No) twice the user for confirmation to delete the data.
- 15.39 The HHT shall have battery low indication and automatic cut off to avoid further drain of the battery. The battery status should be indicated in the form of Bar-graph in the LCD display itself, clearly indicating the amount of charge available.
- 15.40 HHT should support endurance with fully charged battery for minimum 8 hours of operation.
- 15.41 Amendments to HHT application, if required, shall be provided free of cost and HHT shall be upgradable for all such software amendments.
- 15.42 The data stored in HHT shall be in common format as per Annexure-IX.

- 15.43 The protocol for communication between HHT and BCS shall be common as per Annexure-X. HHT should communicate with BCS software using protocol given in Annexure-X only.
- 15.44 HHT should have degree of protection as per IP54.
- 15.45 The technical documents and manuals for GPRS enabled HHT shall be provided with all relevant details about HHT program and configuration required for HHT.
- 15.46 The HHT shall be type tested for (a) Tests of Mechanical requirement such as Free fall test, Shock Test, Vibration test, (b) Tests of Climatic influences such as Tests of Protection against Penetration of Dust and Water (IP 54), Dry Heat test, Cold Test, Damp Heat Cyclic Test, (c) Tests for Electromagnetic Compatibility (EMC), (d) Test of Immunity to Electromagnetic HF Fields and (e) Radio Interference Measurement.
- 15.47 The equipments offered shall be fully type tested at approved laboratory by National Accreditation Board for Testing and Calibration Laboratories (NABL) as per relevant standards within last 5 years from the date of opening of tender & the type test reports shall be enclosed with the offer.

16.00 METERING PROTOCOL

As per Annexure V & VI.

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. **Stickers of any kind shall not be accepted.**

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. The manufacturer's meter constant shall be marked on the Name Plate.

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

Purchase Order No.

Month and Year of manufacture

Name of purchaser: MSEDCL

Guarantee: Five Years

ISI mark

Communication Capability: 6LoWPAN LPRF

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

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

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

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. Type test reports for HHT as stated in the clause No. 15.46 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 Meters shall pass all the acceptance and routine tests as laid down in IS: 13779 / 1999 (amended up to date) and also additional acceptance tests as prescribed in this specification. (3 to 8 meters from a lot more than 1,000 shall be sealed randomly in the factory and shall be tested for tamper events).

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 meters be tested for error at I_{max} , I_b and 5% I_b at unity power factor and 50% I_{max} and 10% I_b at 0.5 lagging Power Factor besides checking them for starting current. The meter shall be tested with meter cover duly tightened and sealed properly.

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

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

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

B) Other Acceptance Tests

- i) The meter shall withstand continuously for a period of at least 5 minutes at a voltage of 440 V between phase and neutral without damage / problems,
- ii) Tamper conditions as stated in this specification,
- iii) Glow wire testing for polycarbonate material.
- iv) Power consumption tests,
- v) Verification of data transfer / downloading via RF port as per technical specifications, The data verification will be carried out at communication testing lab of IT Section of MSEDCL at corporate office. During the testing in communication testing laboratory, protocol implemented in the meter will be verified. If meter protocol is as per Clause No. 15 then further testing will be carried out. Draft testing parameters are given in Annexure-XI
- vi) The meter shall comply all the tests for external AC / DC (except 0.2 Tesla AC magnet test) magnetic field as per CBIP Tech Report 88 with latest amendments.

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

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

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

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

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

viii) The meter shall withstand impulse voltage at 10 kV

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

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

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

The test report shall be got approved from Chief Engineer, MSEDCL, Material Management Cell, 1st Floor, Prakashgad, Bandra (E), Mumbai – 400 051 before commencement of supply.

19.04 LIMITS OF ERROR

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

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

- i) The meters shall be tested at (-) 15% and at (-) 40% of reference voltage as well as (+) 10% and (+) 20% of reference voltage and shall record energy within limits of variation indicated above. However the meter shall continue to register energy up to 50% of the rated voltage.
- ii) For other influence quantities like frequency variation the limits of variation in percentage error shall be as per IS: 13779 / 1999 (amended up to date).

20.00 GUARANTEED TECHNICAL PARTICULARS

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

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 Company's representative / Engineer attending the above testing shall carry out testing on suitable number of meters as per sampling procedure laid down in IS: 13779 / 1999 (amended up to date) and additional acceptance test as per this specification and issue test certificate approval to the manufacturer and give clearance for dispatch. All the meters offered for inspection shall be in sealed condition. The seals of sample meters taken for testing & inspection shall be break open & resealed after inspection. The first lot of meter may be jointly inspected by the Executive Engineer, Testing Division and the Executive Engineer, Inspection Wing.

22.00 INSPECTION AFTER RECEIPT AT STORES (Random Sample Testing)

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

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

23.00 GUARANTEE

The meter & HHT 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 meter / HHT found defective within above guarantee period shall be replaced by the supplier free of cost, within one month of receipt of intimation. If defective meter / HHT is not replaced within the specified period as above, the Company shall recover an equivalent amount plus 15% supervision charges from any of the bills of the supplier.

24.00 PACKING

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

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 Material indicating contents of each package and spare material.

25.00 TENDER SAMPLE

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

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

26.00 QUALITY CONTROL

- 26.01 The purchaser has a right to send a team of experienced engineers for assessing the capability of the firm for manufacturing and testing of meters as per this specification. The team shall be given all assistance and co-operation for inspection and testing at the bidder's works.
- 26.02 The meters supplied shall give service for a long period with out drifting from the original calibration & performance must be near to zero percent failure.

27.00 MINIMUM TESTING FACILITIES

- 27.01 Manufacturer shall possess fully computerized Meter Test Bench System for carrying out routine and acceptance Tests as per IS: 13779/1999 (amended up to date). Test Reports for each and every meter shall be generated. The list of testing equipments shall be enclosed.

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

- (i) Insulation resistance measurement,
- (ii) No load condition,
- (iii) Starting current,
- (iv) Accuracy requirement,
- (v) Power consumption,
- (vi) Repeatability of error,
- (vii) Transportation test – as per clause no. 19.03.A,
- (viii) Tamper conditions - as per clause no. 10.00,
- (ix) LPRF communication connectivity Test as per clause no. 5.23.
- (x) The manufacturer shall have duly calibrated RSS meter of class 0.1 or better accuracy.
- (xi) The manufacturer shall have Glow Wire Testing facility.
- (xii) The bidder shall have fully automatic Test Bench having in-built constant voltage, current and frequency source with facility to select various loads automatically and print the errors directly.

27.02 Meter Software

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

28.00 MANUFACTURING ACTIVITIES

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

- i) Meter shall be manufactured using SMT (Surface Mount Technology) components and by deploying automatic SMT pick and place machine and reflow solder process. The loops/wired joints must be avoided on PCB. Further, the Bidder shall own or have assured access (through hire, lease or sub-contract, documentary proof shall be attached with the offer) of above facilities.
- ii) Quality shall be ensured at the following stages:
 - At PCB manufacturing stage, each Board shall be subjected to computerized bare board testing.
 - At insertion stage, all components shall undergo computerized testing for conforming to design parameters and orientation.
 - Complete assembled and soldered PCB shall undergo functional testing using Automatic Test Equipments (ATEs).

- Important: - Prior to final testing and calibration, all meters shall be subjected to ageing test (i.e. Meters shall be kept in heating chamber for 72 hours at 55°C temperature at full load current. After 72 hours, meters shall work satisfactory) to eliminate infant mortality.
- iii) The calibration of meters shall be done in-house on a computerized testing bench having stabilized power supply.
- iv) The bidders shall submit the list of all (imported as well as indigenous) components to be used in meter, separately along with the offer. List of makes of components is attached herewith as a guide line (Annexure II).
- v) Bought out items:
A detailed list of bought out items which are used in the manufacturing of the meter shall be furnished indicating the name of firms from whom these items are procured. The bidder shall also give the details of quality assurance procedures followed by him in respect of the bought out items.
- vi) List of Plant and Machinery used for production of energy meters.

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

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

28	Glow Wire Test machine	Testing of Plastic Material
29	Fast transient burst testing setup	Type testing of Meters
30	Short term over Current testing setup	Type testing of Meters
31	Magnetic and other tamper testing setups	Tamper Testing
32	Impulse Voltage Testing Setup	Type testing of Meters
33	Composite Environmental testing chambers	Type testing of Meters

29.00 QUALITY ASSURANCE PLAN

29.01 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.

29.02 Precautions taken for ensuring usage of quality raw material and sub component shall be stated in QAP.

30.00 COMPONENT SPECIFICATION

As per Annexure II enclosed.

31.00 SCHEDULES

The tenderer shall fill in the following schedules and submit along with the offer. If the schedules are not submitted duly filled in with the offer, the offer shall be rejected.

Schedule 'A' ... Guaranteed Technical particulars (As per GTP parameters uploaded on e- Tendering site.)

Schedule 'C' ... Tenderer Experience

The discrepancies, if any, between the specification and the catalogs and/or literatures submitted as part of the offer by the bidders, shall not be considered and representations in this regard will not be entertained. If it is observed that there are deviations in the offer in Guaranteed Technical Particulars other than those specified in the deviation schedules then such deviations shall be treated as deviations.

SCHEDULE 'C'

TENDERER'S EXPERIENCE

Tenderer shall furnish here list of similar orders executed /under execution for supplying meters boxes by him to whom a reference may be made by purchaser in case he considers such a reference necessary.

Sr. No.	Name of client	Order No. & date	Qty. ordered	Qty. supplied
---------	----------------	------------------	--------------	---------------

NAME OF FIRM _____

NAME & SIGNATURE _____

DESIGNATION _____

DATE _____

ANNEXURE I

Quality Assurance Plan

- A) The bidder shall invariably furnish the following information along with his bid, failing which his bid shall be liable for rejection. Information shall be separately given for individual type of material offered.
- i) Statement giving list of important raw materials, names of sub - suppliers for the raw materials, list of standards according to which the raw materials are tested. List of tests normally carried out on raw materials in presence of Bidder's representative, copies of test certificates,
 - ii) Information and copies of test certificates as in (i) above in respect of bought out accessories,
 - iii) List of manufacturing facilities available,
 - iv) Level of automation achieved and list of areas where manual processing exists,
 - v) List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections,
 - vi) List of testing equipments available with the bidder for final testing of equipment specified and test plan limitation, if any, vis-à-vis, the type, special acceptance and routine tests specified in the relevant standards. These limitations shall be very clearly bought out in schedule of deviation from specified test requirements.
- B) The successful bidder shall within 30 days of placement of order, submit following information to the purchaser.
- i) List of raw materials as well as bought out accessories and the names of sub - suppliers selected from those furnished along with offers.
 - ii) Type test certificates of the raw materials and bought out accessories if required by the purchaser.
 - iii) Quality assurance plan (QAP) with hold points for purchaser's inspection. The quality assurance plan 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 authorize work to progress beyond the hold points indicated in quality assurance plans.

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

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

- i) The structure of the organization.

- > The duties and responsibilities assigned to staff ensuring quality of work.
- > The system for purchasing taking delivery and verification of material.
- > The system for ensuring quality workmanship.
- > The system for retention of records.
- > The arrangement for contractor's internal auditing.
- > A list of administration and work procedures required to achieve and verify contractor's quality requirements.

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

- ii) Quality Plans:

- > An outline of the proposed work and programme sequence.
- > The structure of the contractor's organization for the contract.
- > The duties and responsibilities assigned to staff ensuring quality of work.
- > Hold and notification points.
- > Submission of engineering documents required by the specification.
- > The inspection of materials and components on receipt.
- > Reference to the contractor's work procedures appropriate to each activity.
- > Inspection during fabrication / construction.
- > Final inspection and test.

ANNEXURE II

COMPONENT SPECIFICATION

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

3	Display modules	<p>a) The display modules shall be well protected from the external UV radiations.</p> <p>b) The display visibility shall be sufficient to read the Meter mounted at height of 0.5 meter as well as at the height of 2 meters (refer 3.2 d for viewing angle).</p> <p>c) The construction of the modules shall be such that the displayed quantity shall not disturbed with the life of display (PIN Type).</p> <p>d) It shall be trans-reflective HTN (HTN – Hyper Twisted Nematic (120°)) or STN (STN – Super Twisted Nematic (160°)) type industrial grade with extended temperature range. HTN – Hyper Twisted Nematic (120°) STN – Super Twisted Nematic (160°)</p>	<p>Singapore: E-smart, Bonafied Technologies, Display Tech,</p> <p>Korea: Advantek, Jebon, Union Display Inc.,</p> <p>Japan: Hitachi, Sony, L&G.</p> <p>Malaysia: Crystal Clear Technology.</p> <p>China: Success, Tianma</p>
4	Electronic components	<p>The active & passive components shall be of the surface mount type & are to be handled & soldered by the state of art assembly processes.</p>	<p>USA: National Semiconductors, Atmel, Philips, Texas Instruments, BC Component Analog devices, ST, Maxim, Kemet Onsemiconductors, Freescale, Intersil, Raltron, Fairchild, Muruta, Agilent, AVX,</p>

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

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

1.00 SCOPE:

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

2.00 SERVICE CONDITION:

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

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

3.00 APPLICABLE STANDARDS:

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

4.00 DESIGN AND CONSTRUCTION:

- 4.01 The meter box shall be so constructed as to have roof tapering down on both sides for easy flow of rain water and box shall be totally transparent poly-carbonate material natural white colour and having good workmanship.
- 4.02 The meter box shall be made of anti corrosive, dust proof, weather proof, unbreakable, scratch resistant, water proof, ultra violet stabilized and flame retardant high grade poly-carbonate material having good dielectric and mechanical strength.
- 4.03 The box material must be UV stabilized to ensure that the base and cover does not get 'Yellow' over a period of time. The surface appearance of part must be smooth, non porous and homogeneous, free

- of ripples, defects and marks. No fillers or fibers shall be visible at any place.
- 4.04 (a) The meter box shall be made from Poly-carbonate as per IS: 14772 / 2000 and as per requirement of this specification.
- (b) The wall thickness of meter box shall be minimum 3 mm on load bearing side and cover shall be 2 mm.
- 4.05 The internal dimensions of meter box shall be such that there shall be minimum 60 mm clearance at the bottom, 40 mm clearance on three sides, 25 mm clearance on front and 10 mm clearance from back of the meter.
- 4.06 The meter box shall not change in colour, shape, size, dimension when subjected to 200 hours on UV ageing test. Also it shall be capable of withstanding temperature of boiling water for five minutes continuously without distortion or softening.
- 4.07 The cover shall be made overlapping type having collars on all four sides. The cover of the box shall be provided with semi circular / circular gasket of sufficient size to completely fit in the grooves of the base. The gasket shall be made of neoprene rubber or equivalent good quality rubber.
- 4.08 The cover shall be made overlapping type having collars on all four sides. The cover of meter box shall have 4 nos. of non-detachable self-locking push fit type arrangement. It shall have suitable non-detachable fitting to base such that if pushed once inside, the cover shall rest on the base of box in such a way that any access from outside to the meter is not possible. The locking (press fit) knob shall get completely contained in the locking hub inside the meter box. The locking hub shall be closed at its base.
- 4.09 Meter box shall confirm IP-51.
- 4.10 The meter base support inside the box shall be raised by about 10 mm in the box for easy wiring. While fixing the meter, the meter screws shall not protrude outside.
- 4.11 Suitable circular holes shall be provided at the bottom of the box for inlet and outlet cables with glands of 6 or 8 mm size made of brass or poly-carbonate material for the cable securely fixed to the bottom of the box on both sides by chuck nuts with rubber grommet. All the screws and washers shall be properly zinc plated.
- 4.12 For fixing the box to wall or wooden board 4 nos. key holes of min. 5 mm diameter shall be provided at the four corners of meter box. The meter is

to be installed in the box and the box in assembled condition shall have provision to fix it to pole or a wall. The 4 nos. screws of size 5 mm diameter and 37.5 mm long with suitable washers shall be provided with each meter box.

- 4.13 The tolerance permissible on the various dimensions of the meter box shall be $\pm 3\%$.
- 4.14 The surface appearance of part must be smooth, non porous and homogeneous, free of ripples, defects and marks. No fillers or fibers shall be visible at any place.
- 4.15 No optical port shall be on enclosure. Optical port shall be on meter body.

5.00 TESTS:

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

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

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

9.	Resistance to Tracking	IS:14772 / 2000
10.	Flammability (V2)	UL 94 or IS: 11731 (Part. II)
11.	Self extinguishing	IS: 4249/1967
12.	Heat deflection temperature	ISO 75
13.	Glow Wire Test	IS: 11000 (Part 2/ Sec-1) or IEC -60695-2-12
14.	Ball Pressure Test	IEC: 335 or IEC-60695-10-2
15.	Water Absorption	IS:5133 (Part-II)-1969
16.	Light Transmission (Transparency) for Cover	ASTM D 1003
17.	UV Ageing Test for 200 Hours	ASTM G53 (9.3)

6.00 TESTING AND MANUFACTURING FACILITIES

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

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

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

7.00 DRAWING /SAMPLE:

The detailed dimensional drawing showing clearly the dimensions and material for meter box and its constructional features shall be invariably furnished with the offer. Two samples of meter box as per the specifications shall be submitted along with offer. The offer would be

rejected, if meter box samples are not accompanied.

8.00 MARKING / EMBOSSING:

The following information shall be clearly and indelibly embossed (not printed) on the cover of the meter box except Sr. No. which may be indelibly printed with inkjet printing on the base and cover of the meter box. The meter box Sr. No. shall be same as that of the meter Sr. No. fitted inside the meter box.

