The Central Electricity Authority (Technical Standards for Communication System in Power System Operations) Regulations, 2020

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Regulations *Pages*

The Central Electricity Authority (Technical Standards for Communication System in Power System Operations) Regulations, 2020[1]

Whereas the draft of the Central Electricity Authority (Technical Standards for Communication System in Power System Operations) Regulations, 2020 was published in six newspaper dailies, as required by sub-section (3) of Section 177 of the Electricity Act, 2003 (36 of 2003) read with sub-rule (2) of Rule 3 of the Electricity (Procedure for Previous Publication) Rules, 2005, inviting objections and suggestions from all persons likely to be affected thereby, before the expiry of the period of forty-five days, from the date on which the copies of the newspaper containing the said draft regulations were made available to the public;

And whereas copies of the said newspapers containing the said draft regulations were made available to the public on the 26th March, 2019;

And whereas the objections and suggestions received from the public on the said draft regulations were considered by the Central Electricity Authority;

Now, therefore, in exercise of the powers conferred by sub-section (1) of Section 177 of the Electricity Act, 2003 (36 of 2003) read with clause (*b*) of Section 73 of the said Act, the Central Electricity Authority hereby makes the following regulations, namely:—

CHAPTER I
PRELIMINARY

1. Short title and commencement.—(1) These regulations may be called the **Central Electricity Authority (Technical Standards for Communication System in Power System Operations) Regulations, 2020**.

(2) They shall come into force on the date of their publication in the Official Gazette.

2. Definitions.—(1) In these regulations, unless the context otherwise requires,—

(*a*) "Act" means the Electricity Act, 2003 (36 of 2003);

(*b*) "Authority" means the Central Electricity Authority established under sub-section (2) of Section 70 of the Act;

(*c*) "automatic generation control" means capability to regulate the power output of selectable units in response to total power plant output, tie-line power flow, and power system frequency;

(*d*) "bulk consumer" means a consumer who avails supply at voltage of 33 kV or above;

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1 Vide Noti. No. Comm._Std./PCD/CEA, Extra., Part III, S. 4, dated 27-2-2020, published in the Gazette of India, No. 83, dated 27-2-2020.

(*e*) "communication channel" means a dedicated virtual path configured from one node to another node, either directly or through intermediary node;

(*f*) "communication network" means an inter-connection of communication nodes through a combination of media, either directly or through intermediary node;

(*g*) "communication system" is a collection of individual communication networks, communication media, relaying stations, tributary stations, terminal equipment usually capable of inter-connection and inter-operation to form an integrated communication for power sector including existing communication system such as inter-State transmission system or intra-State transmission system, satellite, cellular, optical fiber and radio communication system and their auxiliary power supply system used for regulation of inter-State and intra-State transmission of electricity;

(*h*) "control centre" means National Load Despatch Centre or Regional Load Despatch Centres or State Load Despatch Centres or Renewable Energy Management Centres or Area Load Despatch Centres or Sub -Load Despatch Centres or Load Despatch Centres of distribution licensee including main and backup as applicable;

(*i*) "cyber security" means protecting information, equipment, devices, computer, computer resource, communication device and information stored therein from unauthorised access, use, disclosure, disruption, modification or destruction as defined in clause (*nb*) of sub-section (1) of Section 2 of the Information Technology Act, 2000 (21 of 2000);

(*j*) "data" means a set of values of analogue or digital signal including a text, voice, video, tele protection, alarm, control signal, phasor, weather parameter, parameter of a machine or power system;

(*k*) "earthing" means connection between conducting parts and general mass of earth by an earthing device;

(*l*) "forecasting service provider" means a service provider who provides forecast related to weather or renewable energy resources and demand for use of users;

(*m*) "interface agreement" means an agreement signed between parties sharing the communication system;

(*n*) "node" means a connection point on a communication network, at which data is conveyed via communication channels to or from that point to other points on the network;

(*o*) "power exchange" means the exchange which has been granted registration in accordance with the provisions of the Central Electricity Regulatory Commission (Power Market) Regulations, 2010;

(*p*) "Renewable Energy Management Centre" means the centre being established to enable forecasting, scheduling and monitoring of renewable energy generation;

(*q*) "renewable energy power plant" means the power plants generating grid quality electricity from renewable energy sources, namely, small hydro, wind, solar including its integration with combined cycle, biomass, bio fuel cogeneration, urban or municipal waste and other such sources as approved by the Central Government in the Ministry of New and Renewable Energy;

(*r*) "Schedule" means a schedule annexed to these regulations;

(*s*) "supervisory control and data acquisition" means a system that acquires data from remote locations over communication system and processes it at centralised control location for monitoring, supervision, control as well as decision support;

(*t*) "user" means a person such as a generating company including captive generating plant, renewable energy power plant, transmission licensee, distribution licensee or a bulk consumer, whose electrical system is connected to the inter-State transmission system or the intra-State transmission system;

(*u*) "wideband node" means wide bandwidth data transmission with an ability to simultaneously transport multiple signals and traffic types.

