**GPSPATRON**

GP-Blocker

An RF switch with 110 dB of RF isolation level and
embedded L-band GNSS jammer

Designed to protect a GNSS time server against high-power/military-grade GNSS spoofing

All time servers are equipped with a high-stable local oscillator to provide an accurate clock if PTP or GNSS signals are unavailable. Therefore, the simplest and most reliable way to protect a time server against GNSS spoofing is to disable the GNSS antenna port and switch a time server to Hold Over mode.

The GP-Blocker is an RF switch with a remarkable 110 dB of RF isolation level and an embedded L-band GNSS jammer. The GP-Blocker is installed amid the time server and the GNSS antenna. In case GNSS spoofing is detected, GP-Blocker disconnects the GNSS antenna from the time server antenna port, the time server loses satellite signals and switches to "Hold Over" mode. This maintains high accuracy of the PPS signal under GNSS spoofing.
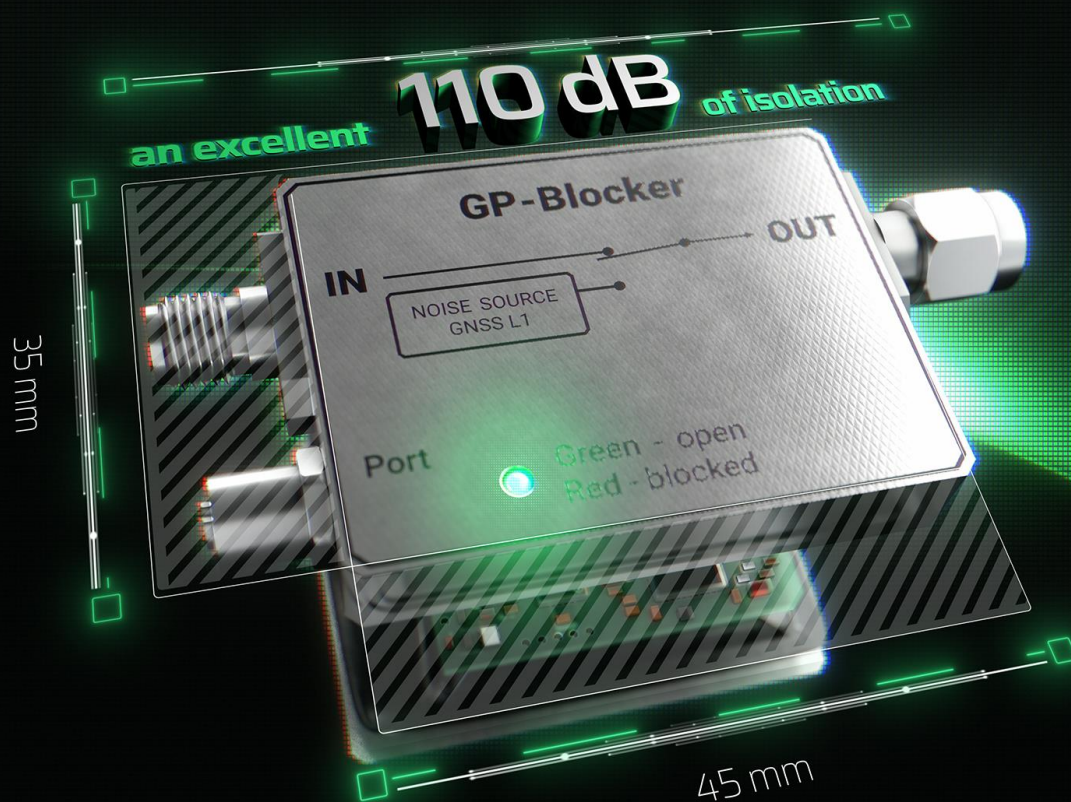
Why GP-Blocker is Needed

The maximum output power of a standard GNSS antenna can reach up to 5 dBm. This may ensue in the case of military-grade spoofing or even when a low power SDR is near the GNSS antenna. The typical receiver sensitivity level is about minus 145 dBm in a tracking mode. Hence, to block spoofing, an RF switch with an isolation level of at least 150 dB is necessary. However, commercially available switches do not provide more than 90 dB. And even if two switches are used, the required blocking level will not be accomplished due to RF cables leakage.