- (i) Purchase order number and date.
- (ii) Year and month of manufacture.
- (iii) Purchaser's name: MSEDCL
- (iv) Guarantee 5.5 Years.
- (v) Sign of danger.
- (vi) Code name of manufacturer
- (vii) Meter box Sr. No. [Printed on both the base and cover of meter box]

9.00 PACKING:

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

10.00 GUARANTEE:

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

ANNEXURE - IV
MAKE CODE OF METERS

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

040	BUXLELS
041	DELHI CONTROL DEVICES PVT. LTD.
042	C.R.E. WOD CO. PVT. LTD.
043	GENUS INNOVATION LTD.
044	CONTIMENTS
045	NAINA POWER PVT. LTD.
046	GANG & CO. LTD., BUDAPEST
048	KRIZIC
050	SIEMENS
052	SCLUMBER
053	L & T
054	Datapro
055	Secure
056	DUKE ARNIES
057	A.B.B
058	ROLEX
059	L&G
061	ELYMER
062	AVENER
063	ELSTER METERING
064	ACCURATE
065	GENUS
066	CAPITAL POWER SYSTEMS PVT LTD

067	VAN ELECTRO DEVICES PVT LTD
068	GEC ALSTHOM INDIA LTD
069	GILBERT ELECTRICALS AND ELECTRONICS PVT LTD
070	KEI ELECTRICALS PVT LTD
071	MODEN INSTUMENTS PVT LTD
072	POWERTEC METERS
074	EMCO
075	HIMACHAL ENERGY
076	HPL
078	SHENZEN
079	SEMICONDUCTOR COMPLEX LTD
080	LOTUS WIRES AND CABLES
081	OMNI AGATE SYSTEM
082	PALMOHAN
083	SYNERGY
084	RC ENERGY METERING PVT. LTD
086	MOTWANI MANUFACTURE
087	MODERN INSTRUMENTS PVT LTD
088	AVON METERS
089	KELTRON COUNTERS LTD
091	TERANA INFOTECK
092	NATIONAL TELECOM
093	TTL LTD

094	TOWERS AND TRANSFORMERS
095	ESPRITE SWITCHGEAR PVT LTD
096	BENTEX ELECTRICALS
097	BHARAT HEAVY ELECTRICAL LTD
098	FLASH

ANNEXURE V

MSEDCL 6LOWPAN PROTOCOL

Introduction

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

Going forward, LPRF meters are sought to be deployed in rural, Rurban and Urban areas.

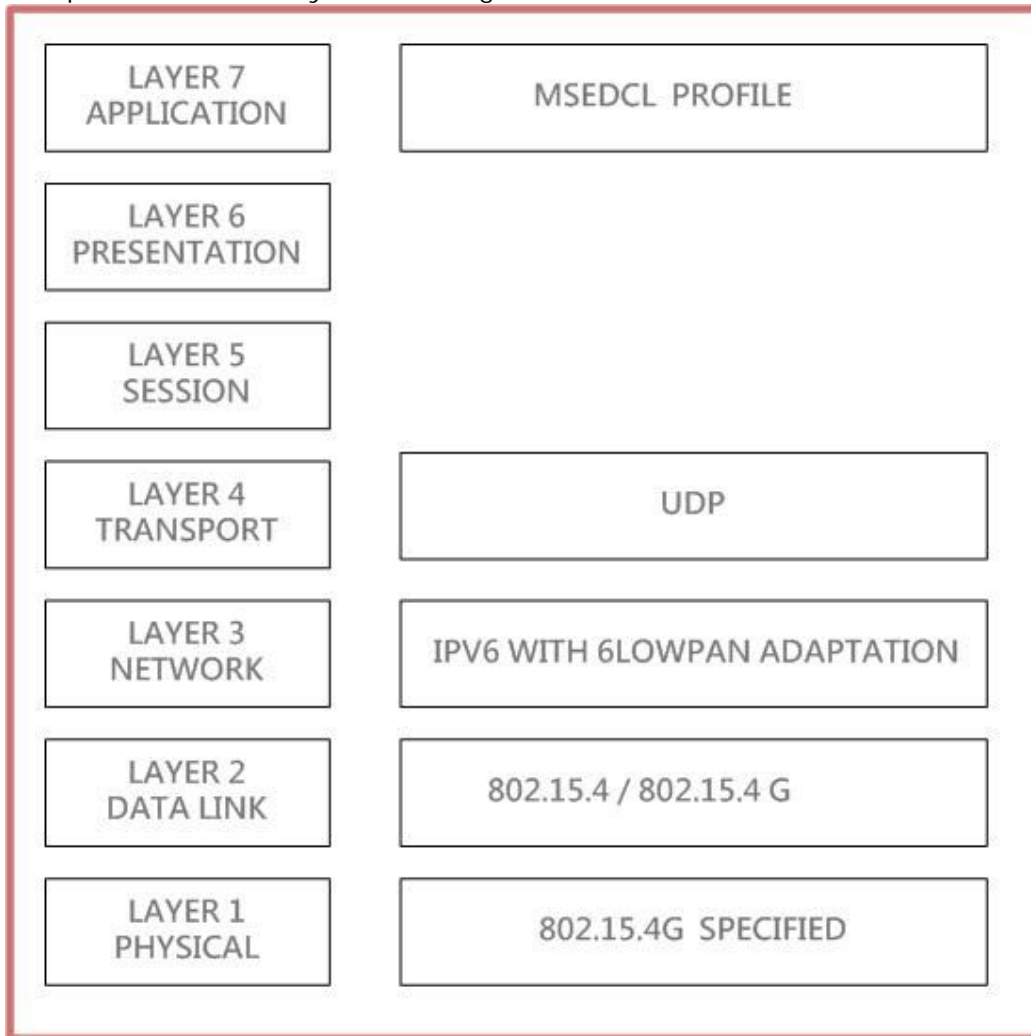
The new meters shall support LPRF data downloading based on 6lowpan networking on sub 1 GHz. The principal driver is the enhanced range that is expected out of a sub 1GHz implementation. At the same time, some of the learning from previous deployments is factored in. This document specifies the complete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

NOTE:

- 1. Any changes in communication protocol if required shall be incorporated subsequently.**
- 2. ALL Hand Held Units shall support dual band operations – the ZigBee based 2.4GHz operation and 6lowpan based sub 1GHz operation. HHU shall facilitate Manual band selection through keypad**

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 HHU / DCU. Port no 61616 for meter data downloads and

critical parameter communication. However, 61618 will be used for network parameters setting and commissioning as specified.

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

NETWORK LAYER

IPv6

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

ICMPv6

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

Addressing

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

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

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

8 byte MAC address, this will consist of:

5 most significant bytes containing organizationally unique identifier (OUI) purchased from IEEE

The last three significant bytes shall be mapped to the serial number of the energy meter.

MESH AND ROUTING

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

ADAPTATION LAYER

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

MAC LAYER

The MAC layer is a derivative of IEEE 802.15.4G specification in terms of MAC Layer headers and usage of IEEE headers. The packet & protocol options, protocol specified commands will be as follows.

MAC layer under 6lowpan is essentially a link layer broadcast protocol. While the 802.15.4G defines multiple packet types, the MAC_DATA_PACKET type suffices for the 6lowpan packet exchange. Further, nodes must respond with BEACON packets in response to BEACON_REQUEST messages. Link layer acknowledgements should be disabled.

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

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

MAC DATA PACKET

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

Point to point application data communication

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

Local broadcast as used in a DIO message (for example)

MHR to be coded as follows :

2byte Frame control	1 byte sequence number	2 byte destination PAN	2 byte Destination address (0xFFFF)	8 byte Source MAC address	Security Header	Payload Data	2 byte FCS
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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)
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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): $\text{ChanCenterFreq} = \text{ChanCenterFreq } 0 + \text{NumChan} \cdot \text{ChanSpacing}$

Where, $\text{ChanCenterFreq } 0 = 865.125 \text{ MHz}$

Data rate: 50 kbps

Modulation: Filtered 2FSK (2GFSK)

Modulation Index: 1.0

Preamble: 0x55555555

Sync word: 0x904E

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

Frequency Deviation: 25 kHz

SECURITY

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

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

FACTORY DEFAULT NETWORK PARAMETERS

Frequency / Channel: 0x02

Device type: Router

Device State: Not joined

PAN: 0xFFFF

Default Encryption Key : 0000000000MSEDCL

Prefix: 0xFFFF000000000000 (0xFFFF::)

MAC address: As defined in section 2.3.3

Theory of Operation – network formation and commissioning

Description:

On power on, if the router is in a commissioned state, shall issue the DIS message (Reference: RFC6550) once every minute, with a 20% random jitter. Network joins happen on the basis of DIO, DAO and ICMP echo-request and ICMP echo-reply messages. The network shall be a storing mode network, with

each node capable of hosting routes of 200 children. The timing of transmission of DIO messages shall follow trickle algorithm specification as specified under RFC 6206.

Subsequent to a network join, a node shall transmit DIO messages at 4s, 8s, 16s, 32s, 64s, 128s, 256s, 512s and 1024s with a 10% random jitter. Subsequent to this, DIO messages shall be transmitted every 1024s with random jitter, till a global repair command is received at which time the trickle timer shall be reset.

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

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

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

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

Specifying a root node.

All the devices in the network should be capable of being 6lowpan root devices, though factory defaults set them to be routers. One of the (centrally located) nodes shall be identified and configured as a ROOT by HHT/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.

Hand Held Terminal (HHT) should join the network as ROOT while commissioning of meters. Though HHT act as ROOT, reply to ping-requests should not be given by HHT

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]
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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	0 to 9
Device Type	0x02	1	1 - Root 2 - Router
IPv6 Prefix	0x03	8	As per IPv6 specifications
AES Key	0x04	16	Hex 16 bytes
Commission State	0x18	1	0 - Un-commissioned 1 - Commissioned
DAG ID	0x19	16	As per IPv6 specifications
Router List	0x1A	N/A	List of 4 byte IPv6 address with the first 12 byte elided.
Number of routers	0x1B	3	Count of routers added in the ROOT.
Other ID values	Reserved		

Note 1: Attribute PAN ID, channel, Device type, IPv6 Prefix, AES key are mandatory while commissioning ROOT device.

Note 2: Restart command should be sent after writing all attributes in Note 1. If restart command is received before writing all attributes in Note 1, response to restart command should be failure.

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

Packet Structure of request to write commissioning attributes :