(2) Words and expressions used and not defined in these regulations but defined in the Act shall have the respective meanings assigned to them in the Act.

3. Application.—These regulations shall apply to all the users, National Load Despatch Centre, Regional Load Despatch Centres, State Load Despatch Centres, Load Despatch Centres of distribution licensee, Central Transmission Utility, State Transmission Utilities, Regional Power Committees, Renewable Energy Management Centres, forecasting service provider and power exchanges.

CHAPTER II

REQUIREMENTS

4. Functional requirement.—(1) The communication system shall provide reliable data and voice communication and tele protection for power system at national level, regional level, inter-State level and intra-State level.

(2) The communication system shall be capable to provide integration with supervisory control and data acquisition system, wide area measurement system, video conferencing system, automatic meter reading, electronic private automatic branch exchange, voice over internet protocol and tele protection.

5. Performance requirement.—(1) User shall be capable of transmitting all operational data as required by appropriate control centre.

(2) Communication system shall relay the control command from the control centre to relevant equipment within two seconds for supervisory control and data

acquisition and within one second for wide area measurement system, whether the command is transmitted directly or via data concentrator.

(3) Communication system shall be planned with required bandwidth to conform the data interval time as specified in Schedule I.

6. Interface requirements.—(1) The required communication interfaces shall be provided at both sending and receiving ends.

(2) All the interfaces shall be provided with audio visual status indication to indicate its normal operation as per relevant standards.

(3) The standards for interfacing to communication system shall be as specified in Schedule II.

7. Reliability.—(1) Total outage period shall be less than sixteen hours on monthly basis each for interface node, wideband node and communication network.

(2) The total outages in a rolling twelve months assessment period shall be less than forty-eight hours.

(3) The communication system shall be designed to ensure adequate redundancy.

8. Design and planning.—(1) Communication system shall be planned up to the interface points of the user and the respective control centre including the interfacing communication equipment at the respective location.

(2) Cellular and radio frequency based communication technology shall not be considered for control and protection functions.

(3) Communication system shall be designed as per communication planning criteria for development of reliable communication system for the power system.

(4) Central Transmission Utility or State Transmission Utility while planning shall consider design of the intervening communication system for seamless integration to have wideband network.

(5) User shall ensure centralised monitoring or management of its communication network and shall provide necessary facilities for configuration, identification of fault and generation of various reports on availability of the communication system.

(6) User shall be responsible for planning, design, implementation, secured operation and maintenance of its own communication infrastructure to be interfaced with the communication system.

(7) User, whose system is proposed to be interfaced with the communication system, shall furnish the requisite interface information to the appropriate control centre as specified by them.

(8) Communication equipment installed shall be interoperable, so as to allow seamless integration between different vendors.

(9) Every interfacing with the intervening communication system shall be covered by interface agreement between the parties sharing the communication which shall contain general and specific technical conditions supported by interfacing details and layout drawings for the interfacing.

(10) Network equipment shall be synchronised through provision of global positioning system clock to achieve the desired functionality.

(11) Communication equipment for all the nodes shall be provided with at least ten hours battery backup and extended backup shall be provided depending upon the requirement.

(12) Supply voltage shall be 220/48V Direct Current +15%, —10%. (positive pole earthed).

(13) The minimum guaranteed life for all the wideband communication equipment shall be ten years.

9. Site responsibility schedule.—(1) A site responsibility schedule for every interface point shall be prepared by the owner of the communication interface equipment at the interfacing location.

(2) Site responsibility schedule shall include—

(*a*) schedule of telecommunication interface equipment, their responsibility for access, maintenance and operation;

(*b*) schedule of auxiliary power supply catering communication equipment;

(*c*) schedule of patching details (like Synchronous Transport Module (STM) level, E-1 level, Transmission Control Protocol/Internet Protocol (TCP/IP level) for channel routing, and numbers of fiber connectivity;

(*d*) type of connectors required for making the connection through;

(*e*) specific information provided by the original equipment manufacturer;

(*f*) site or node common drawings for each interface point; and

(*g*) responsible person for the site.

(3) If packet technology is used in backhaul network, following additional information shall be included, namely:—

(*a*) mode of connectivity;

(*b*) protocol used (Level 2 or Level 3); and

(*c*) bandwidth provisioning.

10. Outage planning.—Monthly outage shall be planned and got approved by the owner of communication equipment in the concerned regional power committee, as per detailed procedure finalised by the respective regional power committee.

