Appendix # 8
to the decision of the Board of Directors of IDGC of Centre, JSC
Minutes dated 29.08.2014 # 19/14

REGULATION
on the technical policy of IDGC of Centre, JSC in the field of telecommunications

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Contents

1. Abbreviations and terms

№	Definition/term	Clarification of definition/term
1.	BWA	Broadband wireless access
2.	HVPL	High-voltage power line
3.	FOC	Optical fiber cable
4.	FOCL	Communication fiber line
5.	FOCL-HVPL	Communication fiber line mounted on a high-voltage power line
6.	ICC	Information computation complex - an element of electric power metering infrastructure, fulfilling functions of request of metering data and auxiliary information from ICCPF or IMC, their verification, consolidation, storage, analysis and representation, and also function of remote control of IMC
7.	ICCPF	Information complex of a power facility - an element of electric power metering infrastructure, fulfilling functions of intermediate collection, consolidation and storage of metering data and their transmission to ICC
8.	IMC	Information-measuring complex of an electric power metering system (an electricity metering device)
9.	OPGW	Optical power ground wire
10.	OPSSNMC	Optical self-supporting nonmetallic cable
11.	FOC-cored phase wire	FOC-cored phase wire
12.	ECA	Automatic emergency response system
13.	Production Site (Distribution Zone)	Production Site (Distribution Zone)
14.	SS	Electrical Substation
15.	Relay protection	Relay protection
16.	Relay Protection and Automation	Relay protection and automation
17.	DS	Distribution substation
18.	DGC	Distribution Grid Company - a branch of IDGC
19.	Distribution Zone	Distribution Zone
20.	CN	Communication network
21.	TS	Transformer substation
22.	GCC	Grid Control Centre
23.	BPL	Abbr. from Broadband over Power Line - the general determination of technologies of broad-band data transfer via power lines
24.	Ethernet	Technology of data transfer at data link layer of OSI model. In the core it is described by standards IEEE of group 802.3
25.	IP	Abbr. from Internet Protocol — the internetwork protocol. Concerns routable protocols of network layer of TCP/IP family
26.	NPL	Abbr. from Narrowband over Power Line - the general determination of technologies of broad-band data transfer via power lines
27.	OFDM	Abbr. from Orthogonal Frequency-Division Multiplexing - a digital circuit of modulation of a signal with usage of several close allocated orthogonal subcarriers, each subcarrier is modulated under the normal circuit of modulation
28.	PDH	Plesiochronous digital hierarchy (abbr. from Plesiochronous Digital

		Hierarchy) — a digital transmission method of data and voice, based on time division of the channel and technology of representation of a signal by means of Pulse Code Modulation (PCM)
29.	PLC	Abbr. from PowerLine Communication - the general determination of technologies of broad-band data transfer on power lines
30.	SDH	The synchronous digital hierarchy (abbr. from Synchronous Digital Hierarchy) — the technology of transport telecommunication networks based on synchronization on time of transferring and accepting devices
31.	xDSL	Abbr. from Digital Subscriber Line, a digital subscriber line) — family of technologies of signal transmission on a subscriber line of a public telephone network with usage of effective line codes and adaptive methods of correction of distortions of a line.
32.	xWDM	Abbr. from Wavelength-Division Multiplexing - wavelength division multiplexing of channels — the technology allowing simultaneously to transfer some information channels on one optical fiber on different carrying frequencies
33.	Data of backup protection and ECA systems	Prefault, critical and emergency data and controls
34.	Communication network	a set of means, nodes and communication lines united by the general technical, technological and organizational principles, intended to support control of technological processes in generation, transmission and distribution of electric power, supervisory control and industrial activity of the electric power industry
35.	Technological segment of CN	The communication network segment intended for support of industrial activity: controls of technological processes in manufacture and transmission of electric power, dispatching and operational technological control, data transfer of systems of relay protection and ECA
36.	Corporate segment of CN	The communication network segment intended for support of management and administrative activity of the Customer
37.	Primary communication network	A set of network communication centres, transmission systems and lines connecting them without their subdivision to usage and communication types. The primary network is uniform for all customers of channels and represents basis for secondary communication networks.
38.	Secondary communication network	A set of switching centres, terminal subscriber devices and channels of the secondary networks organized on the basis of channels of a primary network. Depending on a type of transmittable electrical signals secondary networks unite telephone networks, data communication networks, sound announcement, TV broadcasting.
39.	Transport Communication network	The part of a primary communication network covering backbone nodes, and also lines connecting them.
40.	Aggregation node	The communication centre of the primary network providing concentration of the traffic from access networks and transmission of the aggregated flow in a transport communication network.
41.	Access network	A set of communication centres and lines connecting them providing access of terminal units to a transport communication network.
42.	Corporate communications	Means of communications (any kinds of voice and video communications, means of text communications, integration tools of

	systems	unified communications, etc.), not concerning a technological communication network
43.	CSEC	Centralized system of emergency control

2. Introduction

This «Regulation on the technical policy of IDGC of Centre, JSC in the field of telecommunications» (hereinafter - the Regulation) is an internal document of IDGC of Centre, JSC (hereinafter - the Company) and is developed with a view of regulation of a process of centralized control over development implementation of system projects of communication of the Company.

Observance of requirements of this Regulation is mandatory for the structural subdivisions of the Company participating in process of support of reliability improvement and effective operation and maintenance of facilities of the electric grid complex of the Company.