1-byte 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 CC CC CC CC CC  
CC CC| 04 |00 00 00 00 00 00 00 00 00 00 00 00 4D 53 45 44 43 4C |
```

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

Commissioning packet response (Success):

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

Example

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

**Note 4:**

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

**Commissioning packet failure response :**

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

**Example.**

02 | 02 | 01 | 01 | 00 | 01 |  
 02 : Frame type – Commission Read/write Response  
 02 : Sequence Number  
 01 : Command ID – Commission Write Response  
 01 : Status - failure  
 00: Fail Attribute ID 0x00 ( PAN ID )  
 01: Status - Fail

**Packet Structure for reading commissioning attributes :**

|                   |                    |                   |                        |                      |                      |                                  |                |
|-------------------|--------------------|-------------------|------------------------|----------------------|----------------------|----------------------------------|----------------|
| 1-byte Frame Type | 1-byte Sequence no | 1-byte Command ID | 1-byte Attribute count | 1-byte Attribute ID1 | 1-byte Attribute ID2 | .....<br>.....<br>.....<br>..... | 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 | <b>Attribute 1 read status</b> | Attribute 1 value | Attribute n ID | Attribute ID'n read status |
|-------------------|--------------------|-------------------|------------------------|----------------------|--------------------------------|-------------------|----------------|----------------------------|

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

02 : Frame type Commissioning Read/Write  
 02 : Sequence Number  
 03 : Command ID – Commissioning Read request  
 04 : Attribute Count  
 00 : Attribute ID 1 – Short PAN ID  
 00: Read Status of attribute ID1 : Value 0= success, non-zero value for failure.  
 12 34 : Short PAN ID value  
 01 : Attribute ID 2 – Channel  
 00: Read Status of attribute ID2  
 02 : Channel Value  
 02 : Attribute ID 3 – Device Type  
 00: Read Status of attribute ID3  
 01: Device Type  
 03 : Attribute ID 4 – IPv6 prefix value  
 00: Read Status of attribute ID4  
 CC CC CC CC CC CC CC CC : IPv6 prefix value

**Router List write Request:**

|                         |                          |                         |                              |                           |                          |                            |                                    |                  |                                  |
|-------------------------|--------------------------|-------------------------|------------------------------|---------------------------|--------------------------|----------------------------|------------------------------------|------------------|----------------------------------|
| 1-byte<br>Frame<br>Type | 1-byte<br>Sequence<br>no | 1-byte<br>Command<br>ID | 1-byte<br>Attribute<br>count | 1-byte<br>Attribute<br>ID | 1-byte<br>Add<br>/Remove | 1-byte<br>Routers<br>count | 4-byte<br>Router<br>Address<br>s 1 | -<br>-<br>-<br>- | 4-byte<br>Router<br>Address<br>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<br>Type | 1-byte Sequence<br>no | 1-byte Command<br>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 | 1-byte | 1-byte | 1-byte Fail | 1-byte |
|--------|--------|--------|-------------|--------|

| Frame Type | Sequence no | Command ID | attribute ID | 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 0<sup>th</sup> address

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

Example:

To download router list of 35 devices, HHT/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 0<sup>th</sup> address.

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

This command should return remaining 15 router addresses (20-34) starting from 20<sup>th</sup> 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<br>Type | 1- byte Sequence<br>no | 1 byte Status |
|----------------------|------------------------|---------------|

Example : | 03 | 02 | 00 |

**APPLICATION LAYER**

MSEDCL ZigBee document attribute list as specified in Annexure VI. Over the Air payload structure, data types information, profile ID, cluster ID, end point information should be the same as legacy ZigBee implementation.

## ANNEXURE - VI

### RF METERING PROTOCOL - SINGLE PHASE RF METER

#### Protocol Version 2.1

### Scope and Purpose

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

### Introduction

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

### Attributes

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

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

### Meter Information Attribute Set (0x00XX)

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

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



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

### Serial Number Attribute

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

### Make Code Attribute

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

### Meter Time

This attribute returns the time currently seen in the meter.

### Protocol Version

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

### Meter Phase

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

### Vendor ID

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

### Tamper Present Status

This attribute returns the time currently seen in the meter.

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

Example : 0000 0000 0000 00000000 0000 0001 0101

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

|          |    |   |
|----------|----|---|
| Reserved | 32 | N |
|----------|----|---|

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

### Instantaneous Voltage

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

### Instantaneous Current

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

### Cumulative Active Energy Attribute Set (0x01XX)

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

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

### Cumulative Active Energy

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

#### Cumulative Active Energy of previous Months 1-12

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

### Maximum Demand Attribute set (0x02XX)

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

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

|      |                                             |                         |                 |           |   |
|------|---------------------------------------------|-------------------------|-----------------|-----------|---|
| 0x02 | Maximum 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 Month 3           | Unsigned 16-bit integer | 0x0000 – 0xffff | Read only | M |
| 0x07 | Maximum Demand of Current Month 3 Timestamp | UTC Time                | 4 bytes         | Read only | M |
| 0x08 | Maximum Demand of Current Month 4           | Unsigned 16-bit integer | 0x0000 – 0xffff | Read only | M |
| 0x09 | Maximum Demand of Current Month 4 Timestamp | UTC Time                | 4 bytes         | Read only | M |
| 0x0a | Maximum Demand of Current Month 5           | Unsigned 16-bit integer | 0x0000 – 0xffff | Read only | M |
| 0x0b | Maximum Demand of Current Month 5 Timestamp | UTC Time                | 4 bytes         | Read only | M |
| 0x0c | Maximum Demand of Current                   | Unsigned 16-bit integer | 0x0000 – 0xffff | Read only | M |

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

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

#### **Maximum Demand of Current Month**

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

#### **Maximum Demand of current Month Timestamp**

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

#### **Maximum Demand of Previous Months 1-12**

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

#### **Maximum Demand of previous Months Timestamp 1-12**

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

#### **Tamper information Attribute Set1 (0x03XX)**

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

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

|                            |                                                                                     |          |         |           |   |
|----------------------------|-------------------------------------------------------------------------------------|----------|---------|-----------|---|
| 0x20- 0x29<br>0x30- 0x39   | Latest 10 Tamper Events-Load Through Local Earth Start (0x2x) and Stop (0x3X) times | UTC Time | 4 bytes | Read only | M |
| 0x2a – 0x2f<br>0x3a – 0x3f | Reserved                                                                            |          |         |           |   |
| 0x40 – 0x49<br>0x50 – 0x59 | Latest 10 Tamper Events – Neutral Disconnected Start (0x04X) and Stop (0x5X) times  | UTC Time | 4 bytes | Read only | M |
| 0x4a – 0x4f<br>0x5a – 0x5f | Reserved                                                                            |          |         |           |   |
| 0x60-0x69<br>0x70-0x79     | Latest 10 Tamper Events Magnetic Tamper Start (0x6X) and Stop (0x7X) times          | UTC Time | 4 bytes | Read only | M |
| 0x6a-0x6f<br>0x7a-0x7f     | Reserved                                                                            |          |         |           |   |
| 0x80                       | Meter Cover Open                                                                    | UTC Time | 4 bytes | Read only | M |

#### Latest 10 Tamper Event Attributes

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

#### Meter Cover Open

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

#### Tamper information Attribute Set2 (0x08XX)

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

| Identifier | Name      | Type | Range   | Access | Mandatory / Optional |
|------------|-----------|------|---------|--------|----------------------|
| 0x00-0x09  | Latest 10 | UTC  | 4 bytes | Read   | M                    |

|           |                                                               |      |  |      |  |
|-----------|---------------------------------------------------------------|------|--|------|--|
| 0x10-0x19 | Tamper Events – ESD Tamper Start (0x0X) and Stop (0x1X) times | Time |  | only |  |
|-----------|---------------------------------------------------------------|------|--|------|--|

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

**Time Zone wise Active Energy Attributes Set (0x04XX)**

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

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

**Time zone wise Active Energy**

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

**Time Zone wise Maximum Demand Attribute Set (0x05XX)**

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

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

|      |                                       |                                |                   |              |   |
|------|---------------------------------------|--------------------------------|-------------------|--------------|---|
| 0x03 | TZ2<br>Maximum<br>Demand<br>Timestamp | UTC<br>Time                    | 4 bytes           | Read<br>only | M |
| 0x04 | TZ3<br>Maximum<br>Demand              | Unsigned<br>32- bit<br>integer | 0x0000-<br>0xffff | Read<br>only | M |
| 0x05 | TZ3<br>Maximum<br>Demand<br>Timestamp | UTC<br>Time                    | 4 bytes           | Read<br>only | M |
| 0x06 | TZ4<br>Maximum<br>Demand              | Unsigned<br>32- bit<br>integer | 0x0000-<br>0xffff | Read<br>only | M |
| 0x07 | TZ4<br>Maximum<br>Demand<br>Timestamp | UTC<br>Time                    | 4 bytes           | Read<br>only | M |

#### Time zone wise Maximum Demand

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

#### Time zone wise Maximum Demand Timestamp

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

#### Load Profile Attributes Set (0x06XX)

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

#### Load Profile

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

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

| Field Name             | Type     |
|------------------------|----------|
| Interval Start<br>Time | UTC time |



|         |                         |
|---------|-------------------------|
| kWH     | Unsigned 32 bit integer |
| kWMD    | Unsigned 16 bit integer |
| Voltage | Unsigned 16 bit integer |
| Current | Unsigned 16 bit integer |

Note :

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

### Power On/OFF events Attribute set (0x07XX)

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

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

## **Part II : Interoperability**

### **The objectives of MSEDCL:**

- 1) Interoperability with any make of meter; any make of radio module
- 2) Mesh networking with hopping
- 3) Systems should be ready for future AMR
- 4) Standardization.
  - The meter based on 6LoWPAN and HHT shall be based on both open Zigbee 2007 PRO and 6LoWPAN
  - The HHT shall support Simple Metering Cluster and related attributes from the Smart Energy profile of ZigBee Pro, on a manufacturer specific profile that has been defined in the document “ZigBee Automated Metering Initiative Profile” which represents data previously covered by the MSEDCL protocol; this cluster may be implemented by all meter vendors for interoperability

### **Interoperability in the field**

- The HHT should be able to act as a ZigBee Coordinator /6LoWPAN root in order to facilitate the installation & commissioning of meters. The devices are combo devices, capable of commissioning a network and also act as routers/end device to download data.
- Zigbee based meter devices shall join the ZigBee Global Commissioning PAN (0x0050C27710000000) formed by HHT. The HHT shall then configure meter devices for the destination operating network by use of the ZigBee Cluster Library's Commissioning cluster. Devices shall then be instructed to leave the ZigBee Global Commissioning PAN and join the new network. If the new operating PAN has not been started, the HHT shall start the new network, commissioning an energy meter as a coordinator for that new PAN. If for any reason the new operating PAN is not accessible the meter should return to factory defaults.

**Note:**

All settings provided for Zigbee devices specified in the tender document are only for tender samples. The proper settings will be communicated to successful bidder.

### **Part III : Setting Critical Parameters**

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

These operations involve setting critical parameters in the meters.

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

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

#### **Protocol Sequences.**

##### **1) Change of password in the meter.**

The default password in the meter shall be the meter's serial number. The following packets shall be sent from the HHU to the meter.

##### **Packet 1:**

Attribute ID: 0x0000

Attribute type: String type

Attribute length: 6 – 20 bytes

Description: Old password.

Attribute ID: 0x0001

Attribute type: string type

Attribute length: 6 – 20 bytes

Description: New password.

##### **Packet 2:**

To be issued within 120 seconds of Packet 1:

Attribute ID: 0x0002

Attribute type: string type

Attribute length: 6 – 20 bytes

Description: New Password Reconfirm.

##### **Response :**

For success- 0x00

For failure- any non-zero value.