11. Connection with earth.—Earth connection of communication equipment (indoor and outdoor) shall be done in accordance with the norms of the Institute of Electrical and Electronics Engineers (IEEE)-1100, the Institute of Electrical and Electronics Engineers (IEEE)-80 or the Bureau of Indian Standards (BIS):3043, as per the applicability.

12. Lightning and surge protection.—(1) Protection against lightning and electric surge shall be provided as per International Electro-Technical Commission (IEC) 61000-4-5 and compliant to relevant parts of IS/IEC 62305, as per the applicability.

(2) The resistibility of communication equipment installed against over voltage and over current shall be as per International Telecommunications Union — Telecommunication (ITU-T)-K 20 recommendations.

13. Safety and testing.—(1) Owner of communication equipment shall be responsible for the safety of its equipment installed.

(2) Testing shall be carried out as and when the communication equipment is replaced or upgraded to conform the compliance to these standards.

14. Cyber security.—(1) All users and control centres connected to the communication system shall have robust programs in place to adequately and continuously manage cyber security risks that could have adversely impact power system communications infrastructure.

(2) The cyber security program shall address the following, namely:—

(*a*) compliance with provisions of the Information Technology Act, 2000 (21 of 2000) and National Cyber Security Policy, 2013 as amended from time to time;

(*b*) implementation of the National Critical Information Infrastructure Protection Centre (NCIIPC) Guidelines;

(*c*) implementation of guidelines and advisories issued by Computer Emergency Response Team (CERT—India) and applicable Sectoral Computer Emergency Response Team (CERT); and

(*d*) compliance to the Central Electricity Authority (Cyber Security) Regulations, as and when they come into force.

15. Access to connection site or node.—Owner of the interface site or node shall provide reasonable access and space to the user or its authorised representative, whose equipment is installed or proposed to be installed, at the interface site for installation, configuration, testing and operation and maintenance of the equipment.

16. Access to data.—(1) Confidentiality of data and information of the power system shall be maintained.

(2) Protecting data and information from unauthorised, incorrect or accidental access, use, modification, destruction or disclosure shall be the responsibility and obligation of the concerned user and control center.

(3) Communication system access shall be designed, developed, built, configured and maintained in such a way that only authorised person has access.

17. Data retention.—(1) User shall keep evidence of compliance on availability for the previous two calendar years plus the current year for all the interfaces which are in operation.

(2) Historical data of ninety days shall be kept.

18. System upgradability and expandability.—(1) All Communication interfaces shall be sized, though not necessarily equipped, to support system/sub-system expansion or upgradation to full capacity as provided by specified aggregate transmission rates.

(2) Equipment units provisioned for equipped sub-units shall be terminated with appropriate termination interfaces.

19. Centralised monitoring.—(1) Control centre shall have centralised supervision and monitoring system by integrating its network management system with network management system of other users and standalone network elements, which are not being monitored on network management system within its jurisdiction on national and regional basis.

(2) Users shall provide necessary support to interface their network management system or network element with centralised network management system.

(3) Users shall take necessary action for operation and maintenance of their respective interfaces.

(4) Network management system shall have features to store necessary information and facility to generate report on communication system availability of major equipment as well as the data channels on daily or weekly or monthly or annually basis.

(5) Network management system shall have displays for audio visual alarm generation and logging facility to facilitate the operator for quick fault detection.

(6) Network management system shall facilitate access to the equipment for configuration and fault restoration as well as to facilitate monitoring the performance of the communication system.

(7) Centralised monitoring shall be in main and back-up control centre architecture with centralised database and twenty-four hours maintenance on all days.

(8) For very small aperture terminal communication, Network Management System (NMS) shall have facility of maintaining link availability status along with signal strength of the nodes.

(9) For very small aperture terminal communication, redundant configuration shall be enabled in network management system.

20. Maintenance and testing.—(1) User shall permit in-service diagnostic testing to be executed both locally and from remote network management system locations to facilitate performance trending, efficient diagnosis and corrective resolution of all the interfaces in operation.

(2) The testing equipment and tools shall be maintained to facilitate testing of the interfaces of the communication system at the time of fault and during the course of maintenance.

21. Training.—(1) Specialised training shall be provided to the persons manning the centralised monitoring center and to the field support staff to ensure quick fault detection and restoration of the communication system.

(2) Training shall be provided to the maintenance persons on all communication equipment for its operation and maintenance.

22. Adoption of new technologies.—Plan shall be made for introduction and adoption of new technologies, with the approval of the appropriate Commission or as per the regulations or pursuant to the reforms programme of the appropriate Government.

23. Standards and codes of practice.—(1) The industry best practices and applicable industry standards in respect of the equipment installation and operation and maintenance shall be followed.

