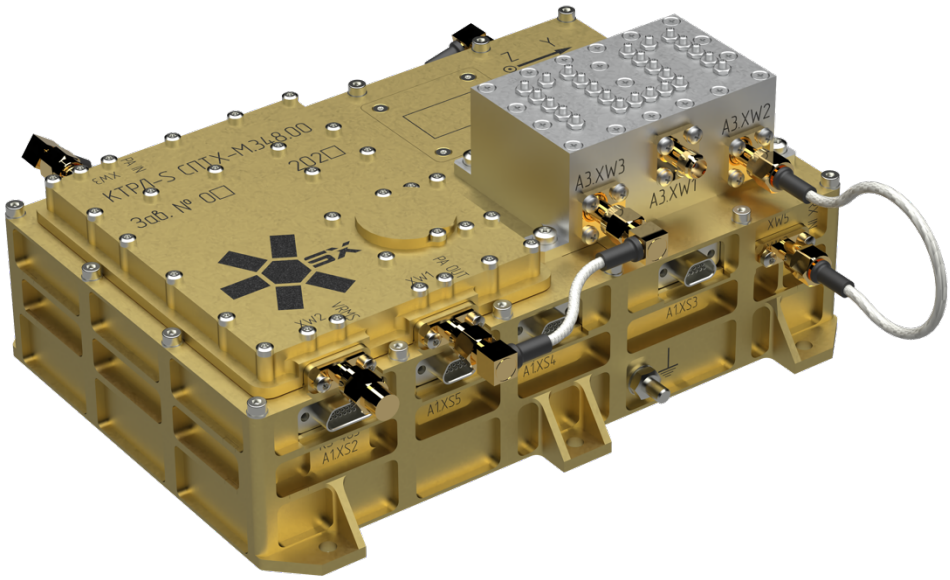
SPUTNIX
BY SITRONICS

Line of microsatellite devices

Onboard computers

SX-SBOX



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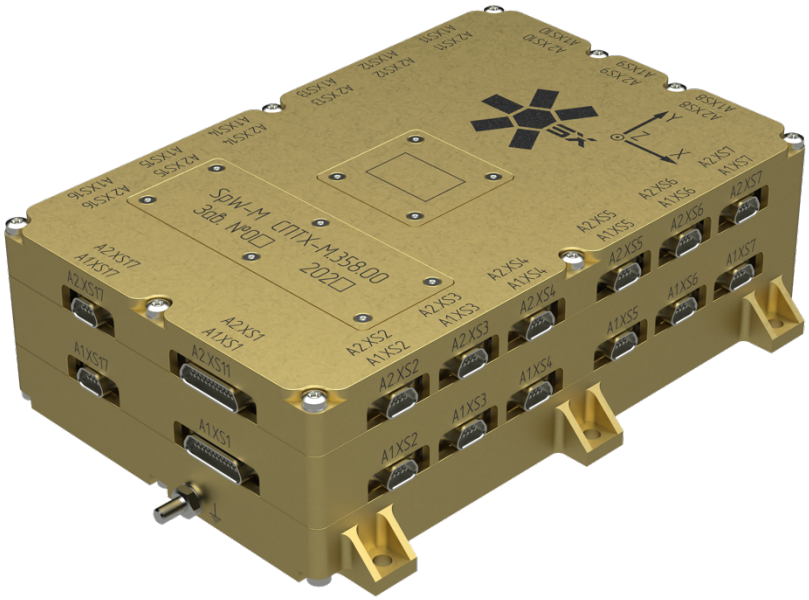
SpaceWire-router and on-board storage device of the on-board computer complex

SX-SBOX-SPW-OBDH-MEM-01



Parameters	Value
Power consumption	4 W
Power voltage	22-34 V, galvanic isolation 500 V
Mass	960 g
Dimensions	171 x 111 x 51 mm (without fasteners)
Duplicated interfaces	CAN2B, SpaceWire
Number of ports for connection	Up to 16
Exchange rate via SpaceWire	Up to 200 Mbps
RMAP support	ECSS-E-ST-50-52C
Built-in memory	8 MB

The router is used to organize the SpaceWire network in the system in terms of packet routing, communication of terminal devices with each other. One router is an assembly of 2 identical semi-sets that can work in both cold and hot standby.

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One semi-set includes:

- Power supply system, consisting of a primary DC / DC isolated converter and secondary PDM converters to create the required voltage grid;

- 16-port SpaceWire routing switch with a built-in processor based on MIPS32 architecture, with exchange rates for each channel up to 200 Mbit / s, support for broadcast packets, adaptive multicast routing, both RMAP protocol over SpaceWire and UART debug port;

- EEPROM with a capacity of 1 Mbit for storing the image of the switch control software, which initializes the built-in processor, performs self-tests and configures the registers of the router;

- MRAM as non-volatile memory with a useful capacity of 8 MB for the organization of "cloud" storage in the SpaceWire network;

Own development of the company according to company standards, compatible with ECSS recommendations, relatively low cost, light weight and energy consumption; use of Russian electronic components; adaptation to customer requirements; use of unified electrical, information and mechanical interfaces; the GEM cycle has been successfully completed.