The GP-Blocker with a high level of RF isolation combined with the built-in GNSS jammer can block the most powerful military-grade GNSS spoofing.

Key Features

- Intended to operate both in combination with GP-Probe TGE2 and stand-alone
- RS485 interface with open API for remote control
- Two-stage RF switch with total RF isolation level of 110 dB
- Small enclosure: 35mm @ 45mm
- DC switch to shut the GNSS antenna's embedded preamplifier and simulate a GNSS antenna failure
- L-band GPS, Galileo, BeiDou, GLONASS jammer with power regulation
- Backup power from the GNSS receiver, in the absence of main power supply
- Supplied with GP-Divider – 2-way GNSS splitter
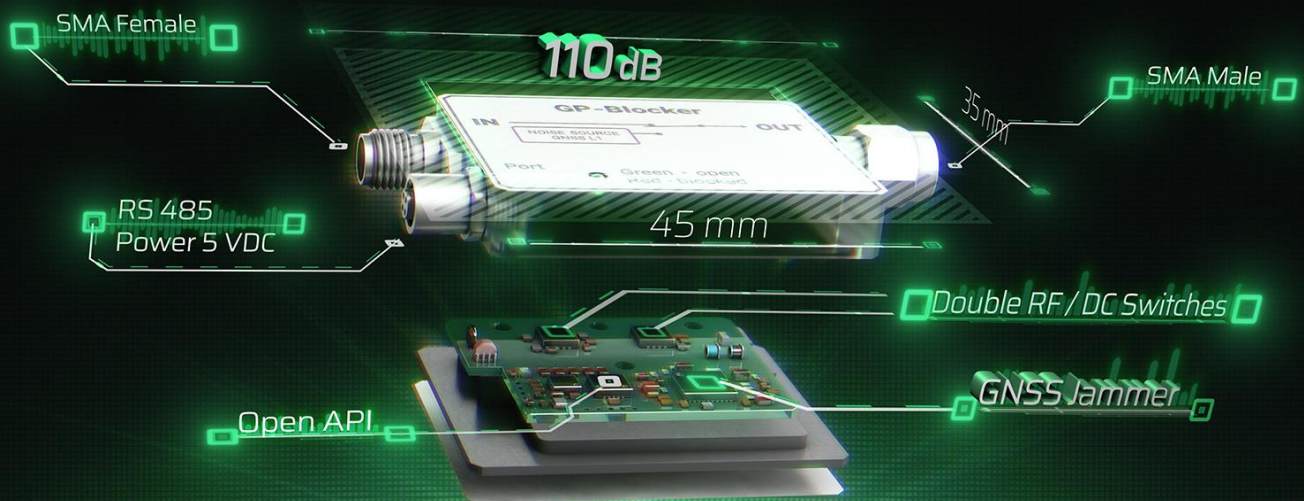
Embedded DC Switch

Many time servers measure the antenna's preamplifier current to detect cable breaks. If the current value tends to zero, the time server generates an error and switches to Hold Over mode. Thus, the DC switch provides additional protection against the most dominant synchronous spoofer.

Backup Power

What transpires if the main power fails?

Since the GPSPATRON solution protects critical infrastructure, it is essential to guarantee the operability of the system in case of a power outage or equipment failure. When power is interrupted, typical electronic switches do not pass the RF signal.

We built-in a secondary power circuit into the GP-Blocker. It is activated in the absence of the main power supply. Power is taken from an antenna port of the connected GNSS receiver. Only the RF and DC switches are powered, providing a "clear" channel for the GNSS signal.