(2) Save as otherwise provided in these regulations, the relevant Indian Standards shall be followed to carry out the purpose of these regulations and where relevant Indian Standards are not available, International Standard shall be followed and in the event of any inconsistency, the provisions of these regulations shall prevail:

Provided that whenever an International Standard is followed, necessary corrections or modifications shall be made for prevailing local ambient conditions before adoption of the said Standard.

(3) The effects of wind, storms, floods, lightning, elevation, temperature range, icing, contamination, pollution, earthquakes, etc., shall be considered in the design and operation of the connected facilities.

CHAPTER III

WIDEBAND NETWORK

24. The communication system shall be formed by a wideband network to support the requirement of power system operation.

25. Requirement of wideband network.—(1) The wideband network shall be designed in a manner to ensure absolute channel delay less than 25 milliseconds and channel delay asymmetry less than 0.1 milliseconds required for protection applications.

(2) The wideband network shall be configured for automatic switchover to the alternate path or route in case of failure of one path and the switching time delay shall be less than 50 milliseconds.

(3) Terminal equipment shall support automatic switchover function between the redundant modules, and modules and hardware required for supporting the automatic switch over shall be provided.

(4) New node, when added to the existing network, the terminal equipment shall be compatible to the existing one and shall be possible to integrate with the existing respective network management system either at State level or at Central level for complete monitoring, reconfiguration and control.

(5) Terminal equipment shall be designed with required number of directions considering the route redundancy and future expansion.

(6) The wideband network shall have the following communication interfaces, namely:—

(*a*) high speed bundled n × E-1 support including ethernet, gigabit ethernet (GbE);

(*b*) high speed E-1 channel support;

(*c*) 64 kilobits per second (kbps) and n × 64 kilobits per second (kbps) data and Protection channel support;

(*d*) low speed (300 -1200 bits per second) data channel support;

(*e*) voice (2 wires, 4 wires) channel support;

(*f*) data transport supporting network management channels; and

(*g*) Institute of Electrical and Electronics Engineers (IEEE)-C37.94 interface card for teleprotection of lines.

(7) The relevant standards and code of practice of wideband network as specified in the Bureau of Indian Standards (BIS), the International Telecommunications Union —Telecommunication (ITU-T) and the International Electro-Technical Commission (IEC) shall be followed.

CHAPTER IV

FIBRE OPTIC COMMUNICATION

26. Requirements of fibre optic communication.—(1) All wideband communications shall be established using fibre optic communication consisting of underground fibre optic cable, Optical Ground Wire (OPGW) or Underground Fiber Optic Cable (UGFO) and All Dielectric Self Supporting (ADSS).

(2) Unarmoured cable shall be laid within a polyvinyl chloride (PVC) pipe or hume pipe or Permanently Lubricated High-Density Polyethylene (PLB HDPE) pipe.

(3) The cable shall be rodent and termite proof.

(4) The cable shall contain 12 or 24 or 48 numbers Dual Window Single Mode (DWSM) or Dual Window Multi Mode (DWMM) Fibre Depending on the local network design and requirement envisaged and shall consider the overall design and requirement of the backbone network.

(5) Approach cable for optical ground wire termination to Fibre Optic Distribution Panel (FODP) shall be armoured or unarmoured cable with suitable protection and matching the fiber count equal to optical ground wire cable to maintain uniformity and ease of utilisation of fibers.

(6) Ingress protection Class 66 or better complaint splice enclosures shall be provided to encase the optical cable splices in protective, moisture and dust free environment.

(7) Maximum twelve fibres shall be terminated in a single splice tray.

(8) Fibre Optic Distribution Panel (FODP) shall be ingress protection Class 55 compliant and shall be of corrosion resistant, robust construction and shall allow both top or bottom entry for access to the splice trays and shall be provided with ground lugs.

(9) The overall optical fibre path attenuation shall not be more than as calculated below:—

(*a*) maximum attenuation at 1550 nanometer: 0.21 decibel (dB)/kilometer × total kilometer + 0.05 decibel (dB)/splice × no. of splices + 0.5 decibel (dB)/connector × no. of connectors + maintenance margin, if any, as specified in relevant standards;

(*b*) maximum attenuation at 1310 nanometer: 0.35 decibel (dB)/kilometer × total kilometer + 0.05 decibel (dB)/splice × no. of splices + 0.5 decibel (dB)/connector × no. of connectors + maintenance margin, if any, as specified in relevant standards.

(10) Attenuation of the fibre shall be distributed uniformly throughout its length such that there are no point discontinuities in excess of 0.10 decibel (dB).

(11) Induced attenuation due to temperature shall be ≤ 0.05 decibel (dB) (-60 deg. C to + 85 deg. C).

(12) Fibre optic cable shall be protected from damage due to factors like crushing, bending, twisting, tensile stress and moisture, wide temperature variation, Hydrogen evolution, etc.

