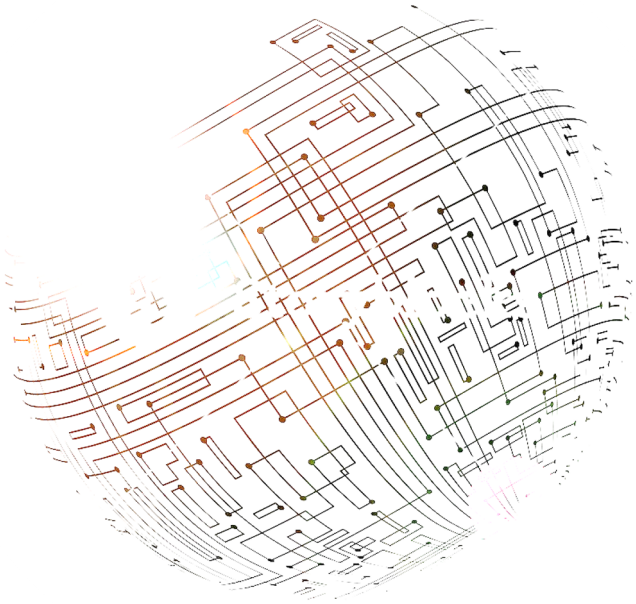


Verticross India Pvt. Ltd.

SMART METER

Corporate Office:
301, Third floor,
Sri Manu's Aroha Chambers,
Rukminipur, A S Rao Nagar,
ECIL Main Road, Hyderabad - 500062, INDIA.

INTRODUCTION

Smart meter forms is one of the key components of advanced metering infrastructure (AMI). They measure and record electrical parameters in real time and transfer the information / data to utility companies. These are days when, energy consumption and efficiency have become critical and smart meter has emerged as an innovative solution world-wide. Verticross have indigenously designed and developed single phase (VSM-09) and three phase (VTM-09) smart meters to address the concerns of utilities.

The smart meters have pluggable communication NIC (Network Interface card) card which is used for transferring data to the data centre. Various types of communication technology are used which include RF, Cellular, Broadband, and PLC technology. The utility companies uses these data for Billing, demand management, validation and customer engagement.

The solution's objective is to measure and validate data and also ensure data security. Since there are other manufactures of smart meters and various software's that are used to build analysis, interoperability and standardization has become a major challenge.

Our meters are single chip solution that helps measure the voltage and current factors. VSM-09 and VTM-09 consist of several different technical components which may vary according to the specific market conditions in different DISCOMs, but the majority include the following features:

- Accurate measurement and transmission of electricity consumption data.
- Enabling new energy services for improving energy-efficiency.
- Accurate billing and Real-time energy usage monitoring
- Provision of two-way information gateway and communication infrastructure between the meters and relevant parties and their systems.
- Empowering the consumer through delivery of actual consumption data.
- Improving Customer services, including automated billing/invoicing based on detailed metering data.
- Managing energy networks/grids better by shifting or reducing energy consumption.
- Encouraging decentralized, micro-generation of energy, thus transforming the consumer into an energy producer.

What makes it "smart"?

Smart Metering systems feature a number of innovations: digital technology, communications, control and better operation of networks. Smart Metering technologies have changed the way that metering works completely. They provide customers with much more information on how they use energy and enable those customers to reduce their usage.

These specifications cover the design, manufacturing, testing of AC whole current, single phase, 2 wire Smart Energy Meter with bidirectional communication facility & remote connect/disconnect switch. The meter shall communicate with Head End System (HES) on any one of the communication technologies mentioned in IS 16444 Part1, as per the requirement of the utility.

DIFFERENT VERSIONS OF SMART METERS

- Single Phase (5-30A) (4G)
- Single Phase (10-60A) (4G)
- Single Phase (5-30A) (RF)
- Single Phase (10-60A) (RF)
- Three Phase whole current (10-60A) (4G)
- Three Phase whole current (10-60A) (RF)
- Three Phase LTCT (4G)
- Three Phase LTCT (RF)

BENEFITS OF SMART METER

CONSUMERS

- Consumers can be informed remotely (historical data) or locally (real-time data) on energy costs and carbon emissions.
- Energy consumption of household electrical equipment can be displayed on the appliance or on displays
- Multi tariff functions can be added to allow demand response techniques
- Allows electrical appliances to be automatically controlled
- Allows the consumer to reduce costs by increasing energy consumption during off-peak cheaper tariff periods.

