



PROTECTION AND AUTOMATION OF FACILITIES OF SCIENTIFIC RESEARCH INSTITUTE OF RADIOENGINEERING MEASUREMENTS

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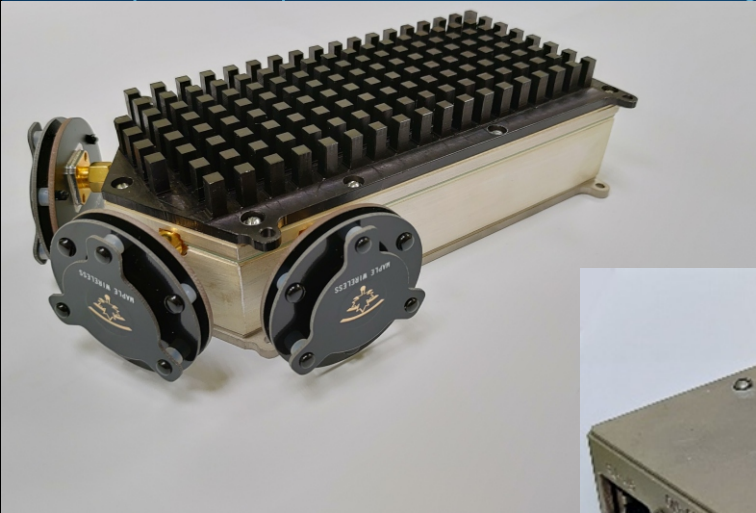
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РАДИМІР RADMIR



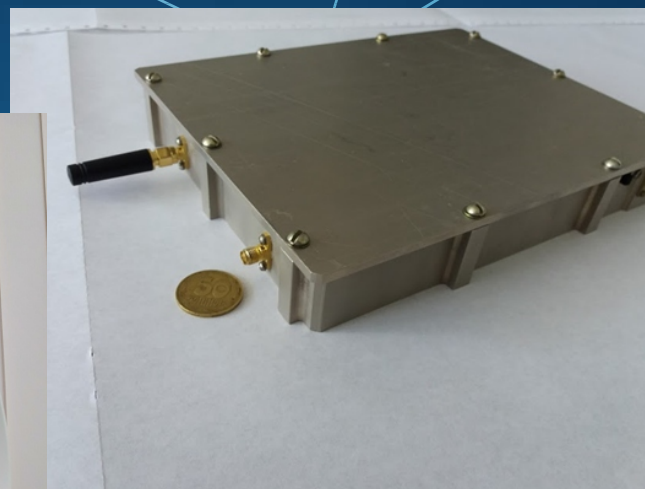
Brief Historical Reference

- 1953 – The Experimental Design Office «OKB No. 285» is established at the Shevchenko Plant in Kharkov; Design Office Objectives– developing and implementing a series of high-precision phase-metering systems to be employed for testing rockets and all types of satellite carriers; manufacturing of on-board equipment for radio-location and radiometric measurements of the ocean's surface physical characteristics; manufacturing other type of equipment to be applied in the «Kosmos» and «Okean» satellites, the «Salut» and «Mir» space complexes, and the «Energija» Rocket Carrier.
- 1959 – The Technical Complex is established as a part of the Experimental Design Office «OKB No. 692» (currently – OJSC «Khartron»);
- 1968 – The «Ukrainian Subsidiary of the Scientific Research Institute of Measurement Facilities (UFNIIT)» – a standalone enterprise – is established;
- 1986 – The Scientific Research Institute of Radioengineering Measurements (NIIRI)» is established;
- 1995 – The Open Joint-Stock Company «JSC Scientific Research Institute of Radioengineering Measurements» is established.
- 2011 - The Public Joint-Stock Company «JSC Scientific Research Institute of Radioengineering Measurements» is established
- 2014 - Restrukturizatsija PJSC «JSC SRIRM». The Subsidiary «Protection and automation of Facilities Scientific Research Institute of Radioengineering Measurements» (S «PAF SRIRM») is formed. The successor of works on rocket and space technics.



On-board equipment of a combined command-telemetric radio line and the UAV payload data transmission radio line

Frequency band	-	C-band
Mode	-	duplex
Modulation type	-	OQPSK
Spread spectrum	-	DSSS
Data rate:		
downlink data, Mbps	-	up to 12
telemetry downlink, kbps	-	up to 115,2
control uplink, kbps	-	up to 115,2
Signal polarization	-	circular right
Antenna gain, dB	-	2,0 / 8,0
Transmitter power, W	-	1,0 / 10,0
Range, km	-	120 / 300
Maximum power consumption, W	-	10 / 42



Equipment of the ground station of a combined command-telemetric radio line and the UAV payload data transmission radio line

Frequency band	-	C-band
Mode	-	duplex
Modulation type	-	OQPSK
Spread spectrum	-	DSSS
Data rate:		
downlink data, Mbps	-	up to 12
telemetry downlink, kbps	-	up to 115,2
control uplink, kbps	-	up to 115,2
Signal polarization	-	circular right
Antenna gain, dB	-	28,0
Transmitter power, W	-	1,0 / 10,0
Range, km	-	120 / 300
Maximum power consumption, W	-	15 / 45



S-band TT&C Transceiver format CUBESAT

- Frequency range:
uplink – 2025...2110 MHz
downlink – 2200...2290 MHz
- Data rate:
uplink – 32 kbit/s
downlink – 32/64 kbit/s
- Modulation type:
uplink – PCM/PM/SP-L
Downlink – QPSK
- Downlink data encoding type –
convolutional coding (7, 1/2)
- Input range – (-120...-50) dBm
- Transceiver sensitivity
At BER=10⁻⁶ – no more then -110 dBm
- Output RF power – no less then 30 dBm
(for 15 min of active mode)
- Maximum power consumption, no more than:
active mode – 12,4 W
stand-by mode – 3,0 W
- Input voltage – 6,1...8,4 V
- Mass – no more than 415 g
- Dimension – 96x90x53 mm
- Lifetime –2 years

The S-band AI035 transceiver has passed the whole scope of ground tests.
The S-band AI035 transceiver is planned for use in composition of the YuzhSat-1 and GS-1 satellites planned to be launched in 2021.