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

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

## 2) Protocol sequence for reset MD.

### Packet 1:

Attribute ID: 0x0000

Attribute type: string type

Attribute length: 6 – 20 bytes

Description: Password.

Attribute ID: 0x0004

Attribute type: No data type

### Response :

For success- 0x00

For failure- any non-zero value.

## 3) Protocol sequence for TOD timeslot setting

### Packet 1:

Attribute ID: 0x0000

Attribute type: string type

Attribute length: 6 – 20 bytes

Description: Password.

Attribute ID: 0x0005

Attribute type: Variable length array.

### Response :

For success- 0x00

For failure- any non-zero value.

Attribute Description: The 0th element will be a 16 bit element consisting of the length of the array and the following elements will be of 8 bit unsigned integer type.

The number in the 0th element lists the number of time of day (TOD) slots. The following array elements will describe the number of hours in each slot.

## 4) Protocol sequence for setting time in the meter.

### Packet 1:

Attribute ID: 0x0000

Attribute type: string type

Attribute length: 6 – 20 bytes

Description: password.

Attribute ID: 0x0006

Attribute type: UTC Time.

Description: This command will set the RTC time in the meter.

### Response :

For success- 0x00

For failure- any non-zero value.

## ANNEXURE - VII

### WORKING OF HHT APPLICATION FOR MSEDCL

#### 1.0 ASSUMPTIONS:

The network is being implemented with two considerations.

- Meter reading through DCU (Data Concentrator Unit)/6LoWPAN root in future. DCU / HHT will join the existing network as a router.
- Ease of meter installation and commissioning process.
- Meter Installers are different from Commissioning Technicians.
- Tamper Present status is always captured along with billing information.
- In case of response not received to HHT for tamper present status, HHT should store 'XXXX' in BILL.MRI. E.g. In old meters, supplied against earlier tenders, (no provision to record tamper present status ) who do not return any response to tamper present status download command, the HHT should store 'XXXX' as a response for tamper present status.
- In old meters, supplied against earlier tender, EMI/EMC field tamper attributes are not implemented. HHT should retry three times for this tamper.

#### 2.0 INTRODUCTION

##### 2.1 Scope

**MSEDCL would like to deploy RF enabled meters in Urban (high density of consumers) and rural area.**

**Along with RF Enabled meters, the system has following components:**

1. BCS:

Base computer software used for communication with HHT. Stores commissioning and meter reading data.

2. Hand Held Terminal (HHT):

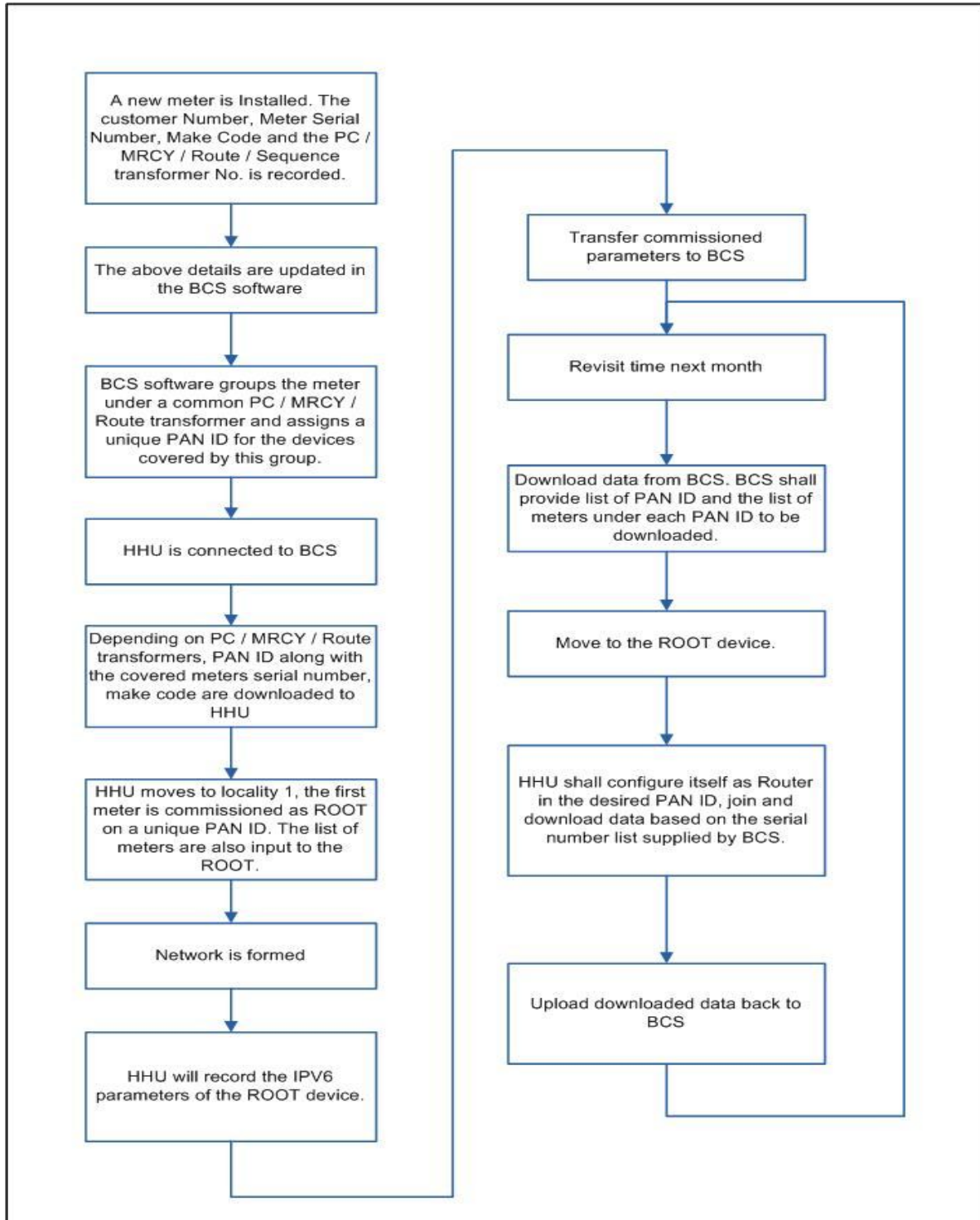
Used during commissioning phase and collects meter reading data thereafter.

This document explains the flow of the HHT software for commissioning and fetching data from these meters as per new commissioning and deployment strategy (reference "Commissioning and Deployment.doc") finalized by MSEDCL.

This Document restricts itself to explain the communication flow and data parameters to be transferred between HHT and BCS software.

Any other communication is out of scope of this document.

### 3.00 PROCESS FLOWCHART:



#### **4.00 HHT FUNCTIONALITY:**

##### **4.01 Installation of meters**

Whenever a meter is installed, the installation personnel are required to make note of the following information:

- Consumer Number
- Meter Serial Number & Make Code
- Meter Phase
- PC, MRCY, Route & Sequence
- Transformer Identity Number which services this particular meter.
- Any other customer identity / address.

The above data should then be entered into the BCS software.

##### **4.02 6LoWPAN and Zigbee Network related BCS Functionality :**

BCS shall group the meters (Serial Number & Make Code) separately based on their transformer details.

This classification is important since in future if MSEDCL goes the DCU way,

- Generate a pool of 64-bit PAN Id: Extended PAN Id of the network.

128-bit link key: Link key used for joining the network.

The HHT shall use a free PAN ID and link key and allot them for each network it commissions.

Adequate measures to be taken to ensure non duplication of ID's and other parameters.

##### **4.03 6LoWPAN and Zigbee Network related HHT Functionality :**

A HHT before going out has to be interfaced with the BCS software. On choosing the area where it is supposed to work for the day, the BCS shall send transfer the following data to HHT:

- Transformer Identities



- Meter Serial Number & Make Code of the meters that are serviced by the Transformer
- Pool of free PAN ID and Link Key

HHT broadly has two functions to perform in the field.

1. Commission newly deployed meters and create new networks as required.
2. Fetch data from the meters for which networks have already been created.

The process is explained below:

Meter Reader downloads the following details from BCS to HHT before going on the field.

- List of area & transformers to be covered.
- List of meters / serial number & make code that are serviced by the Transformer
- Pool of free PAN IDs and Link Keys
- Non-commissioned meters in the above list.
- List of free / unused networks which will be used for creating new networks. For the first time for a area the HHT will contain list of all unused networks only.

There are two scenarios that the HHT shall face

- First Visit
- Revisit

#### **First Visit:**

The HHT shall move to the meter in the field and commission the first meter as the 'coordinator' or 'root' depending upon band of operation i.e. Zigbee or 6LoWPAN, on a free PAN ID and Link Key. The following details shall be stored for transfer to the BCS:

- Serial Number & Make Code of the Meter
- Whether Coordinator or Router
- PAN ID
- Link Key

- Meter Phase
- Meter Type

Then the HHT addresses the nearby router, one after the other, and commissions them as routers in the just commissioned Network. These details too are stored for transfer to BCS at the end of the Day.

#### **4.05 Revisit:**

When the HHT is connected to the BCS, list of localities are offered to the HHT. On choosing the appropriate locality, the following details are downloaded to the HHT

- List of PAN ID, Link Key and meter serial number with make code under each PAN ID
- List of newly installed meters that need commissioning.

The HHT arrives at the location, commissions the new meters into available networks. The HHT joins each network and downloads the required data.

#### **4.06 Meter information:**

For the newly commissioned meters following details will be stored in HHT, which will be later transferred to BCS software:

- Serial Number & Make Code of the Meter
- Whether Coordinator or Router or root
- PAN ID
- Link Key
- Meter Phase

#### **4.07 Billing Information**

HHT can download the billing data along with tamper present status from any meter. After joining the network, the data can be downloaded from any target meter in the network.

#### **5.00 PROTECTION OF DATA:**

HHT can be misplaced or stolen, such HHTs need to be de-registered. In order to protect the data stored in HHT, every HHT should have a unique serial number and HHT application should have a password.

## **6.00 MENUS OF HHU APPLICATION:**

Refer Annexure-VIII for HHT Menu.

### **6.01 Facility in HHU:**

Meter Reader on field will be able to perform following tasks from HHT:

Download Billing Data from all the meters in existing Network

Download Billing Data from un-commissioned Meters ( Meters in Global PAN )

Commission newly installed meters – should automatically create a new network with a meter being commissioned as a coordinator if necessary.

Download Load Profile Data

Download Tamper Data

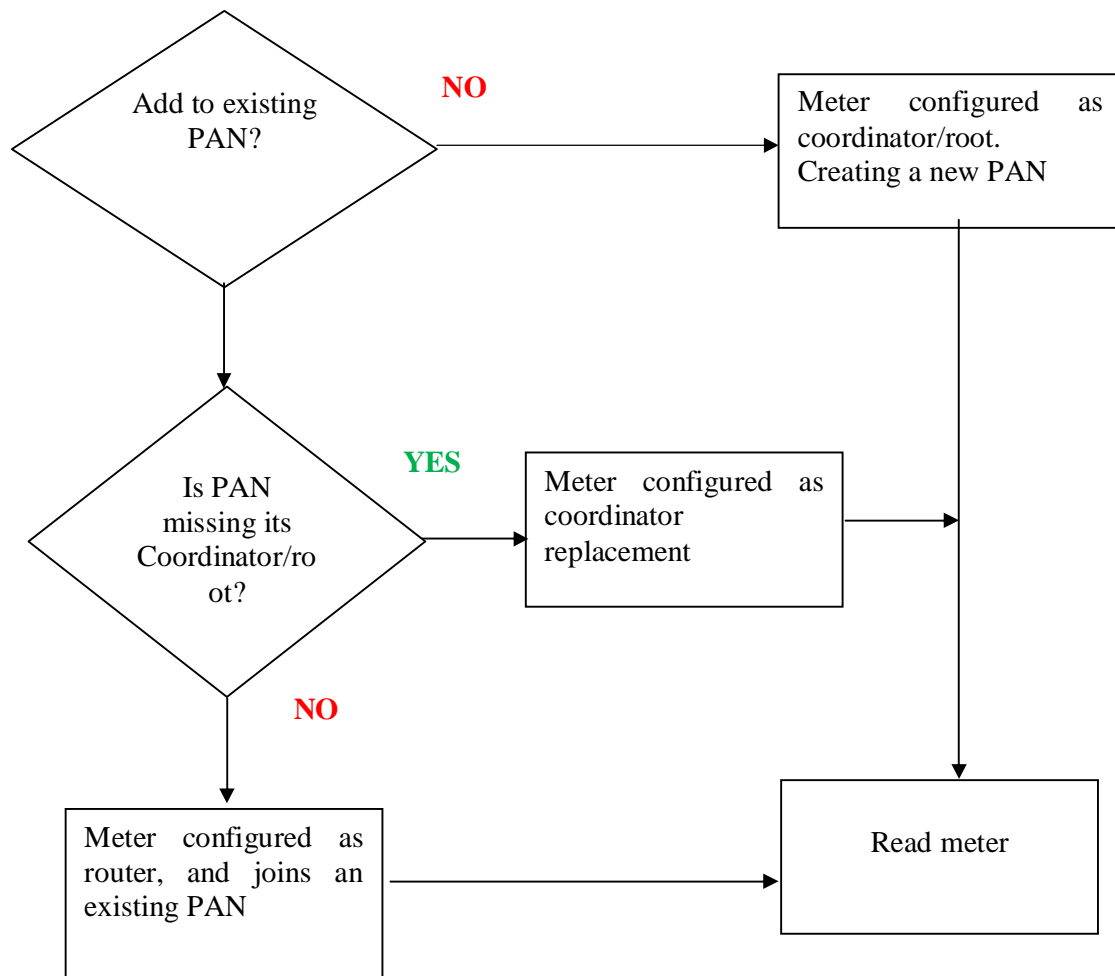
Download TOD Data

Reset Maximum Demand

Reset TOD Slots

Reset Corrupt RTC of Meter

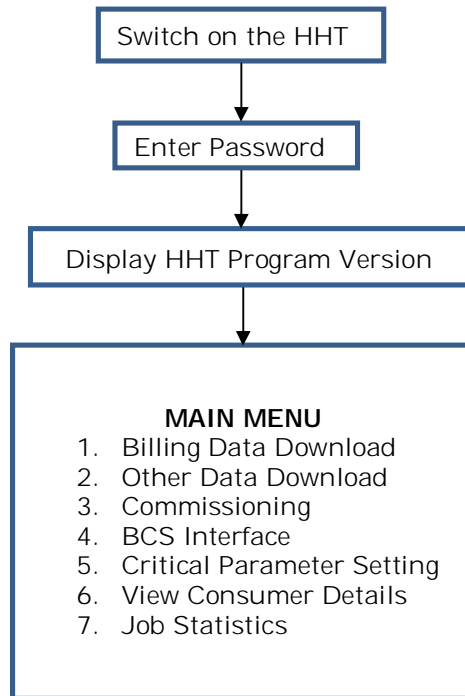
### Commissioning & deployment - Flow Chart



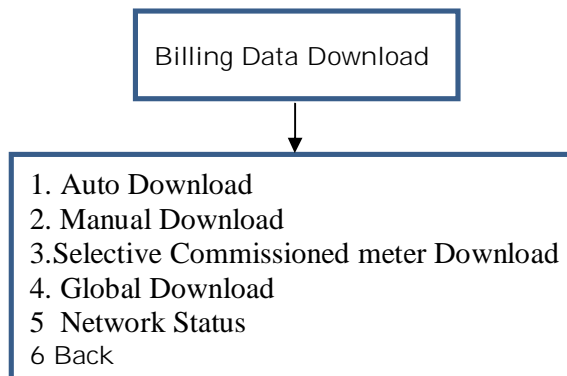
## ANNEXURE - VIII

### COMMON MENU STRUCTURE FOR HHT APPLICATION

#### Menu of HHT APPLICATION



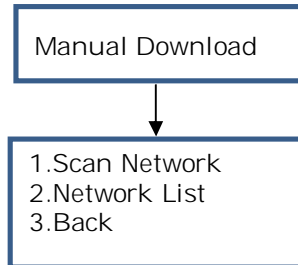
#### 1) Billing Data Download Sub Menu -



#### NOTE :

- On Selection of options 1 i.e. "Auto Download", HHT will scan for the PANs available and will download each PAN and thereafter Meters(if any) on global mode will be downloaded .

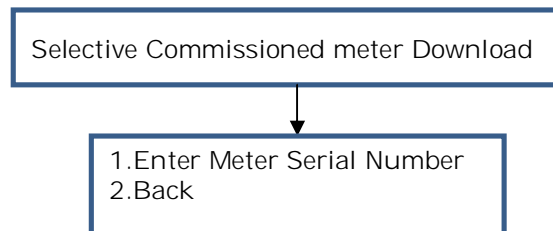
### Manual Download Sub Menu



#### NOTE :

- On Selection Of Scan Network Menu HHT will scan for the PANs available , after completion of the scan list of available PANs will be displayed as PAN id and Coordinator serial number on the HHT screen User has to manually select the PAN to be Downloaded.
- On Selection Of Scan Network Menu the PANs available in job configured to HHT will be displayed as PAN id and Coordinator serial number on the HHT screen. User has to manually select the PAN to be Downloaded.

### Selective Commissioned Meter Download



#### NOTE :

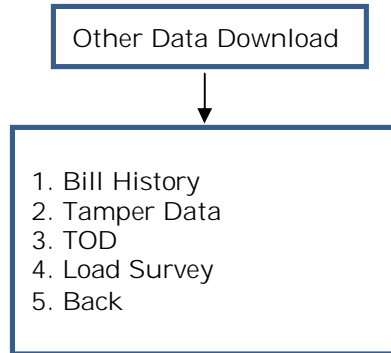
- User will enter the serial number of commissioned meter in the which is available in Job. The Billing Data of that meter will be downloaded.

### Global Download Sub Menu

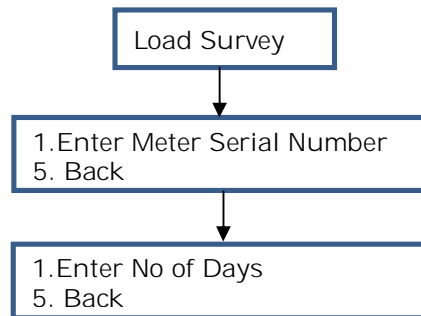
#### NOTE :

- On selecting Global Download Menu , HHT will scan all the meter in the surrounding which are on Global Mode and download only "Billing Data" for meters in global mode.

## 2) Other Data Download Sub Menu -



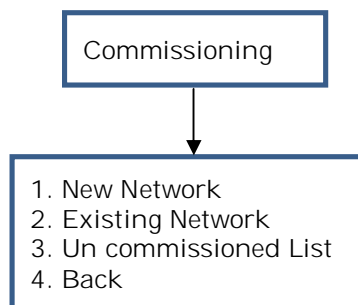
## Load Survey Sub Menu



### NOTE :

- After selecting load Survey Menu user will be prompted to enter the meter serial number after entering the meter serial number , it will again prompt for Number days for which Load Survey Data Needs to be downloaded.
- The range for number of days to be entered is 1 to 45 days.

## 3) Commissioning Sub Menu



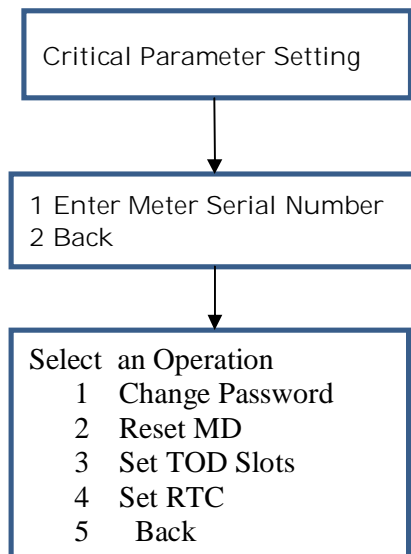
NOTE :

- On selecting options 1 i.e. "New Network" , User will be prompted to enter serial numbers of the meters to be commissioned. New network will be formed with first meter number entered as a coordinator and user may enter the serial number of meters all at a time or one meter can be added after previous one is commissioned.
- On selecting option 2 i.e. "Existing Network" , the PAN available in the job configured to HHT will be displayed on the HHT screen user has to select the PAN . After selecting the PAN user will be prompted for the meter serial number to be commissioned. The meter will be added to the selected PAN as a router.
- On selecting option 3 i.e. "Un commissioned List" ,list of all the un commissioned meters in the job configured to HHT will be displayed.

#### 4) BCS Interface

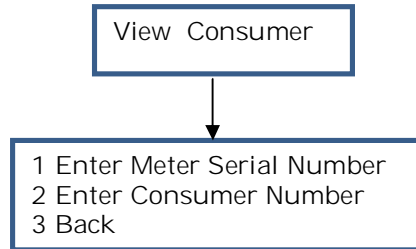
- HHT will Display a message "BCS COMMONICATION....." on screen.

#### 6) Critical Parameter Setting Sub Menu





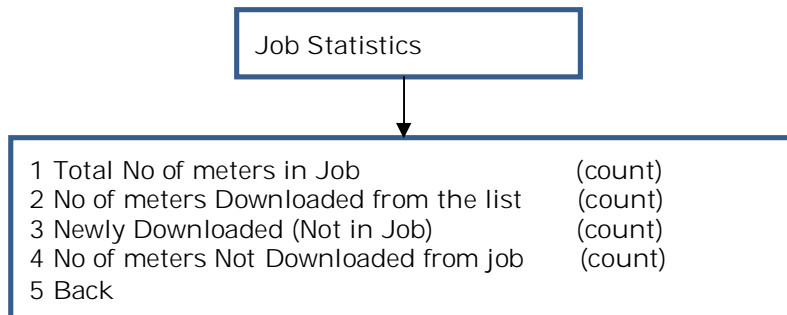
## 6) Consumer Details



NOTE :

- User will either select meter number or Consumer number. The consumer details will be displayed on the HHT screen Consumer Details include
  1. Consumer Number
  2. Consumer Name
  3. Consumer Address
  4. Meter Make Code
  5. Meter Serial Number
  6. Meter Download Status(Downloaded/ Not Downloaded)
  7. Billing Data(KWH value Downloaded)

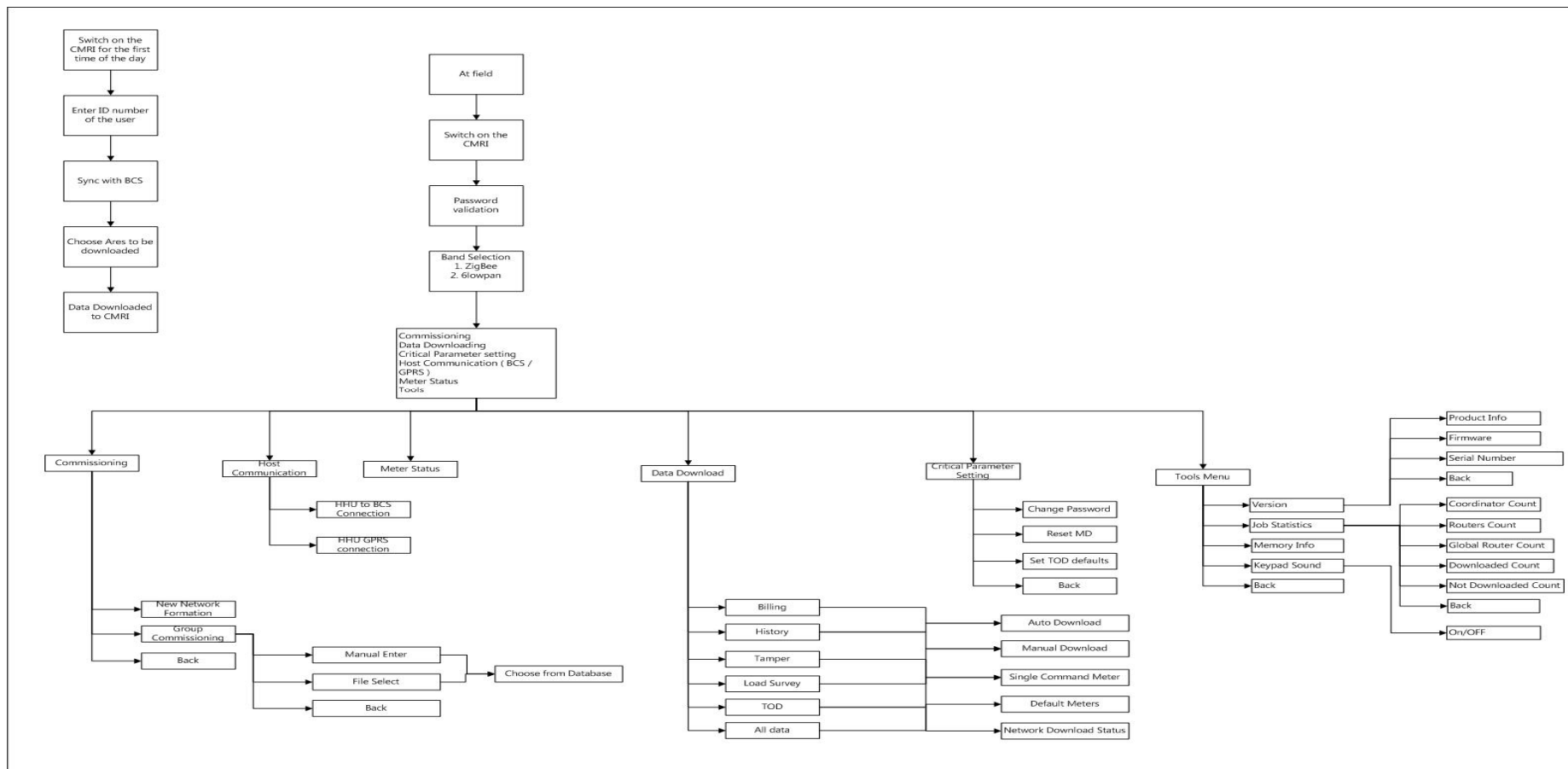
## 7) Job Statistics



NOTE :

- Whenever user selects any options from 1 to 4. The corresponding meters serial numbers in that category will be displayed.

**HHT Workflow for Data Download and Commissioning**



## **ANNEXURE - IX**

### **Common File Saving Formats of HHT**

The purpose of this document is to specify a common file saving format for data acquired in HHT through LPRF Port.

#### **Total Number of Files required to be stored in HHT**

1. Billing
2. Meter History kWh
3. Tamper
4. Load Survey
5. TOD Data
6. Meter\_Consumer\_details File.
7. Network Details for Meters File.
8. Job Details in HHT File

#### **Filenames**

**Following are the file names for saving the above files in HHT.**

1. BILL.MRI (For Billing file)
2. KWH.MRI (For Meter History kWh File)
3. TPR.MRI (For Tamper File)
4. LSD.MRI (For Load Survey File)
5. TOD.MRI ( For TOD data)
6. RFMSTR.MRI (For Meter Consumer details File)
7. NETWORK.MRI (For Network Details of Meters in HHT)
8. JOB.MRI (For Job Details Stored in HHT)

## **HHT File Format for Meter Data**

### **Note:-**

- All data must be in format provided by MSEDCL.
- In meter data file, every meter data must start with new line.
- At the end of each meter data files suffix "Q" must be added.
- During downloading of Billing, Following Sequence for writing data shall be adhered:
  - Meter Serial Number
  - Make Code
  - Active Energy in kWH (current month)
  - MD (kW/kVA) (current month)
  - MD Date/time (current month)
  - Time (Meter RTC)
  - Date (Meter RTC)
  - Active Energy in kWH of previous month1
  - Active Energy in kWH of previous month2
  - Active Energy in kWH of previous month3
  - Active Energy in kWH of previous month4
  - Active Energy in kWH of previous month5
  - Active Energy in kWH of previous month6
  - MD(kW/kVA) of previous month1
  - MD Date/time of previous month1
  - MD(kW/kVA) of previous month2
  - MD Date/time of previous month2
  - MD(kW/kVA) of previous month3
  - MD Date/time of previous month3
  - MD(kW/kVA) of previous month4
  - MD Date/time of previous month4
  - MD(kW/kVA) of previous month5
  - MD Date/time of previous month5
  - MD(kW/kVA) of previous month6
  - MD Date/time of previous month6

**Note : In case of Single Phase meters MD values should be in kW and in case of Three Phase meters MD values should be in kVA**

- During downloading of Tamper, Following Sequence for writing data shall be adhered:
  - Reverse Tamper
  - Earth Tamper

- Neutral Missing Tamper
- Magnet Tamper
- Meter Cover Open Tamper
- EMI/EMC Field Tamper
- Missing Potential Tamper
- Potential Imbalance Tamper
- Current Unbalance Tamper
- Current reversal Tamper
- Current circuit short Tamper
- CT Bypass Tamper
- Power ON OFF Tamper

### **Tags**

1. BIL For Billing Data
2. KWH For Only kWH Data
3. TAR For Reverse Tamper Data
4. TAE For Earth Tamper Data
5. TAN For Neutral missing Tamper Data
6. TAM For Magnet Tamper
7. TAS For EMI/EMC Field Tamper
8. TAC For Meter Cover Open Tamper
9. TAP For Missing Potential
10. TAT For Potential Unbalance
11. TAU For Current unbalance Tamper
12. TAV For Current reversal Tamper
13. TAX For current circuit short Tamper
14. TAY For CT Bypass Tamper
15. TAZ For Power On OFF
16. LSD For Load Survey Data
17. MTR For Meter Serial Number file
18. EN# End Of Data.
18. Q At the end of the file.
19. CPT For setting TOD timings through critical parameter setting.
20. NWK For Network related Entries
21. JOB For Job related entries
22. RFM For RF Meter related data.

**Format of Billing File ( BILL.MRI) :**

| TAG | Serial Number | Make Code | Meter Phase | Meter Type | Data | EN# |
|-----|---------------|-----------|-------------|------------|------|-----|
|-----|---------------|-----------|-------------|------------|------|-----|

**i.e**

Tag                BIL  
                     <Serial Number>  
                     <Make Code>  
                     <Meter Phase>

Data                <kWH><MDkW/kVA><MD Time HH:MI><MD Date DD:MM:YY><Reading  
Time HH:MI><Reading Date DD:MM:YY><Meter RTC Time  
HH:MI><Meter RTC Date DD:MM:YY><Instantaneous Voltage > <  
Instantaneous Current><Tamper present status>

End of Data       EN#

Note:

1. The meter Phase attribute should mention values as follows:

- 1: Single Phase Meter
- 3: Three Phase Meter

**Example of billing data file ( containing data of two meters).**

