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KORT

UAV control and telemetry system «TLM-2»

The UAV control system from LLC (KORT) "TLM-2" is a two-way data transmission system with a maximum data transmission speed of up to 40 kbit/s in each direction. It is built based on transceivers with GFSK modulation and its own PPRFT (pseudo-probabilistic radio frequency tuning) algorithm with a frequency tuning speed of up to 180 jumps per second.

Serial samples work in the range of 500 - 700 MHz, but any performance in the range of 280 - 930 MHz with a frequency overlap ratio of no more than 1.7 is possible by pre-order. It is also possible to develop similar systems for any other ranges.

The control and telemetry system consists of two transceivers and a set of antennas, 2 each for the UAV and the ground control station. On UAV antennas with vertical polarization and circular pattern. There are three options for antennas at the ground control station:

- omnidirectional antennas with circular polarization TLM-AM-P-1 - control within a radius of up to 12 km;
- directional antennas with circular polarization TLM-AM-B-4 - control up to 45 km;
- directional antennas with vertical polarization TLM-AM-L-1 control up to 35 km;

In addition, TLM-2 transceivers have built-in antenna switches that allow external commands to switch the signal between two antenna outputs. This is necessary, for example, to switch between directional or omnidirectional antennas at a ground station, or between differently oriented antennas on a UAV, which can change its orientation in space from horizontal to vertical.

The operating frequency range of 500-700 MHz was chosen because it is a non-standard range for data transmission systems in UAVs (this range is allocated for the DVB-T television system and, at the moment, is almost not occupied), and therefore most it is not supported for electronic devices (especially portable ones). DVB-T transmitters operating in this frequency range will not be able to create communication obstacles, as the system maintains its performance even with the loss of up to 50% of packets, and the actual occupancy of the specified frequency range by DVB-T transmitter frequencies does not exceed 15%.

With the help of special software that comes with the radio line, it is possible to create and change frequency tables at any time, for example, before each departure. The tables are formed according to the pseudo-probability law. Reception and transmission between the base and the subscriber are carried out at different frequencies in the entire operating range.

Also, with the help of the software, it is possible to:

- change the power of transmitters at the ground station and UAV in real time;
- put the radio line into radio silence mode;
- display the input signal level of ground station and UAV receivers;
- display information about the number of transmitted packets per second (in %);
- provide control (in manual and automatic mode) of external video channel frequency converters to complicate their interception and suppression;
- assign a unique line identifier for the possibility of simultaneous use of several UAVs in the same area;
- control the built-in antenna switch.

To use this software, it is necessary to connect the ground station transceiver to a PC with the software installed using the USB interface.

Also, the radio line has the possibility of controlling the built-in antenna switch and switching to radio silence mode on two separate signal lines.

To improve the quality of reception, TLM-2 transceivers have an additional antenna input to which an additional antenna is connected to ensure scattered reception.

Specifications:

Ground station

- Transceiver TLM-M3-02 – 1 pc

- Antenna TLM-AM-L-1 – 1 pc

On-board equipment

- Transceiver TLM-S3-02 – 1 pc

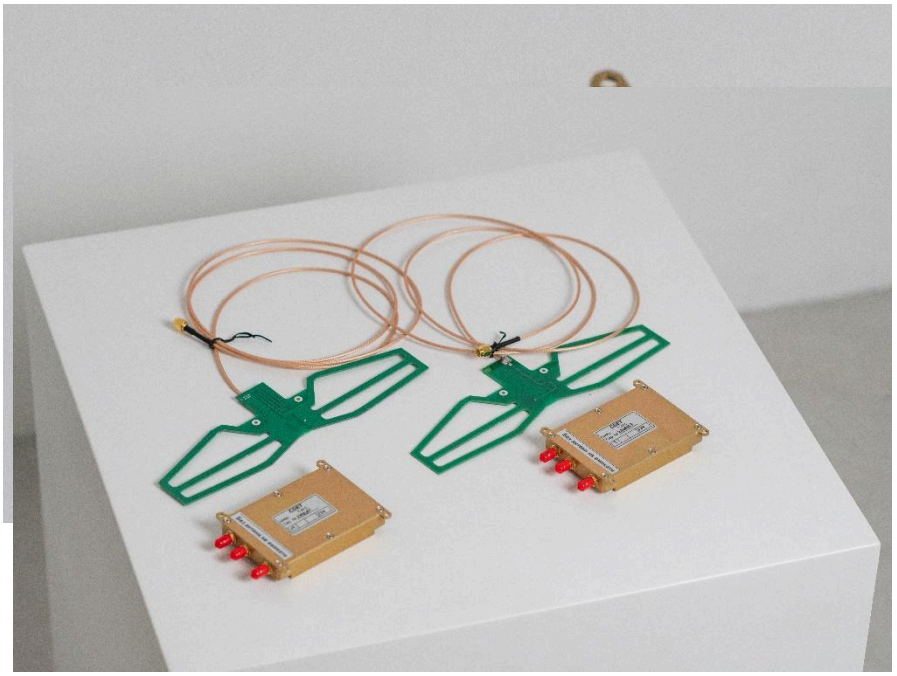
- Antenna TLM-AS-2 – 2 pcs

Technical specifications

Operating frequency range, MHz	500-700
(any other is possible by pre-order in the range of 280 - 930 MHz with an overlap ratio Fmax/Fmin no more than 1.7)	
Output power, W, not less than	2
The minimum sensitivity of the receiver, dBm, no more than	98
modulation type	GFSK
Channel bandwidth, kHz	125
Supply voltage, V	10-17 (3S-4S)
Power consumption, W, no more than	8
RF connector type	SMA(f)
Input interface type	UART(LVTTL)
UART transmission speed, bit/s	57600
The exchange protocol is agreed with the customer	
Transmission speed, kbit/s up to	40 (each way)
The amount of data that can be transferred in one parcel is	60 bytes