GP-Divider

The GP-Blocker is supplied with a 2-way GNSS splitter – a GP-Divider. It's intended to share one GNSS antenna between two receivers.
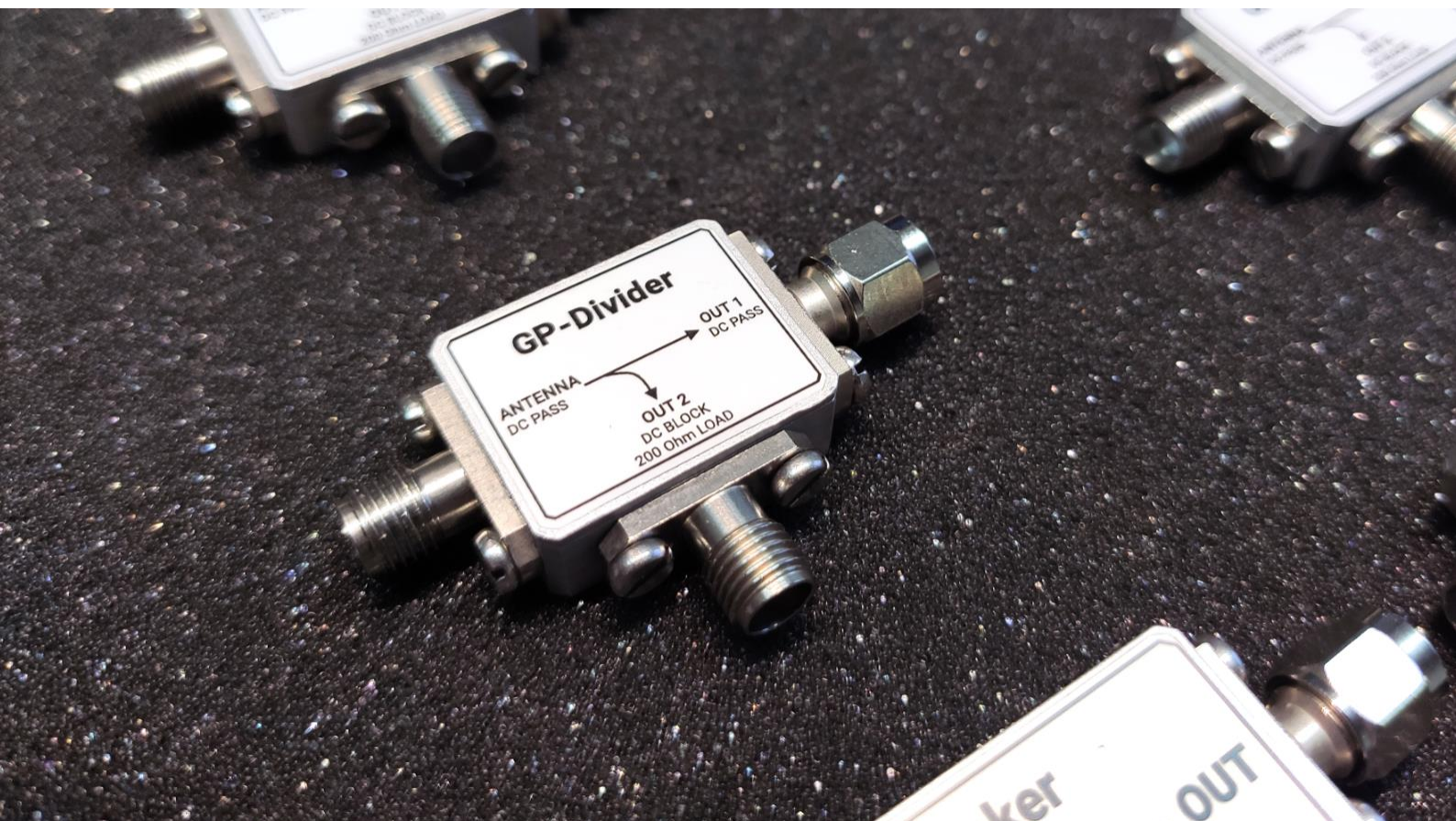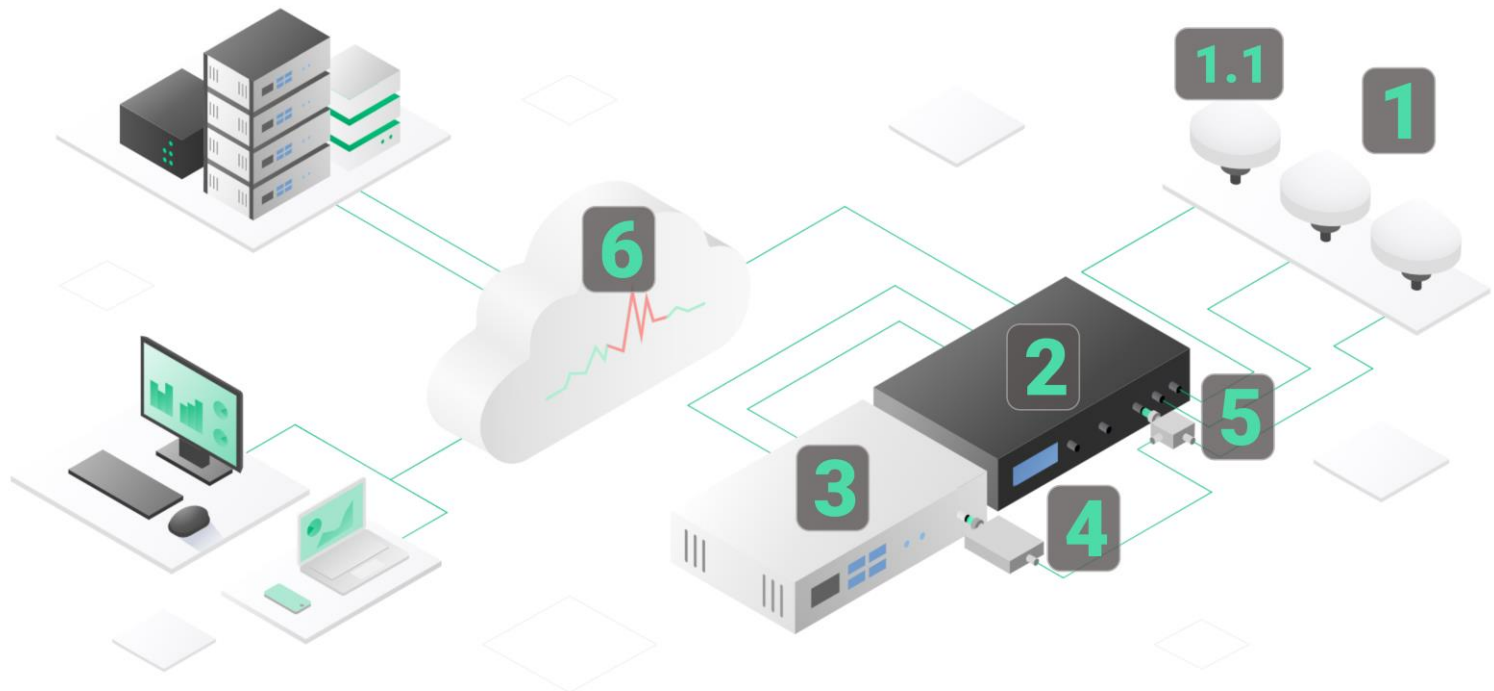
1. Antenna system. To guarantee uncompromised detection of an advanced spoofing attack, the GP-Probe uses three-spaced antennas for spatial integrity analysis of GNSS signals.