(13) Short circuit current for optical ground wire shall be ≥ 6.32 kilo ampere for 1.0 second (for 220 kilo volt and above lines) and ≥ 5.60 kilo ampere for 1.0 second (for 132 kilo volt and 66 kilo volt lines).

(14) Direct current (DC) resistance at 20 deg. C shall be ≤ 1.0 ohm/kilometer.

(15) Everyday tension (EDT) of optical ground wire shall be ≥ 20% of ultimate tensile strength (UTS).

(16) Maximum permissible dynamic strain shall be +/- 150 micro strains.

(17) Proof stress level shall be ≥ 0.69 gigapascal.

(18) Maximum chromatic dispersion shall be 18 picosecond (ps)/(nanometer (nm) × kilometer (km)) at 1550 nanometer (nm), 3.5 picosecond (ps)/(nanometer (nm) × kilometer (km)) at 1288-1339 nanometer, 5.3 picosecond (ps)/(nanometer (nm) × kilometer (km)) at 1271-1360 nanometer, as the case may be.

(19) Zero dispersion wavelength shall be 1300 to 1324 nanometer.

(20) Maximum zero dispersion slope shall be 0.092 picosecond (ps)/ (nanometer^2 × kilometer (nm^2 × km).

(21) Cable cut-off wavelength (λcc) shall be ≤ 1260 nanometer (nm).

(22) Bend performance shall be—

(*a*) at 1310 nanometer (nm) (75 ± 2 millimeter(mm) dia Mandrel), 100 turns: Attenuation Rise ≤ 0.05 decibel (dB);

(*b*) at 1550 nanometer (nm) (30 ± 1 millimeter(mm) radius Mandrel), 100 turns; Attenuation Rise ≤ 0.05 decibel (dB);

(*c*) at 1550 nanometer (nm) (32 ± 0.5 millimeter(mm) dia Mandrel), 1 turn; Attenuation Rise ≤ 0.50 decibel (dB).

(23) Polarisation mode dispersion coefficient shall be ≤ 0.2 picosecond/ kilometer ½ (ps/km ½).

(24) The relevant standards and code of practice of fibre optic communication as specified in the Bureau of Indian Standards (BIS), the International Telecommunications Union Telecommunication (ITU-T), the International Electro-Technical Commission (IEC), the Institute of Electrical and Electronics Engineers (IEEE), the Electronic Industries Association/Telecommunications Industry Association (EIA/TIA), the Bell Core, the Telecommunication Engineering Centre (TEC), the American Society for Testing and Materials (ASTM) and the Electro chemical Impedance Spectroscopy (EIS) shall be followed.

CHAPTER V

POWER LINE CARRIER COMMUNICATION

27. Requirements of power line carrier communication.—(1) Power Line Carrier Communication (PLCC) shall be used in the grid network between two consecutive substations and power line carrier communication shall provide speech, data and tele protection requirements of the power system.

(2) Power line carrier communication shall be duplex, independent Transmission (Tx) and Receiving (Rx) channels, operating in the carrier frequency spectrum 40 to 500 kHz.

(3) Power line carrier communication terminal shall be operated in either analogue power line carrier communication or Digital Power Line Carrier Communication (DPLC) or mixed mode.

(4) Power line carrier communication shall be suitable for use with the outdoor equipment viz. line traps, Capacitive Voltage Transformer (CVT), coupling device and High Frequency (HF) cable.

(5) Input circuit of the power line carrier communication terminal shall be provided with protective device to eliminate any surge transfer.

(6) Companders and expanders shall be provided to improve voice transmission characteristics for the system.

(7) Fail safe devices shall be provided to avoid malfunction in one unit or damage of any sub-assembly.

(8) Power line carrier communication set shall be designed to give guaranteed performance from 0 deg. C to 50 deg. C and the thermal capability of the equipment shall be so designed to be operational up to 55 deg. C for 24 hours continuously.

(9) Coupling device (line matching unit and protective devices) shall be interposed between the capacitive voltage transformer and the connection line (coaxial cable) to the power line carrier communication terminals and shall conform to the carrier frequency operating characteristics between phase to earth coupling units as specified in following Table, namely:—

TABLE

Serial number	Characteristics	Units	Values
(1)	(2)	(3)	(4)
1.	Nominal impedance (equipment side)	Ohm (ω)	150 (for balanced secondary circuit) 75 (for unbalanced secondary circuit)
2.	Maximum composite loss	decibel (dB)	2
3.	Return Loss	decibel (dB)	Equal to or greater than 12 decibel (dB)
4.	Transmission band	Kilo Hertz (kHz)	40 to 500

(10) The coupling device shall be suitable for outdoor mounting and shall be fitted on the steel structure and the temperature of metallic equipment mounted outdoor is expected to rise up to 65 deg. C with ambient temperature of 50 deg. C.