This Regulation defines a set of interconnected technical requirements adding existing standard documents, focuses attention on the most progressive technical solutions, determines the list and boundaries of application of those or other technical solutions, the equipment and the technologies directed to increase a technological level of managerial processes in the electric grid complex of the Russian Federation.

On the basis of requirements of the Regulation the Company should develop the specifications and technical documentation set (organization standards, regulations, norms and rules), defining priorities and rules of application of technical solutions of the Regulation in a course of implementation of programs of new construction, complex modernization and reconstruction of facilities of the electric grid complex of the Russian Federation, and also at innovative and perspective development of the Company.

3. General provisions

The Company’s communication network (hereinafter – the Communication network) represents a set of means, nodes and communication lines united by the general structure, general technical, technological and organizational principles.

The communication network is intended for transmission of all types of information (voice, data, video) to control technological processes in generation, transmission and distribution of electric power, operation and supervisory control, industrial and administrative activity of the Company.

For exception of influence of the administrative activity in the control over technological processes of the electric power industry as part of the Communication network two corresponding segments, divided physically or logically, are provided: technological and corporate.

The technological segment of the Communication network is intended to control technological processes in generation, transmission and distribution of electric power, operation and supervisory and technological control, transfer of data, signals and commands of systems of relay protection and ECA, electric power control and metering.

The corporate segment of the Communication network is intended for support of administrative and business activity:

- control over financial and economic activity;
- control over maintenance service (PM) and equipment repairs (equipment certification, diagnostics data, planning PM and repairs, control of PM and repairs performance, formation of work orders);
- personnel records and salary accounting;
- inventory management;
- control over grid connections;
- document management and maintenance of electronic archives;
- means of corporate communications (video, voice, text);
- video surveillance;
- access to the Internet resources and to services of public networks.

4. The objectives and tasks of a technical policy in the field of telecommunications

The objective of development of a technical policy in the field of telecommunications (hereinafter – the Policy) - description of the main principles of creation and development of a communication network of the Company, and also requirements to the equipment and communication channels, for support of all users of technological and enterprise systems with necessary telecommunication services with the set indicators of reliability and quality of service at optimal expenses for development and maintenance of a communication network.

The primary goals of the Policy are:

- determination of uniform rules and approaches to support telecommunication equipment of the Company’s facilities;

- formation and implementation of strategy of technical and technological development of the Communication network;

- support of achievement of necessary functionality and performance of requirements to quality of services at development of the Communication network;

- reduction of capital expenses and operational costs in a communication network for the account of application of optimal typical technical solutions by development of design documentation, application of modern technologies and data transfer equipment, automated systems of monitoring and control over network resources.

5. Principles of creation and development of the Communication network

At creation and development of the Communication network it is necessary to follow the following main principles:

- transition from analog and TDM-communication systems to perspective packet switched networks under condition of performance of technical requirements on the organization of exchange of technological information between objects of electric grid facilities of the Company;
- possibility of selective (for a specific subsystem or service) flexible and dynamic change of information transmission rate in a broad range depending on current needs;
- scalability of a network - possibility of extension of a network without change of basic technical principles of its creation and the full changeover of data communications equipment;
- separation of technological and corporate network segments of communication at physical or logical levels;
- ensuring prioritization of data types critical to time delays at the expense of implementation of mechanisms on support of quality of service (QoS);
- support of information security to exclude illegal access to resources of the Communication network;
- invariance of access - information exchange possibility between users irrespective of used technology of the organization of communication channels;
- guaranteed access of communication network users to a full range of services with observance of requirements to quality of service;
- multi-service – simultaneous transmission on the Network of all types of traffic (voice, data, video);
- intellectuality - possibility of control over a service, a call and a connection from the user and possibility of creation of new services with use of standardized means;
- network upgrade only in the presence of technical and economic feasibility;
- reduction of capital and operational expenses for the account of usage of unified typical solutions and automation of processes of diagnostics and control;
- organization of interaction with existing and created communication networks of subjects of the electric power industry, and also with networks of telecommunications operators;
- use of only open and standardized protocols and interfaces;
- taking into account of forecasts of potential needs for telecommunication and information services on a 5-year-old perspective basis.

6. Requirements to the organization of the Communication network

6.1. Structure and composition of the Communication network

The communication network should consist of the technological and corporate segments divided at physical or logical levels.

The technological segment of the Communication network should provide functioning of the following systems of technological control:

- Operation-technological systems (the most critical to parameters of quality of the Network):
  - systems of relay protection, operation and emergency control automation;
  - systems of the dispatcher voice communication;
  - automated systems of the supervisory and technological control;
  - automated management systems of technological processes of a substation, including subsystems of registration of emergency events and fault location.
- Other technological systems:
  - automated monitoring systems of quality of electric power.
  - automated electric power monitoring and metering systems (the wholesale market and the retail market of electric power, technical metering);
  - systems of diagnostics and equipment condition monitoring;
  - mobile repair staff management systems.

The technological segment of the Communication network should provide transmission of the following types of information:

- telemetry measurements, remote signalling and remote control;
- voice information and data for human resource management support at power facilities and crews;
- data of registration of emergency events and processes, and fault location;
- electric power metering data, configuring and setting parameters of AMR;
- signals and commands of relay protection and ECA, data of configuring and setting parameters of relay protection and automation devices;
- data of intercomputer exchange of systems of technological control.

