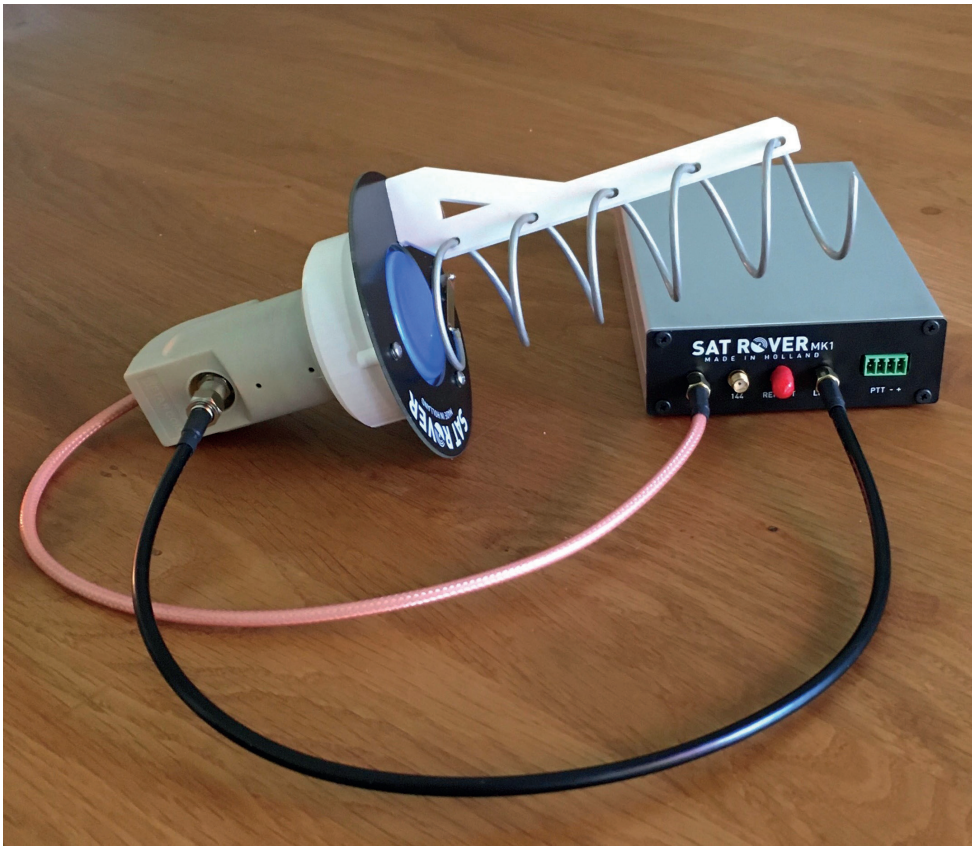
SAT ROVER MK1

MADE IN HOLLAND

QO100 TRANSVERTER

User Manual



Type: SatRover MK1 - **Version:** 4 november 2023

Table of contents

1 Introduction

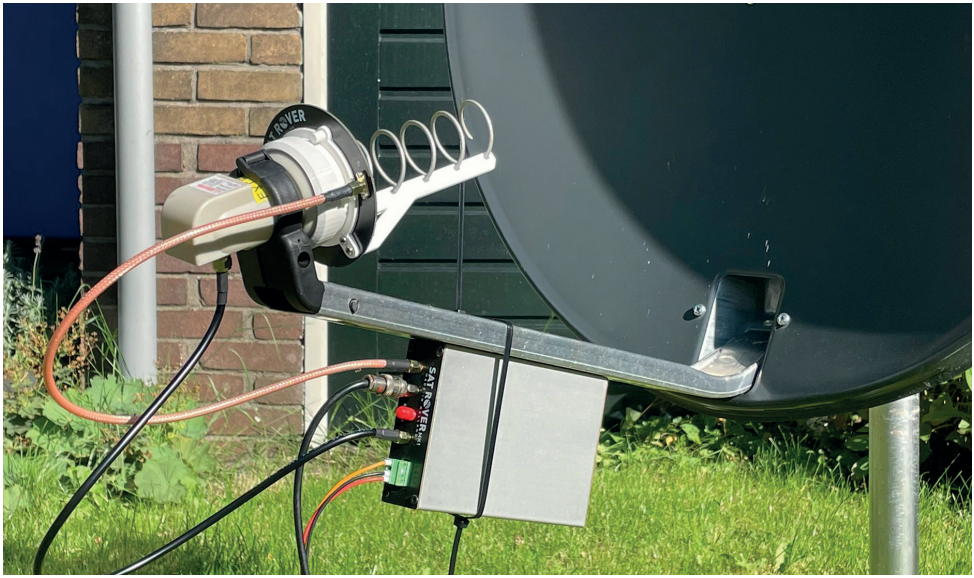
Congratulation with the purchase of your SatRover QO100 transverter.

