

**SATELLITE DATA TRANSFERING SUBSYSTEM
BASED ON SYSTEM "MATERIK"**

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**ПОДСИСТЕМА СПУТНИКОВОЙ СВЯЗИ
ДЛЯ КОМПЛЕКСНОЙ СИСТЕМЫ ПЕРЕДАЧИ ИНФОРМАЦИИ
НА БАЗЕ АССК "МАТЕРИК"**

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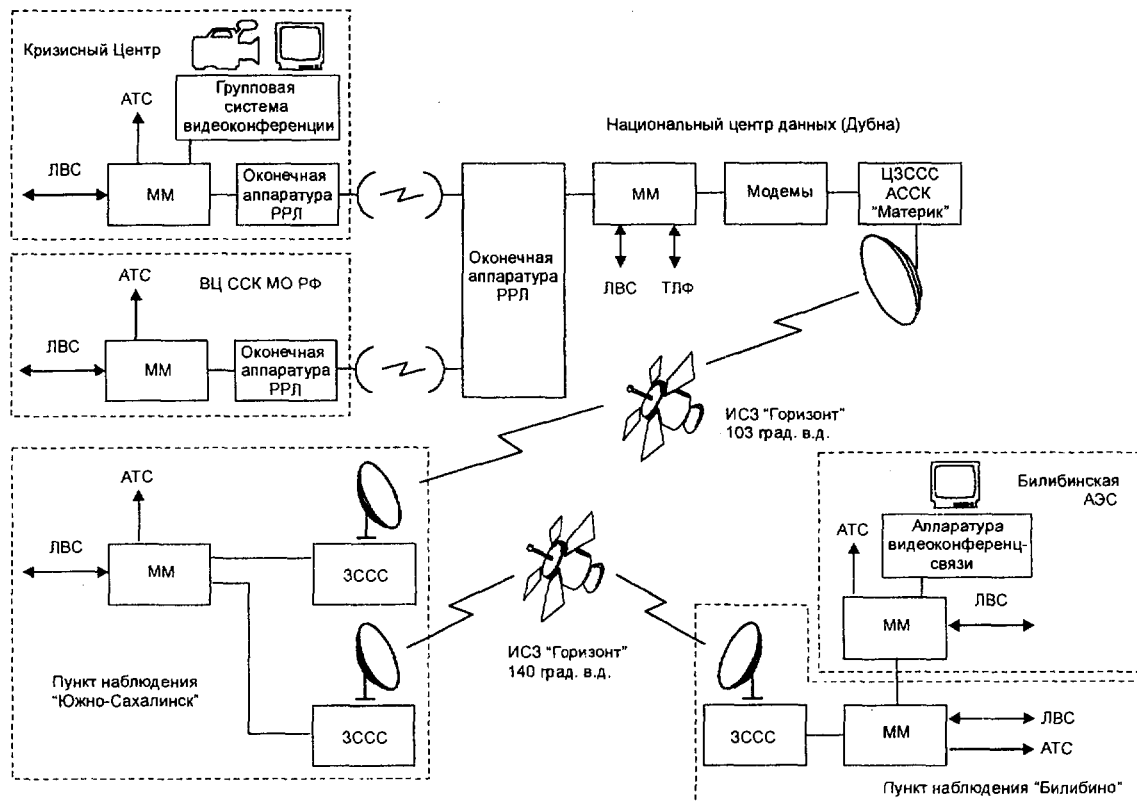
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One of the most important indicators of successful function of the International Monitoring System is existence of highly reliable communication channels providing transfer of data from observation points in a real time scales. Up to present, the most communication channels were provided with existing VF-channels (Voice Frequency) that are relatively low-speedy in transfer process (4.8-9.6 kbit/sec.). In addition, reliability of the channels is insufficient because of many retransmission points. In connection with it, the special control service of MD RF decided to improve the information transfer system (ITS) installed between the observation point and National Data Center (Dubna-city). The improvement of the ITS comprises replacement of wirelines of VF-channels with satellite ones within the framework of the computer-aided satellite communication system (CASCS) "Materik". Besides, it was considered to be expedient that the satellite system of data transfer from NPP to the Crisis Center of "ROSENERGOATOM" Concern would be combined with the CASCS "Materik", using the facilities of the Central Earth Station of Satellite Communication (CESSC) in Dubna. Such approach to the creation of satellite communication has advantages in solution of radiation safety and global monitoring issues, and allows transponding information to the international information networks.