The corporate segment of the Communication network should provide functioning of the following information systems:

- unified communications (voice, text, video, data transfer);
- control over financial and economic activity;

- control over maintenance service (PM) and equipment repair (equipment certification, diagnostics data, PM and repair planning, control of carrying out PM and repair, creation of work orders);
- recruiting and certification of staff, registration of personnel and salary calculation;
- inventory management;
- registration of productive supply, calculation of balances and electric power losses;
- control over grid connections;
- document management;
- electronic archives keeping;
- video conferencing;
- video surveillance.

The corporate segment of the Communication network should provide transmission of the following types of information:

- data of corporate management information systems;
- data of systems of video conferencing and video surveillance;
- data of systems of telephone communication and other types of corporate communications.

The Communication network is divided into the following components:

- primary (transport and access) communication network representing a set of networks, lines and communication channels providing delivery of all types of information;

- secondary networks representing a set of means, providing transmission, switching, and distribution of information of a certain type.

For creation of a primary communication network and back-up support the following types of networks, lines and communication channels can be used:

• Wire:

- Cable communication lines (CCL);
- Communication fiber lines (FOCL);
- High-frequency communication channels on HVPL (high frequency-communication).

• Wireless:

- radio-relay communication lines (radio-relay link);
- broadband wireless access networks (BWA);
- network of mobile VHF-radio service;
- communication satellite network;
- network of mobile cellular communication.

Besides, in places of absence of own telecommunication infrastructure usage of channels and communication lines rented at third party operators is allowed.

The primary communication network should be organized preferentially on a ring topology. Besides, the following topology of creation of the primary network is allowed:

- point - to point;
- point-to-multipoint;
- chain;
- multiple ring.

The communication network architecture should represent a set of nodes of aggregation united by a radially-ring principle by trunk communication lines (transport network), and mutually reserved communication channels connected to them with power facilities (access network). Connection of power facilities to a communication network should be carried out through the nearest nodes of aggregation with access network usage.

For fail safety support data communications equipment should be doubled on transport network communication centres. The main and reserve channels should be organized without usage of common technical means.

On sections of the transport network, demanding the big transmission capacity, it is necessary to apply the wavelength division multiplexing equipment (xWDM).

In economically well-founded cases for communication network creation the SDH technology with FOCL usage can be used. In a typical configuration SDH multiplexers should be hybrid (for support of the subsequent transfer of the network to IP/Ethernet with saving the before made investments), have an amount of Ethernet interfaces necessary for a specific network topology.

Network management of the branch level of an electric grid company should be carried out with usage of the uniform centralized management and monitoring system.

6.2. The general requirements

The communication network at all levels of hierarchy operation-dispatching, technological and corporate management should provide an exchange of all types of information (sound, video, data) with guaranteed quality.

Requirements to the organization of an information exchange between the Company and JSC «SO UES», including requirements to operation-dispatching communication, should correspond to the requirements given in the existing provisions about information interaction between JSC «SO UES» and electric grid companies in sphere of technological information exchange.

Communication channels with power facilities which are not in control (management) of JSC «SO UES» are characterized by the following parameters of quality:

- availability;
- coefficient of readiness;
- transmission capacity.

Availability of a communication channel is defined by correspondence of parameters of signal transmission of telecommunication to the requirements «Norms on electrical parameters of the main digital channels and paths of trunk and central-office primary networks of the unified communications system of Russia», approved by Order of the Ministry of Communications of Russia from August, 10th, 1996 №92.

The coefficient of readiness of each direction of an information exchange for the technological segment of the Communication network should have the value not less than 0,999, for the corporate segment the coefficient of readiness - not less than 0,99.

The bandwidth range of digital channels should be selected so that to provide for transmission of all traffic of tasks of control with the given parameters of quality, including functioning of telephone communication of operative and dispatcher staff, industrial-technological telephone communication, transmission of telemetry information on technological operation modes of the equipment, emergency control centralized systems, etc.

Equipment and materials applied at creation of communication networks should correspond to requirements of the operating specifications and technical documentation. Correspondence of the equipment should be confirmed by certificates of conformity, and correspondence of materials by declarations on compliance, issued by the federal executive authority in the field of communication.

6.3. Requirements to communication lines and channels

6.3.1. Cable communication lines

Continuation of maintenance of copper cable communication lines (CCL) is allowed only in economically well-founded cases. At development and upgrade of the Communication network it is necessary to decommission CCL with changeover to FOCL, or other types of communication lines.

In some cases application of CCL for the organization of communication channels xDSL modems should be used. For simplification of routing, unification of network devices and support of centralization of control and routing, the preference should be given to xDSL-modems which have been built in network equipment in the form of interface units.

CCL application: the main and reserve channels of an access network.

6.3.2. FOCL

Communication Fiber Optic lines (FOCL) should be a basis for creation of a transport communication network.

At construction of FOCL on HVPL (FOCL-HVPL) optical cables of the following types can be applied:

- On HVPL 10kV and lower: Optical Self-supporting Cables, FOC-cored Phase Wire.
- On HVPL above 10kV: Optical Pilot Ground Cable, Optical Self-supporting Cables.

The choice of type of a used cable should be defined by economic feasibility with taking into account the condition of the HVPL and possibilities of its switch-off for the period of construction and possible repair of FOCL. The minimum quantity of fibers in the FOC: on trunk directions - not less than 48, on an access network – not less than 24.

Optical fibers in a cable on the elementary cable section between adjacent optical cross connects should be manufactured by one vendor under the recommendation ITU-T G.652.D - the single-mode optical fiber with low peak of water, optimized on wavelength 1310, 1550 and 1383 nanometers.

