



*Technical Description
Drone Jammer and Detector*

www.symmlab.ch

SL
Symmlab GmbH

Content

1	Main features	3
1.1	Antenna diversity.....	4
1.2	Jamming Algorithms.....	4
2	Follower (Signal Generator Module).....	5
3	Power Amplifier Modules.....	6
4	Antennas.....	7
5	Housing.....	8
6	GUI (graphical interface)	9
7	Operational Power Source	10
8	Remote Login (only if User allows).....	10

1 Main features

In general, the system is scalable and based on modules. That means that power and frequency can be customized.

To disturb the drone signals in the range of the link, video and positioning it is a minimal requirement for the following bands:

- 863 to 928 MHz
- GNSS (GPS, Glonass, Baidu)
- 2403 to 2483 MHz
- 5150 to 5875 MHz

Out of the minimal requirement, the system can be customized to output power of 50 - 2000W and a coverage of 20 to 6000MHz. The system uses polarisation diversity in receiving and in transmitting mode. This will give an additional gain of 6 – 20dB (4 – 100 times better than without polarisation diversity).

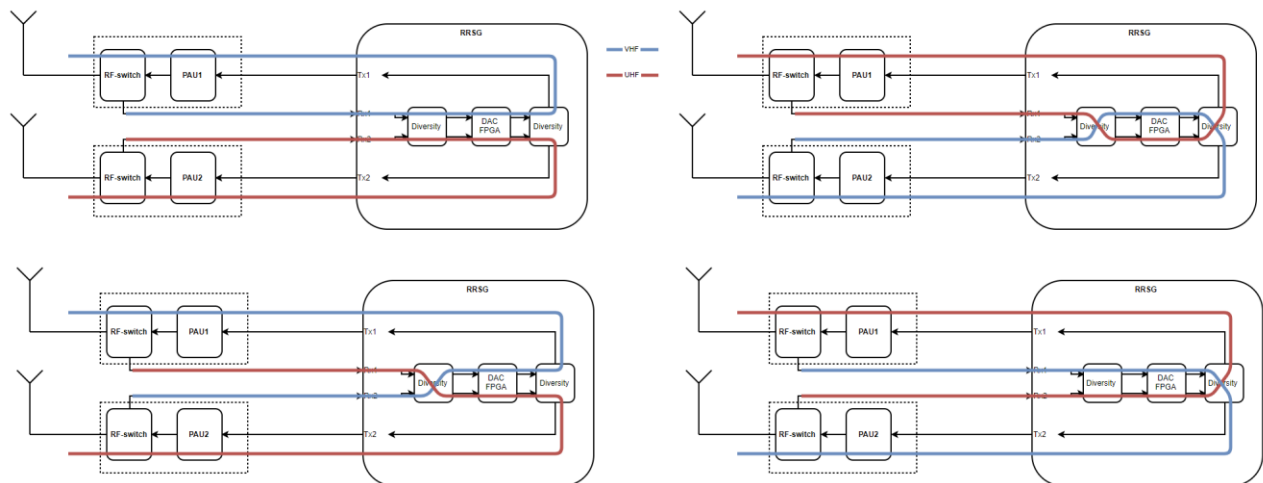
The system could have additional monitoring receivers to survey the frequencies of other expected drones (just monitoring and analysing). The visualisation of received frequencies will be depicted in form of a spectrum analyzer and waterfall diagram.

The system can be installed quickly on a car or on a position in the field. From this position the operator can setup a 200m – 500m fibre optic to operate the system from another position (far from the jammer) to be safe from potential threats.



1.1 Antenna diversity

The follower or generator module has two switches and in the PA is one RX and TX switch. With this function an antenna diversity for Rx and Tx can be programmed. Four modes are implemented. Picture below shows the possible modes for VHF/UHF as an example.