Parcel dispatch period, ms	11
The number of service channels is	64
The number of working channels is	1024
Estimated communication range	
- with non-directional antennas (Kp=0dBi)	
in line of sight, at least	15 km
- with a non-directional antenna (Kp=0dBi) on the subscriber	
and a directional antenna (Kp=6dBi) at the base station	
with direct visibility, at least	30 km
The ability to automatically change the power of the subscriber's	
transmitter according to commands from the base station.	
The possibility of changing the frequency table by command from the base station.	
The maximum time to restore the connection when it is lost, ms	500
Overall dimensions, mm, no more than (WxDxH)	64x105x16
Weight, g, no more than	110
The possibility of connecting a second antenna for remote reception.	

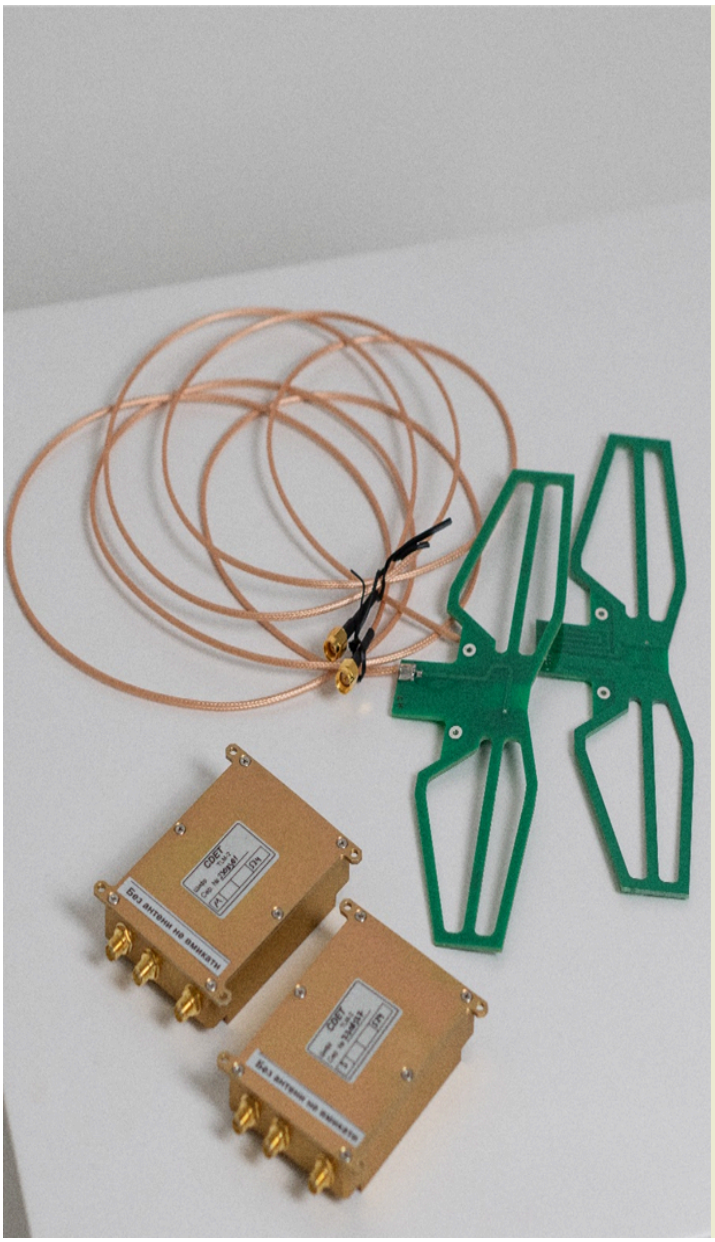