A complex section of satellite system of data transfer, combining "Bilibino" and "Yuzhno-Sakhalinsk" observation points, on the one hand, and NPP in Bilibino, on the other hand, with the Central earth station through satellite communication channels is being considered. It is necessary to note that the CESSC "Dubna" is set to operate with the satellite "Staczionar-21" ("Horizont") through the fixed point of 103 degree (E. longitude) at geostationary orbit, which does not allow covering the area where a stable communication process could be set (in particular, "Bilibino" observation point and NPP in Bilibino). In connection with it, it was decided to use "double-hop" principle for the above satellite communication subsystem. That is, the earth satellite communication station is installed at "Bilibino" observation point and is set to operate with the satellite "Staczionar-7" through the fixed point of 140 degree (E. longitude). The analogous ESSC is installed at the observation point "Yuzhno-Sakhalinsk", which is also located in the area covered by the satellite "Staczionar-21".

Thus, it is possible to transmit data through the satellite communication station that can be additionally installed and set to operate with the satellite "Staczionar-21". That is, it is possible to provide a direct satellite channel communication with Dubna. It is necessary to note that both two objects ("Bilibino" observation point and NPP in Bilibino) use one satellite communication station, in the above subsystem, which is economically beneficial in terms of expenditures for the system equipment purchase.

According to requirements of a customer, the speed of the block duplex and digital stream, in direction to the observation points (OP), is 64 kbit/sec., and 256 kbit/sec.- in direction to NPP. Moreover, the information transmitted to the OP consists of data (32 kbit/sec.) and telephone traffic (9.6+5.3 kbit/sec), and to NPP – data (64 kbit/sec), telephone traffic (4×9.6 kbit/sec) and videoconference communication (128 kbit/sec). Generalized diagram of the satellite communication subsystem is presented in the Figure.



- ЗССС – Earth Station of Satellite Communication
- ММ – multiplexer-router
- РРЛ – radio-relay line
- ЦЗССС – Central Earth Station of Satellite Communication

At the Bilibino – Yuzhno-Sakhalinsk space, the information from the OP and NPP is transmitted through the re-transmitter of the satellite with a speed of 320 kbit/sec. (64+256). In Yuzhno-Sakhalinsk, the information stream is increased by additional 64 kbit/sec. from the OP. Thus, at Yuzhno-Sakhalinsk – Dubna space, the speed of the group information stream is 384 kbit/sec.

Power calculations of the communication line “Dubna – Yuzhno-Sakhalinsk – Bilibino” showed that the power of $\approx 0.3W_t$ is required to support the duplex communication channels with the group speeds of 384 and 320 kbit/sec. from the retransmitters of the satellites “Staczionar-21” and “Staczionar-7”, which is $\approx 4\%$ of the saturation power.

Powers of the earth satellite communication station transmitters, depending on the operating conditions and information transfer speed, is within 4...2 W per a carrier.

The following reliability requirements are established to the satellite communication channel: error-free running time should not be less than 3000 hours when the operating ration $K_o \geq 0.9987$, which corresponds to the average recovery time $T_r \leq 4$ hours. Taking into account the reliability factors of the satellite retransmitters, the operating ration of which was assumed to be 0.99998, and radio-relay link with $K_o \geq 0.9998$ ($T_{ef} \geq 20000$ hours, $T_r \leq 4$ hours), the operating ration of the remainder equipment of the channel should not be less than $K_o \geq 0.99894$, when $T_{ef} \geq 3000$ hours and $T_r \leq 3$ hours. The set factors of the reliability were obtained at the expense of redundancy of the HF-equipment in all ESSC, and production of reserve instrumentation and devices (group and individual). As a result, the error-free running time of the communication channel of OP was 4300 hours, recovery time – 2 hours. As to the communication channel of NPP (when linked to Moscow), the error-free running is 3500 hours, recovery time – 2 hours.

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