UTILITIES

- Gain first-class data
- Influence the energy consumption of their users
- improve profitability of the technology.
- A reduction in ‘costs to serve’
- Open gateways for the delivery of energy services
- Assistance in the development of liberalized energy market
- Help for revenue protection
- Monitoring of the generation from building renewables
- Support in demand response techniques
- New communication channel to customers

STANDARDS

- IS 13779 with latest amendments - Alternating Current Static Watt-hour Meter class 1& 2
- IS 15884 with latest amendments - Alternating Current Direct Connected Static Prepayment Meters for Active Energy Class 1 and 2 Specification
- IS 16444 Part 1 with latest amendments - Alternating Current Static Direct Connected Watt Hour Smart Meter Class 1 and 2- Specification
- IS 15959 Part 1 & Part 2 with latest amendments - Data Exchange for Electricity Meter Reading, Tariff and Load Control Companion Standards 3

The meters shall comply with IS 16444 Part 1 for all requirements.

Sl.No	Specification	Standards
1	Reference Voltage	As per relevant IS (240 V)
2	Current Rating	5-30 A
3	Category	UC1
4	Starting Current	As per IS 16444 Part 1
5	Accuracy	Class 1.0 as per IS 16444 Part 1
6	Limits of error	As per IS 16444 Part 1
7	Operating Temperature	As per IS 16444 Part 1
8	Humidity	As per IS 16444 Part 1
9	Frequency	As per IS 16444 Part 1
10	Influence Quantities	As per IS 16444 Part 1
11	Power Consumption of meter	As per IS 16444 Part 1
12	Current and Voltage Circuit	As per IS 16444 Part 1
13	Running at No Load	As per IS 16444 Part 1
14	Test output device	As per IS 16444 Part 1
15	Meter Display	As per IS 16444 Part 1
16	Name Plate & Marking	As per IS 16444 Part 1
17	Meter Display	As per IS 16444 Part 1
18	Parameters to be measured	As per IS 16444 Part 1 / IS15959 Part-2
19	Maximum Demand reset	As per IS 15959 Part 2
20	Power Quality Information	As per IS 15959 part 2
21	LED/LCD Indicators	As per IS 16444 Part 1
22	Load Survey/Interval Data	As per IS 15959 part 2
23	Tamper/ Event Recording	As per IS 15959 part 2
24	Measuring Elements	As per IS 16444 part 1
25	Alarm	As per IS 16444 Part 1/ 15959 Part 2
26	Load Control	As per IS 16444 Part 1
27	Connect/Disconnect switch - UC1	As per IS 16444 Part 1
28	Status of load switch	As per IS 16444 Part 1

29	Programmability	As per IS 16444 Part 1
30	Communication	As per IS 16444 Part 1
31	Data Exchange Protocol	As per IS 16444 Part 1
32	Remote Firmware upgrade -	As per IS 15959 part 2
33	Real Time Clock (RTC)	As per IS 16444 Part 1/ IS 15959 Part1 & Part 2

Note: The clock day/date setting and synchronization shall only be possible through password/Key code command from one of the following:

(a) From remote server through suitable communication network.
(b) Hand Held Unit (HHU) or Meter testing work bench and this shall need password enabling for meter.

Data Retention	As per CEA regulations
Battery Backup	Meter shall be supplied with separate battery backup for RTC
Guarantee	60 months from the date of supply

Note: The meter which are found defective/inoperative at the time of installation or have become inoperative/defective within the guarantee period, the same shall be replaced/repaired by the manufacturer /supplier within one month of receipt of report (as per agreement with utility)

The Smart Meters shall have a dedicated Scalable slot for accommodating plug-in type bi - directional communication module which shall integrate the respective communication technology (Cellular) with the smart meters, leading to easy adaptability for network interfaces. The Plug-In module shall be field swappable/ replaceable.