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On-board computer

SX-SBOX-OBC-01

Parameters	Value
Power consumption	Up to 10 W
Power voltage	22-34 V, galvanic isolation 500 V
Dimensions	171 x 111 x 51 mm (without fasteners)
Mass	860 g

OC is an assembly of 2 identical semi-sets in a single body.

The OC board includes:

- Power system, consisting of a primary DC / DC isolated converter, and secondary PDM converters to create the required voltage grid;

- Radiation-resistant 32-bit microprocessor based on the SPARC v8 architecture of the Leon4FT core, operating at 80 MHz as the main computing device. It includes 2 cores (hot standby), as well as CAN interface controllers with an exchange rate of up to 1 Mbit / s and 4

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cores of the SpaceWire interface controller with built-in physical layer drivers with an exchange rate of up to 100 Mbit / s, for information exchange with system devices;

- EEPROM with a capacity of 1 Mbit for storing the image of the bootloader of the microprocessor, which performs the initial initialization of the periphery, performs self-testing, loads and transfers control to the main executable program, provides algorithms for updating the software without the participation of the main program;

- MRAM as non-volatile memory with a useful capacity of 16 MB for storing the image of the main program and other data;

- 16 MB RAM for standard memory during operation;

Own development of the company according to company standards, compatible with ECSS recommendations, relatively low cost, light weight and energy consumption; use of Russian electronic components; adaptation to customer requirements; use of unified electrical, information and mechanical interfaces; the GEM cycle has been successfully complete.

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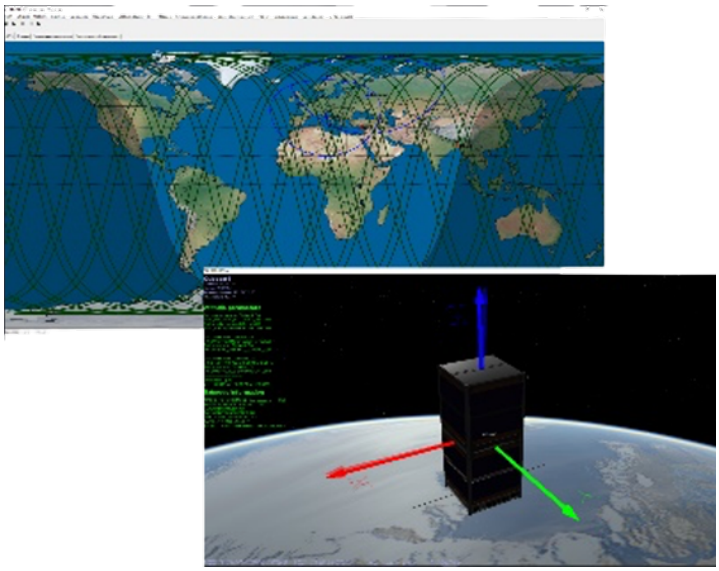
Onboard software

SX-SBOX-KINOSOFT



The on-board software for the on-board computer complex (BCC) was developed for the on-board computer (BC) of the space platform (CP) of the Pallada CP and uses the backlog created by the company during the implementation of the Tablettsat KP and cubsat projects. The architectural solution of the OSS under RTEMS OS is based on the ECSS-E-ST-70-41C Telemetry and telecommand packet utilization standard, as well as the company's developments in attitude control and stabilization systems algorithms, tested in flight aboard the Tablettsat-Aurora, Zorkiy "And other devices and systems developed by SPUTNIX.

The SxPA module (Sputnix PnP Architecture) is a key component of the OS, which is important for organizing a distributed computing network. This component as part of the BC system power supply unit is responsible for automatic configuration recognition and preparation (initialization) of onboard equipment on the SpaceWire bus when devices and systems are connected.

Functions of this OS:

- Management and performance monitoring of devices from the CP and payload:
  - Switching power lines for devices and payloads;
  - Interrogation of telemetric information from functioning devices;
  - Switching backup devices or sets as part of a device;
  - Switching between operating modes of devices;

- Performing the functions of a telemetry system:
  - Saving telemetry information from devices;

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• Formation of own telemetry BCC;
• Formation of telemetry packets and sending them to the service radio channel for subsequent transmission to the Earth in the following modes:
▪ Direct transfer;
▪ Reproduction of previously recorded information;

- Execution of command and program information (CPI):
• Reception of CPI from the onboard service radio channel;
• Processing and execution of the adopted CRPD;
• Formation and execution of the flight task (FT) on the basis of the adopted CPI;
- Automatic control of the gearbox outside the radio visibility zones:
• Execution of the flight task formed on the basis of the accepted CPI;
• Performing switching between standard modes of gearbox functioning;
• Switching between backup devices and sets available for the current operating mode of the CP;
• Implementation of cyclograms of commands as a reaction to an identified contingency situation (CS);

