



# ROGER™



GNSS TECHNOLOGY FOR NEW MARKETS

ROGER GPS™ Repeater • ROGER GPS™ Amplifier • ROGER GPS™ Splitter • ROGER GPS™ Amplifier&Splitter

## Company

Roger-GPS Oy is a company specialized in GPS technology. Its customers include a wide range of users who need GPS signal reception indoors. Users include rescue services, police, defence, airlines and companies manufacturing, selling and servicing GPS terminals. Roger-GPS Oy's business concept permits the use of GPS devices and services in places where it was previously impossible.

The company was established in 2009 to carry on the development, manufacture and marketing of GPS products started by Sparklike Ltd. In September 2008 Sparklike Ltd. launched the first CE-certified GPS repeater. Product family was approved by the communications authorities in Finland and Sweden for use as a radio-licensed devices. So far it is the only product of its type to meet the applicable standards.

The first GPS repeater users in Finland and Sweden are the fire-fighting and rescue services. Additionally, devices have been installed in the premises of local police departments and airlines and in testing and servicing companies.

The increasing popularity of GPS terminals has generated new applications and given rise to expectations that these devices would be able to operate indoors as well.

At the end of 2010, ROGER GPS products were sold by retailers in over 30 countries. Additionally, devices have been exported directly from Finland to countries worldwide. All ROGER GPS products are designed and manufactured in Finland.

  
**DECLARATION OF CONFORMITY**

*Name and Address of Product Owner:*  
Roger-GPS Ltd.  
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We hereby declare under our own responsibility that the below mentioned electrical product:

Radio frequency signal repeater for retransmitting received Global Navigation Satellite Systems (GNSS) signals to indoor spaces.

Available accessories include outdoor receiving antenna, RF cabling, CE certified power supply, line amplifier (to provide longer cable runs) and GPS signal splitter (splitting the signal to several ROGER™ GPS Repeaters).

*Commercial name of the device:*  
ROGER™ GPS Repeater

*Type number:*  
GPSR-1

The structure of the ROGER™ GPS Repeater device complies and conforms to the relevant universal standards and / or other standardising documents and the Essential Principles for Safety and Performance stipulated in R & TE Directive 1999/5/EC.

Following standards and requirements have been used for the assessment:

- ETSI EN 302 045 V1.1.1 (2010-03), Harmonized EN covering the essential requirements of article 3.2 of the R&TE Directive
- DIRECTIVE (guideline) 2004/40/CE of European Parliament dated from the 29th of April 2004
- DIRECTIVE (guideline) 2008/46/CE of European Parliament dated from the 23th of April 2008.

*This declaration of conformity is valid from 21 of January 2012*

*Authorized Signatory:*

  
Simo Ruoko, CEO, Roger-GPS Ltd.

## What is ROGER GPS Repeater?

ROGER GPS repeater operates by receiving GPS satellite signals with an antenna located outdoor and re-radiating the signals to the indoor area or covered space.

Use of the re-radiated signals mean that the GPS receiver is tracking the current GPS status. When the GPS receiver is moved from covered area to outdoors, the receiver will instantly track the location instead of the time consuming acquisition of GPS data.

### Note!

ROGER GPS repeater cannot be used for indoor navigation since the receiver will always give the position of the outdoor antenna.

### Operating license note

Note: GPS repeaters may require a license or they may not be allowed to use in your country. Check the license conditions with your local (radio)authorities before operating the GPS repeater product. In some countries the ROGER™ package contains instructions to obtain an operating license from the local authorities.

## Description of GPS Repeater controls and connectors :

### 1. Gain control knob

The gain control knob is used to control the output power of the GPS repeater.