The use of this transverter is limited to licensed radio amateurs in countries where it is allowed to transmit in the 2,4 GHz amateur band.

This transverter package contains the most parts to communicate via the QO100 narrow band geostationary satellite. To make your satellite ground station work. You must add the following parts:

- 12V power supply (or batteries) capable of 2A.
- Satellite offset dish reflector 60 to 90 cm diameter.
- 144 MHz all mode transceiver what output power level can be reduced within a range of 0,5 to 4 Watt.
- Coaxial cable between 144 MHz transceiver and SatRover.

The SatRover is developed with simplicity in mind. The "Rover" in the name means it is intended to use on portable or "Rover" operation. Together with a portable 144MHz transceiver it is small enough to put in your backpack or with your camping gear. There is no need for a computer or external frequency reference.



2 Dimensions and Specifications

2.1 Dimensions

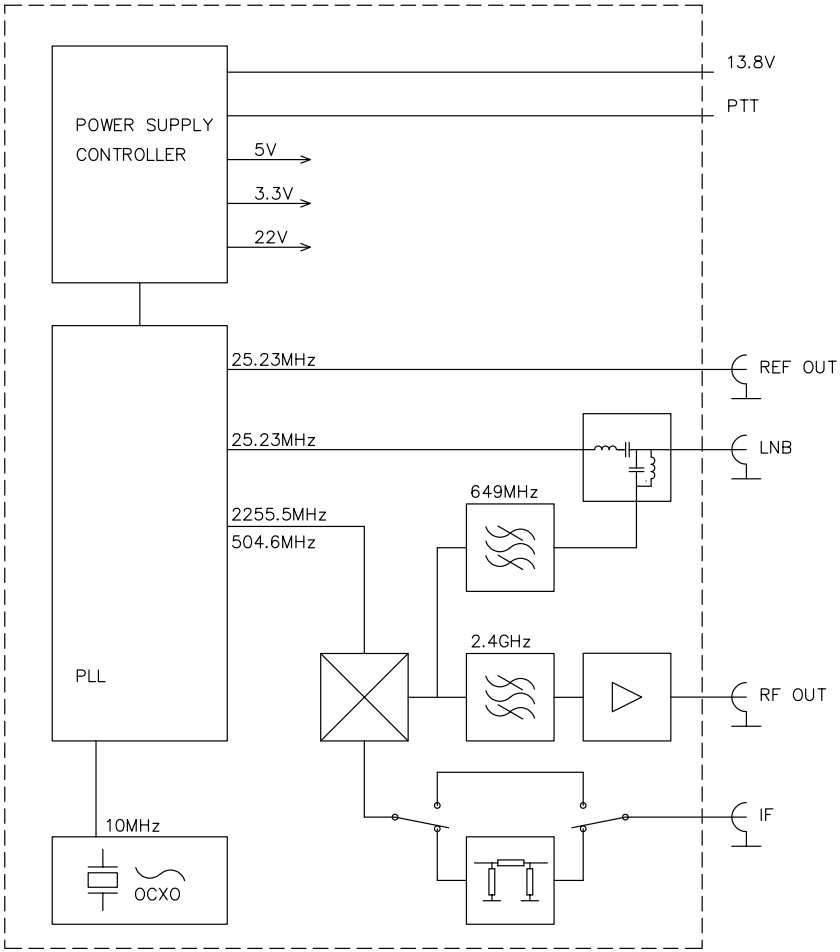
Transverter enclosure:	
Length	165 mm
Width	105 mm
Hight	40 mm
LNB/Helix:	
Length	200 mm
Diameter	100 mm
Mount diameter	40 mm (standard LNB mount)

2.2 Specifications

TX frequency range	2400.0 – 2400.5 MHz
TX output power	4 Watt, 36 dBm
TX – IF frequency range	144.5 – 145.0 MHz
TX – IF recommended input power	2 Watt, 33 dBm
TX Heterodyne	Single conversion
RX frequency range	10489.5 – 10490.0 MHz
RX – IF frequency range	144.5 – 145.0 MHz
RX Heterodyne	Double conversion (first IF 649 MHz)
RX conversion gain	40 dB
RX dish feed LNB	Scalar Horn
TX dish feed	5,5 turn Helix
Recommended dish	90 cm offset f/D 0,6
Frequency reference	internal 10 MHz OCXO
PTT control	Contact close to ground, +12-5V over IF cable
Supply voltage	10-13.8 V DC
Current consumption	< 2A (TX)