Appearance

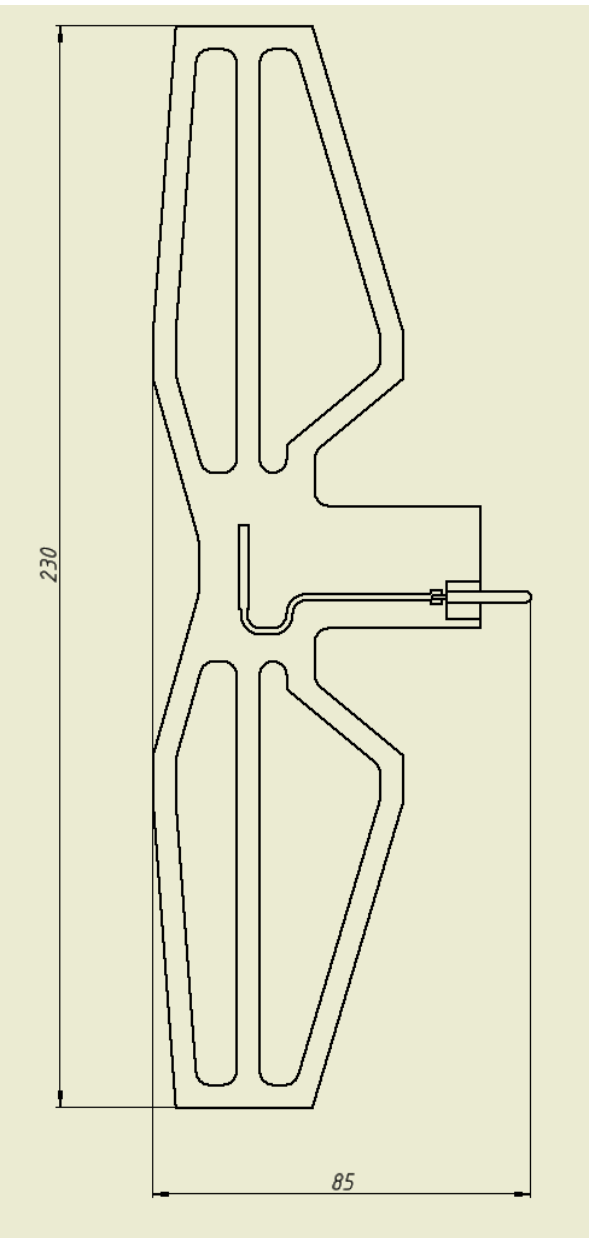


Antenna "Air" TLM-AS-2

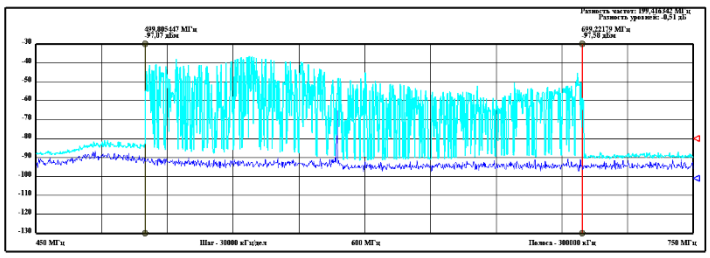
Operating frequency range, MHz	450 - 850
• Polarization	vertical
• The amplification factor AF is relatively isotropic	
emitter, dBi, not less than 2	
• Directionality	omnidirectional
• Maximum input power	
for each input, kW	0.2
• Input standing wave coefficient in the operating	

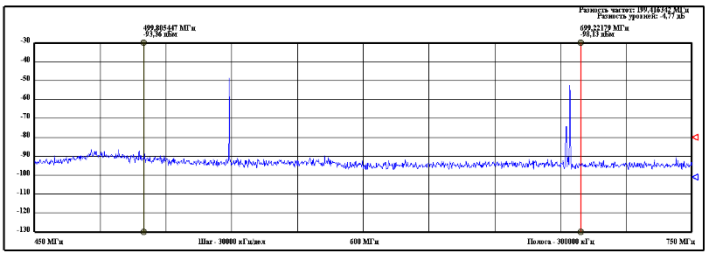
frequency range, no more than	2
• Input resistance, Ohm	50
• Input connectors	SMA(m)
• Antenna height, mm, no more than	250
• Weight, g, no more than	30

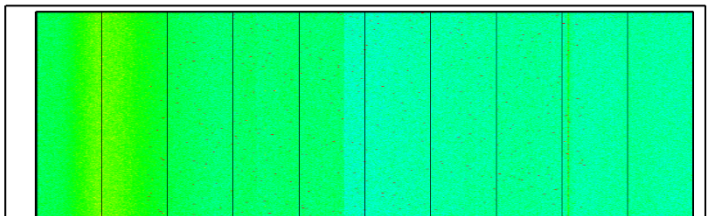


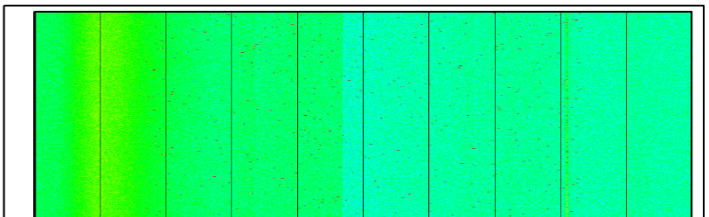


Radio signals on the spectrum



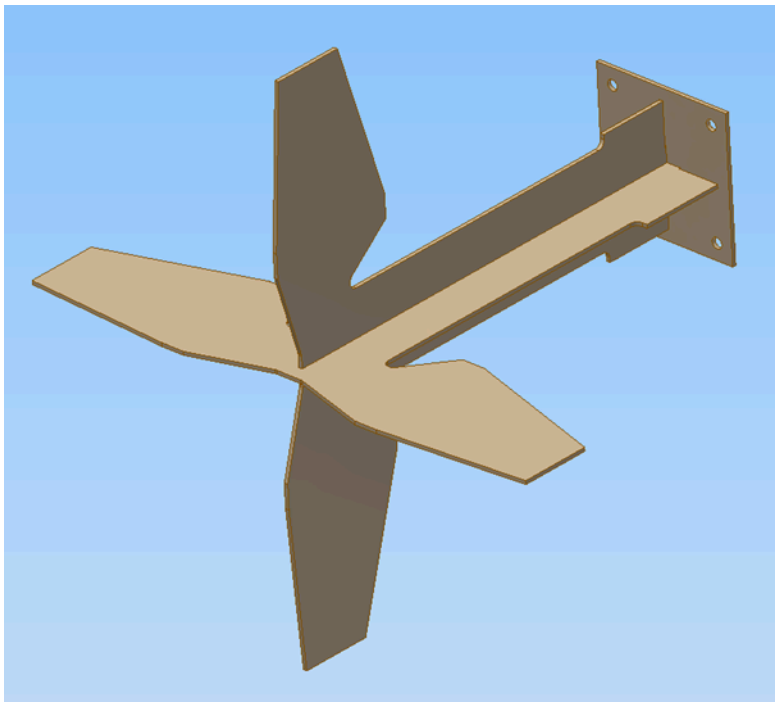






Antenna "Earth" TLM-AM-P-1
omnidirectional, circular polarization (0-12 km)