### 2. DC power connector

The repeater power is supplied through the DC input connector. The connection is reverse polarity protected. (+12VDC 300mA in)

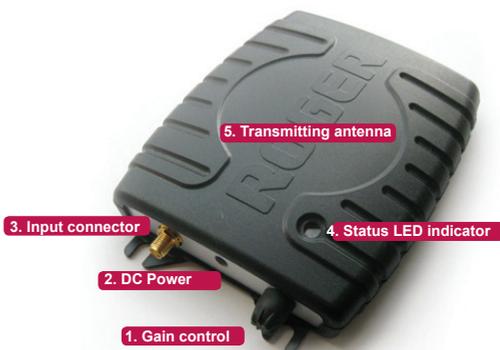
### 3. Receiving antenna connector

Receiving antenna should be connected to the SMA input with the cable supplied. Alternatively a custom cable can be used. (SMA female, +5VDC 100mA output for active antenna)

### 4. Status LED indicator

The status LED indicator should flash few times at startup and then turn constant red or green.

### 5. Integrated antenna inside the case



## Technical information

Size	110*143*28 mm
Weight	165 g
Overall Gain	> 40dB
Noise Figure	< 2dB
Variable attenuation	0-40dB
Impedance	50Ω
Input connector	SMA-female
Operating temperature	-35 - +60°C
Power supply	+12VDC, 300mA      Power supply included
Indoor coverage radius	10-18m
Antenna power output	+5VDC, 100mA
TX antenna gain	max +4dBd, RHCP polarization

## Other features

Automatic gain control	Output power limit -60dBm, 0,000001mW
Feedback oscillation suppression	Status/power LED
Manual gain control	Internal transmit antenna

## Products

### ROGER GPS Repeater Package (GPSR-BP)

A single ROGER GPS Repeater Package is enough to provide a GPS indoor coverage area about 1000 square meters and distance up to 20m from the repeater center. Mount the external antenna on the roof of the building and connect the cable (RG58), supplied with the kit, to the antenna and to the repeater installed indoors.

Connect the power supply unit to the repeater, adjust the repeater's transmission power according to the local conditions to prevent a signal loopback and indoor GPS coverage is immediately available. The kit includes clear installation instructions.

Several ROGER GPS Repeater Packages can be installed in the same building. Alternatively, the signal coverage provided by a single package can be extended with ROGER GPS Accessories, such as line amplifiers and signal splitters.



#### WHAT'S IN THE BOX

- 1x Outdoor antenna
- 1x Antenna mount
- 1x Adapter for cables
- 1x ROGER GPS Repeater unit
- 1x Power supply
- 1x RF-cabling 19,5m
- 1x This manual.

#### Technical information

Size	110*143*28 mm
Weight	165 g
Overall Gain	> 40dB
Noise Figure	< 2dB
Variable attenuation	0-40dB
Impedance	50Ω
Input connector	SMA-female
Operating temperature	-35 - +60°C
Power supply	+12VDC, 300mA
Indoor coverage radius	10-18m (max)
Antenna power output	+5VDC, 100mA
TX antenna gain	max +4dBd, RHCP polarization

#### Other features

- Automatic gain control
- Output power limit -60dBm
- Feedback oscillation suppression
- Status/power LED
- Manual gain control
- Internal transmit antenna

## About installation

### Receiving antenna installation

The receiving antenna should be placed in a place where it can 'see' as much of the sky as possible. It should be also located as far as possible from any RF interference sources, like any transmitting antennas. Before fixing the antenna, check that the cable is long enough and it can be run from the antenna to the required indoor location.



It is also recommended that the system is first tested by running the cable through a convenient route to the indoor installation place and checking that the indoor GPS coverage is suited to the use.

Whatever the environment - wet, cold, sunny, hot, harsh RF jamming GPS antenna included in the box can take it, year after year. The antenna is housed in completely waterproof packaging designed to withstand exposure to shock, excessive vibration, extreme temperatures, rain, snow and sunlight. The enclosure is a textured off-white colour and is both weatherproof and waterproof. The dome is all plastic, and the threaded socket in the base of the antenna is corrosion resistant.

#### Important!

The antenna supplied with the basic repeater package has an whopping RF gain of 35 dB, which results in a cable loss budget of approximately -20 dB. The Roger GPS repeater system needs ~ 15 dB RF gain from the antenna including cable losses for best performance. If using different antenna, the loss budget for repeater must be calculated to make sure - 20 dB of link loss is not exceeded!