IF input-output / impedance	SMA female 50 Ohm
LNB input / impedance	SMA female 50 Ohm
25.23 MHz Ref output / impedance	SMA female 50 Ohm
RF output / impedance	SMA female 50 Ohm
TX cable	Coax (sma-sma)
RX cable	Coax (F-sma)
IF cable	Coax (sma-?) not included
Fulfilled Standards	EMC directive 2014/30/EU, Low voltage directive 2014/35/EU ROHS directive 2011/65/EU

3 Block Diagram



- LNB: IF= 649 MHz / REF = 25.23 MHz
- RF UIT: 2400 MHz
- IF: 144.5 – 145 MHz
- REF UIT: 25.23 MHz

4 Assembly

This transverter intended to be used by radio amateurs. Due to European regulation the radio amateur must do the final assembly their self. This chapter guides you through this assembly process. To simplify this process there are only a few parts to assemble.

4.1 Unpack and identify parts.

After unpacking you can identify the following parts

1 Bottom half of the enclosure with pcb already mounted.
2 Top half of the enclosure
3 Fuse
4 4 pcs M3 x 5mm flat Philips screws
5 LNB/Helix assembly
6 LNB coax (black)
7 2400 MHz coax (brown)
8 4 pole DC connector

4.2 Assembly steps

Execute the following steps carefully.

- Place the bottom half with the PCB flat on your worktable
- Place the fuse in the holder
- Place the top half on the bottom half in the correct position (only one position possible)
- Screw both together with the remaining 4 x M3 screws

Now your SatRover is ready for installation.

5 Installation and Interface

The front panel of the SatRover contains 4 SMA female connections and a 4 pin multipole connector.

5.1 Source supply

Source supply is made on the right 2 pins of the 4 pole connector.

- Most right pin, Positive 10-13.8V DC
- Second right pin, Negative

If you connect it reverse the internal fuse will be blown to prevent any further damage.

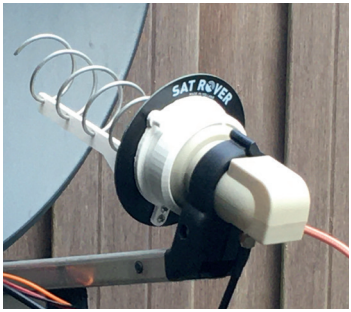
5.2 Radio connection

- The SatRover will work with any 144 MHz all mode transceiver where the output power level can be reduced within a range of 0,5 to 3 Watt. The RF connection between the SatRover and your 144 MHz trx is not supplied in the kit. Find yourself a coaxial cable of the proper length (RG58) connecting the output of your TRX to the SMA connector on the SatRover marking "144". Length is not important as long there arrives 0,5 to 3 Watt at the end of it.
- PTT connection can be made in 2 different ways.
  1. If there is a DC voltage (5-12V) during transmit on the 144 MHz coaxial line the SatRover changes over to transmit automatically. (Yeasu FT290 is interfaced this way)
  2. The most left pin of the 4 pin multipole connector needs a pull down to make the SatRover go to transmit. (Icom IC705 can be interfaced this way)
- The red transmitting led on the backside of the SatRover indicate transmitting status.

5.3 Antenna Set-Up

- The SatRover works well with an offset dish diameter of 60 cm – 90 cm. Bigger has no use because the QO100 noise floor is audible in the receiver with a 90 cm dish.
- On transmit Leila kicks in with the 90 cm dish indicating you are strong enough.
- The offset dish needs a standardized 40 mm LNB holder.
- When mounting the SatRover LNB/Helix combo, the F-type connector of the LNB should facing downwards or upwards for good polarization.
- The 2,4 GHz helix can be rotated in any position due to the circular polarization.

5.4 LNB / Helix connection



The LNB / Helix combo should be mounted in the 40mm holder on the dish support arm (see picture). On 10 GHz the polarization is linear, mount the LNB with the "F-type" connector facing up- or down-wards. Later we can optimize this position.