• Operating frequency range, MHz	450 - 850
• Polarization	elliptical
• The amplification factor AF is relatively isotropic emitter, dBi, not less than	0
• Directionality	omnidirectional
• Maximum input power for each input, kW	0.2
• Input standing wave coefficient in the operating frequency range, no more than	2
• Input resistance, Ohm	50
• Input connectors	SMA(m)
• Antenna height, mm, no more than	250
• Weight, g, no more than	200

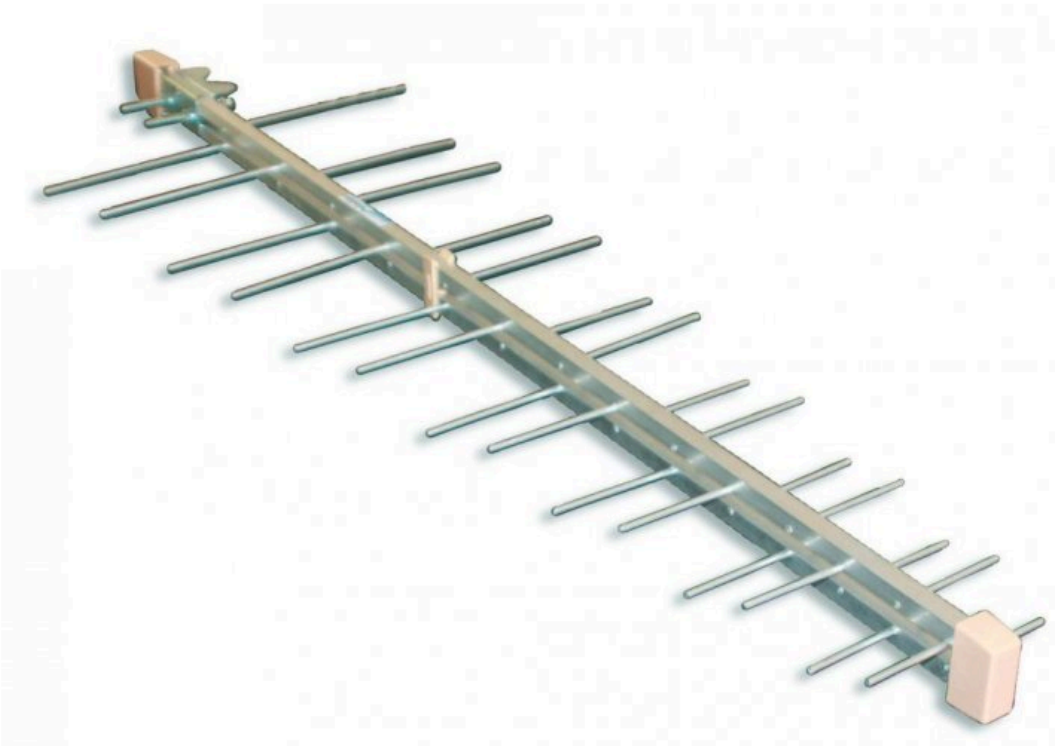


Antenna “Ground” TLM-AM-L-1

directional, wide-angle, vertical polarization (0-40 km)

• Operating frequency range, MHz	450 - 720
• Polarization	vertical
• The amplification factor AF is relatively isotropic emitter, dBi, not less than	6
• Directionality	directed
• Maximum input power for each input, kW	0.2
• Input standing wave coefficient in the operating frequency range, no more than	2.5
• Input resistance, Ohm	50

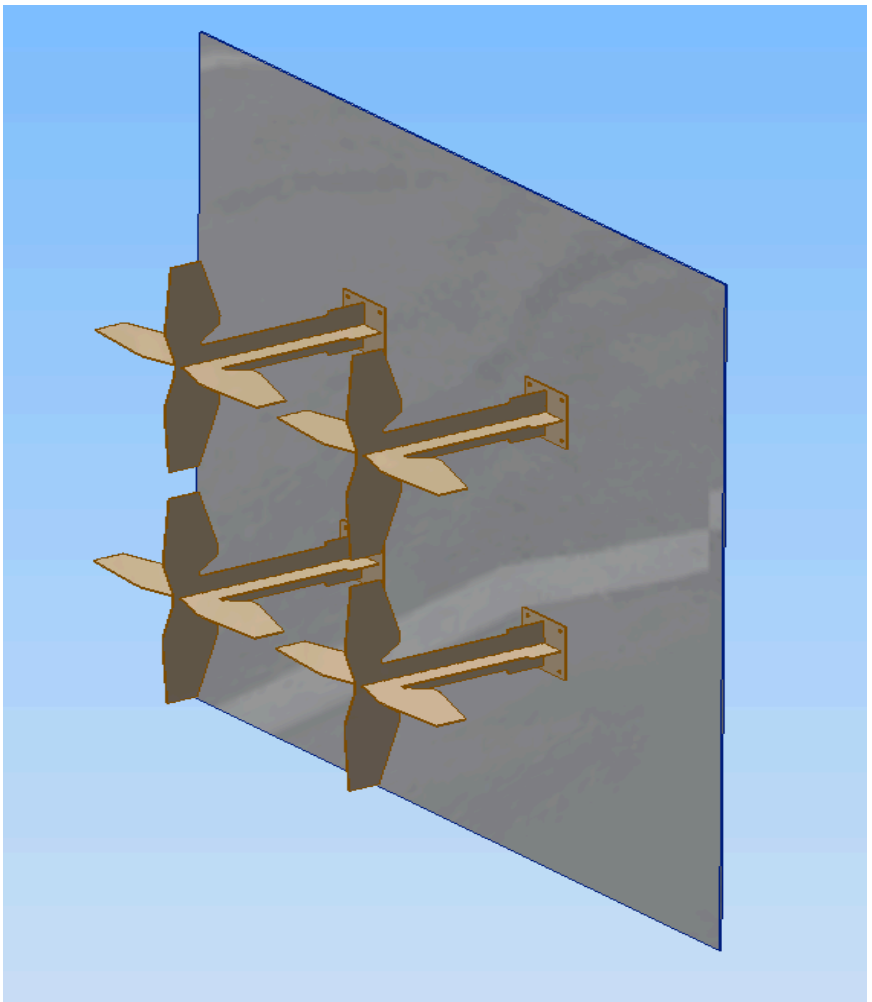
• Input connectors	SMA(m)
• Overall dimensions of the antenna, mm, no more than	750x350x90
• Weight, g, no more than	400