```
BIL(00114214)(071)(1)(00011.4)(01.3)(00:30)(01:10:12)(10:19)(01:10:12)
(10:19)(01:10:12)(230)(7500)(0000000000000000000000000000101)EN#
```

```
BIL(00114216)(056)(1)(00075.3)(02.7)(00:48)(00:10:12)(10:19)(01:10:12)
(10:19)(01:10:12)(240)(7000)(0000000000000000000000000000101) EN#Q
```

**Note : In case of Single Phase meters MD values should be in kW and in case of Three Phase meters MD values should be in KVA**

**Format of Meter History KWH File (KWH.MRI) :**

| TAG | Serial Number | Make Code | Data | EN# |
|-----|---------------|-----------|------|-----|
|-----|---------------|-----------|------|-----|

i.e

Tag            KWH  
  
                 <Serial Number>  
  
                 <Make Code>

Data

<kWH><MDkW/kVA><MD kW/kVA Date DD:MM:YY><MD kW/kVA Time HH:MI>  
 <kWH><MDkW/kVA><MD kW/kVA Date DD:MM:YY><MD kW/kVA Time HH:MI>  
 <kWH><MDkW/kVA><MD kW/kVA Date DD:MM:YY><MD kW/kVA Time HH:MI>  
 <kWH><MDkW/kVA><MD kW/kVA Date DD:MM:YY><MD kW/kVA Time HH:MI>  
 <kWH><MDkW/kVA><MD kW/kVA Date DD:MM:YY><MD kW/kVA Time HH:MI>  
 <kWH><MDkW/kVA><MD kW/kVA Date DD:MM:YY><MD kW/kVA Time HH:MI>  
 <kWH><MDkW/kVA><MD kW/kVA Date DD:MM:YY><MD kW/kVA Time HH:MI>  
 <kWH><MDkW/kVA><MD kW/kVA Date DD:MM:YY><MD kW/kVA Time HH:MI>  
 <kWH><MDkW/kVA><MD kW/kVA Date DD:MM:YY><MD kW/kVA Time HH:MI>  
 <kWH><MDkW/kVA><MD kW/kVA Date DD:MM:YY><MD kW/kVA Time HH:MI>  
 <kWH><MDkW/kVA><MD kW/kVA Date DD:MM:YY><MD kW/kVA Time HH:MI>  
 <kWH><MDkW/kVA><MD kW/kVA Date DD:MM:YY><MD kW/kVA Time HH:MI>

End of Data      EN#

**Example of Meter History KWH data file ( containing data of two meters).**

KWH(00100869)(052)(00018.1)(04.50)(10:02:14)(13:10)  
 (00015.1)(03.50)(11:01:14)(12:10)  
 (00013.1)(05.50)(12:12:13)(12:15)



(00012.3)(04.57)(11:11:13)(10:10)  
 (00011.1)(04.30)(16:10:13)(12:10)  
 (00008.1)(03.50)(18:09:13)(12:30)  
 (00007.6)(04.23)(11:08:13)(10:30)  
 (00007.1)(04.57)(07:07:13)(15:30)  
 (00006.9)(04.23)(11:06:13)(17:45)  
 (00006.6)(04.57)(19:05:13)(16:30)  
 (00005.9)(04.23)(11:04:13)(07:30)  
 (00005.6)(04.34)(21:03:13)(12:30)EN#Q

**Note : In case of Single Phase meters MD values should be in kW and in case of Three Phase meters MD values should be in kVA**

**Format of Tamper Data File (TPR.MRI) :**

| TAG | Serial Number | Make Code | Data | EN# |
|-----|---------------|-----------|------|-----|
|-----|---------------|-----------|------|-----|

**i.e**

Tag (Any one of the following tag as per tamper event)

- TAR For Reverse Tamper Data
- TAE For Earth Tamper Data
- TAN For Neutral Missing Tamper Data
- TAM For Magnet Tamper
- TAS For EMI/EMC Field Tamper
- TAC For Meter Cover Open Tamper
- TAP For Missing Potential
- TAT For potential Unbalance
- TAU For Current unbalance Tamper
- TAV For Current reversal Tamper
- TAX For current circuit short Tamper
- TAY For CT Bypass Tamper
- TAZ For Power On Off Tamper

<Serial Number>

<Make Code>

Data

<Event Number><Occurance Date DD:MM:YY>

<Occurance Time HH:MI>><Restoration Date DD:MM:YY>

<Restoration Time HH:MI>

End of Data EN#

**Example of tamper data file (containing data of two meters)..**

TAC(00100869)(001)(27:01:11,15:05)EN#

TAM(00100869)(001)(01,24:02:11,10:28,24:02:11,10:52)(02,24:02:11,10:22,24:02:11,10:25)(03,24:02:11,10:14,24:02:11,10:17)(04,24:02:11,10:07,24:02:11,10:11)(05,00:00:00,00:00,00:00:00,00:00)(06,00:00:00,00:00,00:00:00,00:00)(07,00:00:00,00:00,00:00:00,00:00)(08,00:00:00,00:00,00:00:00,00:00)(09,00:00:00,00:00,00:00:00,00:00)(10,00:00:00,00:00,00:00:00,00:00) EN#

TAS(00100869)(001)(01,10:01:11,12:28,17:01:11,12:28)(02,00:00:00,00:00,00:00:00,00:00)(03,00:00:00,00:00,00:00:00,00:00)(04,00:00:00,00:00,00:00:00,00:00)(05,00:00:00,00:00,00:00:00,00:00)(06,00:00:00,00:00,00:00:00,00:00)(07,00:00:00,00:00,00:00:00,00:00)(08,00:00:00,00:00,00:00:00,00:00)(09,00:00:00,00:00,00:00:00,00:00)(10,00:00:00,00:00,00:00:00,00:00) EN#

TAR(00100869)(001)(01,15:10:12,13:40,00:00:00,00:00)(02,25:10:12,15:20,31:10:12,14:10)(03,00:00:00,00:00,00:00:00,00:00)(04,00:00:00,00:00,00:00:00,00:00)(05,00:00:00,00:00,00:00:00,00:00)(06,00:00:00,00:00,00:00:00,00:00)(07,00:00:00,00:00,00:00:00,00:00)(08,00:00:00,00:00,00:00:00,00:00)(09,00:00:00,00:00,00:00:00,00:00)(10,00:00:00,00:00,00:00:00,00:00)EN#

TAE(00100869)(001)(01,02:11:12,11:56,00:00:00,00:00)(02,01:11:12,19:54,01:11:12,20:51)(03,00:00:00,00:00,00:00:00,00:00)(04,00:00:00,00:00,00:00:00,00:00)(05,00:00:00,00:00,00:00:00,00:00)(06,00:00:00,00:00,00:00:00,00:00)(07,00:00:00,00:00,00:00:00,00:00)(08,00:00:00,00:00,00:00:00,00:00)(09,00:00:00,00:00,00:00:00,00:00)(10,00:00:00,00:00,00:00:00,00:00) EN#

TAN(00100869)(001)(01,01:11:10,20:07,01:11:10,20:13)(02,00:00:00,00:00,00:00:00,00:00)(03,00:00:00,00:00,00:00:00,00:00)(04,00:00:00,00:00,00:00:00,00:00)(05,00:00:00,00:00,00:00:00,00:00)(06,00:00:00,00:00,00:00:00,00:00)(07,00:00:00,00:00,00:00:00,00:00)(08,00:00:00,00:00,00:00:00,00:00)(09,00:00:00,00:00,00:00:00,00:00)(10,00:00:00,00:00,00:00:00,00:00) EN#

TAP(00100869)(001)(01,01:12:13,21:07,01:12:13,21:13)(02,00:00:00,00:00,00:00:00,00:00)(03,00:00:00,00:00,00:00:00,00:00)(04,00:00:00,00:00,00:00:00,00:00)(05,00:00:00,00:00,00:00:00,00:00)(06,00:00:00,00:00,00:00:00,00:00)(07,00:00:00,00:00,00:00:00,00:00)(08,00:00:00,00:00,00:00:00,00:00)(09,00:00:00,00:00,00:00:00,00:00)(10,00:00:00,00:00,00:00:00,00:00) EN#

TAU(00100869)(001)(01,05:11:14,18:07,05:11:14,20:13)(02,00:00:00,00:00,00:00:00,00:00)(03,00:00:00,00:00,00:00:00,00:00)(04,00:00:00,00:00,00:00:00,00:00)(05,00:00:00,00:00,00:00:00,00:00)(06,00:00:00,00:00,00:00:00,00:00)(07,00:00:00,00:00,00:00:00,00:00)(08,00:00:00,00:00,00:00:00,00:00)(09,00:00:00,00:00,00:00:00,00:00)(10,00:00:00,00:00,00:00:00,00:00) EN#

TAC(00100870)(001)(27:01:11,15:05)EN#

TAM(00100870)(001)(01,24:02:11,10:28,24:02:11,10:52)(02,24:02:11,10:22,24:02:11,10:25)(03,24:02:11,10:14,24:02:11,10:17)(04,24:02:11,10:07,24:02:11,10:11)(05,00:00:00,00:00,00:00:00,00:00)(06,00:00:00,00:00,00:00:00,00:00)(07,00:00:00,00:00,00:00:00,00:00)(08,00:00:00,00:00,00:00:00,00:00)(09,00:00:00,00:00,00:00:00,00:00)(10,00:00:00,00:00,00:00:00,00:00) EN#

TAS(00100870)(001)(01,24:02:11,10:28,24:02:11,10:52)(02,24:02:11,10:22,24:02:11,10:25)(03,24:02:11,10:14,24:02:11,10:17)(04,24:02:11,10:07,24:02:11,10:11)(05,00:00:00,00:00,00:00:00,00:00)(06,00:00:00,00:00,00:00:00,00:00)(07,00:00:00,00:00,00:00:00,00:00)(08,00:00:00,00:00,00:00:00,00:00)(09,00:00:00,00:00,00:00:00,00:00)(10,00:00:00,00:00,00:00:00,00:00) EN#

TAR(00100870)(001)(01,00:00:00,00:00,00:00:00,00:00)(02,00:00:00,00:00,00:00:00,00:00)(03,00:00:00,00:00,00:00:00,00:00)(04,00:00:00,00:00,00:00:00,00:00)(05,00:00:00,00:00,00:00:00,00:00)(06,00:00:00,00:00,00:00:00,00:00)(07,00:00:00,00:00,00:00:00,00:00)(08,00:00:00,00:00,00:00:00,00:00)(09,00:00:00,00:00,00:00:00,00:00)(10,00:00:00,00:00,00:00:00,00:00) EN#

TAE(00100870)(001)(01,02:11:10,11:56,00:00:00,00:00)(02,01:11:10,19:54,01:11:10,20:51)(03,00:00:00,00:00,00:00:00,00:00)(04,00:00:00,00:00,00:00:00,00:00)(05,00:00:00,00:00,00:00:00,00:00)(06,00:00:00,00:00,00:00:00,00:00)(07,00:00:00,00:00,00:00:00,00:00)(08,00:00:00,00:00,00:00:00,00:00)(09,00:00:00,00:00,00:00:00,00:00)(10,00:00:00,00:00,00:00:00,00:00) EN#

TAN(00100870)(001)(01,01:11:10,20:07,01:11:10,20:13)(02,00:00:00,00:00,00:00:00,00:00)(03,00:00:00,00:00,00:00:00,00:00)(04,00:00:00,00:00,00:00:00,00:00)(05,00:00:00,00:00,00:00:00,00:00)(06,00:00:00,00:00,00:00:00,00:00)(07,00:00:00,00:00,00:00:00,00:00)(08,00:00:00,00:00,00:00:00,00:00)(09,00:00:00,00:00,00:00:00,00:00)(10,00:00:00,00:00,00:00:00,00:00) EN#

TAV(00100870)(001)(01,01:11:10,20:07,01:11:10,20:13)(02,00:00:00,00:00,00:00:00,00:00)(03,00:00:00,00:00,00:00:00,00:00)(04,00:00:00,00:00,00:00:00,00:00)(05,00:00:00,00:00,00:00:00,00:00)(06,00:00:00,00:00,00:00:00,00:00)(07,00:00:00,00:00,00:00:00,00:00)(08,00:00:00,00:00,00:00:00,00:00)(09,00:00:00,00:00,00:00:00,00:00)(10,00:00:00,00:00,00:00:00,00:00) EN#

TAX(00100870)(001)(01,01:11:10,20:07,01:11:10,20:13)(02,00:00:00,00:00,00:00:00,00:00)(03,00:00:00,00:00,00:00:00,00:00)(04,00:00:00,00:00,00:00:00,00:00)(05,00:00:00,00:00,00:00:00,00:00)(06,00:00:00,00:00,00:00:00,00:00)(07,00:00:00,00:00,00:00:00,00:00)(08,00:00:00,00:00,00:00:00,00:00)(09,00:00:00,00:00,00:00:00,00:00)(10,00:00:00,00:00,00:00:00,00:00) EN#

TAY(00100870)(001)(01,01:11:10,20:07,01:11:10,20:13)(02,00:00:00,00:00,00:00:00,00:00)(03,00:00:00,00:00,00:00:00,00:00)(04,00:00:00,00:00,00:00:00,00:00)(05,00:00:00,00:00,00:00:00,00:00)(06,00:00:00,00:00,00:00:00,00:00)(07,00:00:00,00:00,00:00:00,00:00)(08,00:00:00,00:00,00:00:00,00:00)(09,00:00:00,00:00,00:00:00,00:00)(10,00:00:00,00:00,00:00:00,00:00) EN#

TAZ(00100870)(001)(01,01:11:10,20:07,01:11:10,20:13)(02,00:00:00,00:00,00:00:00,00:00)(03,00:00:00,00:00,00:00:00,00:00)(04,00:00:00,00:00,00:00:00,00:00)(05,00:00:00,00:00,00:00:00,00:00)(06,00:00:00,00:00,00:00:00,00:00)(07,00:00:00,00:00,00:00:00,00:00)(08,00:00:00,00:00,00:00:00,00:00)(09,00:00:00,00:00,00:00:00,00:00)(10,00:00:00,00:00,00:00:00,00:00) EN#Q

**Format of Load Survey Data File (LSD.MRI) :**

| TAG | Serial Number | Make Code | Meter Phase | Data | EN# |
|-----|---------------|-----------|-------------|------|-----|
|-----|---------------|-----------|-------------|------|-----|

i.e

Tag

LSD  
<Serial Number><Make Code><Meter Phase>

Data <Load Profile Data >

End of Data EN#

**Note:**

**In case of Single Phase RF meters Load Profile Data will consists of Interval Start Time, KWH, MD KW, Voltage and Current Parameters**

In case of Three Phase RF meters Load Profile Data will consists of Interval Start Time, KWH, KVA<sub>rh</sub> (Lag), KVA<sub>rh</sub> (Lead), KVA<sub>h</sub>, Voltage<sub>RN</sub>, Voltage<sub>YN</sub>, Voltage<sub>BN</sub>, Current R, Current Y, Current B Parameters.

**Example of load survey data file for single phase RF meter ( containing data of one meter)**

```
LSD(00100869)(071)(01)((24:02:11 00:00,00.0,00.00,000,0000)
(24:02:11 00:30,00.0,00.00,000,0000)(24:02:11 01:00,00.0,00.00,000,0000)
(24:02:11 01:30,00.0,00.00,000,0000)(24:02:11 02:00,00.0,00.00,000,0000)
(24:02:11 02:30,00.0,00.00,000,0000)(24:02:11 03:00,00.0,00.00,000,0000)
(24:02:11 03:30,00.0,00.00,000,0000)(24:02:11 04:00,00.0,00.00,000,0000)
(24:02:11 04:30,00.0,00.00,000,0000)(24:02:11 05:00,00.0,00.00,000,0000)
(24:02:11 05:30,00.0,00.00,000,0000)(24:02:11 06:00,00.0,00.00,000,0000)
(24:02:11 06:30,00.0,00.00,000,0000)(24:02:11 07:00,00.0,00.00,000,0000)
(24:02:11 07:30,00.0,00.00,000,0000)(24:02:11 08:00,00.0,00.00,000,0000)
(24:02:11 08:30,00.0,00.00,000,0000)(24:02:11 09:00,00.0,00.00,000,0000)
(24:02:11 09:30,00.0,00.00,000,0000)(24:02:11 10:00,00.0,00.00,000,0000)
(24:02:11 10:30,00.0,00.00,000,0000)(24:02:11 11:00,00.0,00.00,000,0000)
(24:02:11 11:30,00.0,00.00,000,0000)(24:02:11 12:00,00.0,00.00,000,0000)
(24:02:11 12:30,00.0,00.00,000,0000)(24:02:11 13:00,00.0,00.00,000,0000)
(24:02:11 13:30,00.0,00.00,000,0000)(24:02:11 14:00,00.0,00.00,000,0000)
(24:02:11 14:30,00.0,00.00,000,0000)(24:02:11 15:00,00.0,00.00,000,0000)
(24:02:11 15:30,00.0,00.00,000,0000)(24:02:11 16:00,00.0,00.00,000,0000)
(24:02:11 16:30,00.0,00.00,000,0000)(24:02:11 17:00,00.0,00.00,000,0000)
(24:02:11 17:30,00.0,00.00,000,0000)(24:02:11 18:00,00.0,00.00,000,0000)
(24:02:11 18:30,00.0,00.00,000,0000)(24:02:11 19:00,00.0,00.00,000,0000)
(24:02:11 19:30,00.0,00.00,000,0000)(24:02:11 20:00,00.0,00.00,000,0000)
(24:02:11 20:30,00.0,00.00,000,0000)(24:02:11 21:00,00.0,00.00,000,0000)
(24:02:11 21:30,00.0,00.00,000,0000)(24:02:11 22:00,00.0,00.00,000,0000)
(24:02:11 22:30,00.0,00.00,000,0000)(24:02:11 23:00,00.0,00.00,000,0000)(24:02:11
23:30,00.0,00.00,000,0000))EN#Q
```

**Example of load survey data file for Three phase RF meter ( containing data of one meter)**