(11) High frequency cable shall be provided to connect coupling unit installed in the sub-station to the power line carrier communication terminals installed indoors, and values of attenuation per km of the cable shall be as per the following Table, namely:—

TABLE

Frequency (kilohertz)	Attenuation (decibel/ Kilometer) (dB/km)
10	0.8
60	1.4
300	3.3
500	4.7

(12) The nominal bandwidth for transmitting or receiving shall be programmable from 4 kilohertz (kHz) to 8 kilohertz (kHz) in steps of 4 kilohertz (kHz). Power Line Carrier Communication terminal at bandwidth of 4 kilohertz (kHz) shall be suitable for following configuration, namely:—

(*a*) speech + 4 × 1200 Baud Data (minimum);

(*b*) data rates shall be selectable in steps, compliant with commonly used standardised data rates such as 200, 300, 600 and 1200 Bauds; and for digital power line carrier communication 1200, 2400, 4800 and 9600 bauds;

(*c*) gross speed and transmission bandwidth shall be programmable for up to 28.800 kilo bit/s in 4 kilohertz (kHz) spectral bandwidth, up to 72 kilo bit/s in 8 kilohertz (kHz) bandwidth;

(*d*) return loss in the transmitter band shall be > 10 decibel (dB);

(*e*) tapping loss shall be < 1.5 decibel (dB) (as per International Electro-Technical Commission (IEC):60495);

(*f*) Automatic Gain Control (AGC) range of the receiver shall be 40 decibel (dB) (minimum).

(13) Regarding data multiplexing—

(*a*) power line carrier communication terminal shall be provided with an internal multiplexer for the time division multiplexing of up to eight serial data channels which can be allocated individually to the internal modems.

(*b*) Data ports shall be compliant with V. 24/V. 28, RS 232 and/or V. 11/X. 21/X. 24 as per functional requirement.

(*c*) Ethernet port shall be provided for equipment configuration via Local Area Network (LAN), or for general IP forwarding and shall have facility to operate at 9600 bits/s at good Signal-to-Noise Ratio (SNR) of 35 decibel (dB) and above within the nominal band width of 4 kHz and this functionality shall be possible for Signal-to-Noise ratio (SNR) of 25 decibel (dB) for band width of 8 kilohertz (kHz).

(14) Power line carrier communication equipment comprising of not limited to the following shall be provided—

(*a*) coupling devices (line matching unit and protective devices);

(*b*) coupling filters;

(*c*) high frequency cable;

(*d*) power line carrier terminals;

(*e*) tele protection equipment;

(*f*) private automatic exchange;

(*g*) 48V Direct Current (DC) power supply equipment; and

(*h*) wave trap.

(15) The relevant standards and code of practice of power line carrier communication as specified in the Bureau of Indian Standards (BIS), the

International Electro-Technical Commission (IEC), the European Standards (EN) and the International Special Committee on Radio Interference (CISPER) shall be followed.

CHAPTER VI
CELLULAR COMMUNICATION

28. Requirements of cellular communication.—(1) Cellular communication may be used for data acquisition system, where feasibility of access to wideband network is not possible.

(2) Cellular communication shall be adopted after ensuring the available signal level up to the required strength and dual or more Subscriber Identification Module (SIM) with different service provider with automatic changeover to ensure 99.5 per cent link availability for interruption free operation of the communication system.

(3) Design shall be for satisfactory and continuous operation in open environment with operating temperature range of -10 deg. C to 55 deg. C and humidity up to 95 per cent non-condensing.

(4) Field interface shall be optical port/RS232/RS485/RJ45 IP or any other suitable port.

(5) Receiving device shall support International Electro-Technical Commission (IEC) 60870 -5- 101 and International Electro-Technical Commission (IEC) —60870 -5- 104 protocol and Device Language Message Specification (DLMS) (IS15959/IEC 62056), Modbus for interfacing.

(6) Receiving end shall have Multi Wide Area Network Virtual Private Network (WAN VPN) concentrator with built-in facility to manage at least 250 remote nodes for a fixed IP provided for control center.

(7) Receiving end shall have redundant Multi Wide Area Network Virtual Private Network (WAN VPN) Concentrator with a fail over —fall back feature for uninterrupted data communication.

(8) Router shall be capable of handling Virtual Private Network (VPN) based security by assuming a fixed IP issued by the Multi Wide Area Network Virtual Private Network (WAN VPN) concentrator at the supervisory control and data acquisition (SCADA) end.

(9) Device shall have the capability of data encryption with Triple Data Encryption Standard (3-DES) or Advanced Encryption Standard (AES) 128 or latest to ensure secured communication network over broadband, 2G or 2.5G or 3G or 4G or 5G or latest.