Construction of FOCL-HVPL with engaging of extratariff investments of third party organizations (telecommunications operators) with provision to them for temporary restricted use of electric grid infrastructure to suspend the FOCL is allowed. For the right to pass on the HVPL the Company should receive in the property not less than 1/12 fibers in the optical fiber cable (but not less than 6 fibers).

Construction of FOCL should be carried out preferentially by a radially-ring principle of connecting communication centres for support of physical reservation of communication channels.

For construction of FOCL it is allowed to use several HVPL of different voltage classes, coinciding with a direction of the FOCL route.

At suspension on HVPL of an optical fiber cable of any type while making design and exploration work survey of the state of foundations and metallic structures of poles and their fixtures in the ground with taking into account additional load arising at mounting FOC should be performed. For performance of civil and erection works on the fulfilled detail design a positive conclusion of a project institute that designed the given HVPL should be received about observance of requirements to safe loads on HVPL poles and to admissible distances between HVPL and FOC wires.

Designing, construction and maintenance of FOCL-HVPL should be carried out according to:

- the Rules on labour safety at maintenance of electrical installations,

approved by Order of the Ministry of Labour and Social Protection of the Russian Federation from 24.07.2013 № 328n (registered in the Ministry of Justice of Russia from 12.12.2013 № 30593);

- «the Electrical Installations Code», edition 7, approved by Order of the Ministry of Energy of Russia from 20.05.2003 №187;
- Regulation Document 153-34.0-48.519-2002 Rules of designing, construction and maintenance of fiber lines of communication on overhead power lines of 0,4-35 kV;
- Regulation Document 153-34.0-48.518-98 Rules of designing, construction and maintenance of fiber lines of communication on overhead power lines of 110 kV and above.

The executive documentation should be fulfilled according to requirements of the Regulation Document 45.156-2000 «Composition of the executive documentation on the completed line constructions of trunk and intra-zone fiberoptics transmission» and the Regulation Document 45.190-2001 «Section of a cable elementary of a transmission fiber line. The typical program of acceptance checkouts».

Taking into account increased requirements to reliability of operation of a transport network, it is necessary to determine expediency of setting of automated systems of monitoring of the optical fibers, allowing in a real time mode to conduct condition monitoring of physical parameters of optical fibers.

With a view of unification of technical maintenance and for a possibility of carrying out of certification, planned measurements and measurements in the course of carrying out emergency and restoration work any mounted optical fiber passing on HVPL, should have not less than one free termination (a demountable connector) on the optical cross connect installed in territory of a facility (SS, other facilities of the electric power industry) where the round-the-clock access of attendants of the line crews during all life-cycle of FOCL should be provided. Optical fibers and units in FOC should have the following colours: dark blue, orange, green, brown, gray, white, red, black, yellow, violet, pink, cyan.

Main principles and directions of development of FOCL are:

- engaging in construction of FOCL of extratariff investments of telecommunications operators and other third-party organizations;
- long-term planning of development of a network together with telecommunications operators;
- mutual exchange of resources of FOCL and other infrastructure of communication networks with third-party owners on a contractual basis.
- planned decommissioning of TDM equipment and moving to IP/Ethernet.

Application of FOCL: a priority type of infrastructure for creation of a transport communication network. Application of FOCL at the access network

organization is defined by technical requirements and economic feasibility.

6.3.3. Transmission channels via an electricity transmission grid

6.3.3.1. PLC (BPL)

Usage of PLC technology for communication organization between neighbouring facilities with voltage class below 35 kV, as well as devices of electric power metering with the organization of the general network connection point (gateway) to communication channel is allowed.

Requirements to technical implementation:

- compliance with standard documents on electromagnetic compatibility;
- open protocol implementation of data transfer, interchangeability of equipment of various vendors within the limits of one system of electric power metering.

Application of PLC (BPL): the organization of communication channels to power facilities with voltage class of 35kV and below, channels of a data communication network of systems of electric power metering.

Application of PLC technology in data communication networks of systems of electric power metering is in details considered in section 6.4.6.

6.3.3.2. High frequency-communication on HVPL (NPL)

Application of digital high frequency-communication on network sections is allowed where it is required to transfer restricted information volume, and application of other types of communication is economically inexpedient. Real transmission capacity of digital high frequencies should be defined by a rated way at a design stage, with the registration of singularities of equipment, state of HVPL, presence of taps and additional attenuation caused by weather conditions and breakaways of HVPL.

In economically well-founded cases application of combined equipment of high frequency-communication (simultaneous transfer of voice, data, signals of relay protection and ECA) with a condition of priority signal transmission and commands of Relay Protection and Automation is allowed.

Communication high frequency channels should be organized with provision of reserve on superimposed attenuation under unfavourable weather conditions (a fog, a drizzle, ice, a rain). For transmission of commands Relay Protection and Automation communication RF channels on HVPL should provide in addition some reserve on superimposed attenuation at possible short circuits on HVPL. At the organization of communication channels conditions to support electromagnetic compatibility should be satisfied.

Suspension of high frequency band-elimination filters and loops should be carried out with application of technical solutions eliminating overcrossing.

Main principle and direction of development of lines of high frequency communication is increase of functionality, reliability and quality of high frequency communication, namely:

reconstruction of analog systems of high frequency communication. Implementation of multifunctional digital systems which meet the requirements of the Standard of OJSC «FGC UES» STO 56947007 33.060.40.108-2011«Norm of designing of systems of high frequency communication»;

- usage of systems with digital handling and digital data transmission;
- effective utilization of the frequency resource of channels of high frequency communication at the expense of usage of one high frequency channel for transmission of several types of information;
- creation of the Uniform information system for choice of frequencies of channels of high frequency communication (UIS of high frequency).