Antenna TLM-AM-B-4

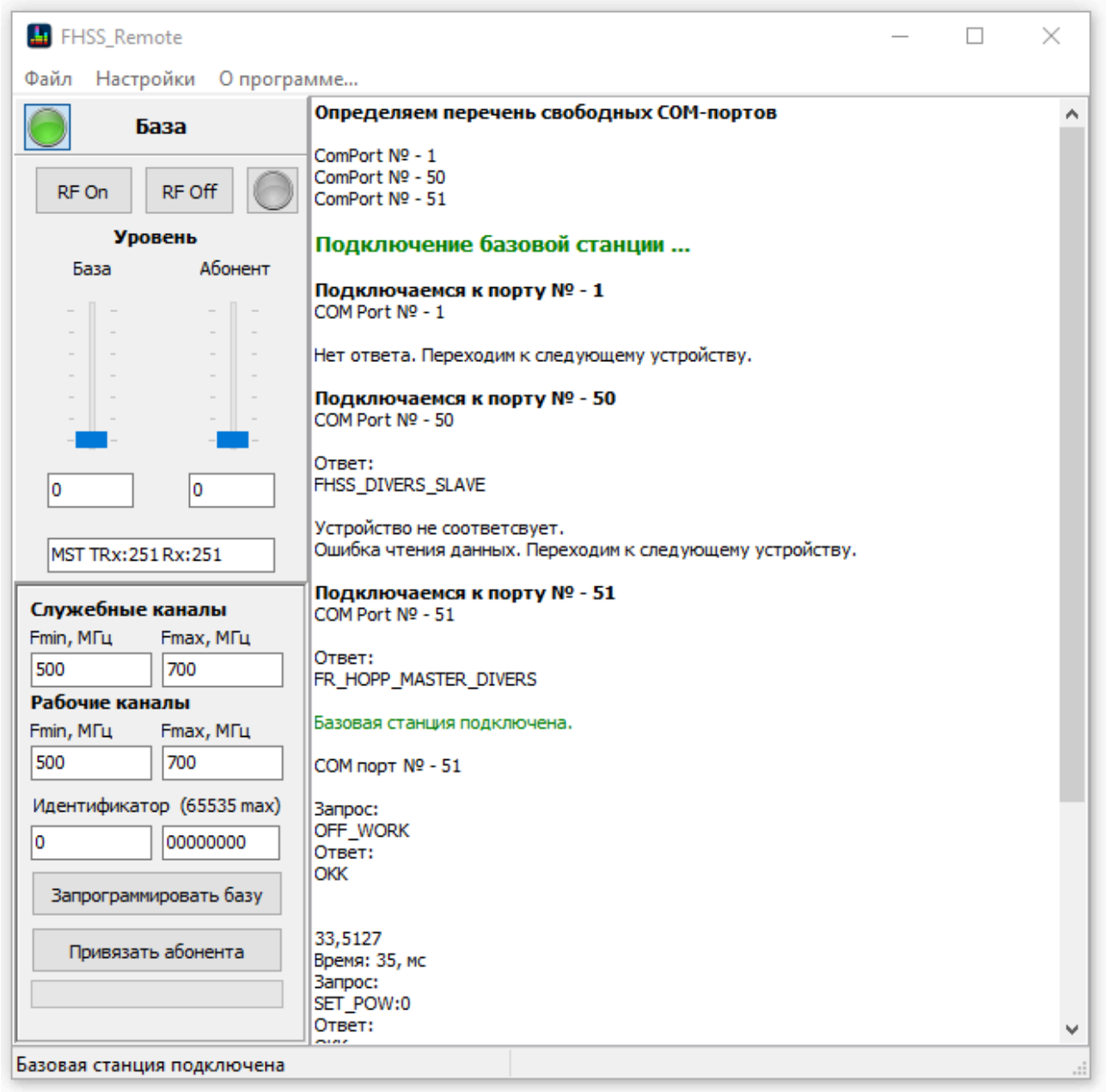
directional, wide-angle, circular polarization (0-55 km)

• Operating frequency range, MHz	450 - 850
• Polarization	elliptical
• The amplification factor AF is relatively isotropic emitter, dBi, not less than	8
• Directionality	directed
• Maximum input power for each entrance, kW	0.5
• Input standing wave coefficient in the operating frequency range, no more than	2
• Input resistance, Ohm	50
• Input connectors	N(f)
• Overall dimensions of the antenna, mm, no more than	750x750x300
• Weight, kg, no more than	6