## GPS antenna mount

The antenna mount supplied with the ROGER GPS Repeater kit can be used in different kind of installation locations. With this antenna mount, GPS antenna is easily mounted to any surface and at any angle.



## Cable mount

The cable mount supplied with the antenna is very useful for connecting cable with the antennas output connector.



## GPS repeater installation

Install the GPS repeater transmitter by fixing it to the ceiling, wall or a suitable mount. The repeater has an integrated antenna, which is located next to the status LED. The transmitter radiates mostly towards to the same direction as the LED. Ideally the transmitter should be located so that any desired GPS receiving location (like an antenna on top of a van in a garage) has a direct line-of-sight to the repeater antenna.

Also note the length of the wall adapter cable when planning the installation location.

After the outside antenna, cable and repeater has been installed, plug in the wall adapter cable and the adapter to a power outlet. The LED of the repeater should flash a few times at startup and then turn constant red or green.

### The indications of the status LED are:

- **GREEN:** Transmitter is operating normally
- **Constant RED/GREEN:** Transmitter is operating normally, output power has been limited to maximum allowed value.
- **RED:** Transmitter has detected an error or interfering signal. Typical reason is that the input antenna is located so that it can pick up the signal from the transmitter and a feedback oscillation occurs. Other common reason is that there is an interference source close to the receiving antenna.

## ROGER GPS Splitter&Amplifier Package (GPSR-SAP)

To extend the coverage area provided by the ROGER GPS Repeater Package, use the complete ROGER GPS Repeater Splitter & Amplifier extension kit that includes all you need!

### WHAT'S IN THE BOX



- 1x ROGER GPS Amplifier&Splitter
  - 1x ROGER GPS Amplifier
  - 2x ROGER GPS Repeater unit
- Cables:
- (1x3m TNC-m/TNC-m)
  - (1x20m TNC-m/TNC-m)
  - (1x25cm TNC-m/TNC-m)
  - (2x20m TNC-m/SMA-m)

With this installation kit, two extra repeaters can be added to the ROGER GPS Repeater Package to provide greater indoor GPS coverage. If necessary with these products both repeaters can be installed up to 43 metres away from the outdoor antenna. The extension kit is easy to integrate with the existing system that comprises an external antenna and indoor repeater.

## ROGER GPS Repeater Package Easy (GPSR-EP)

A single ROGER GPS Repeater Package Easy is enough to provide a GPS indoor coverage area of 30 metres in diameter from the repeater. Mount the patch antenna so that it gets the line of site from outside GPS satellites, and connect the antenna cable, 6 meters (RG174). The patch antenna has a permanent magnet so it is easy to mount.

GPS antenna, 1575.42 MHz, 50 Ohm, Gain 26 dB at 3V and 28 dB at 5V, Cable: RG174, length 6m.

### WHAT'S IN THE BOX

- 1x Patch outdoor antenna
- 1x ROGER GPS Repeater unit
- 1x Power supply
- 1x RF-cabling 6m



## ROGER GPS Car Installation Package (CPSR-CIP)

A ROGER GPS repeater can also be installed in a vehicle that has limited receiving capabilities. An onboard repeater ensures trouble-free transmission of the GPS signal inside the vehicle. This provides reliable operation for the GPS trackers (eg. handheld radios or phones) when the vehicle is on the move.



### WHAT'S IN THE BOX

- 1x Patch antenna
- 1x ROGER GPS Repeater unit
- 1x Voltage regulator (12V or 24V)

Voltage regulator is used to connect the repeater with the cars power circuit. Regulator type is: In 11-32 VDC, Out 12 VDC 0.7A - Centre.

## Troubleshooting

### GPS receiver cannot receive signals next to the repeater?

- Check that +5VDC is present in the antenna end of the cable and in at the antenna connector of the repeater. Broken or short-circuited cable?
- Check that the repeater power and LED indication are on.