- Execution of algorithms for the orientation and stabilization system:
• Interrogation of data from measuring devices of the attitude and stabilization system (ASS);
• Issuance of commands to the ASS actuators;
• Execution of ASS mathematical algorithms;

- Formation of the SpaceWire information network for the transfer of service information between the CP devices and the payload;
- Formation of an exchange via the CAN information network for the transfer of service information between on-board equipment devices;

- Organization of the uniform time service (UTS):
• By transmitting the PPS signal from satellite navigation equipment (SNE) via a duplicated CAN line;
• By means of transmission of synchro-signals over the SpaceWire line;

- Provision of storage of service information in the non-volatile storage device BCC, accessible from the SpaceWire network via the RMAP protocol;
- Management of means of the thermal control system:
• Interrogation of temperature sensors;
• Commutation of electric heaters.

Own development of the company according to the company's standards, compatible with the recommendations of ECSS / CCSDS; adaptation to customer requirements; support for distributed networks based on CAN buses, SpaceWire.

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Options of devices delivery

- EM – engineering model
- FM – flight model

The differences between the EM and FM options are in the scope of the tests. Options are shown in the table.

№	Test	Model		Comment
		EM	FM	
1	Preliminary tests: - Checking power supply circuits; - Verification of information exchange (with the device and device nodes); - Calibration (if necessary)	+	+	Carried out in the laboratory of SPUTNIX LLC under normal climatic conditions.
2	Functional Acceptance Tests (FAT)	-*	+*	Checks for compliance of the device with the functional characteristics specified in the Operational Manual and compliance with the MS
3	Vibrodynamic Acceptance Tests	-	+*	Tests for resistance to mechanical external influences specified in Technical conditions (or Operational Manual)
4	Thermovacuum Acceptance Tests	-	+*	Checks for resistance to thermal and climatic external influences

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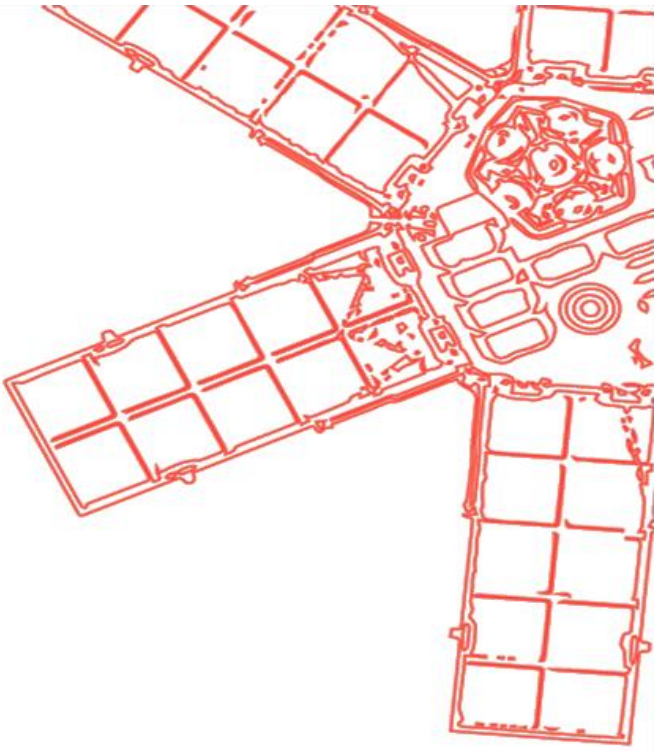
				specified in Technical conditions (or Operational Manual)
5	Electromagnetic Acceptance Tests	-	+*	Tests for resistance to electrical external influences specified in Technical conditions (or Operational Manual)
Notes: *Inspection can be carried out, carried out partially or excluded as agreed with the Customer				

If the requested device intended for laboratory testing will not be installed in a real satellite, EM with test type 1 (minimum test scope) should be used.

If the requested device is intended for use as part of a specialized functional stand, EM should be used with preliminary and functional acceptance tests (1 and 2).

If the requested device is intended for installation on a satellite, or for use as part of a stand for ground experimental testing of a flight product, it is required to use a FM with a full scope of tests (1, 2, 3, 4, 5).

If the requested device is intended for installation on a satellite (flight model), but for some reason it is not possible to conduct a full scope of tests, it is allowed to exclude certain types of tests for external influences (3,4,5) in a combination and sequence discussed with the Supplier. In this case, the responsibility for carrying out the missing tests lies with the Customer.



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SPUTNIX LLC is a Russian private company manufacturing high-tech satellite components and platforms, as well as ground equipment for sat testing, ground-based satellite stations, and equipment for aerospace education.