High frequency-communication application: the main and reserve channels of a technological segment of access network.

6.3.4. Radio relay link

Application of digital radio relay link is allowed at the communication organization in remote and hard to reach location with a difficult relief, where construction of FOCL is economically not feasible.

Methods of reservation of radio relay links:

- under the circuit 1+0 for the organization of reserve communication channels on trunk directions of a transport network at impossibility, or economic inexpediency of construction of FOCL on a ring topology;
- under the circuit 1+1 for the organization of channels of an access network to the most significant facilities.

Requirements to radio relay link:

- range of used radio frequencies: 7 - 15 GHz;
- transmission rate of the main traffic: not less than 100 Mbit\s.
- used technologies: packet switching or SDH (in economically well-founded cases).

Obtaining of approvals about selection and assignment (allocation) of radio frequencies for electric grid facilities is carried out according to «the Regulation about the order of organization and usage of means of radio communication in enterprises and organizations of the electric power industry», approved by OJSC RAO "Unified Energy Systems of Russia" from 23.06.2003, Federal law on communication from 07.07.2003 № 126-FZ and Regulation of State Radio Frequency Commission № 11-13-02 from 20.12.2011.

Application of radio relay link: the main and reserve communication channels of a transport network and an access network.

6.3.5. BWA

At creation of an access network of power facilities which are in control of the Company, application of equipment of broadband wireless access (BWA), including for organization «last mile» to nodes of telecommunications operators is allowed.

BWA network can be constructed both completely on the basis of own infrastructure (antenna mast structures, buildings), and by rent in necessary points of locations of antennas on poles of telecommunications operators.

Requirements to BWA equipment:

- operation possibility under the circuit "point-point" and "point-to-multipoint";
- range of operational frequencies: defined by designing. The recommended range: 5,9 – 6,4 GHz;
- data transmission rate: 10-100 Mbit\s in a mode "point-point", 512 Kbit\s – 10 Mbit\s on each subscriber station in a mode "point-to-multipoint".

Application of BWA: the main and reserve communication channels of an access network, «the last mile» to public service network communication centres.

6.3.6. VHF-radion communication

VHF-radio communication network should be developed by extension of a zone of radio coverage and changeover of out-of-date analog radio sets with modern digital ones. At upgrade of analog systems of VHF-radio communication the main standard for creation of a radio network at the level of a production unit (Distribution Zone) should be the digital standard DMR, allowing to carry out passage from an analog network of VHF-radio communication to digital with retaining before made investments.

VHF-radio communication system should have in the composition a subsystem of positioning radio sets (both portable and installed in motor transport vehicles) and display locations on the screen of a workplace of a dispatcher.

Applied radio sets should have possibility of quick change of operational frequencies with a view of their usage in other radio networks at elimination of emergencies, and also a GPS receiver for location determination.

The resource of the charged battery of a portable radio set should provide its independent operation within 12 hours by operation in a cycle 5/15/40 (transmission/reception/waiting).

At determination of need for communications means it is necessary to consider structure of HVPL services at each enterprise, sizes of operational zones

of line sections, quality of cellular and satellite communication in zones of operational responsibility of each line section.

Obtaining of approvals about selection and assignment (allocation) of radio frequencies for electric grid facilities is carried out according to «the Regulation about the order of organization and usage of means of radio communication in enterprises and organizations of the electric power industry», approved by OJSC RAO "Unified Energy Systems of Russia" from 23.06.2003, Federal law on communication from 07.07.2003 № 126-FZ and Regulation of State Radio Frequency Commission № 11-13-02 from 20.12.2011.

Application of VHF-radio modems for organization of reserve data links from power facilities of the level of SS 35-110 kV and for organization of the main and reserve data links with SS of voltage below 35 kV is allowed

VHF-radio communication application: the main communication means with staff of line and first responding and restoration crews; reserve communication means for operational and technological control of a distribution electrical network.

6.3.7. Satellite communication

Channels of the fixed satellite service can be applied to the organization of the main and reserve digital channels of a transport communication network (no more than one channel in one direction) under condition of performance of the requirements shown to the organization of dispatching-technological telephone communication and information transfer for automated and automatic management systems.

Means of mobile satellite service are reserve means for communication of the dispatcher and operational personnel with staff of the line and first responding and restoration crews.

Main principles and directions of development of a communication satellite network are**:**

- implementation of modern systems corresponding to requirements, set by the Ministry of Information Technologies and Communications of the Russian Federation;
- rigid control over quality indicators of channels (a service level agreement, SLA);
- transfer of channels of satellite communication in a mode of operational readiness;
- regional development on the basis of one operator and uniform technology;
- at upgrade and new construction application of technologies, allowing to construct fully-connected communication satellite network («mesh»

topology), for support of two-way user-to-user transmission of data between subscriber stations and an information collection centre;

- at maintenance of already constructed communication satellite networks organized on «star» topology, it is recommended to connect an information collection centre to a Hub-station of the operator of satellite communication with terrestrial communication channels (main and reserve).
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6.3.8. Mobile cellular communication

Means of mobile cellular communication under certain conditions can be applied as reserve to make operative talks between:

- staff of dispatcher stations and staff of operative and operation-repair mobile crews;
- staff of dispatcher stations and operation personnel who permanently is at substations

Conditions of application of means of cellular communication to make operative talks are:

- presence of technical and economic validity;
- performance of requirements of operating and maintenance rules about record of operative talks.