X-band HDR Transmitter format CUBESAT

Mobile ground telemetry station for launching of space vehicles on unequipped launch paths



Frequency range	-	8025...8400 Mhz
Data rate	-	50 Mbit/s
Modulation type	-	filtered OQPSK, Butterworth filter 6-th order BT = 0.5 according to ECSS-E-ST-50-O5C
Data encoding type	-	convolutional coding (7, 1/2), CCSDS compatible, forming polynomials [171] octal and [133] octal; the Q signal is INVERTED
Output RF power	-	no less then 33 dBm (for 12 min of active mode)
Maximum power consumption	-	no more than 18 W
Input voltage	-	6,1...8,4 V
Mass	-	no more than 350 g
Dimension	-	96x90x32 mm
Lifetime	-	2 years

Frequency band of data reception, MHZ	-	2200-2290
Minimum slant range of signal reception, km	-	15
Maximum slant range of signal reception, km	-	2500
Bit error rate, 1/bit	-	1 × 10-5
Modulation of received signal, type	-	QPSK, OQPSK
Data reception rate, k bit/s	-	up to 2048
Logging time, s	-	900
Power consumption, kVA, not more	-	5

The X-band AI325 transmitter has passed the whole scope of ground tests.
The X-band AI325 transmitter is planned for use in composition of the YuzhSat-1 satellite planned to be launched in 2021.

The universal S- and/or X-band TT&C ground station

The ground control station in the S/X-band which meets CCSDS requirements, based on an antenna device with a diameter from 3 m to 8 m reflector

1. Frequency band, Mhz:
Ground-Space communication
Space-Ground communication
2. Carrier frequency tuning step, kHz
3. Signal polarization
4. Signal modulation command telemetry link
Ground-Space communication
Space-Ground communication
5. Data rate command telemetry link
Ground-Space communication
Space-Ground communication
6. Transmitter power translated to feed element output, W
7. Antenna position control
8. Maximum antenna position control error, arc minutes, max
9. Maximum session duration, minutes
10. Station preparation time before session, minutes, max
11. Time for reconfiguring to another satellite, minutes, max
12. Maximum power consumption, kW
- 2025-2120
7145-7235

- 2200-2300
8400-8500

- 1,0

- circular, left and right

- PM / PCM, BPSK, QPSK, OQPSK
BPSK, QPSK, OQPSK

- 0.1 Kbps to 2,0 Mbps;
0.1 Kbps to 2,0 Mbps;

- 10-100

- manual, software

- 5

- 15

- 10

- 10

- 30 kW

X-band remote sensing ground stations based on antenna with diameter from 5 to 12 meters

1. Frequency band, MHz:
2. Carrier frequency tuning step, kHz
3. Signal polarization
4. Signal modulation
5. Data rate, Mbps
6. channel count
7. Antenna position control
8. Maximum antenna position control error, arc minutes, max
9. Maximum session duration, minutes
10. Station preparation time before session, minutes, max
11. Time for reconfiguring to another satellite, minutes, max
12. Maximum power consumption, kW
- 7900-8500

- 1

- circular, left and right

- BPSK / QPSK / OQPSK / 8PSK

- 20-500

- 4

- manual, software

- 5

- 15

- 10-20

- 10

- 18-30



Universal hardware and software complex
with high data rate (HDR) demodulators
which meets CCSDS requirements



Mobile x-band remote sensing
ground station based on
3.6 m diameter antenna.



Universal hardware and software complex with high data rate demodulators is designed to receive signals of remote sensing of the Earth, demodulation, decoding, pre-processing and data recording. The HDR demodulators are designed to operate as part of ground stations in the X-band.

Main technical specifications

- | | |
|----------------------------------|--|
| 1. Input signal frequency | 300,0 .. 1000,0 MHz |
| 2. Carrier frequency tuning step | 1 kHz; |
| 3. Signal modulation | BPSK / QPSK / OQPSK / UQPSK /8PSK |
| 4. Data rate | 20 Mbps to 500 Mbps; |
| 5. Number of channels | Up to 4; |
| 6. Signal strength | -50 .. -10 dBm; |
| 7. Inner decoder | LLR Hard Dec;
I/Q Hard Dec;
Viterbi k=7 One Way;
Viterbi k=7 Two Ways;
4D-TCM; |
| 8 Differential decoder mode | Mod 2 NRZ-M/L;
Mod 4 Q-NRZ 1i
Mod 4 Q-NRZ 2n |
| 9. Post Processing | Scrambler Self-synchronizing;
Sync marker Self-synchronizing |

- | | | |
|--|---|-------------------------------|
| 1. Frequency band, MHz: | - | 7900-8500 |
| 2. Carrier frequency tuning step, kHz | - | 1 |
| 3. Signal polarization | - | circular, left and right |
| 4. Signal modulation | - | BPSK / QPSK /
OQPSK / 8PSK |
| 5. Data rate, Mbps | - | 20-500 |
| 6. channel count | - | 4 |
| 7. Antenna position control | - | manual, software |
| 8. Maximum antenna position control error,
arc minutes, max | - | 5 |
| 9. Maximum session duration,
minutes | - | 15 |
| 10. Station preparation time before session,
minutes, max | - | 10 |
| 11. Time for reconfiguring to another satellite,
minutes, max | - | 10 |
| 12. Maximum power consumption, kW | - | 12 |