### No LED indication on GPS Repeater?

- Check that 220 VAC/+12VDC is present for the power adapter.

### LED turns RED and GPS coverage is lost?

- Check that the outdoor receiving antenna is in a location where it cannot receive signals from the repeater.
- Try turning down the gain setting.
- Check that there are no interference signals close to the receiving antenna. The system is very sensitive to interference at the GPS L1 frequencies (1575.42±20 MHz).

### Small indoor coverage radius?

- Check that the outside antenna is correctly positioned.
- Check that there are no interference sources close to the receiving antenna.
- Check the gain setting.
- Check the repeater positioning.
- Are there any obstacles that could limit signal coverage?
- Shorter cable run or add a line amplifier to improve signal level.
- Signal splitter and additional repeater units may be required to cover a larger or obstructed areas.

## What to consider when planning a ROGER GPS Repeater installation with custom cables?

### 1. Distance between the outdoor antenna and repeater

The Roger GPS repeater system need - 15dB RF gain from the antenna including cable losses for best performance. The antenna supplied with the basic repeater package has an RF gain of 35dB, which results in a cable loss budget of approximately -20dB. Using an RG-58/RG-223 cable to connect the antenna therefore limits the distance between the antenna and the repeater to -30m as the typical loss of a RG-58 cable is -0,65dB/m @ 1575MHz. If the distance between the outdoor antenna and the repeater requires longer cable runs different methods can be used.

#### A) Use a lower loss cable

RG214/RG213 allows a cable run of 65-70 meters as the typical attenuation is -0,3dB/m @1575MHz. ECOFLEX cable allows run of 90-95m as the typical attenuation is -0,2dB/m @1575MHz.

#### B) Use a line amplifier to compensate cable losses

Connecting the ROGER Amplifier between the antenna and the repeater provides additional +18dB gain, which increases the allowed cable length to 50m with RG-58/RG-223 cable, 110m when using RG214/RG213 cable and 160m with ECOFLEX cable. The ROGER Amplifier should be placed as close as possible to the outdoor antenna and it is powered by the ROGERS GPSR-1 repeater through the coaxial cable so no other power line connection is needed. Two ROGER Amplifiers can be connected in series, increasing the maximum cable length to 160m (240m) by using RG214/RG213 (ECOFLEX) cable and 75m when using RG-58/RG-223 cable.

### 2. Size of the area where repeater is needed

The area covered by the repeater has typically radius of 10-18 meters. This means that for some installations, like parking houses or garages, will need multiple repeaters to provide the desired coverage.

For example five repeaters and one 1:5 signal Splitter are used to cover the whole garage. The ROGER Splitter allows up to 5 repeaters to be connected to one receiving antenna. One splitter output is DC-coupled with -4dB coupling loss. It must always be connected to the repeater for allowing DC to be fed to the receiving antenna and/or to the Amplifier. The four remaining outputs are DC-blocked with -12dB coupling loss and they should be terminated if they are not in use.

For covering bigger areas, an additional signal splitters can be connected in a daisy chain configuration by using the DC-coupled output.

#### Important!

In applications with multiple repeaters, please calculate the loss budget that for each repeater the -20dB of link loss is not exceeded.

#### Example of link loss budget

Antenna to Amplifier loss,  
3m of RG-58 cable: -2dB  
Line Amplifier gain: +18dB  
Line Amplifier to Splitter loss,  
40m RG-213: -12dB  
Splitter coupling loss: -12dB  
Splitter to repeater loss,  
10m RG-58: -7dB

Total Link (from antenna to the repeater) loss: -15dB

The low loss RG214/RG213 cable is more expensive to buy than RG-58/RG-223, if it's only a question of increasing the distance between the outdoor antenna and a single repeater, using a low loss RG214 cable will be more economical than adding a line Amplifier. However, if a signal Splitter is used to allow more than one repeater sharing the same outdoor antenna, most applications will require a line Amplifier to be used.

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