Usage of means of cellular communication (GPRS, 3G, 4G) is allowed for transmission of technological information from power facilities with the voltage class below 35 kV, and also for organization of systems of electric power metering.

Application of technology Circuit Switched Data (CSD) is allowed only for operating communication channels in economically well-founded cases. At development and upgrade of the Communication network it is necessary to switch off CSD out of operation.

Main principles of development of a data communication network on the basis of a cellular transmission network are**:**

- usage of an uniform system of monitoring and control of SIM at the DGC level;
- creation of closed APN networks overlaid on a network of the cellular operator, without data transfer through the Internet;
- fictitious number capacity (possibility of reception and sending of messages only from/to SIM cards registered in the system);
- support of enciphering of transmittable data;
- elimination of zones of absence of covering of a mobile communication network by setting up repeaters;
- at usage of a cellular transmission network as the main transmission channel the preference should be given to the equipment with support of

operation not fewer than with two cellular operators (Dual SIM) with redundant operation.

6.4. Requirements to the organization of secondary communication networks

Secondary communication networks include:

- Technological segment of the Communication network:
  - dispatcher telephone network of communication (including communication with operation-mobile crews);
  - data communication network of operation-technological systems (Relay Protection and Automation and emergency protection automatics, Automatic Control System of TP SS, information acquisition and transmission system, TM, energy management system, management of mobile operation personnel);
  - data communication network of other technological systems (Automated Informational-Measuring System Energy management, quality assurance of electric power, diagnostics of equipment, control of mobile repair staff);
  - video surveillance data communication network;
  - network management system.
- Corporate segment of the Communication network:
  - telephone corporate communication network;
  - data communication network of corporate information systems;
  - video conferencing network.
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6.4.1. Telephone communication network

The telephone communication network should be developed by substitution of subscriber devices with IP-terminals and applications of switching equipment interacting with terminals on SIP protocol.

At upgrade of a network and creation of its new segments it is necessary to create virtual arranged IP-PBX, system consisting of a central module (CPBX) and media gateways at the Company's enterprises. At the same time, in well-founded cases possibility of functioning of legacy fleet of TDM-PBX and subscriber devices should be kept.

Switching equipment (including with media gateways) should support protocols necessary for interaction with networks of telecommunications operators and OJSC «SO UES». The equipment used as dispatcher switches should have necessary functionality and be certified in the order set in the Company.

The most expedient is installation of the CPBX in the executive office of the Company. Control of all voice and video-calls, and also transmission of instant text messages (IM) between subscribers of a branch, including, maintaining databases of subscribers, determination of the status of availability (Presence) should be

carried out in the CPBX.

In case of temporal inaccessibility of the CPBX for any reasons, all media gateways in the Company's subdivisions should work as independent IP-PBX with provision of basic voice services:

- routing of calls in/from PSTN;
- incoming/outgoing telephone communication;
- calls between subscribers connected to the media gateway;
- joining of subscribers in groups;
- support of facsimile messages;
- audioconferences with the number of participants - not fewer than 10.

At all power facilities, having access to CPBX, only SIP telephones should be installed. Thus at the upgrade at initial stages (before decommissioning of TDM-PBX) voice gateways should be installed on a telephone communication network with currently used on the network time digital and analog interfaces for connection with operating automatic telephone exchanges, subscriber devices and channel banks. In case of the voice communication organization on the high frequency channels, which do not support transmission the Ethernet traffic, the media gateways transforming IP-interfaces into FXS should be applied. At call realization between subscribers if a different CPBX data transfer about a name of the calling party in Russian (with support of a Cyrillic transliteration in the Latin alphabet until decommissioning the TDM-PBX) and call routing according to set up on the CPBX called party access groups should be carried out.

CPBX should have the uniform management system allowing:

- to provide control of all user connections and system settings through the uniform graphic Web-interface;
- to provide adjustment of the dial plan, uniform policies of usage of a band transmitting communication channels for voice and video, rules of network routing and network security;
- to carry out monitoring of all equipment of a network of telephone communication.

The primary goals of development of a telephone network are:

- implementation of distributed software-controlled IP-PBX, providing certificated by federal enforcement authority in the field of communication connection to the public telecommunication network;
- creation of a uniform network of telephone communication of the Company on the basis of a corporate multiservice communication network;
- usage of an open protocol of SIP connection supervision;
- application of the normalized compression (codecs of type G.7226 and G.729);
- implementation and development of a uniform management system and monitoring at the CPBX level;

- implementation of a uniform dial plan;
- convergence with other types of communications (implementation of technologies of unified communications).

6.4.1.1. Uniform telephone dial plan

Formation of the dial plan of a network of telephone communication should be carried out at the level of the Executive Office of DGC. The basic principles of formation of a uniform dial plan:

- a system of telephone numbering - open;
- intrabuilding numbers - 4-digit, thus the main building is the Executive Office of a regional branch, software, and in well-founded cases - a Distribution Zone;
- recommended prefix to exit to a trunk telephone network of communication - digit "9";
- recommended prefix to exit to PSTN - digit "0".
- number format at making local (intrabuilding and intraexchange) telephone connection: $X_1X_2X_3X_4$, where X_1 - any digits, except «9» and «0», and $X_2X_3X_4$ - any digits.
- number format at making trunk telephone connection: «9» ABC DE $X_1X_2X_3X_4$, where ABC – a trunk code of a regional branch of DGC, DE - the code of a facility in a trunk zone (Production Site, Distribution Zone, etc.), $X_1X_2X_3X_4$ - local intrabuilding number.