The appearance of the software interface

for managing the parameters of the radio link



The price of the control and telemetry kit of the UAV "TLM-2"

Ground equipment

- Transceiver TLM-M3-02 -	1 pc	
- RG316 cable with SMA(m) - SMA(m) connectors -		1 pc
- Software -		1 pc
- Antenna TLM-AM-L-1 (or AM-P-1) -	1 pc	

On-board equipment

- Transceiver TLM-S3-02 -	1 pc	
- Antenna TLM-AS-2 -	2 pcs	
- RG316 cable with SMA(m) - SMA(m) connectors -		1 pc

TOTAL: 8000.00 €

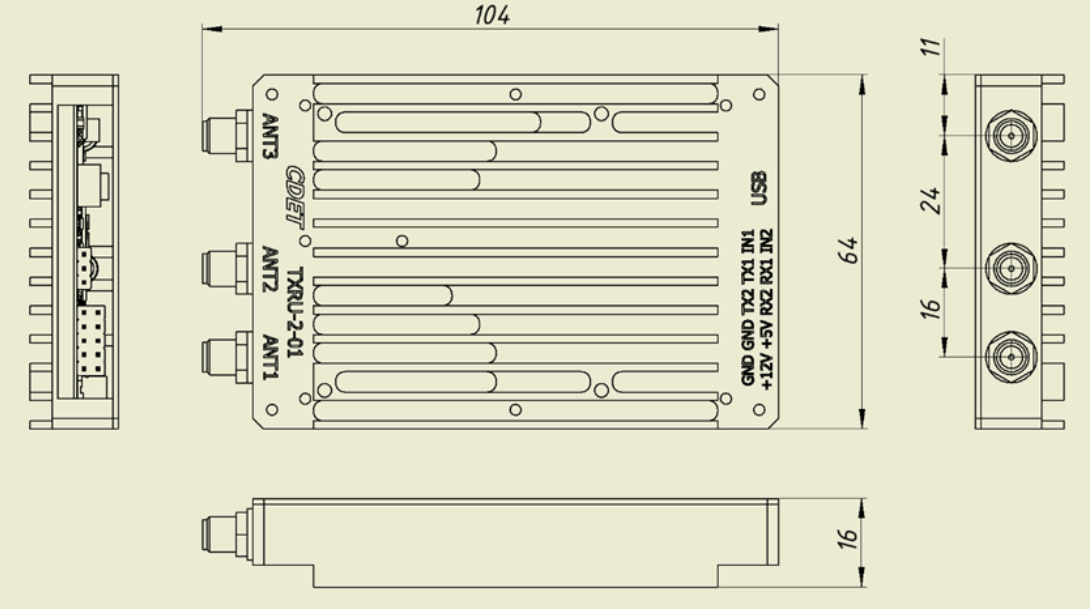
Additional equipment