(10) Device shall have capability to decide and act according to the best available link in redundant mode configuration with automatic switch over.

(11) Quality of Service (QoS) and bandwidth management shall be planned to get optimal bandwidth usage.

(12) Centralised monitoring at control centre shall be available.

(13) Receiving device shall have Internet Protocol Security (IPsec), Point-to-Point Tunneling Protocol (PPTP), and Layer 2 Tunneling Protocol Virtual Private Network (L2TP VPN) support up to eight concurrent tunnels with max 70 Mbps throughput.

(14) Communication equipment or modem shall comply with Ingress Protection (IP) rating suitable for the installation condition as agreed between the user and provider.

(15) The relevant standards and code of practice of cellular communication as specified in the Bureau of Indian Standards (BIS), the International Electro-Technical Commission (IEC), the European Standards (EN), the European Telecommunications Standards Institute (ETSI) and the International Special Committee on Radio Interference (CISPER) shall be followed.

CHAPTER VII

VERY SMALL APERTURE TERMINAL COMMUNICATION

29. Requirement for very small aperture terminal.—(1) Very small aperture terminal communication shall be used for Supervisory Control and Data Acquisition (SCADA) control functions of power system operation and shall not be used for primary protection function of power system as geostationery satellite hop delay is 240 milliseconds.

(2) Very small aperture terminal shall be able to work with all geostationary satellites to the extent possible, visible from India and work efficiently from all parts of India.

(3) Very small aperture terminal shall work either on Ku-band or C band or extended C band or any other band for interruption free continuous operation in extremely rainy (more than 10 millimeter/hour intensity) and cloudy conditions.

(4) Very small aperture terminal communication shall be adopted after ensuring link availability of 99.5 per cent and required level of signal strength.

(5) Very small aperture terminal communication shall not be part of national or State wideband backbone network.

(6) All regulatory clearance from regulatory bodies shall be taken to operate the very small aperture terminal communication.

(7) All regulatory guidelines including size of the antenna shall be followed.

(8) Pool band width feature shall be adopted for the very small aperture terminal network.

(9) Uplink and down link configuration of very small aperture terminal communication shall be redundant (1 + 1) at Hub.

(10) Very small aperture terminal communication network shall be designed based on Frequency Time Division Multiple Access (FTDMA) or Multi-frequency Time Division Multiple Access (MFTDMA) or Single Channel Per Carrier Demand Assigned Multiple Access (SCPC DAMA) technology or any other

proven future technology with configurable data rate as per data communication requirement.

(11) Bit error rate shall be lesser than 1×10^7(data) to 1×10^4(Voice).

(12) Very small aperture terminal communication shall support broadcast, unicast, multicast, Transmission Control Protocol (TCP) spoofing.

(13) Very small aperture terminal communication shall support IP RJ45 (IP or E&M).

(14) Receiving device shall support the International Electro-Technical Commission (IEC) - 60870 -5-104 and the International Electro-Technical Commission (IEC) - 60870 -5-101 protocols for interfacing data as well as to IPv4, IPv6, RIP v1, v2, Address Resolution Protocol (ARP)/Virtual Local Area Network (VLAN), Internet Control Message Protocol (ICMP), Transmission Control Protocol (TCP), User Datagram Protocol (UDP), Telnet, Internet Group Management Protocol (IGMP), v1, v2, Simple Network Management Protocol (SNMP) for networking utilities.

(15) Very small aperture terminal communication system shall be designed for 230 V +/- 30% Alternating Current (AC) power supply at 50 Hz.

(16) Very small aperture terminal communication system shall be designed for trouble free operation at temperature range -10 deg. C to 55 deg. C and humidity up to 95 per cent non-condensing, and wind speed of minimum 80 kilometers per hour (kmph).

(17) Very small aperture terminal communication system shall be able to deliver bi-directional composite data traffic.

(18) Round trip delay shall be less than 800 milliseconds (ms).

(19) Very small aperture terminal in door unit (IDU) (for remote sites) shall support Transport Control Protocol/Internet Protocol (TCP/IP) without the need of an external router.

(20) Very small aperture terminal in door unit (IDU) shall have separate storage banks for software and firmware, to enable configuration changes pertaining to either the terminal (firmware) or the overall system architecture (software), without affecting the other.

(21) Very small aperture terminal shall be able to take the software and firmware downloads from the hub over the air, without any disturbance to the online user traffic while in operation on per terminal (Unicast), per group (Multicast) or entire network (Broadcast) basis.

(22) The relevant standards and code of practice of very small aperture terminal communication as specified in the Bureau of Indian Standards (BIS) and the International Telecommunications Union (ITU-R) shall be followed.