Data Display shall be in two modes:

1	Auto Scroll
2	Scroll with Push Button

The display parameters include the following

1	Display Check
2	Date and Time
3	Last Recharge Amount
4	Last Recharge Time
5	Current Balance Amount
6	Current Balance Time
7	Cumulative Active Energy KWh with legend
8	Current calendar month MD in KW with legend
9	Instantaneous voltage
10	Instantaneous Phase current
11	Instantaneous Load KW
12	Instantaneous average Power Factor

These parameters should be displayed on the Meter Display continuously for a period of 10 seconds on Auto scroll. All Parameters mentioned under Auto-Scroll mode should be displayed in push button mode. Additionally, the following Parameters shall also be displayed:

1	Internal diagnostics (display check)
2	Meter Serial No.
3	Last month cumulative kWh with legends
4	Last month MD in KW with legends
5	Current month Average Power Factor
6	Last month Average Power Factor

Further, the Meter should display High Resolution energy values with resolution of three digits before decimal and two digits after decimal in push button mode. The meter's display should return to default display mode (continuous auto scroll) if push button is not operated for more than 10 seconds. (The order of display may be revised as per requirement of the utility). Meter display should not go in to sleep mode during Power-On condition.

The meter shall continue recording energy under tamper conditions as defined in IS 15959 Part 2 and should log the event and send alarm to Head End System after detection of the defined theft features as per IS 15959 Part 2.

REQUIREMENTS

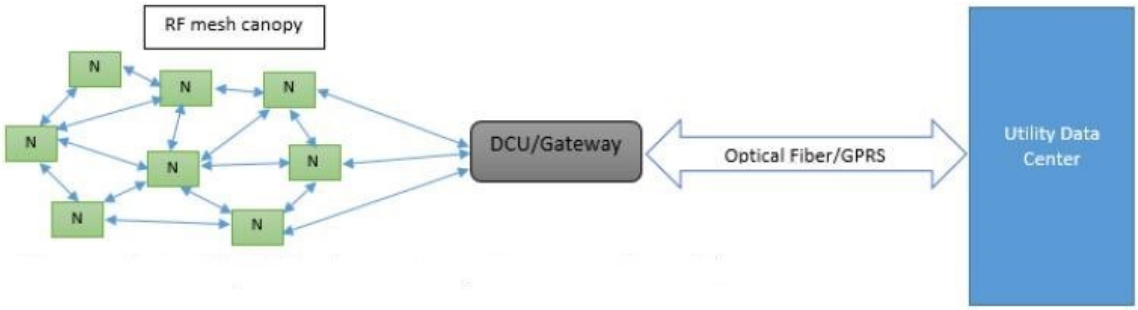
- Meter shall be BIS marked as per IS 16444 Part 1.
- Constructional requirement shall be as per IS 16444/IS 13799.
- **Meter Base & Cover** : Meter base & cover shall be as per IS 16444 Part1 / IS 13779. The meter Base & cover shall be 'Break to open' design. The material for meter base and cover shall be made of high grade polycarbonate.
- **Terminal Block & Cover** : As per IS 16444 Part 1/ IS 13779 .
- **Design :** Voltage circuit, sealing arrangement, terminal block, terminal cover and nameplate etc. shall be in accordance with IS-16444 Part 1(latest version). The meter shall be compact and reliable in design, easy to transport and immune to vibration and shock involved in transportation and handling.
- **Name Plate & Marking :** The name plate on the meter should be clearly visible, effectively secured against removal and indelibly/distinctly marked in accordance with relevant IS. In addition, "Name of the Utility", Purchase Order No. and year/month of manufacturing shall be provided on the name plate. The rating plate information shall be as per relevant IS.
- **Connection Diagram :** As per IS 16444 Part 1
- **Fixing arrangements:** The meter shall be mounted type. The Meter should have three fixing holes, one at top and two at the bottom. The top hole should be such that the holding screw is not accessible to the consumer after fixing the meters. The lower screws should be provided under seal-able terminal cover.

- **Sealing Arrangements:** Arrangements shall be provided for proper sealing of the meter cover so that access to the working parts shall not be possible without breaking the seal. The sealing arrangement and number of seals shall be as per relevant IS/ requirement of utility.