1.1. The GNSS antenna will be shared between two receivers: the first channel of the GP-Probe and the GNSS receiver of a time server.

2. GP-Probe. The first channel is connected to a shared antenna through GP-Divider

3. Time server. The GNSS receiver is connected to the shared antenna through GP-Blocker and GP-Divider.

4. GP-Blocker

5. GP-Divider

6. GP-Cloud

The GP-Probe measures GNSS signal parameters of all visible satellites and transmits raw data to the GP-Cloud for real-time processing. If GP-Cloud detects spoofing/jamming or signal quality degradation, it sends a notification to GP-Probe. The GP-Probe sends a command to GP-Blocker via RS485 interface (not shown in diagram) to block the GNSS antenna port of the time server. The time server loses satellites and switches to Hold Over mode.

System Latency Time < 3 sec

The total system latency between the start of the spoofing attack and the GNSS signal block is less than 3 seconds.

GP-Blocker Specifications

Frequency Range:	1.15 GHz – 1.65 GHz
VSWR:	1.30:1
P1dB:	28 dBm
Isolation	110 dB min
Insertion Loss	2.5 dB typical 3.0 dB max
Power Supply:	5 VDC nominal 15KV ESD protection
Backup Power Consumption:	• 2.2 mA @ 3.3 VDC antenna bias • 2.5 mA @ 5 VDC antenna bias

Power Consumption:	• GP-Blocker is not active
	  17 mA
	• GP-Blocker is active, the jammer is disabled
	  21 mA
	• GP-Blocker is active, the jammer is enabled
	  100 mA @ low power output
	  115 mA @ high power output

Interface:	RS-485 15KV ESD protection

GNSS Jammer	
GNSS Jammer Bands:	• 1575.42 GHz • 1561.098 GHz • 1598.0625 – 1609.3125 GHz
GNSS Jammer Max Power:	5 dBm -75 dBm/Hz
GNSS Jammer Min Power:	-25 dBm -105 dBm/Hz
Modulation:	noise-modulated

Mechanical	
Housing:	Aluminum, IP20
Size:	64.5 x 32.0 x 8.5 mm
Weight:	50 g

Environmental	
Operational Temperature:	-40°C to +85°C
Storage Temperature:	-50°C ~ +85°C

Humidity:	0% – 95% RH non-condensing @ 40°C
Vibration and Shock:	15g/0.53oz, 11ms half-sine wave
Vibration:	10 – 55 Hz/0.07g, 55 – 500 Hz/1.0g
GNSS Antenna Input/Output	
Connector Input:	SMA(F)
Connector Output:	SMA(M)
Impedance:	50 Ω
Antenna Bias Voltage:	3.3 – 5 VDC
ESD Protection:	15 KV
Regulatory Compliance	
EMC:	EN 55022 EN 55024
Safety:	EN 60950-1: 2006+A2: 2013
RoHS:	ROHS3 Compliant
Warranty & Support	
Warranty:	1 year Extended warranty is available
Support:	1 year of complimentary technical support
Package Content	
GP-Blocker:	1 pc. RF switch with an embedded L-band GNSS jammer
GP-Divider:	1 pc. 2-way GNSS splitter to share one GNSS antenna between two receivers
HOST Cable:	1 pc. 1.83 m length
RJ45 Adapter:	1 pc. Adapter to convert from custom 4-pin connector to standard twisted pair. Intended to extend the distance between GP-Blocker and GP-Probe. It is also used when several GP-Blockers need to be connected to one GP-Probe
USB-RS485 Adapter	RS-485 Adapter to connect GP-Blocker to HOST computer
Manuals:	Quick start guide

GP-Divider Specifications

Frequency Range:	1.15 GHz – 1.65 GHz
VSWR:	1.30:1
Max Input Power:	33 dBm
Insertion Loss:	0.7 dB
Isolation:	22 dB @ L1 16 dB @ L2

Mechanical

Housing:	Aluminum, IP20
Size:	45.0 x 27.5 x 8.5 mm
Weight:	20 g

Environmental

Operational Temperature:	-40°C to +50°C
Storage Temperature:	-50°C ~ +85°C
Humidity:	0% – 95% RH non-condensing @ 40°C
Vibration and Shock:	15g/0.53oz, 11ms half-sine wave
Vibration:	10 – 55 Hz/0.07g, 55 – 500 Hz/1.0g

GNSS Antenna Input/Output

Connector Input:	SMA(F)
Connector OUT 1:	SMA(M)
Connector OUT 2	SMA(F)
Impedance:	50 Ω
Antenna Bias Voltage:	3.3 – 5 VDC Through OUT 1 to Antenna Input
OUT 2 Load	200 Ohm resistance load DC blocked