Trunk codes of a network of telephone communication are specified in table 1.1.

Table 1.1.:

Business entity	Trunk codes	Reserve codes
OJSC "Rosseti"	201	200, 285 - 299
OJSC "IDGC of Centre"	202 - 212	213, 214
OJSC "IDGC of North Caucasus"	215 - 220	221, 222
OJSC "IDGC of North-west"	223 - 229	230, 231
OJSC "IDGC of Urals	232 - 234	235, 236
OJSC "IDGC of Siberia"	237 - 244	245, 246
OJSC "Tyumenenergo"	247	248
OJSC "Lenenergo"	249	250
OJSC "IDGC of South"	251 - 254	255, 256
OJSC "MOESK"	257	258
OJSC "IDGC of Centre and Volga Region"	259 - 267	268, 269
OJSC "IDGC of Volga"	270 - 276	277, 278
OJSC "Kubanenergo"	279	280
OJSC "Yantarenergo"	281	282
OJSC "TRK"	283	284

6.4.2. Data communication network

Data communication network infrastructure, fulfilling channel forming functions, covers not only the network layer, but also data link layer of the OSI model. Thus, the data transfer equipment, being a part of a secondary network, can concern also the primary network.

Requirements to the equipment of data transfer of a node of a transport network:

- backup of processor units and power units;
- support of technologies MPLS and MPLS L2/L3 VPN;
- support of technology MPLS TE and TE FRR;
- support of VLAN (802.1q) with prioritization (802.1p);
- support of mechanisms of quality of service of network traffic (QoS) and hierarchical policies of quality of service (H-QoS);
- support of the protocol for support of fast recovery of communication at usage of ring topology and-or the line reservation by means of aggregation of communication channels (LAG);
- at usage of ring topologies transition time to the reserve channel should be no more than 100 msec;
- support in a router mode (L3) of static routing and dynamic OSPF protocol;
- operation possibility on copper and optical communication links, including on one-fiber;
- support of standard SNMP protocol with possibility of remote control;
- power supplies from DC mains of 24 or 48 V, and also from AC mains from 190 to 250 V.

Requirements to the equipment of data transfer of a node of an access network:

- support of VLAN (802.1q) with prioritization (802.1p);
- support of mechanisms of quality of service of network traffic (QoS) and hierarchical policies of quality of service (H-QoS);
- operation possibility on copper and optical communication links, including on one-fiber;
- support of standard SNMP protocol with possibility of remote control.

Additional requirements to the data transfer equipment:

- at installation at an SS - compliance with requirements of standards IEC-61850-3 and IEEE-1613;
- an expanded set of interfaces: Gigabit Ethernet, Fast Ethernet, FastEthernet with POE (for access nodes), RS-232, RS-485, E1Channelized;
- support of technology VRF-lite for logical sharing of processes of routing of corporate and technological traffic;

- presence of network firewall oriented on a technological segment, possibility provision to grant or deny each port to operate a specific protocol (MEK-101/104);
- support of access lists for filtration of network traffic (ACL – Access Control List).

The data communication network should be divided at least into the following segments:

- segment of data transfer of operation-technological systems;
- segment of data transfer of other technological systems (joining with a segment of corporate information systems is allowed);
- segment of data transfer of corporate information systems;
- control segment.

The data communication network should be developed according to the following main principles and directions:

- usage of typified solutions;
- traffic distribution on all available network resources at an overload of the main channel (loading equalization);
- classification of traffic by a level of criticality and corresponding prioritization;
- creation and implementation of a uniform management system and monitoring at the level of a branch of the Company with notification of the Executive Office of the Company about critical events;
- segmentation of connected LAN;
- implementation of flexible and scalable systems of support of protection of information;
- usage of technologies of optimization of traffic of information systems;
- usage for all enterprises of a uniform typical plan of IP addressing.

6.4.2.1. Principles of formation of the plan of IP addressing

Planning of address space of an IP-network should be carried out according to the following main principles:

- support of the hierarchical centralized address allocation with selection of subnets for various technological and corporate network segments of communication, and also for groups, categories of objects and users;
- support of sufficiency of an amount of IP addresses with the registration of perspective development of corporate and technological systems, and also communication networks as a whole;
- support of minimization of traffic and influence of separate segments, nodes of a network or groups of devices on productivity of the entire network as a whole.
- support of controllability of a network, both in a regular mode of the network, and in case of failures;

- usage of dynamic selection (DHCP addresses only for a corporate network segment of data transfer;
- prohibition of translation of addresses of a technological segment and a network management segment in addresses of public networks;
  information security support.

6.4.3. A video conferencing network

A video conferencing system (VCS) should provide video conferencing by a hierarchical principle to the level of a Distribution Zone according to the organizational structure of IDGC (Executive Office of IDGC – a branch – (Production Site) – a Distribution Zone).

For support of optimal quality VCS equipment should have implemented mechanisms of automatic adaptation of parameters of coding depending on accessible bandwidth range and qualitative characteristics of a communication channel.

A VCS system should provide for:

- registration of software and hardware video-terminals and call management on CPBX;
- connection of remote video clients from exterior networks, including the Internet;
- carrying out of video conferences in a mode of multiaddress mailing (multicast);
- uniform and centralized operation by usage of bandwidth range of communication channels for services of telephony and VCS;
- possibility for users of interactive control from the panel of the video-terminal over keymap, content and a list of participants;
- centralized planning, control of VCS sessions and monitoring of VCS equipment;
- record of held video conferences on electronic carriers;
- usage of VCS equipment for carrying out of interactive training;
- support of transmission quality of voice and video not lower than HD (720p) at the level of the Executive Office of the Company and not lower than 4CIF at the level of branches;
- support of teamwork with documents.