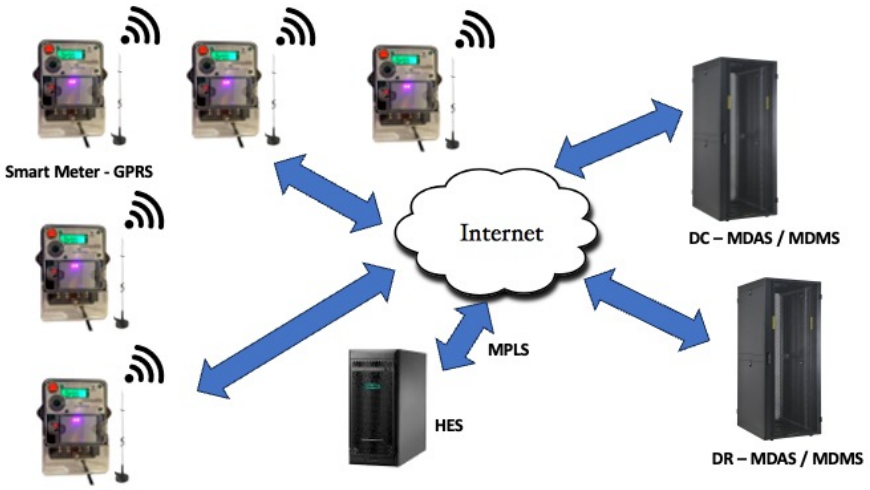
COMMUNICATION

Smart Meters have a pluggable NIC (Network Interface Card) card which supports RF / GPRS network.

- In case of RF, a star network is formed and data is routed to the master unit in this case a DCU and data is transferred to the HES / MDAS system



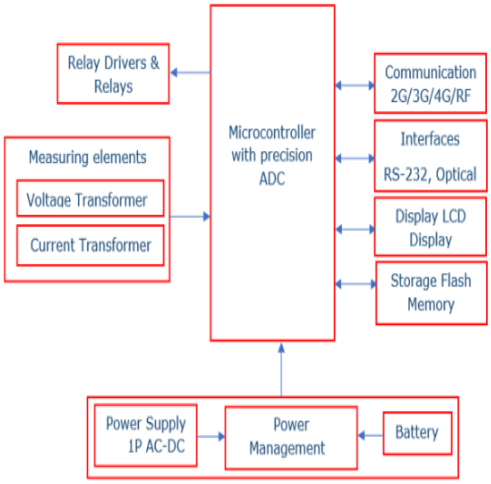
- In case of GPRS system, the static SIMs will transfer the data through the MPLS network to the HES/MDAS system.
-



SINGLE PHASE METER SPECIFICATION (VSM-09)

Single Phase Smart Energy Meter is designed for residential and small commercial energy consumers in distribution networks. Smart meter is an ac-static watt-hour meter that records electric energy in intervals of an hour or half or configurable intervals and communicates to the Head End System (HES) through a wireless communication network (GSM/GPRS/4G/RF/Nb-IoT). Meter also records energy with time of use registers, has internal connect and disconnect switches with two-way communication capability. It is designed to measure the flow of forward (import) energy, store and communicate the same along with other parameters. It can remotely be accessed for collecting data/events, programming for select parameters.

The smart meters collect data locally and transmit via a local area network to a data collector. The collector retrieves the data and may or may not carry out any processing of the data. Data is transmitted via a wide area network (WAN) or NAN to the utility central collection point for processing and use by business applications. Since the communications path is two-way, signals or commands can be sent directly to the meters, customer premise or distribution device



Features

- Class 1.0 accuracy compliance with IS/IEC standards
- Programmable Time of Use metering.
- Load Connect/Disconnect feature with inbuilt relays
- Firmware download feature through remote communication
- LED indications for Calibration and Meter status
- Optical/IR communication for local meter reading
- Communication: GPRS/4G/RF/Nb-IoT

Measured Values/Units

- Active energy and Apparent Energy
- Maximum Demand kW and Maximum Demand kVA
- Instantaneous Voltage and current

- Instantaneous Frequency and power factor
- Tamper count

Event logging

- Current Reversal
- Power ON / OFF
- Magnetic influence
- Top Cover Open Detection
- Overload
- High Voltage
- Low Voltage

Name Plate Details

Voltage	240V(L-N)
Basic Current	5Amp
Maximum Current	30Ams
Accuracy	Class 1.0
Connection	Single phase two wire
Operating Voltage	96V to 290V AC
Starting Current	0.4% of basic current
Power factor	Zero Lag-Unity-Zero Lead
Local Data download	Optical Port
Remote Data download	GPRS
Standards	IS16444, IS15959-2, IS13779

Registers

Maximum Demand	Programmable Integration period
Billing Registers	Up to 12 months
Time of Use	Programmable time zones
Tariff Registers	Programmable Tariff registers

Environmental

Protection	IP51
Enclosure material	Polycarbonate
Operating Temperature	-10 degrees to +60 degrees
Storage Temperature	-20 degrees to +80 degrees
Humidity	95% non-condensing