Connector Pinout Diagram
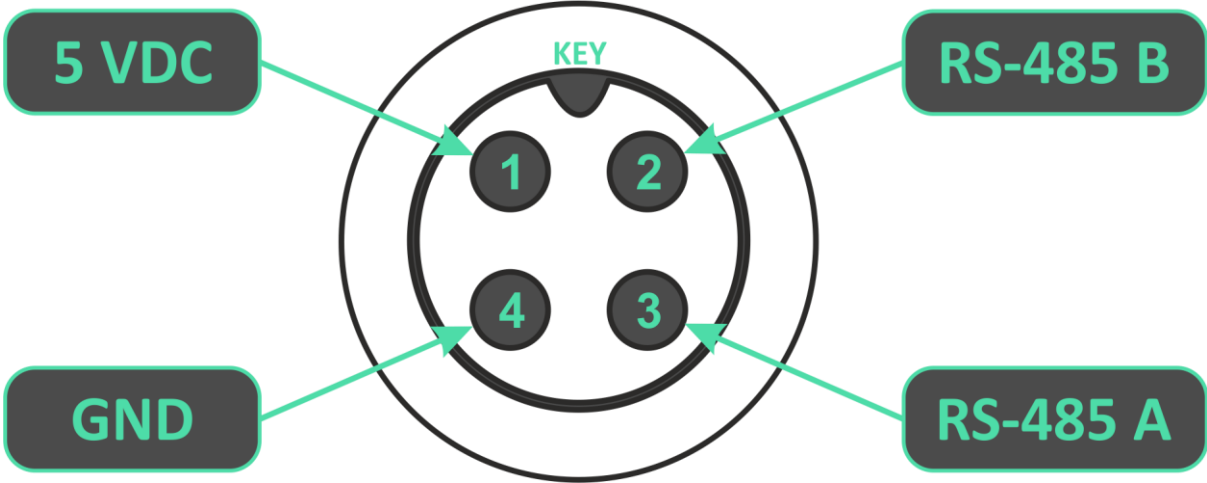
RS-485 Physical Layer Configuration

Differential input voltage:	±12 V max
Common mode input voltage:	-7...+5 V
Output current:	60 mA max
Differential output voltage magnitude:	2.5V typ, 2V min @ Rload=100 Ω
Integrated bus terminating resistor:	100Ω

Serial Configuration

Baud Rate:	9600
Data Size:	8-bit
Parity:	None
Stop Bits:	1
Flow Control:	Off
Echo:	None

Protocol Overview

$	ID:<ID>	Command	*<checksum>	\n
Start character. Always '$'.	Optional ID field. Can be used if there is more than one device on the line. Starts with a 'ID:'. <ID> consists of 2 ASCII characters representing a decimal number from 01 to 99. <ID> can be set by set_id command. Default value is 01.	Command field. Commands are described below.	Checksum field. Starts with a '*' and consists of 2 characters representing a hex number. The checksum is the exclusive OR of all characters between '$' and '*'.	The character "\n" (ASCII 10) in the last data byte of a command string is used as a command terminator.

You can check your checksum calculation function with https://www.scadacore.com/tools/programming-calculators/online-checksum-calculator/

Error Codes

After each command, the device sends an error code.

0, no error	Command executed without errors
1, timeout error	Timeout error. The command terminator "\n" (ASCII 10) did not arrive until the timeout expired. The timeout is 50 ms.
2, command error	Error in command syntax

Command Syntax

blocker open	GP-Blocker is not active, RF channel is open and "transparent" for GNSS signals. **Default Value**.
blocker close	GP-Blocker is active, RF channel is closed. GNSS jammer works if command **jammer_en 1** is utilized.
jammer_en 0	GNSS jammer is disabled when GP-Blocker is active. This is a configuration command, so you can only send it once. **Default Value**.
jammer_en 1	GNSS jammer is enabled when GP-Blocker is active. This is a configuration command, so you can only send it once.
jammer_pow low	Set GNSS jammer power to low. The output power peak level is -45 dBm. This is a configuration command, so you can only send it once. **Default Value**.
jammer_pow high	Set GNSS jammer power to low. The output power peak level is -10 dBm. This is a configuration command, so you can only send it once.
set_id <ID>	<ID> consists of 2 ASCII characters representing a decimal number from 01 to 99. *Example:* *$set_id 02*12\n*
get_id?	Set GNSS jammer power to low. The output power peak level is -10 dBm. This is a configuration command, so you can only send it once.
*idn?	Return device description string: "GPSPATRON, GP-Blocker, v.1.0\n". No error code is returned for this command.

GP-Divider

ANTENNA
DC PASS

OUT 1
DC PASS

OUT 2
DC BLOCK
200 Ohm LOAD

GP-Blocker

IN

NOISE SOURCE
GNSS L1

OUT