```
LSD(00100869)(071)(001)(03)((24:02:1100:00,0000,0000,0000,0000,0000,0000,0000)
(24:02:11 00:30,0000,0000,0000,0000,0000,0000,0000)
(24:02:11 01:00,0000,0000,0000,0000,0000,0000,0000)
(24:02:11 01:30,0000,0000,0000,0000,0000,0000,0000)
(24:02:11 02:00,0000,0000,0000,0000,0000,0000,0000)
(24:02:11 02:30,0000,0000,0000,0000,0000,0000,0000)
(24:02:11 03:00,0000,0000,0000,0000,0000,0000,0000)
(24:02:11 03:30,0000,0000,0000,0000,0000,0000,0000)
```

(24:02:11 04:00,0000,0000,0000,000,000,000,00000,00000,00000,00000)

(24:02:11 04:30,0000,0000,0000,000,000,000,00000,00000,00000,00000)

(24:02:11 05:00,0000,0000,0000,000,000,000,00000,00000,00000,00000)

(24:02:11 05:30,0000,0000,0000,000,000,000,00000,00000,00000,00000)

(24:02:11 06:00,0000,0000,0000,000,000,000,00000,00000,00000,00000)

(24:02:11 06:30,0000,0000,0000,000,000,000,00000,00000,00000,00000)

(24:02:11 07:00,0000,0000,0000,000,000,000,00000,00000,00000,00000)

(24:02:11 07:30,0000,0000,0000,000,000,000,00000,00000,00000,00000)

(24:02:11 08:00,0000,0000,0000,000,000,000,00000,00000,00000,00000)

(24:02:11 08:30,0000,0000,0000,000,000,000,00000,00000,00000,00000)

(24:02:11 09:00,0000,0000,0000,000,000,000,00000,00000,00000,00000)

(24:02:11 09:30,0000,0000,0000,000,000,000,00000,00000,00000,00000)

(24:02:11 10:00,0000,0000,0000,000,000,000,00000,00000,00000,00000)

(24:02:11 10:30,0000,0000,0000,000,000,000,00000,00000,00000,00000)

(24:02:11 11:00,0000,0000,0000,000,000,000,00000,00000,00000,00000)

(24:02:11 11:30,0000,0000,0000,000,000,000,00000,00000,00000,00000)

(24:02:11 12:00,0000,0000,0000,000,000,000,00000,00000,00000,00000)

(24:02:11 12:30,0000,0000,0000,000,000,000,00000,00000,00000,00000)

(24:02:11 13:00,0000,0000,0000,000,000,000,00000,00000,00000,00000)

(24:02:11 13:30,0000,0000,0000,000,000,000,00000,00000,00000,00000)

(24:02:11 14:00,0000,0000,0000,000,000,000,00000,00000,00000,00000)

(24:02:11 14:30,0000,0000,0000,000,000,000,00000,00000,00000,00000)

(24:02:11 15:00,0000,0000,0000,000,000,000,00000,00000,00000,00000)

(24:02:11 15:30,0000,0000,0000,000,000,000,00000,00000,00000,00000)

(24:02:11 16:00,0000,0000,0000,000,000,000,00000,00000,00000,00000)

(24:02:11 16:30,0000,0000,0000,000,000,000,00000,00000,00000,00000)

(24:02:11 17:00,0000,0000,0000,000,000,000,00000,00000,00000,00000)

(24:02:11 17:30,0000,0000,0000,000,000,000,0000,00000,00000,00000,00000)  
 (24:02:11 18:00,0000,0000,0000,000,000,000,0000,00000,00000,00000,00000)  
 (24:02:11 18:30,0000,0000,0000,000,000,000,0000,00000,00000,00000,00000)  
 (24:02:11 19:00,0000,0000,0000,000,000,000,0000,00000,00000,00000,00000)  
 (24:02:11 19:30,0000,0000,0000,000,000,000,0000,00000,00000,00000,00000)  
 (24:02:11 20:00,0000,0000,0000,000,000,000,0000,00000,00000,00000,00000)  
 (24:02:11 20:30,0000,0000,0000,000,000,000,0000,00000,00000,00000,00000)  
 (24:02:11 21:00,0000,0000,0000,000,000,000,0000,00000,00000,00000,00000)  
 (24:02:11 21:30,0000,0000,0000,000,000,000,0000,00000,00000,00000,00000)  
 (24:02:11 22:00,0000,0000,0000,000,000,000,0000,00000,00000,00000,00000)  
 (24:02:11 22:30,0000,0000,0000,000,000,000,0000,00000,00000,00000,00000)  
 (24:02:11 23:00,0000,0000,0000,000,000,000,0000,00000,00000,00000,00000)  
 (24:02:11 23:30,0000,0000,0000,000,000,000,0000,00000,00000,00000,00000))EN#Q

**Format of TOD Data File (TOD.MRI) :**

| TAG | Data | EN# |
|-----|------|-----|
|-----|------|-----|

i.e

Tag                    TOD

Data

<Serial Number><Make Code><Meter Phase><Reading UTC Time>

<TZ1 KWH><TZ1 MD><TZ1 MD Timestamp>

<TZ2 KWH><TZ2 MD><TZ2 MD Timestamp>

<TZ3 KWH><TZ3 MD><TZ3 MD Timestamp>

<TZ4 KWH><TZ4 MD><TZ4 MD Timestamp>

End of Data        EN#

**Example of TOD data file (containing TOD data of One Consumers)**

TOD(12346578)(001)(01)(11:10:15 15:30)(135)(09.00)(10:10:15 2:30)(130)(07.00)(10:10:15 14:00)(115)(05.00)(10:10:15 10:00)(120)(5.5)(10:10:15 20:30)EN#Q

### Format of Network Data File (NETWORK.MRI) :

#### For Zigbee

| TAG | Data | EN# |
|-----|------|-----|
|-----|------|-----|

i.e

Tag            NWK

Data

<NetworkID><Co-ordinator Serial Number><Co-ordinator make code> <Security Key><Network-Key><Ext-PAN> <Short-Pan><Channel><Channel Mask><Meter Count><Last Downloaded Timestamp>

End of Data    EN#

#### For 6LoWPAN :

| TAG | Data | EN# |
|-----|------|-----|
|-----|------|-----|

i.e

Tag            NWK

Data

<NetworkID><Root Serial Number><Root make Code><PANID><Channel><AES KEY><ipv6Prefix><Meter Count> EN#

End of Data    EN#

Note:

- 1) The RF Module returns date in Hex format, but it shall be the responsibility of the HHT software/firmware to decode the date and store in proper date format of dd-MM-yyyy hh24:mi:ss
- 2) All values should be written in Big endian format only.

#### Example of Network data file (containing data of only one network)

NWK(0001)(10100389)(076)(05244414020789450524441402078945)(E91A57C6D681517E2AA9C2D18BD536FF)(0524441402078945)(0)(0)( 2105344)(4)(18:05:2015 14:32:12)EN#Q

### Format of Meter Master Data File (RFMSTR.MRI) :

| TAG | Serial Number | Make Code | Data | EN# |
|-----|---------------|-----------|------|-----|
|-----|---------------|-----------|------|-----|



**i.e**

Tag MTR

Data

<Meter SI No><Mk Code><Consumer number><Consumer  
name><Cons Address><Commission Status><Device Type> <Network  
ID><MAC Address><DL Status><CP New Password> <CP Old Password><CP RTC Flag><CP  
MD Reset flag><CP TOD Flag><CP TOD slot count><CP TOD Slots>  
End of Data EN#

Note:

- a) In case of flags the following convention is to be followed:
  - 0: Forbidden to reset
  - 1: Allowed to reset
  - 2: Reset successful
  - 3: Reset Failed
- b) In case of CP TOD Slots, the slots separated by ':' represent the duration of the slots.
- c) As the count of TOD slots is also mentioned, the TOD hour slots data will only be equal in number to the earlier mentioned value of TOD hour slots count.
- d) In case of '0' count of TOD slots a null value bracket of TOD hour slots will be present.
- e) After updating CP meter data viz., CP Password reset, CP MD Reset, etc. it shall be the responsibility of the HHT software/firmware to update the corresponding flags in the RFMSTR.MRI file according to conventions given in Note (a) under RFMSTR.MRI file specification heading.
- f) All values should be written in Big endian format only.

**Example of Meter Master data file (containing data of Two Consumers)**

MTR(00000030)(082)(123456789123)(MSEDCL Sample Consumer1)(HOIT Prakashgad)  
(1)(C)(0001)(00124B000000001E)(0)(00000030)(00000030)(0)(0)(1)(4)(6:6:6:6)(1)(0500)(0)(0)(0)

EN#

MTR(00130704)(053)(123456789124)(MSEDCL Sample Consumer2)(HOIT Prakashgad)  
(1)(R)(0001)(3CC1F6030001FE90)(0)(00130704)(00130704)(1)(1)(0)(0)(0)(0)(0)(0)(0) EN#Q

**Format of Job Data File (JOB.MRI) :**

| TAG | Job ID | Job Date | Data | EN# |
|-----|--------|----------|------|-----|
|-----|--------|----------|------|-----|

**i.e**

Tag           JOB

Data

<JobID><Job Date><<Job Description><BU><Commission  
Allowed><Job Download Status>

End of Data    EN#Q

Note:

- a) The commission allowed flag indicates whether the HHT Operator is allowed to perform the activity of commissioning of meters in this job. The convention to be followed is as follows:

0: Not allowed to commission

1: Allowed to commission the available un-commissioned meters.

- b) The job download status is as follows :

'0' : New Job ( No readings/ meter data available in .MRI files)

'1' : Readings / Meter Data for at least any one meter is present in HHT.

'2' : Job in HHT is successfully downloaded to BCS. ( Jobs in HHT can be downloaded to BCS multiple times )

**Example of Job data file (containing data of One Job [Jobs are only one per HHT])**

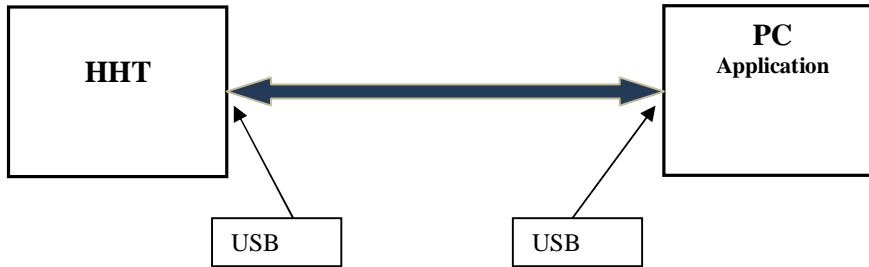
JOB(123456789)(16-May-2015)(Example Job)(9999)(1)(0)EN#Q

## ANNEXURE - X

### File Transfer Protocol for Communication between HHT and BCS

#### File Transfer Process: USB

##### Connectivity Diagram



##### Pin Configuration for USB Data Cable of HHT

The data cable of HHT should be USB 2.0 Compliant. No other cable (viz. Serial, COM, etc.) shall be accepted.

The configuration for the USB is as follows:



**A**

Type A USB Pin for Computer / PC End of data cable



**B**

Type B USB Pin for HHT End of Data Cable

**Figure : USB Pin Configuration for Data Cable**

The pin-out for the cable shall be as given in the table:

##### **The USB Pinout:**

| Pin | Name | Cable color | Description |
|-----|------|-------------|-------------|
| 1   | VCC  | Red         | +5 VDC      |
| 2   | D-   | White       | Data -      |
| 3   | D+   | Green       | Data +      |
| 4   | GND  | Black       | Ground      |

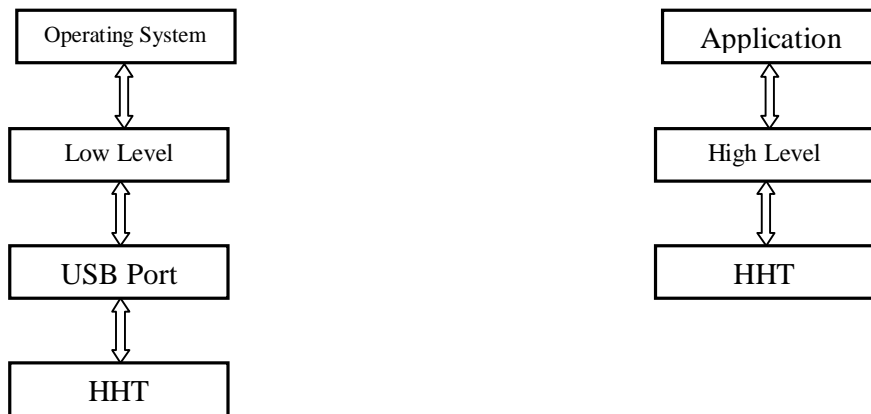
### **Low Level Device Driver**

PC needs device driver to detect when HHT connected for the first time. This is the Low Level Driver and need to be installed once in PC. This low level driver take care the communication and detection of HHT in Operating System. This will be provided by the Meter Manufacturer. Any configuration other than low driver installation like manual IP configuration to HHT, should not be required.

### **High Level Device Driver**

High Level Device Driver needs to establish communication between Application and HHT. Meter manufacturer will provide the high level driver. This high level device driver shall be provided as a native DLL along with necessary wrappers for java, and all the header files and libraries and other dependencies, if any.

### **Implementation Hierarchy**



### **High Level Device Driver**

The following functionality shall be available in High Level Device Driver:-

1. A function which can Assign Job to HHT
2. A function which upload data from HHT
3. Set RTC of HHT
4. Get RTC of HHT
5. Can Clear Job from HHT
6. Can get the list of files in relevant location of HHT
7. Get the Serial Number of HHT

**High Level Device Function Description**

| <u>SIN</u><br><u>o</u> | <u>Description</u>           | <u>Function Name</u>      | <u>Parameters</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <u>Return Parameters</u>                                                                                                                                                                                                                                                                                                                             |
|------------------------|------------------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                      | <u>Configure Job to HHT</u>  | <u>ConfigureJobToHHT</u>  | <ul style="list-style-type: none"> <li>• <u>Data Type: String</u></li> <li>• <u>Parameters</u> <ol style="list-style-type: none"> <li>1. <u>Job File name( i.e.JOB.MRI)</u><br/>: Full path name of JOB.MRI in PC to be sent to HHT</li> <li>2. <u>Network file Name:</u><br/>(i.e.NETWORK.MRI)<br/>Full path name of NETWORK.MRI in PC to be sent to HHT</li> <li>3. <u>Meter Details File Name</u><br/>(i.e. RFMSTR.MRI )<br/>Full path name of RFMSTR.MRI in PC to be sent to HHT</li> </ol> </li> </ul> | <ul style="list-style-type: none"> <li>• <u>Data Type:int</u></li> <li>• <u>Values</u> <ol style="list-style-type: none"> <li>1. <u>Successful</u></li> <li>2. <u>PC File does not exist</u></li> <li>3. <u>Error in detecting USB</u></li> <li>4. <u>Others</u></li> </ol> </li> </ul>                                                              |
| 2                      | <u>Download Job From HHT</u> | <u>DownloadJobFromHHT</u> | <ul style="list-style-type: none"> <li>• <u>Data Type: String</u></li> <li>• <u>Parameters</u> <ol style="list-style-type: none"> <li>1. <u>Job File name( i.e.JOB.MRI)</u><br/>: Full path name of in PC where JOB.MRI to be received from HHT.</li> <li>2. <u>Network file Name</u><br/>(i.e.NETWORK.MRI):<br/>Full path name of in PC where NETWORK.MRI to be received from HHT.</li> <li>3. <u>Meter Details File Name</u></li> </ol> </li> </ul>                                                       | <ul style="list-style-type: none"> <li>• <u>Data Type:int</u></li> <li>• <u>Values</u> <ol style="list-style-type: none"> <li>1. <u>Successful</u></li> <li>2. <u>HHT File does not exist</u></li> <li>3. <u>Error in detecting USB</u></li> <li>4. <u>Others</u></li> <li>5. <u>File already exists in PC with same name</u></li> </ol> </li> </ul> |

|          |                           |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                              |
|----------|---------------------------|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
|          |                           |                  | <p><u>(i.e. RFMSTR.MRI)</u> :<br/>Full path name of in PC where RFMSTR.MRI to be received from HHT.</p> <p>4. <u>BILLING DATA File Name (i.e. BILL.MRI)</u> :<br/>Full path name of in PC where BILL.MRI to be received from HHT.</p> <p>5. <u>BILL HISTORY DATA File Name (i.e.KWH.MRI)</u> :<br/>Full path name of in PC where KWH.MRI to be received from HHT.</p> <p>6. <u>TAMPER DATA File Name (i.e. TPR.MRI)</u>:<br/>Full path name of in PC where TPR.MRI to be received from HHT.</p> <p>7. <u>LOAD SURVEY DATA File Name (i.e. LSD.MRI)</u>:<br/>Full path name of in PC where LSD.MRI to be received from HHT.</p> <p>8. <u>TRANSACTION DATA File Name (i.e. TRANS.MRI)</u>:<br/>Full path name of in PC where TRANS.MRI to be received from HHT.</p> |                                                                                                                                              |
| <u>3</u> | <u>Setting RTC of HHT</u> | <u>SetHHTRTC</u> | <u>DateValue : in DD/MM/YYYY HH:MM:SS</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <ul style="list-style-type: none"> <li>• <u>Data Type: Boolean</u></li> <li><u>True - Successful</u></li> <li><u>False - Fail</u></li> </ul> |
| <u>4</u> | <u>Get RTC of HHT</u>     | <u>GetHHTRTC</u> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <ul style="list-style-type: none"> <li>• <u>DateValue : in DD/MM/YYYY HH:MM:SS</u></li> </ul>                                                |

|          |                                              |                    |                                                           |                                                                                                                                                                                       |
|----------|----------------------------------------------|--------------------|-----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |                                              |                    |                                                           | <u>Null - Fail</u>                                                                                                                                                                    |
| <u>5</u> | <u>Clear HHT Data</u>                        | <u>ClearHHT</u>    |                                                           | <ul style="list-style-type: none"> <li>• <u>Data Type: Boolean</u></li> <li><u>True - Successful</u></li> <li><u>False - Fail</u></li> </ul>                                          |
| <u>6</u> | <u>List of Files</u>                         | <u>GetFileList</u> | <u>HHTFilename : Each time it will send a File to BCS</u> | <ul style="list-style-type: none"> <li>• <u>Data Type: String</u></li> <li>- <u>Files names separated with comma- successful</u></li> <li>- <u>Empty – Fail</u></li> <li>-</li> </ul> |
| <u>7</u> | <u>Get Manufacturer Serial Number of HHT</u> | <u>GetHHTSINo</u>  |                                                           | <ul style="list-style-type: none"> <li>• <u>Data Type: String</u></li> <li><u>HHTSINo : Serial Number of HHT</u></li> <li>• <u>Empty- Fail</u></li> </ul>                             |

**ANNEXURE - XI**

**Draft Testing Template**

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

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



| Test Parameter                                                                                                                                                                                                                                                                                                                                                                                                                             | Test Result / Observations |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| <b>BCS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                 |                            |
| 19. Operating System Version supported                                                                                                                                                                                                                                                                                                                                                                                                     |                            |
| 20. BCS User Name                                                                                                                                                                                                                                                                                                                                                                                                                          |                            |
| 21. BCS Password                                                                                                                                                                                                                                                                                                                                                                                                                           |                            |
| 22. Database                                                                                                                                                                                                                                                                                                                                                                                                                               |                            |
| 23. BCS Software Version and display available in BCS (Yes/No)                                                                                                                                                                                                                                                                                                                                                                             |                            |
| 24. BCS Database is Password Protected (Yes/No)                                                                                                                                                                                                                                                                                                                                                                                            |                            |
| 25. Importing Consumer Master xls file to BCS (Yes/No)                                                                                                                                                                                                                                                                                                                                                                                     |                            |
| 26. Number of consumers data loaded in BCS                                                                                                                                                                                                                                                                                                                                                                                                 |                            |
| 27. Exporting Consumer Meter details from BCS to HHU (Yes/No)                                                                                                                                                                                                                                                                                                                                                                              |                            |
| 28. HHU data downloaded in BCS (Yes/No)                                                                                                                                                                                                                                                                                                                                                                                                    |                            |
| 29. Bill string file generated as per MSEDCL format <ul style="list-style-type: none"> <li>a. Bill string for 1ph Meters (Yes/No)</li> <li>b. Bill string for 3ph Meters (TOD format) (Yes/No)</li> <li>c. Control Total generated (Yes/No)</li> </ul>                                                                                                                                                                                     |                            |
| 30. PAN Management (Manual / Auto)                                                                                                                                                                                                                                                                                                                                                                                                         |                            |
| 31. Reports available through BCS * <ul style="list-style-type: none"> <li>A. Commissioning Report (Yes/No)</li> <li>B. Meter Reading downloaded Statistics (Yes/No)</li> <li>C. RTC Corrupted Report (Yes/No)</li> <li>D. Consumer wise Tamper Report (Yes/No)</li> <li>E. Consumer wise Load Survey Report (Yes/No)</li> <li>F. Consumer wise TOD Report (Yes/No)</li> <li>G. PAN wise coordinator and router Report (Yes/No)</li> </ul> |                            |