Mechanical layout

Dimensions	135 190 mm x 115 110 mm x 43 45 mm (Width x
Housing type	Polycarbonate
Protection	IP55
Weight	Less than 500 gms

GSM/GPRS

Bands	850MHz,900MHz,1800MHz,1900MHz
GPRS	Multi - slot class12
Data Speed	85.6 kpbskbps
SMS	MT, MO, CB, Text and PDU mode

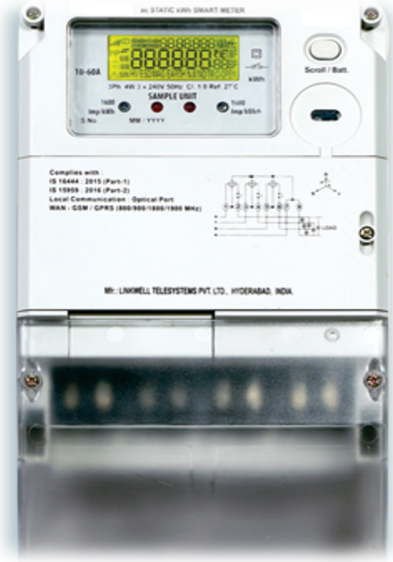
Immunity

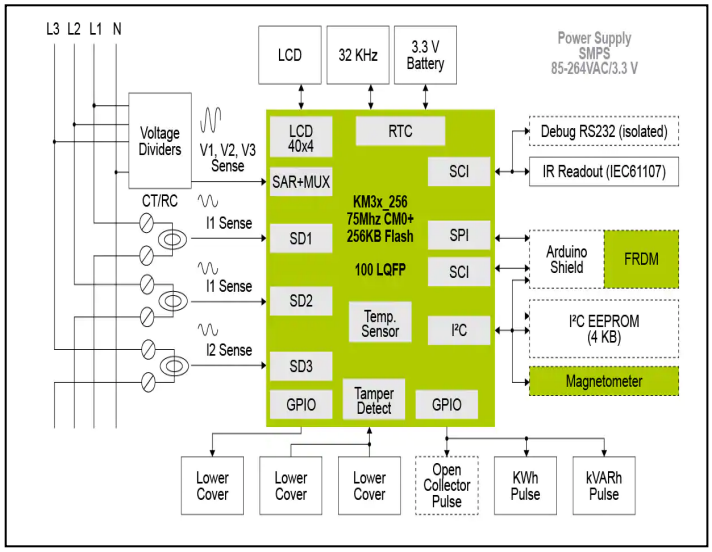
Surge IEC 61000-4-5, 2005	6 kV Performance criteria A
Conducted Emission CISPR 22	150 KHz to 30 MHz Performance criteria A
Radiated Emission CISPER 22	30 MHz to 1000 MHz Performance criteria A
Electrostatic Discharge IEC 61000-4-2, 2008	6 kV in Contact Discharge 8 kV in Air Discharge
Radiated Susceptibility IEC 61000-4-3, 2010	80 MHz to 1000 MHz (3 V/m) Performance criteria A
Electrical Fast Transient IEC 61000-4-4, 2011	4 kV Performance criteria A

THREE PHASE METER SPECIFICATION (VTM-09)

Three Phase Smart Energy Meter is designed for high value residential and commercial energy consumers in three phase distribution networks. Smart meter is an ac-static watt-hour meter that records electric energy in intervals of an hour or half or configurable intervals and communicates to the Head End System (HES) through a wireless communication network (GSM/GPRS/4G/RF/Nb-IoT). Meter also records energy with time of use registers, has internal connect and disconnect switches with two-way communication capability. It is designed to measure the flow of forward (import) energy, store and communicate the same along with other parameters. It can remotely be accessed for collecting data/events, programming for select parameters.