Antenna TLM-AM-B-4
(Directional / circular polarization) – 1pc

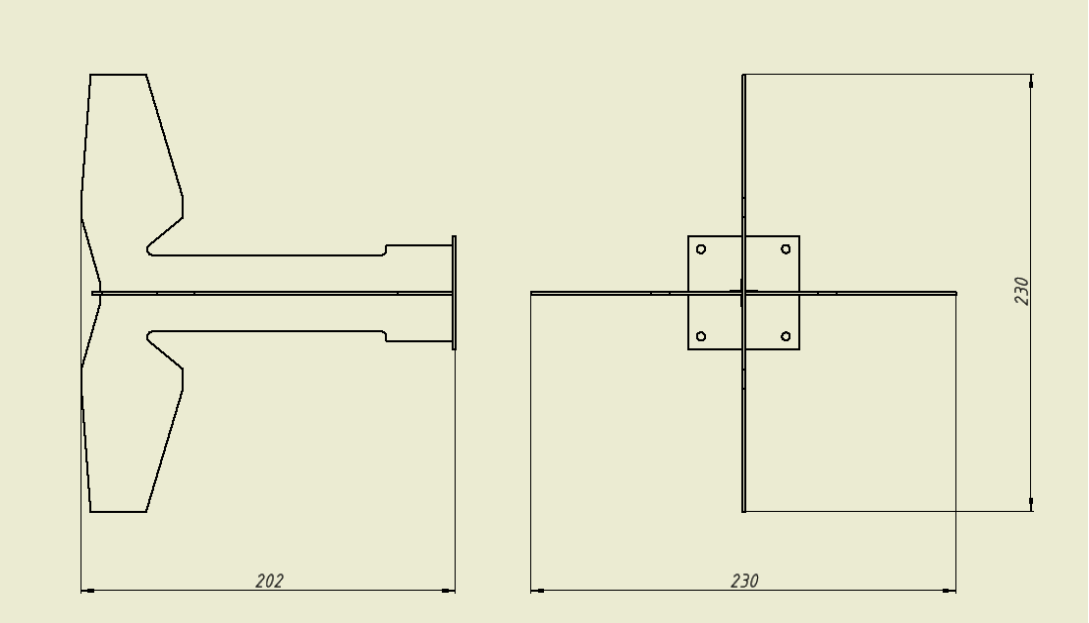
TOTAL: 3000.00 €

To order:
+38 096 109 8953
e-mail: kort@cdet.com.ua

Dimensions of the transceiver

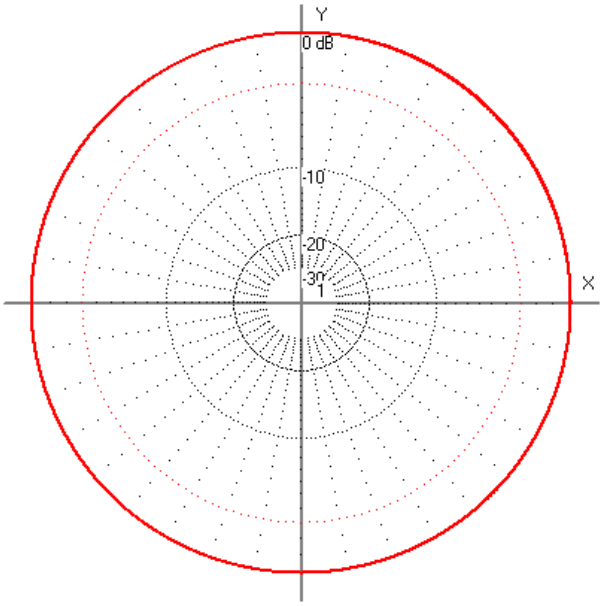


Dimensions of the antenna "Air" TLM-AS-2

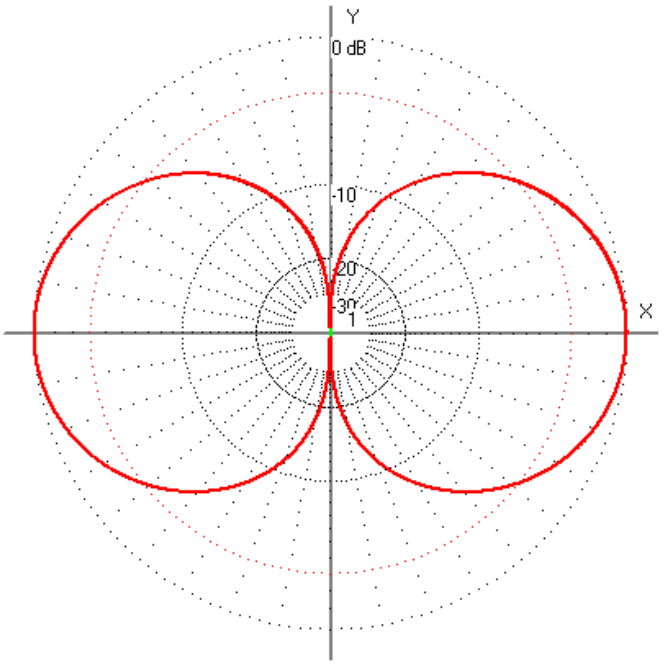


Directivity diagrams of the antenna TLM-AS-2

Directivity diagram in the horizontal plane

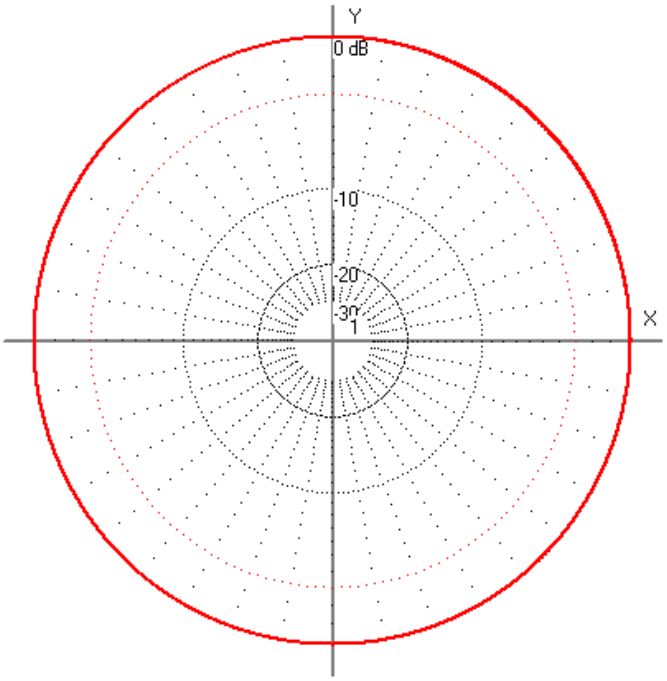


Directivity diagram in the vertical plane

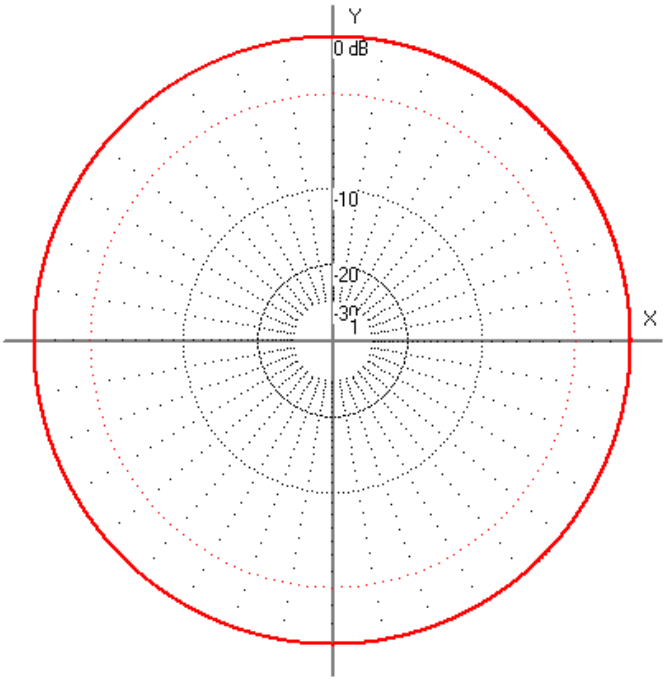