| 32. Facility for Backup and Restoration of Database (Yes/No)                                                                                                                                                                                                                                                                                                                                                                               |                            |
| 33. Option for clearing the HHU data in HHU (Yes/No)                                                                                                                                                                                                                                                                                                                                                                                       |                            |
| 34. Security while data transfer between HHU and BCS (Yes/No)                                                                                                                                                                                                                                                                                                                                                                              |                            |

| Test Parameter                                                                                            | Test Result / Observations |
|-----------------------------------------------------------------------------------------------------------|----------------------------|
| <b>HHU</b>                                                                                                |                            |
| 35. HHU Serial Number                                                                                     |                            |
| 36. HHU Make and model                                                                                    |                            |
| 37. HHU Processor/Microcontroller Family                                                                  |                            |
| 38. RF Module to HHU is Internal (Yes/No)                                                                 |                            |
| 39. HHU supports dual band operations i.e. Zigbee operations 2.4 GHz and 6LoWPAN operations on 865-867MHz |                            |

|                                                                                                                                                                                                                                  |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| (Yes/No)                                                                                                                                                                                                                         |  |
| 40. HHU RF Module Details<br>a. Make & Name of RF Module<br>b. RF Module IEEE Address                                                                                                                                            |  |
| 41. MSEDCL RF Protocol ( as given in latest Tender document ) is implemented in HHU (Yes / No)                                                                                                                                   |  |
| 42. Ports available on HHU (COM / USB etc.)                                                                                                                                                                                      |  |
| 43. Communication cable for HHU and PC (COM / USB Cable)                                                                                                                                                                         |  |
| 44. Memory Capacity of HHU (MB)                                                                                                                                                                                                  |  |
| 45. Maximum time for which HHU waits to receive response from meter, before retrying the same command ( In milliseconds)                                                                                                         |  |
| 46. Type and make of batteries present in HHU                                                                                                                                                                                    |  |
| 47. Hours of operations if batteries are fully charged                                                                                                                                                                           |  |
| 48. Battery status is indicated in the form of bar-graph in HHU display ( Yes/No)                                                                                                                                                |  |
| 49. Low battery indication provided ( Yes/No)                                                                                                                                                                                    |  |
| 50. Automatic cut-off time if HHU is not in operation                                                                                                                                                                            |  |
| 51. Details of Type Tests                                                                                                                                                                                                        |  |
| 52. HHU Operating System                                                                                                                                                                                                         |  |
| 53. HHU Firmware / Kernel Version                                                                                                                                                                                                |  |
| 54. Details of database implemented in HHU                                                                                                                                                                                       |  |
| 55. HHU Password Protected (If Yes, Mention password )                                                                                                                                                                           |  |
| 56. HHU Software Version and display available on HHU (Yes / No)                                                                                                                                                                 |  |
| 57. Program starts automatically after power on (Yes/No)                                                                                                                                                                         |  |
| 58. Maximum Number of consumers data loaded in HHU                                                                                                                                                                               |  |
| 59. Consumer details like number, name and address available in HHU data (Yes/No)                                                                                                                                                |  |
| 60. Modes of commissioning available in HHU<br>a. Auto (Yes / No)<br>b. Manual (Yes / No)                                                                                                                                        |  |
| 61. Commissioning attributes sent by HHU while commissioning of meters ( for Zigbee)<br>a. Preconfigured Link Key (Yes / No )<br>b. Channel Mask (Yes / No )<br>c. Startup Control (Yes / No )<br>d. Extended PAN ID (Yes / No ) |  |
| 62. Commissioning attributes sent by HHU while commissioning of meters ( for 6LoWPAN)<br>a. PAN ID (Yes / No )<br>b. Channel (Yes / No )                                                                                         |  |

|                                                                                                                                                                                                                                                                                                                                                                                    |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <ul style="list-style-type: none"> <li>c. Device Type (Yes / No)</li> <li>d. IPv6 Prefix (Yes / No)</li> <li>e. AES Key (Yes / No)</li> <li>f. Commission state (Yes / No)</li> <li>g. DAG ID (Yes / No)</li> <li>h. Router List (Yes / No)</li> </ul>                                                                                                                             |  |
| 63. Indication of HHU after successful downloading of any data from meter (e.g. Sound beep or message on HHU screen)                                                                                                                                                                                                                                                               |  |
| 64. Data stored in HHU is according to HHU common file format declared by MSEDCL <ul style="list-style-type: none"> <li>a. BILL.MRI – For Billing Data (Yes/No)</li> <li>b. KWH.MRI- For Bill History (Yes/No)</li> <li>c. TPR.MRI- For Tamper Data (Yes/No)</li> <li>d. LSD.MRI – For Load Survey Data (Yes/No)</li> </ul>                                                        |  |
| 65. HHU is having common menu structure declared by MSEDCL ( Yes/No)                                                                                                                                                                                                                                                                                                               |  |
| 66. Statistics of commissioning / readings downloaded in HHU <ul style="list-style-type: none"> <li>a. Total meters uploaded in HHU for reading (Yes/No)</li> <li>b. Total meter reading downloaded in HHU (excluding the new meters) (Yes/No)</li> <li>c. No. of New meter reading downloaded in HHU (Yes/No)</li> <li>d. No. of Meters not downloaded in HHU (Yes/No)</li> </ul> |  |
| 67. Settings of Critical Parameters like <ul style="list-style-type: none"> <li>a. Change the password in the meter (Yes / No)</li> <li>b. Reset of Maximum Demand (Yes / No)</li> <li>c. Set the number of TOD slots and their durations (Yes / No)</li> <li>d. Set meter time (RTC) (Yes / No)</li> </ul>                                                                        |  |
| 68. Interoperability with different make of meters in setting of critical parameters ( Yes/No)                                                                                                                                                                                                                                                                                     |  |
| 69. Data download options available in HHU <ul style="list-style-type: none"> <li>a. Billing data (Yes/No)</li> <li>b. Billing History (Yes/No)</li> <li>c. Tamper (Yes/No)</li> <li>d. Load Survey (Yes/No)</li> <li>e. TOD (Yes/No)</li> <li>f. All Data (Yes/No)</li> </ul>                                                                                                     |  |
| 70. HHU download tamper present status along with billing data (Yes/No)                                                                                                                                                                                                                                                                                                            |  |
| 71. HHU download tamper data according to tamper present status along with billing data ( Yes/No)                                                                                                                                                                                                                                                                                  |  |
| 72. Time (in seconds) required to capture Billing Data                                                                                                                                                                                                                                                                                                                             |  |

|                                                                                                    |  |
|----------------------------------------------------------------------------------------------------|--|
| without tamper present status from Meter                                                           |  |
| 73. Time (in seconds) required to capture Billing Data along with tamper present status from Meter |  |
| 74. Total time (in seconds) required to download the complete data                                 |  |
| 75. Average time required to commission a single meter (in sec.)                                   |  |
| 76. Interoperability with different makes of Meters (Yes/No)                                       |  |
| 77. If Yes, List of meter make used for interoperability.                                          |  |
| 78. Facility to update HHU software (Yes / No)                                                     |  |
| 79. HHU software updation is password protected (Yes/No)                                           |  |
| 80. HHU is having in-built GSM/GPRS Modem ( Yes/No)                                                |  |

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

**Overall Remark :**

**SCHEDULE 'A'**

**GUARANTEED TECHNICAL PARAMETERS**

| ITEM NAME | LT AC SINGLE PHASE 5 - 30 AMPS. STATIC ENERGY METER WITH 6LOWPAN BASED INTERNAL LPRF AS COMMUNICATION CAPABILITY FOR INTEROPERABILITY |            |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------|------------|
| SR. NO.   | GUARANTEED TECHNICAL PARAMETERS                                                                                                       | GTP VALUES |
| 1.0       | MAKE & TYPE                                                                                                                           | TEXT       |
| 2.0       | APPLICABLE STANDARD                                                                                                                   | TEXT       |
| 3.0       | ACCURACY CLASS 1.00 (YES/NO)                                                                                                          | BOOLEAN    |
| 4.0       | METER BEARS ISI MARK (YES/NO)                                                                                                         | BOOLEAN    |
| 5.0       | RATED VOLTAGE 240 V (YES/NO)                                                                                                          | BOOLEAN    |
| 6.0       | VOLTAGE RANGE (-) 40% TO (+) 20% OF RATED VOLTAGE (YES/NO)                                                                            | BOOLEAN    |
| 7.0       | FREQUENCY 50 HZ +/- 3% (YES/NO)                                                                                                       | BOOLEAN    |
| 8.0       | RATED BASIC CURRENT 5 AMPS (YES/NO)                                                                                                   | BOOLEAN    |
| 9.0       | MAXIMUM CONTINUOUS CURRENT I <sub>MAX</sub> 30 AMP (YES/NO)                                                                           | BOOLEAN    |
| 10.0      | STARTING CURRENT 0.2 % OF I <sub>B</sub> . (YES/NO)                                                                                   | BOOLEAN    |
| 11.0      | POWER CONSUMPTION IN VOLTAGE CIRCUIT 2 W & 10 VA (YES/NO)                                                                             | BOOLEAN    |
| 12.0      | POWER CONSUMPTION IN CURRENT CIRCUIT 4 VA (YES/NO)                                                                                    | BOOLEAN    |
| 13.0      | POWER FACTOR ZERO TO UNITY (ALL LAG OR LEAD) (YES/NO)                                                                                 | BOOLEAN    |
| 14.0      | STANDARD REFERENCE TEMPERATURE FOR PERFORMANCE IS 27°C (YES/NO)                                                                       | BOOLEAN    |

|      |                                                                                                                                  |         |
|------|----------------------------------------------------------------------------------------------------------------------------------|---------|
| 15.0 | MEAN TEMPERATURE CO-EFFICIENT DOES NOT EXCEED 0.07% (YES/NO)                                                                     | BOOLEAN |
| 16.0 | TEMPERATURE RISE IS AS PER IS: 13779 / 1999 (AMENDED UP TO DATE) (YES/NO)                                                        | BOOLEAN |
| 17.0 | OPAQUE METER BASE & TRANSPARENT TOP COVER MADE OF UNBREAKABLE, TOUGH, HIGH GRADE, FIRE RESISTANT POLYCARBONATE MATERIAL (YES/NO) | BOOLEAN |
| 18.0 | METER BODY TYPE TESTED FOR IP 51 DEGREE OF PROTECTION AS PER IS 12063 (YES/NO)                                                   | BOOLEAN |
| 19.0 | FURNISH PHYSICAL WATER ABSORPTION VALUE                                                                                          | TEXT    |
| 20.0 | FURNISH THERMAL HDDT VALUE                                                                                                       | TEXT    |
| 21.0 | FLAMMABILITY V2 (YES/NO)                                                                                                         | BOOLEAN |
| 22.0 | FURNISH FLAMMABILITY VALUE                                                                                                       | TEXT    |
| 23.0 | GLOW WIRE TEST AT 650° C                                                                                                         | TEXT    |
| 24.0 | TENSILE STRENGTH                                                                                                                 | TEXT    |
| 25.0 | FLEXURE STRENGTH                                                                                                                 | TEXT    |
| 26.0 | MODULUS OF ELASTICITY                                                                                                            | TEXT    |
| 27.0 | IZOD IMPACT STRENGTH NOTCHED AT 23° C                                                                                            | TEXT    |
| 28.0 | FURNISH PHYSICAL WATER ABSORPTION VALUE                                                                                          | TEXT    |
| 29.0 | MOULDED TERMINAL BLOCK CONFORMS TO IS: 13779 / 1999 (AMENDED UP TO DATE) (YES/NO)                                                | BOOLEAN |
| 30.0 | EXTENDED TRANSPARENT TERMINAL COVER AS PER CLAUSE NUMBER 6.5.2 OF IS: 13779 / 1999 (AMENDED UP TO DATE) IS PROVIDED (YES/NO)     | BOOLEAN |
| 31.0 | TRANSPARENT TERMINAL COVER IS SEALABLE INDEPENDENTLY (YES/NO)                                                                    | BOOLEAN |

|      |                                                                                                                |         |
|------|----------------------------------------------------------------------------------------------------------------|---------|
| 32.0 | PROPER SIZES OF GROOVES ARE PROVIDED AT BOTTOM OF TERMINAL COVER (YES/NO)                                      | BOOLEAN |
| 33.0 | METER BASE & COVER ARE ULTRA-SONICALLY WELDED (CONTINUOUS WELDING) (YES/NO)                                    | BOOLEAN |
| 34.0 | THICKNESS OF MATERIAL FOR METER 2 MM MINIMUM (YES/NO)                                                          | BOOLEAN |
| 35.0 | RTC PRE-PROGRAMMED FOR 30 YEARS DAY / DATE (YES/NO)                                                            | BOOLEAN |
| 36.0 | TIME ACCURACY OF RTC AS PER CBIP TECH REPORT 88 (YES/NO)                                                       | BOOLEAN |
| 37.0 | PROVISION TO PUT AT LEAST TWO SEALS BY UTILITY USER (YES/NO)                                                   | BOOLEAN |
| 38.0 | PUSH BUTTON PROVIDED FOR SCROLLING THE PARAMETERS IN ALTERNATE DISPLAY (ON DEMAND) MODE (YES/NO)               | BOOLEAN |
| 39.0 | OPERATION INDICATOR PROVIDED IN THE FORM OF BLINKING LED / LCD (YES/NO)                                        | BOOLEAN |
| 40.0 | METER CONSTANT INDELIBLY PROVIDED ON THE NAMEPLATE (YES/NO)                                                    | BOOLEAN |
| 41.0 | METER ACCURACY DOES NOT GET AFFECTED BY MAGNETIC FIELD FROM ALL SIDES OF THE METER (YES/NO)                    | BOOLEAN |
| 42.0 | ONE CT IN NEUTRAL CIRCUIT AND ONE MANGANIN BASED, E-BEAM WELDED SHUNT IN PHASE CIRCUIT PROVIDED (YES/NO)       | BOOLEAN |
| 43.0 | METER WITHSTANDS PHASE TO PHASE VOLTAGE (440 V) IF APPLIED BETWEEN PHASE TO NEUTRAL FOR MINIMUM 5 MIN (YES/NO) | BOOLEAN |
| 44.0 | POWER SUPPLY UNIT IS TRANSFORMER LESS (YES/NO)                                                                 | BOOLEAN |

|      |                                                                                                                                                                    |         |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| 45.0 | COMPLETE METERING SYSTEM & MEASUREMENT NOT AFFECTED BY EXTERNAL ELECTROMAGNETIC INTERFERENCE AS PER CL. NO. 6.16 OF TECH. SPECS. (YES/NO)                          | BOOLEAN |
| 46.0 | METER MEETS THE REQUIREMENT OF CBIP TECH. REPORT 88 (AMENDED UP TO DATE) EXCEPT 0.2 TESLA AC MAGNET TEST (YES/NO)                                                  | BOOLEAN |
| 47.0 | METER ACCURACY DOES NOT GET INFLUENCED BY INJECTION OF HIGH FREQUENCY AC VOLTAGE / CHOPPED SIGNAL / DC SIGNAL AND HARMONICS ON THE TERMINALS OF THE METER (YES/NO) | BOOLEAN |
| 48.0 | METER RECORDS AND DISPLAYS TOTAL ENERGY INCLUDING HARMONIC ENERGY.                                                                                                 | BOOLEAN |
| 49.0 | METER DISPLAYS UNSATISFACTORY FUNCTIONING OR NONFUNCTIONING OF REAL TIME CLOCK BATTERY (YES/NO)                                                                    | BOOLEAN |