1.2 Jamming Algorithms

1. Continuous jamming – jammer generates signal in user programable ranges. Input RF signal has no influence on output. This mode includes algorithms as:
 - Barrage permanent – device is generating noise signal on defined frequencies with defined power,
 - Custom permanent – device uses previously saved signal, bandwidth and numbers of carriers can be adjusted and uploaded from a preloaded file
 - Waveforms can be generated accordingly customer needs
2. Reactive jamming – jammer reacts on RF input signal by generating/replaying signal on output with predefined power. This mode includes algorithms as:
 - Reactive – generating output signal when input power is above a defined threshold
 - Reactive – generating an output signal according to input signal
 - Reactive – generating an output signal according to input signal, if there is no signal detected in the programmed band, the signal generator create in the whole band a white noise with maximum power

Both active and reactive jamming can be combined in the same band (hybrid)

2 Follower (Signal Generator Module)

The follower has two options to disrupt. Follow (reactive, responsive) mode and active mode.

In follower mode, the follower listens to signals which are present. Then it determines the frequencies and generates an interference signal only on the received frequency.

In active mode, the listening is omitted, and an interference signal is generated constantly. This can be done white noise or a predefined signal.

Settings:

A follower has 2 bands, and each band can cover up to 300MHz frequency range. The 300MHz can be between 20MHz and 6000MHz. This is defined by entering the start and stop frequency. In this range, one can define the sub bands.

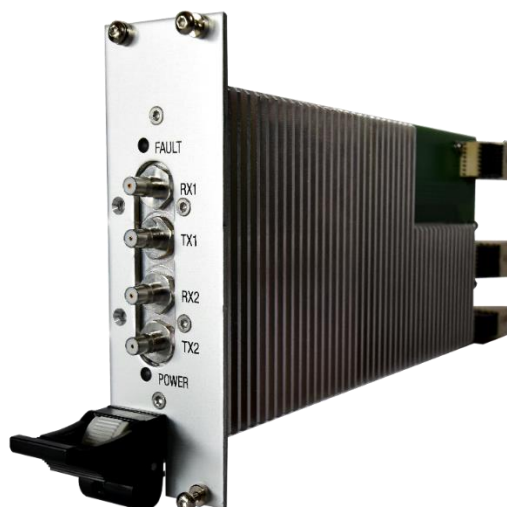
A sub band defines exactly which frequencies have to be disturbed in the 300MHz and in which mode. A sub band can be with a maximum width of the 300MHz. For each sub band, the power can be defined. The power can be up to a maximum of 16 dBm and is set to 0 dBm by default.

In follow mode, the input sensitivity threshold of each sub-band can be set. This specifies how large a signal must be to be detected. This can be between -110 dBm and 0 dBm (depending on the adjusted BW).

It is possible to set both modes at each frequency. This means that follow and active sub bands can overlap.

The 2 RX and the 2 TX can be swoped by software within each other.

- Module dimensions (L x W x H): 245 x 130 x 40 mm
- Weight: 1120g



3 Power Amplifier Modules

There are three types of PA, low frequencies from 20 MHz to 700 MHz, middle frequencies from 700 MHz to 2700 MHz and for high frequencies 2700MHz – 6000MHz (optional up to 40GHz). It amplifies the input signal up to 50dBm (100W) to the output port.

A RF switch is integrated in the PA. This allows to use the same antenna as a receiving and transmitting antenna.

The PA can be set to have the amplification permanently on or off, or to switch in auto mode. In auto mode, the PA is switched on/off according to the timing. In addition, the operator can define the output power between 0dBm to 50dBm.

The RF-switch setting is made via the PA itself. There are 4 different states. There is the RX mode, which routes the antenna input to the RX port. TX mode, which routes the antenna input to the TX port. And there is the switch mode, which switches the antenna input to TX or RX according to timing.

Available PA's.

Typ	from	to	power
PAL	20 MHz	700 MHz	100W
PAM	700 MHz	2700 MHz	100W
PAH	2700 MHz	6000 MHz	100W

- Module dimensions PAL/PAM: (L x W x H): 245 x 130 x 40 mm
- LPA and MPA weight: 2240g
- Module dimensions PAH: (L x W x H): 245 x 130 x 80 mm
- HPA weight: 4500g



4 Antennas

The antennas are optimized for the dedicated ranges. The horn antenna has 2 polarisations (vertical and horizontal) for diversity gain. The average gain of the antenna is 15dB. This means that the ERP (radiated power) at 100W output power is 3kW per polarisation. The omnidirectional antenna is used for the monitoring receivers only.