- Connect the black cable from the LNB "F type" connector to the "SMA" connector on the SatRover marking "LNB"
- Connect the brown cable from the helix "SMA" connector to the "SMA" connector on the SatRover marking "TX"
- Strap the SatRover to the dish support arm with a rubber band or tie wrap.
- Do not use longer cables! The coax losses on 2,4 GHz are very high, this may affect your signal strength on TX.
- The SatRover is not waterproof. If you want to use it in wet weather, you make yourself some kind of waterproof enclosure.

6 Getting started

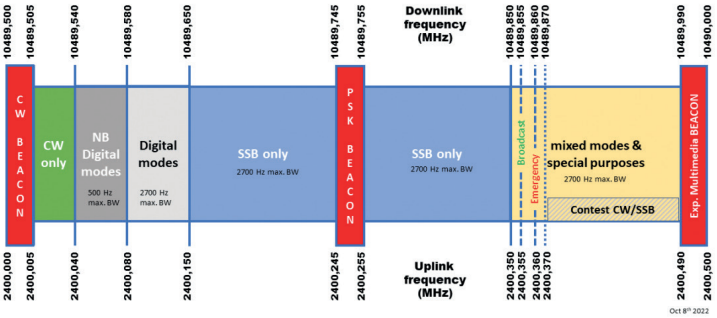
Before using your SatRover you must aim the antenna to the satellite. Be sure there is a window to the satellite from the location where you want to set up the antenna. There are many apps or websites to find the proper azimuth and elevation heading.

6.1 Antenna aiming

- Power up the SatRover and let it warm up for at least 5 minutes
- Switch your 144 MHz transceiver on and dial in 144.500 MHz in mode FM
- Turn the squelch down until you hear the noise
- Start scanning your antenna direction from left to right increasing the elevation after ever scan
- On some point the noise goes down and you hear the lower beacon in FM
- Optimize the beam heading on minimal noise level (The signal stays always a little noisy)
- Optimize the rotation of the LNB to find the correct skew setting
- Secure the antenna and LNB in this position

6.2 Making QSO's

- Switch your transceiver over to USB mode and look for signals between 144.500 and 145.000
- You can Identify the beacons and maybe you hear some other stations
- If you want to reply push the microphone and talk to them
- Use your RIT to find the convenient split for you
- ***AMSAT-DL prescribes that you monitor the return path of your transmission, this can be done in several ways, such as consulting an extra receiver or a web-sdr (telephone). It is also possible to hear your own signal with the Satrover. However, this is only very short (echo) but very useful for frequency control.***
- ***Conform yourself to the band plan as shown below***
- Happy TX ing

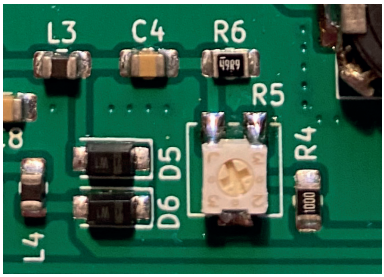


7 Adjustments

It is possible to make some adjustments to the SatRover. The power output can be adjusted to match the drive power on 144MHz, both TX frequency and RX frequency can be set individually. To make these settings you must take off the top half of the enclosure. Before any adjustments are made warm up the transverter for at least 5 minutes to settle the OCXO 10MHz frequency. Some help may be monitoring the "BATC NB web-sdr" on your computer or telephone to find the correct levels.

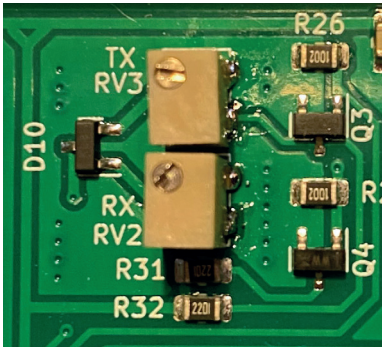
7.1 Power adjustments

After opening the enclosure top you can identify the R5 trim resistor.
With this resistor you can set the drive level. Set it in a way there is not that much compression using a power meter or monitoring the web-sdr.



7.2 Frequency adjustments

There is a possibility to adjust the TX and RX frequency. We advise you not to do this unless you have the measuring equipment to do so. If there is a small difference between RX and TX you can solve that with the RIT of your 144 MHz transceiver. There will always be some difference because the conversion frequency of the QO100 satellite also have some drift. In practice this does not go over 200 Hz.
After opening the enclosure top you can identify the RV2 (RX) and RV3 (TX) trim resistors. Beware the RX adjustment is very sensitive.



Holsink Holding BV
Hilvertsweg 285
1214 JG Hilversum
The Netherlands

e-mail
holsink@hetnet.nl

website
www.hybridpretender.nl