Directivity diagrams of the antenna TLM-AM-P-1

Directivity diagram in the horizontal plane

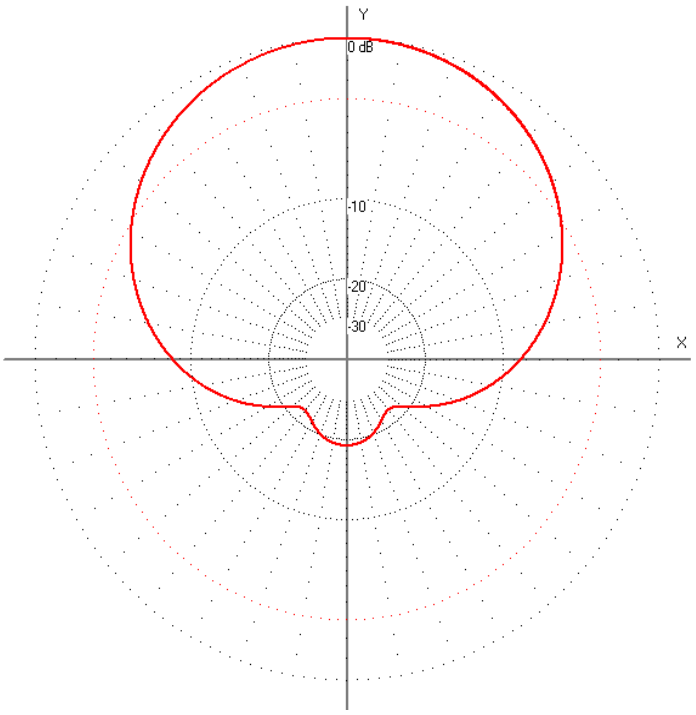


Directivity diagram in the vertical plane

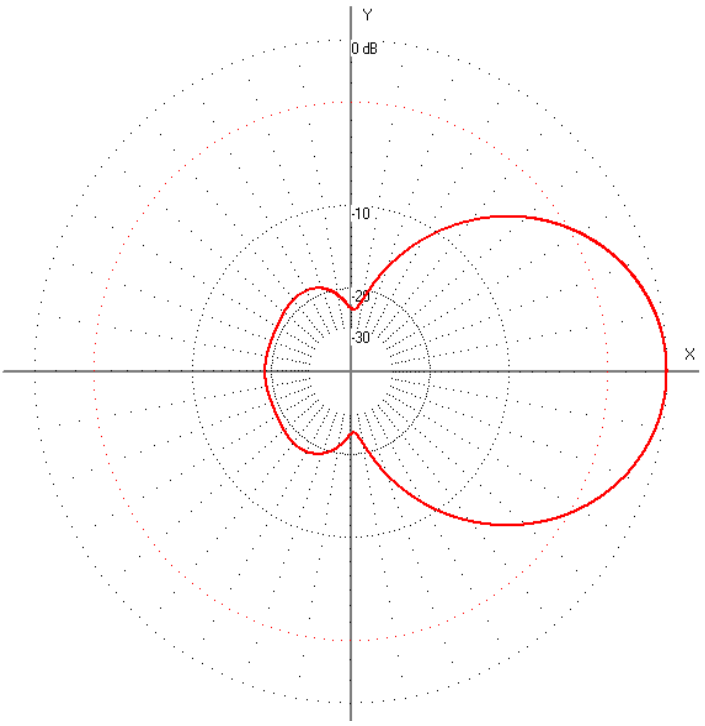


Directivity diagrams of the antenna TLM-AM-L-1

Directivity diagram in the horizontal plane

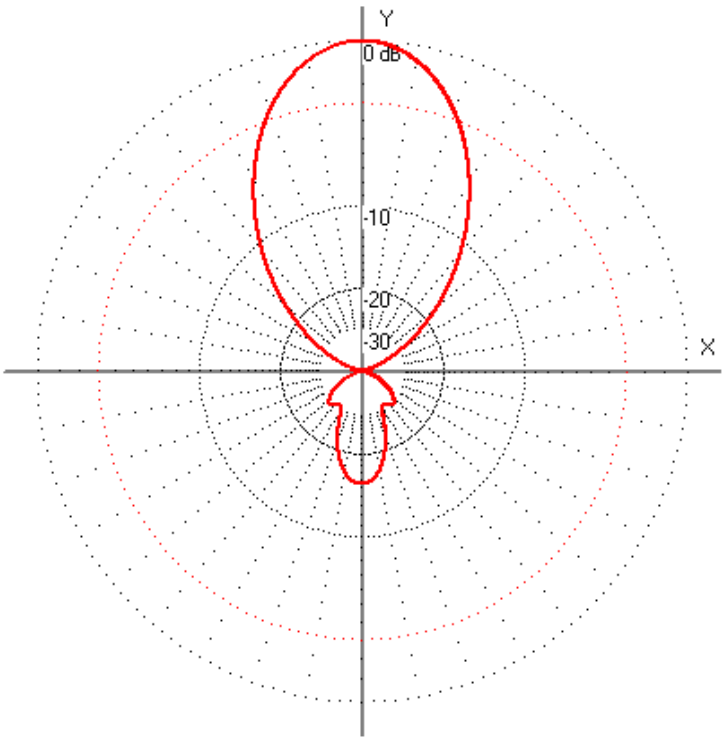


Directivity diagram in the vertical plane



Directivity diagrams of the antenna TLM-AM-B-4

Directivity diagram in the horizontal plane



Directivity diagram in the vertical plane