The smart meters collect data locally and transmit via a local area network to a data collector. The collector retrieves the data and may or may not carry out any processing of the data. Data is transmitted via a wide area network (WAN) or NAN to the utility central collection point for processing and use by business applications. Since the communications path is two-way, signals or commands can be sent directly to the meters, customer premise or distribution device





Features

- Class 1.0 accuracy compliance with IS/IEC standards
- Programmable Time of Use metering.
- Load Connect/Disconnect feature with four inbuilt relays
- Firmware download feature through remote communication
- LED indications for Calibration and Meter status
- Optical/IR communication for local meter reading
- Communication: GPRS/4G/RF/Nb-IoT
- Tamper data: 20 events for each tamper with date and time
- Historical billing information

- Meter records correct energy with same accuracy under reverse current connection
- Auto scroll & manual scroll mode (push button mode UP/DN)
- 8+2 digits on LCD(digit size 10 X5 mm)
- Rated Frequency: 50Hz +/- 5%
- Specified range of operation: 70% to 120% of reference Voltage i.e. 240 Volts

Measured Values / Units

- Active energy and Apparent Energy
- Maximum Demand kW
- Maximum Demand kVA
- Instantaneous Voltage
- Instantaneous Current
- Instantaneous Frequency
- Instantaneous Power Factor
- Tamper count
- Tamper count

Event logging

- Current Reversal
- Power ON / OFF
- Magnetic influence
- Top Cover Open Detection
- Over Load
- High Voltage
- Low voltage

Name Plate Details

Voltage	240V(L-N) X3
Basic Current	10Amp
Maximum Current	60Amp
Accuracy	Class 1.0
Connection	Three phase three 4 wire
Operating Voltage	96V to 290V AC (P-N)
Starting Current	0.4% of basic current
Power factor	Zero Lag-Unity-Zero Lead
Local Data download	Optical Port
Remote Data download	GPRS
Standards	IS16444, IS15959-2, IS13779

Registers

Maximum Demand	Programmable Integration period
Billing Registers	Up to 12 months
Time of Use	Programmable time zones up to 8
Tariff Registers	Programmable Tariff registers up to 8

Environmental

Protection	IP51
Enclosure material	Polycarbonate
Operating Temperature	-10 degrees to +60 degrees
Storage Temperature	-20 degrees to +80 degrees
Humidity	95% non-condensing

Mechanical layout

Dimensions	135 190 mm x 115 110 mm x 43 45 mm (Width x
Housing type	Polycarbonate
Protection	IP55
Weight	Less than 950 gms

Immunity test

Surge IEC 61000-4-5, 2005	6 kV Performance criteria A
Conducted Emission CISPR 22	150 KHz to 30 MHz Performance criteria A
Radiated Emission CISPER 22	30 MHz to 1000 MHz Performance criteria A
Electrostatic Discharge IEC 61000-4-2, 2008	6 kV in Contact Discharge 8 kV in Air Discharge
Radiated Susceptibility IEC 61000-4-3, 2010	80 MHz to 1000 MHz (3 V/m)
	Performance criteria A
Electrical Fast Transient IEC 61000-4-4, 2011	4 kV Performance criteria A

GSM/ GPRS details

Bands	850MHz,900MHz,1800MHz,1900MHz
GPRS	Multi - slot class12
Data Speed	85.6 kpbs
SMS	MT, MO, CB, Text and PDU mode

TYPE TEST

1	Meter case	16	Limits of Error Due to Variation of the Current @UPF,Lag,Lead
2	Terminals, Terminal block	17	Display of Measured Values
3	Extended terminal cover	18	Electrostatic Discharge
4	Clearances and Creepage Distances	19	Limits of Error Due to Ambient Temperature Variation
5	Insulating Encased Meter	20	Starting and Running with No-Load
6	Name plate	21	Starting Current
7	Power Consumption in Voltage Circuit	22	Meter Constant
8	Power Consumption in current Circuit	23	Repeatability of Error Test
9	Voltage Range	24	10mT magnetic test
10	Voltage Dips and Interruptions	25	10mT magnetic test
11	Short-Time Over Current	26	60mT magnetic test
12	Influence of Self-Heating	27	Up to third harmonic energy measurement
13	Influence of Heating	28	EFT Test
14	Insulation properties	29	Radiated susceptibility
15	Immunity to Earth Fault	30	Impulse voltage
31	AC high voltage		
32	Radiated Emission		
33	Conducted emission test		
34	Immunity to Electromagnetic-Disturbance		
35	Surge test		
36	Dry Heat Test		
37	Resistance to Heat and Fire		
38	Protection Against Penetration of Dust and Water		
39	DC immunity		
40	Shock Tes		
41	Vibration Test		
42	Spring Hammer Test		
43	Cold Test		
44	Damp Heat Cycle Test		
45	Communication protocol (DLMS)		
46	Connectivity technology		