CHAPTER VIII

RADIO FREQUENCY COMMUNICATION

30. Requirement of radio frequency communication.—(1) Radio frequency (RF) communication shall be used below 132 kilovolt/110 kilovolt system for low speed data acquisition system and shall not be used for protection of power system equipment.

(2) Radio frequency (RF) communication shall be adopted after ensuring required level of signal level with clear line of sight and link availability (99.5 per cent) for interruption free operation of the communication system.

(3) Radio frequency (RF) communication shall be designed for satisfactory and continuous operation in open environment with operating temperature range of -10 deg. C to 55 deg. C and humidity up to 95 per cent non-condensing.

(4) Radio frequency (RF) communication shall not be part of national or State wideband backbone network.

(5) Utilisation of radio spectrum in radio frequency (RF) communication shall be subject to regulatory clearance and all regulatory guidelines shall be followed.

(6) Radio frequency (RF) communication shall be capable of delivering data, voice and Video conferencing, and latency shall be less than 5 milliseconds (ms).

(7) Radio frequency (RF) communication equipment shall comply with Ingress Protection (IP) rating suitable for the installation condition as agreed between the user and provider.

(8) Radio frequency (RF) communication system shall support concurrent use of Internet Protocol (IP), Voice Over Internet Protocol (VoIP) and video.

(9) Radio frequency (RF) communication shall be capable of channel bandwidth selection with 5 MHz steps.

(10) Radio frequency (RF) communication shall be capable to capture both side (local and remote) spectrum view and the equipment shall have site and link management facility for configuration.

(11) Radio frequency (RF) communication shall support Simple Network Management Protocol (SNMP), Management Information Base (MIB) II and Bridge Management Information Base (MIB).

(12) After terminating the radio frequency (RF) network at the gateway, the upstream communication till the receiving end control centre shall comply to IPv4 and IPv6 network protocols with backward compatibility feature.

(13) Radio frequency (RF) communication shall have facility to upgrade software over the air from remote.

(14) Gateway device shall have 10 BASE-T/100 BASE-TX ethernet port to connect to any network.

(15) Network Management System (NMS) shall be provided to monitor the performance from the control centre and the Network Management System shall

be capable to provide bandwidth utilisation, latency, link health and signal strength of the network.

(16) Radio frequency (RF) communication network shall support multiple communication protocols to provide flexibility.

(17) Radio frequency (RF) communication shall provide scalability, interoperability and future proofing.

CHAPTER IX

RELAXATION AND INTERPRETATION OF REGULATIONS

31. Relaxation and Interpretation of Regulations.—The Authority may, by order and for reasons to be recorded in writing, relax any of provisions of these regulations in respect of the matters referred to the Authority on case to case basis.

SCHEDULE I

[*See* Regulation 5(3)]

Data interval time

Category	Data Type	Time Interval (Sec)			Time Interval (Sec) via Data Concentrator		
		765 or 400 kV	220* or 132** kV	Below 132** kV	765 or 400 kV	220* or 132** kV	Below 132** kV
Automatic Generation Control (AGC)	Analog Value	2		3	2		3
Dispatch	Status	2	3	4	2	3	5
	Analog Value	4	5	6	4	5	7
Phasor	Analog/Status	0.04 to 0.01			0.04 to 0.01		
Forecast/ Weather	Value	60			60		

* 220kV may be read as 220 kV or 230 kV depending on voltage level defined.

** 132kV may be read as 132 kV or 110 kV depending on voltage level defined.

SCHEDULE II

[*See* Regulation 6(3)]

Standards for interfacing to communication system

Interfaces	Type	Standards
Electrical Interface	Ethernet	IEEE 802.3/IEEE 802.3u
	Ethernet VLAN	IEEE 802.1 P/Q

	Serial	RS232/RS422/RS485/X. 21/X. 25/G. 703/V. 35/RJ45
Optical Interface		ITU-T G. 957, G. 958
Tele protection/ Control	Relay	IEEE C37.94, ITU-T G. 703
Voice		2-wire FXO/2-wire FXS/4- wire E&M, VoIP
SDH		ITU-T G. 821/G. 826
IP - Packet Switched Networks	Layer 2.5 OSI	RFC 2702, RFC 4379, RFC 4090 and RFC 4553 — Circuit Emulation
RF		IEEE 802.11s, IEEE 802.15.4, ETSI EN 300 220-1, ETSI EN 300 440.
Cyber Security		MD5 Authentication, 3. SNMPv3, Radius/TACS+
Video		H. 323
Cellular	GPRS/3G/4G/ NBIoT/ MPLS	ETSI, 3GPP Compliant
MPLS-TP:		G. 8110, 8112, 8113.1, 8113.2, 8121, 8121.1, 8121.2, 8131, 8151, 8152.
MPLS-IP:		As per standard Industry practice.