| 50.0 | METER PCB IS WIRELESS (YES/NO)                                                                                                                                     | BOOLEAN |
| 51.0 | BATTERY BACK UP WITH MINIMUM 10 YEARS LIFE IS PROVIDED (YES/NO)                                                                                                    | BOOLEAN |
| 52.0 | METER DISPLAYS DEFAULT PARAMETERS ONLY ONCE AFTER ACTIVATION OF BATTERY DURING POWER OFF CONDITION (YES/NO)                                                        | BOOLEAN |
| 53.0 | BATTERY GETS LOCKED AFTER 3 OPERATIONS DURING ONE POWER OFF CYCLE (YES/NO)                                                                                         | BOOLEAN |
| 54.0 | MAKE OF RF MODULE USED IN METER                                                                                                                                    | TEXT    |
| 55.0 | COMMUNICATION CAPABILITY OF THE METER IS AS PER 6LOW PAN LPRF TO READ METER FROM ONE HUNDRED (100) METER RADIUS WITHOUT OBSTRUCTIONS (YES/NO)                      | BOOLEAN |
| 56.0 | COMMUNICATION RANGE FURTHER INCREASED UPTO 5 HOPS THROUGH MESH NETWORKING (YES/NO)                                                                                 | BOOLEAN |



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| 57.0 | 35 KV SPARK DISCHARGE TEST OF IS CARRIED OUT                                                                                                                                                               | BOOLEAN |
| 58.0 | METER MANUFACTURED USING SMT (YES/NO)                                                                                                                                                                      | BOOLEAN |
| 59.0 | TOD TIME ZONES PROVIDED (YES/NO)                                                                                                                                                                           | BOOLEAN |
| 60.0 | ALL ANTI-TAMPER FEATURES AS PER CLAUSE 10.00 ARE PROVIDED (YES/NO)                                                                                                                                         | BOOLEAN |
| 61.0 | PERMANENT BACKLIT LCD TYPE DISPLAY IS PROVIDED (YES/NO)                                                                                                                                                    | BOOLEAN |
| 62.0 | 5 NUMBER OF DIGITS FOR ENERGY DISPAY PROVIDED (YES/NO)                                                                                                                                                     | BOOLEAN |
| 63.0 | MINIMUM SIZE OF DIGITS IS 9X5 MM (YES/NO)                                                                                                                                                                  | BOOLEAN |
| 64.0 | ACTIVE CUMULATIVE ENERGY (KWH) IS DISPLAYED FOR 20 SECONDS (YES/NO)                                                                                                                                        | BOOLEAN |
| 65.0 | OTHER PARAMETERS THAN CUMULATIVE ENERGY AND ALTERNATE MODE PARAMETERS DISPLAYED FOR MINIMUM 6 SECONDS (YES/NO)                                                                                             | BOOLEAN |
| 66.0 | LCD CHECK IS PROVIDED TO DISPLAY HEALTHINESS OF ALL SEGMENTS (YES/NO)                                                                                                                                      | BOOLEAN |
| 67.0 | KWMD PROVIDED (YES/NO)                                                                                                                                                                                     | BOOLEAN |
| 68.0 | MD INTEGRETION PERIOD                                                                                                                                                                                      | TEXT    |
| 69.0 | PROVISION TO RESET MD THROUGH HAND HELD TERMINAL (HHT) OR AUTO RESET AT 24:00 HRS AT THE END OF EACH BILLING CYCLE OR AT THE END OF CERTAIN PREDEFINED PERIOD (SAY, END OF THE MONTH) IS PROVIDED (YES/NO) | BOOLEAN |
| 70.0 | METER PRE-PROGRAMMED FOR<br>(a) 240 V (YES/NO)                                                                                                                                                             | BOOLEAN |
| 71.0 | (b) INTEGRATION PERIOD 30 MIN OF KWMD (YES/NO)                                                                                                                                                             | BOOLEAN |

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| 72.0 | (c) AUTO RESET KWMD AT 2400 HRS. OF LAST DAY OF EACH CALENDAR MONTH (YES/NO)                                                                                    | BOOLEAN |
| 73.0 | (d) NO RESET PUSH BUTTON PROVIDED (YES/NO)                                                                                                                      | BOOLEAN |
| 74.0 | (e) DEFAULT DISPLAY (AUTO SCROLLING MODE) SWITCHES TO ALTERNATE DISPLAY (ON DEMAND DISPLAY MODE) AFTER PRESSING PUSH BUTTON CONTINUOUSLY FOR 5 SECONDS (YES/NO) | BOOLEAN |
| 75.0 | (f) ALTERNATE DISPLAY SWITCHES OVER TO DEFAULT DISPLAY IF PUSH BUTTON IS NOT OPERATED FOR 15 SECONDS (YES/NO)                                                   | BOOLEAN |
| 76.0 | NON-VOLATILE MEMORY PROVIDED (YES/NO)                                                                                                                           | BOOLEAN |
| 77.0 | METERING PROTOCOL AS PER ANNEXURE V & VI. (YES/NO)                                                                                                              | BOOLEAN |
| 78.0 | BASE COMPUTER SOFTWARE PROVIDED IS PASSWORD PROTECTED. (YES/NO)                                                                                                 | BOOLEAN |
| 79.0 | BASE COMPUTER SOFTWARE PROVIDED IS USER FRIENDLY & WINDOWS BASED & SUPPORTS ALL VERSIONS OF "WINDOWS". (YES/NO)                                                 | BOOLEAN |
| 80.0 | BCS SUPPORTS ALL CURRENT OPERATING SYSTEM VERSIONS. (YES/NO)                                                                                                    | BOOLEAN |
| 81.0 | IMPORT / EXPORT OF DATA THROUGH BCS CAN BE THROUGH ANY USB PORT OF PC / LAPTOP. (YES/NO)                                                                        | BOOLEAN |
| 82.0 | BCS SOFTWARE HAS CAPABILITY TO CONVERT ALL THE DATA INTO ASCII FORMAT AS PER MSEDCL REQUIREMENT. (YES/NO)                                                       | BOOLEAN |
| 83.0 | BCS MAINTAINS AUDIT LOG FOR CONNECTION AND DISCONNECTION OF HHT TO BCS. (YES/NO)                                                                                | BOOLEAN |
| 84.0 | BCS HAS OPTION OF DOWNLOADING AUDIT LOG. (YES/NO)                                                                                                               | BOOLEAN |
| 85.0 | BCS MAINTAINS DOWNLOADED BILLING HISTORY. (YES/NO)                                                                                                              | BOOLEAN |

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| 86.0 | BCS STORES DATA TO DATABASE IN ENCRYPTED FORMAT. (YES/NO)                                                                           | BOOLEAN |
| 87.0 | BCS GENERATES EXCEPTIONAL REPORT OF NEW METERS (METERS NOT AVAILABLE IN HHT INITIALLY) READING. (YES/NO)                            | BOOLEAN |
| 88.0 | API / EXE FILE WITH DOCUMENTATION FOR DOWNLOADING DATA FROM METER ALONG WITH SAMPLE METER IS SUBMITTED. (YES/NO)                    | BOOLEAN |
| 89.0 | CHECKSUM LOGIC IS SUBMITTED FOR DOWNLOADED DATA ALONG WITH SAMPLE METER. (YES/NO)                                                   | BOOLEAN |
| 90.0 | CHECKSUM CHECKING EXE / API IS GIVEN FOR VALIDATING DOWNLOADED METER DATA AS WELL AS GENERATED XML FILE WITH SAMPLE METER. (YES/NO) | BOOLEAN |
| 91.0 | API RESIDING ON HHT IS GIVEN FREE OF COST WITH ALL ITS DOCUMENTATION AND TRAINING. (YES/NO)                                         | BOOLEAN |
| 92.0 | TOTAL TIME TAKEN FOR DOWNLOADING ALL DATA FOR 45 DAYS IS 10 TO 12 MINUTES (YES/NO)                                                  | BOOLEAN |
| 93.0 | DOWNLOADING TIME OF ONLY BILLING DATA IS LESS THAN 10 SECS AFTER JOINING THR NETWORK (YES/NO)                                       | BOOLEAN |
| 94.0 | COMMISSIONING AND DEPLOYMENT DOCUMENT OF HHT IS AS PER ANNEXURE VI. (YES/NO)                                                        | BOOLEAN |
| 95.0 | RF MODULE IS INBUILT IN HHT. (YES/NO)                                                                                               | BOOLEAN |
| 96.0 | MAKE OF RF MODULE USED IN HHT                                                                                                       | TEXT    |
| 97.0 | BY DEFAULT, AFTER STARTING HHT IS METER READING MODE. (YES/NO)                                                                      | BOOLEAN |
| 98.0 | MEMORY OF HHT IS 256 MB MIN. (YES/NO)                                                                                               | BOOLEAN |
| 99.0 | HHT POSSESSES SPECIFIC SERIAL NO. (YES/NO)                                                                                          | BOOLEAN |

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| 100.0 | HHT IS PROPERLY LABELED WITH SERIAL NUMBER / TENDER NUMBER / PROGRAM NAME / PROGRAM VERSION. (YES/NO)                                                                                                        | BOOLEAN |
| 101.0 | HHT IS BASED ON OPEN ZIGBEE - 2007 PRO WITH SMART ENERGY PROFILE PROTOCOL AND 6LOWPAN PROTOCOL FOR INTEROPERABILITY AS PER SETTINGS GIVEN IN CLAUSE 5.23 AND ANNEXURE V & VI OF THE SPECIFICATIONS. (YES/NO) | BOOLEAN |
| 102.0 | PROVISION FOR AUTO POWER SAVE ON HHT. (YES/NO)                                                                                                                                                               | BOOLEAN |
| 103.0 | BIDDER AGREES TO SUPPLY HHT IN THE RATIO OF 1:1,000 INCLUDING USER MANUAL, AA SIZE BATTERIES & A SET OF DIRECT COMMUNICATION CORDS (YES/NO)                                                                  | BOOLEAN |
| 104.0 | HHT 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/NO)           | BOOLEAN |
| 105.0 | METER SPECIFIC MRI PROGRAMS HAVE ABILITY TO USE HHT REAL TIME CLOCK TO TAG ALL TIME RELATED EVENTS. (YES/NO)                                                                                                 | BOOLEAN |
| 106.0 | A REAL TIME CLOCK WITH A MINIMUM OF 15 DAYS BATTERY BACKUP WITH 30 YEAR CALENDAR IS PROVIDED IN HHT. (YES/NO)                                                                                                | BOOLEAN |
| 107.0 | TIME DRIFT OF THE RTC IN HHT DOES NOT EXCEED + / - 300 SECONDS PER YEAR. (YES/NO)                                                                                                                            | BOOLEAN |
| 108.0 | INDICATION FOR CONFIRMATION OF SUCCESSFUL DATA TRANSFER IS PROVIDED ON METER & HHT (YES/NO)                                                                                                                  | BOOLEAN |
| 109.0 | HHT DOES NOT ACCEPT ANY EXTERNAL FILE OTHER THAN BCS. (YES/NO)                                                                                                                                               | BOOLEAN |

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| 110.0 | HHT HAS AUDIT TRAIL LOG OF CONNECTION & DISCONNECTION OF HHT WITH BCS. (YES/NO)                                                                                        | BOOLEAN |
| 111.0 | USB PORT ARE PROVIDED ON HHT (YES/NO)                                                                                                                                  | BOOLEAN |
| 112.0 | TWO NOS. OF CHORDS OF MIN. 1 MTR LENGTH ARE PROVIDED WITH EACH HHT (YES/NO)                                                                                            | BOOLEAN |
| 113.0 | NECESSARY SOFTWARE CONFORMING TO THE ENCLOSED COMMUNICATION PROTOCOL, REQUIRED FOR HHT & BASE COMPUTER SYSTEM WITH NECESSARY SECURITY PROVISIONS IS SUPPLIED. (YES/NO) | BOOLEAN |
| 114.0 | HHT HAS OPTION TO CHECK READING STATUS (DOWNLOADED OR NOT DOWNLOADED) FOR ANY PARTICULAR METER. (YES/NO)                                                               | BOOLEAN |
| 115.0 | HHT INDICATES STATUS OF TOTAL CONSUMERS / METERS, NUMBER OF CONSUMERS / METERS READ AND BALANCE CONSUMERS / METERS. (YES/NO)                                           | BOOLEAN |
| 116.0 | SEARCH FACILITY FOR THE BALANCE METERS PROVIDED ON HHT. (YES/NO)                                                                                                       | BOOLEAN |
| 117.0 | HHT CAPABLE OF DOWNLOADING BILLING DATA OF AT LEAST 2,000 (TWO THOUSAND) METERS AT A TIME (YES/NO)                                                                     | BOOLEAN |
| 118.0 | HHT SUPPLIED IS CAPABLE FOR DOWNLOADING DATA OF MULTIPLE DESIGNS & MAKE OF METERS (YES/NO)                                                                             | BOOLEAN |
| 119.0 | HHT HAS FACILITY FOR RE-ENTERING METER SERIAL NUMBERS DIRECTLY FROM BASE COMPUTER SYSTEM (YES/NO)                                                                      | BOOLEAN |
| 120.0 | HHT IS TYPE TESTED AS PER TECHNICAL SPECIFICATION (YES/NO)                                                                                                             | BOOLEAN |
| 121.0 | TYPE TEST REPORT NO & DATE OF HHT                                                                                                                                      | TEXT    |
| 122.0 | ZIGBEE COMPLIANCE CERTIFICATE FOR RADIO MODULES USED IN HHT IS SUBMITTED (YES/NO)                                                                                      | BOOLEAN |

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| 123.0 | ZIGBEE COMPLIANCE CERTIFICATE NUMBER & DATE FOR RADIO MODULES IN HHT                                                                                                           | TEXT    |
| 124.0 | CERTIFICATE OF PICS (PROTOCOL IMPLEMENTATION & CONFORMANCE STATEMENT) IN REGARDS MANUFACTURER SPECIFIC CLUSTER FROM ZIGBEE ALLIANCE OFFICIAL TEST HOUSE IS SUBMITTED. (YES/NO) | BOOLEAN |
| 125.0 | PICS CERTIFICATE NO. & DATE IN REGARDS MANUFACTURER SPECIFIC CLUSTER FROM ZIGBEE ALLIANCE OFFICIAL TEST HOUSE.                                                                 | TEXT    |
| 126.0 | METER IS TYPE TESTED (YES/NO)                                                                                                                                                  | BOOLEAN |
| 127.0 | TYPE TEST REPORT NUMBER & DATE OF METER                                                                                                                                        | TEXT    |
| 128.0 | GUARANTEE 5 YEARS FROM INSTALLATION OR FIVE & HALF YEARS FROM DATE OF DESPATCH (YES/NO)                                                                                        | BOOLEAN |
| 129.0 | IN HOUSE TESTING FACILITIES ARE AVAILABLE FOR (g) INSULATION RESISTANCE MEASUREMENT (YES/NO)                                                                                   | BOOLEAN |
| 130.0 | (h) NO LOAD CONDITION (YES/NO)                                                                                                                                                 | BOOLEAN |
| 131.0 | (i) STARTING CURRENT TEST (YES/NO)                                                                                                                                             | BOOLEAN |
| 132.0 | (j) ACCURACY TEST REQUIREMENT (YES/NO)                                                                                                                                         | BOOLEAN |
| 133.0 | (k) POWER CONSUMPTION (YES/NO)                                                                                                                                                 | BOOLEAN |
| 134.0 | (l) TRANSPORTATION TEST (YES/NO)                                                                                                                                               | BOOLEAN |
| 135.0 | (m) FULLY COMPUTERISED METER TEST BENCH SYSTEM FOR CARRYING OUT ROUTINE AND ACCEPTANCE TEST IS AVAILABLE (YES/NO)                                                              | BOOLEAN |
| 136.0 | (n) MANUFACTURER HAS CALIBRATED STANDARD METER OF 0.1 CLASS ACCURACY (YES/NO)                                                                                                  | BOOLEAN |
| 137.0 | (o) VERIFIATION OF DATA DOWNLOADING AS PER RF PORT (YES/NO)                                                                                                                    | BOOLEAN |

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| 138.0 | (p) GLOW WIRE TESTING (YES/NO)                                                                                                                                                                   | BOOLEAN |
| 139.0 | 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 | TEXT    |
| 140.0 | MANUFACTURING ACTIVITIES ARE AS PER CLAUSE 28.00 (YES/NO)                                                                                                                                        | BOOLEAN |
| 141.0 | QAP SUBMITTED AS PER ANNEXURE-I (YES/NO)                                                                                                                                                         | BOOLEAN |
| 142.0 | AGEING TEST IS CARRIED OUT ON METER (YES/NO)                                                                                                                                                     | BOOLEAN |
| 143.0 | METER & HHT COMPLIES WITH ANNEXURE IV, V & VI OF TECHNICAL SPECIFICATION (YES/NO).                                                                                                               | BOOLEAN |
| 144.0 | PERMANENT NATURE CONNECTION DIAGRAM OF METER IS SHOWN ON INSIDE PORTION OF THE TERMINAL COVER. (YES/NO)                                                                                          | BOOLEAN |
| 145.0 | METER TERMINALS ARE MARKED AND THIS MARKING APPEARS IN THE ABOVE PERMANENT NATURE CONNECTION DIAGRAM. (YES/NO)                                                                                   | BOOLEAN |
| 146.0 | NAME PLATE & MARKING AS PER CLAUSE NO. 18.00                                                                                                                                                     |         |
| 147.0 | <b>GTP FOR METER BOX</b>                                                                                                                                                                         | BOOLEAN |
| 148.0 | MANUFACTURER'S / SUPPLIER'S NAME AND ADDRESS WITH WORKS ADDRESS                                                                                                                                  | TEXT    |
| 149.0 | TRANSPARENT POLY-CARBONATE MATERIAL NATURAL WHITE COLOUR USED FOR BASE AND COVER OF METER BOX (YES/NO)                                                                                           | BOOLEAN |
| 150.0 | WALL THICKNESS OF METER BOX ON LOAD BEARING SIDE 3 MM (YES/NO)                                                                                                                                   | BOOLEAN |
| 151.0 | THICKNESS OF SHEET OF COVER 2 MM (YES/NO)                                                                                                                                                        | BOOLEAN |
| 152.0 | LIFE EXPECTED IS 5.5 YEARS (YES/NO)                                                                                                                                                              | BOOLEAN |

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| 153.0 | APPLICABLE IS: 14772 / 2000 (WITH LATEST AMENDMENT) (YES/NO)  | BOOLEAN |
| 154.0 | FURNISH PHYSICAL WATER ABSORPTION VALUE                       | TEXT    |
| 155.0 | FURNISH THERMAL HDDT VALUE                                    | TEXT    |
| 156.0 | FURNISH FLAMMABILITY VALUE                                    | TEXT    |
| 157.0 | FLAMMABILITY V2 (YES/NO)                                      | BOOLEAN |
| 158.0 | GLOW WIRE TEST AT 650° C (YES/NO)                             | BOOLEAN |
| 159.0 | TENSILE STRENGTH                                              | TEXT    |
| 160.0 | FLEXURE STRENGTH                                              | TEXT    |
| 161.0 | MODULUS OF ELASTICITY                                         | TEXT    |
| 162.0 | IZOD IMPACT STRENGTH NOTCHED AT 23° C                         | TEXT    |
| 163.0 | DIMENSIONS OF BOX IN MM (LXBXH)                               | TEXT    |
| 164.0 | MINIMUM CLEARANCE OF 40 MM FROM THREE SIDES OF METER (YES/NO) | BOOLEAN |
| 165.0 | MINIMUM CLEARANCE OF 25 MM FROM METER FRONT SIDE (YES/NO)     | BOOLEAN |
| 166.0 | MINIMUM CLEARANCE OF 10 MM FROM BACK OF METER (YES/NO)        | BOOLEAN |
| 167.0 | MINIMUM CLEARANCE OF 60 MM FROM BOTTOM OF METER (YES/NO)      | BOOLEAN |
| 168.0 | WEIGHT OF COMPLETE BOX IN KGS                                 | TEXT    |
| 169.0 | METER BOX IS TYPE TESTED (YES/ NO)                            | BOOLEAN |
| 170.0 | TYPE TEST REPORT NOS.                                         | TEXT    |
| 171.0 | IN-HOUSE TESTING FACILITY AS PER CLAUSE NO. 6.0 (YES/NO)      | BOOLEAN |



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| 172.0 | AS PER CLAUSE 4.6 OF ANNEXURE III, I.E. TECHNICAL SPECIFICATION FOR METER BOX, UV AGEING TEST IS CARRIED OUT (YES/NO)                                           | BOOLEAN |
| 173.0 | WHETHER YOU AGREE TO SUPPLY METERS AS PER ANEXURE-D, I.E. TECHNICAL SPECIFICATIONS OF THE TENDER. (YES/NO)                                                      | BOOLEAN |
| 174.0 | WHETHER TYPE TEST REPORTS ALONGWITH COPY OF SAME IN TWO CDS ARE SUBMITTED (YES/NO)                                                                              | BOOLEAN |
| 175.0 | WHETHER 15 NOS. OF TENDER SAMPLE METERS, TWO METER BOXES, ONE HHT, API SOFTWARE, BCS, CHECKSUM LOGIC & DOCUMENTATION ARE SUBMITTED ALONGWITH THE OFFER (YES/NO) | BOOLEAN |