5 Housing

The Jammer housing has the following dimensions (including lids):

Dimension	Outside (without lids)	Inside
Height:	482mm	6 HE
Width:	534mm	19"
Depth:	690mm	
Weight	12 kg (without system)	
Standards	MIL-STD-810	
Colour	Green (RAL6031-f9)	

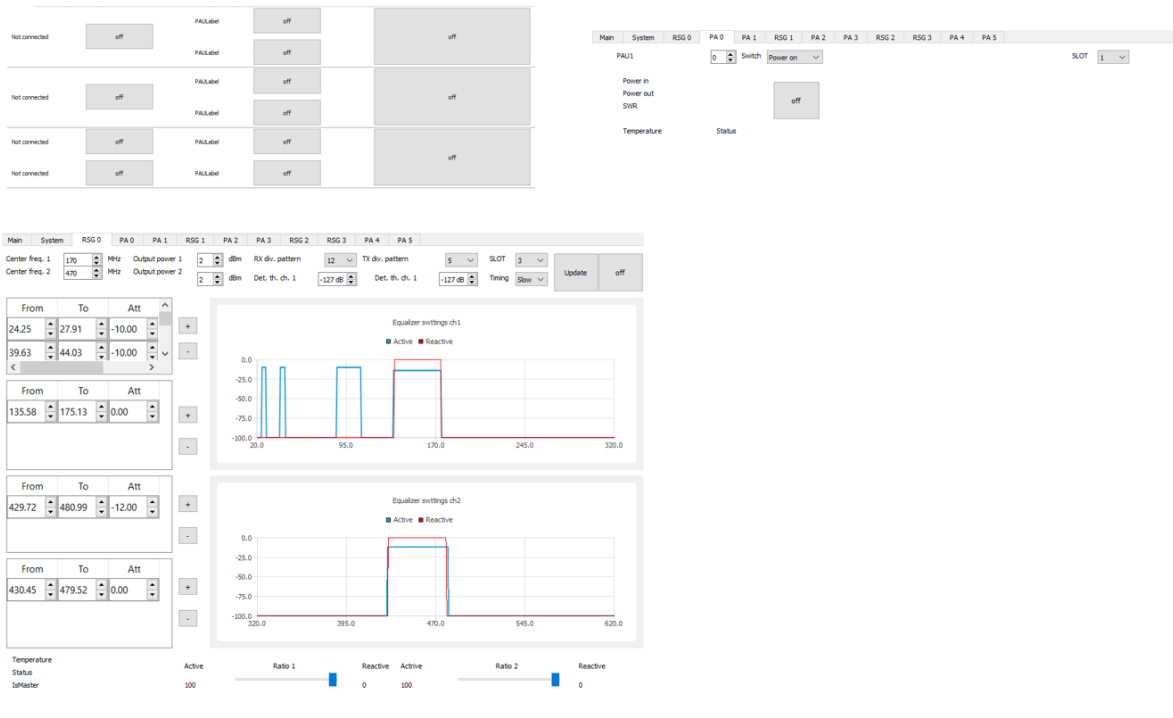


6 GUI (graphical interface)

With the GUI the operator can program the frequencies, the power and the jamming application as barrage, discrete signals reactive and so on. The operator can also program notch frequencies (gaps) which should not be jammed. The GUI can be designed on dedicated needs and customized. However, a standard GUI is provided.

The Jammer offers a variety of indications and alarms. All units are permanently monitored. In case a warning or failure occurs, the operator will be informed through audible tone and on the screen.

Picture as example:



7 Operational Power Source

The system uses 9V – 36V, backed by a battery this guarantees an independent power from an alternator or the grid for about 3h. The system is directly connected to the battery and the battery is directly connected to the charger, which is either on AC (grid anywhere in the world), B2B in the car or additional alternator.



8 Remote Login (only if User allows)

It is possible to remotely access the Jammer via modem and landline connection to the internet. The system supplier can support upon request of the maintenance personnel.