6.4.4. Communication network management system

Communication network management of the level of a branch of IDGC should be carried out with usage of the uniform centralized system in which the following functions should be implemented:

- configuring, monitoring and control of malfunctions;
- control over inventory (registration of physical and logical resources of a network);

- control over productivity (monitoring of parameters of a network and performance review);
- control over performance of tasks on fault recovery;
- quality management of given services (SLA);
- security management (access control to network resources).

In the communication network management system two logic levels of network control should be supported as described in the TMN concept (Management system of networks of operators of telecommunication):

- Network management layer (NML) – network management level;
- Element management layer (EML) – element network management layer.

Network management level should allow to see all network as a whole, to control it and its separate elements, to supervise its state as a whole.

Level of monitoring and control of network elements should allow to track parameters and control separate elements of a network, including control of events and errors, reservation, collection, primary diagnosing and storage of events from network elements, support of hardware and software.

All information necessary for network management should be allocated in a uniform database which can change and be replenished by descriptions of new objects of control, and all exchange of management system service data should be carried out with usage of existing transport system of a controlled network.

6.4.5. Network of clock network synchronization (CNS)

The amount of SDH (PDH) equipment on communication networks of branches of IDGC is that it is not expedient to install own primary reference clocks (PRC) and slave reference clocks (SRC) for synchronization of operation of the equipment on it.

It is recommended to connect the reference network in the Company's branches to the CNS system of OJSC "Rostelecom", or to the CNS system of the Uniform technological communication network of the electric power industry in which own system of clock synchronization is installed.

6.4.6. Data communication network of electric power metering systems

At remote data acquisition of metering data information transfer should be carried out on the communication channels providing collection and data interchange on standard interfaces and exchange protocols of the type "request-response" in automatic and in automated (on demand) modes.

The communication channels, intended for information transfer, should provide steady connections between devices of various levels of metering systems.

Technical implementation of communication channels and used data transfer protocols should provide data transfer of billed metering from lower layer to upper

with the maximum time delay, which does not exceed 50 % from an interval of data acquisition in an automatic mode.

At determination of types of communication channels in each specific case it is necessary to start with territorial layout of subjects and objects of metering and the maximum usage of own telecommunication communications. Ranging of communication channels on priority of usage at new construction and reconstruction of metering systems is presented in table 2.1.

Table 2.1.

Metering facility	Communication channels							
	Measurement and Information System-Information and Computing Complex of an electrical installation (data processing system)					Information and Computing Complex of an electrical installation-data processing system		
	RS-485	PLC	Ethernet	RF*	GPRS	GPRS	Ethernet	RS-485
SS 35 kV and above	2	-	1	3	4	3	1	2
TS 6,10 kV	2	3	1	4	5	3	1	2
Multiroom apartment house	-	1	-	2	3	2	1	-
Private home ownerships	-	1	-	2	3	2	1	-

* the concept «RF» includes the channels implemented in not licensed RF spectrum, including on ZigBee protocols, BlueTooth, Mesh and so forth.

Necessity of a reserve communication channel and choice of one of channels as the core should be made at a development cycle of the project of remote data acquisition of electric power metering data, proceeding from a cycle of polling and volume of transmittable data.

Detailed requirements to communications media and communication channels should be set in specifications and technical references on projects of organization of remote acquisition of metering data.

6.4.7. Requirements to power supplies of equipment of communication centres

6.4.7.1. Local communication centre

Communication centres of Production Site, Distribution Zones, SS, and also intensifying and regeneration points on trunk communication structures of power systems, refer to local communication centres.

The power supply system of communication equipment should be powered from two feeders of an alternating current connected to various assembly of a local distribution board.

Systems of heating, cooling of a cabinet and communication equipment should be powered through separate automatic switches.

For support of uninterrupted power supply of equipment of data transfer uninterruptible power supply units (UPS) should be used. Duration of discharge of

the battery of the UPS should ensure functioning of the equipment in the absence of power supplies from the main source for at least 6 hours.

Metal cases of equipment of data transfer, uninterruptible power supply units, mounting cabinet and supply board should be grounded.

6.4.7.2. Central communication node

Communication nodes of executive offices of subsidiaries and affiliates of OJSC "Rosseti" and their branches refer to central communication nodes. The main power supplies of communication centres should be carried out from AC mains with voltage of 0.4 kV, frequency of 50 Hz and be provided from two independent sources.

In case of absence of possibility to organize two independent inputs from exterior sources as a reserve source a diesel-generator set should be used.

Power should be supplied to a distributing switchboard in a communication centre building with a separate cable from a central distributing switchboard of a building from output of an automatic transfer switch. In the absence of an automatic transfer switch of a building it is possible to install an automatic transfer switch cabinet directly in a communication centre building. In this case power cables should be laid out from two independent input switching devices of a building.

Power supplies of communication equipment, central air conditioning systems, lighting and other customers should be carried out through separate automatic switches.

For support of uninterrupted power supply of equipment of communication centres UPSs should be used, which ensure functioning of the equipment in the absence of power supplies from the main and reserve sources within 4 hours.

Metal cases of equipment of data transfer, uninterruptible power supply units, mounting cabinet and supply board should be grounded.