A Rover/Base (GS10, 14, 15,16, or 18(t/i)) can be set up with usage of a HIGH powered external UHF radio.   This guide will outline the basics of using an external UHF radio RTK Base/Rover connectivity. For the purpose of this guide, we will mainly refer to SATEL branded radios.

Please refer to the *RTK UHF Base/Rover Quick guide Connection* for internal UHF BASE/Rover setup.

An external UHF radio will typically require additional equipment such as antenna mask, various cables to connect to GS sensor base/power source, a power source such a deep cycle battery.

On rover end, ensure to connect the GS sensor with an appropriate radio antenna (e.*g. GAT28 UHF radio antenna for GS18 (frequency range 403-473 MHz), GAT2 for GS14/16*)

Setting up the base

This is a typical requirement for a Base radio kits should contain the following and are not limited to the following:

- Power Cable Set
- Battery Bag
- Base / Repeater Station Battery
- GNSS interface cable

- Base / Repeater Battery Charger
- 5 dB Mobile Whip Antenna
- Tripod with Telescoping Mast and Bag

- Pole Top Antenna Mount
- Antenna Cable
- Satel High Power radio

Tripod with Telescoping Mast

5 dB whip antenna

Satel High Powered Radio

Antenna cable to connect to gainflex

GS 16 Base

External Battery

Cable to radio

GNSS interface Cable to transmit base correction to radio

Cable to power GS
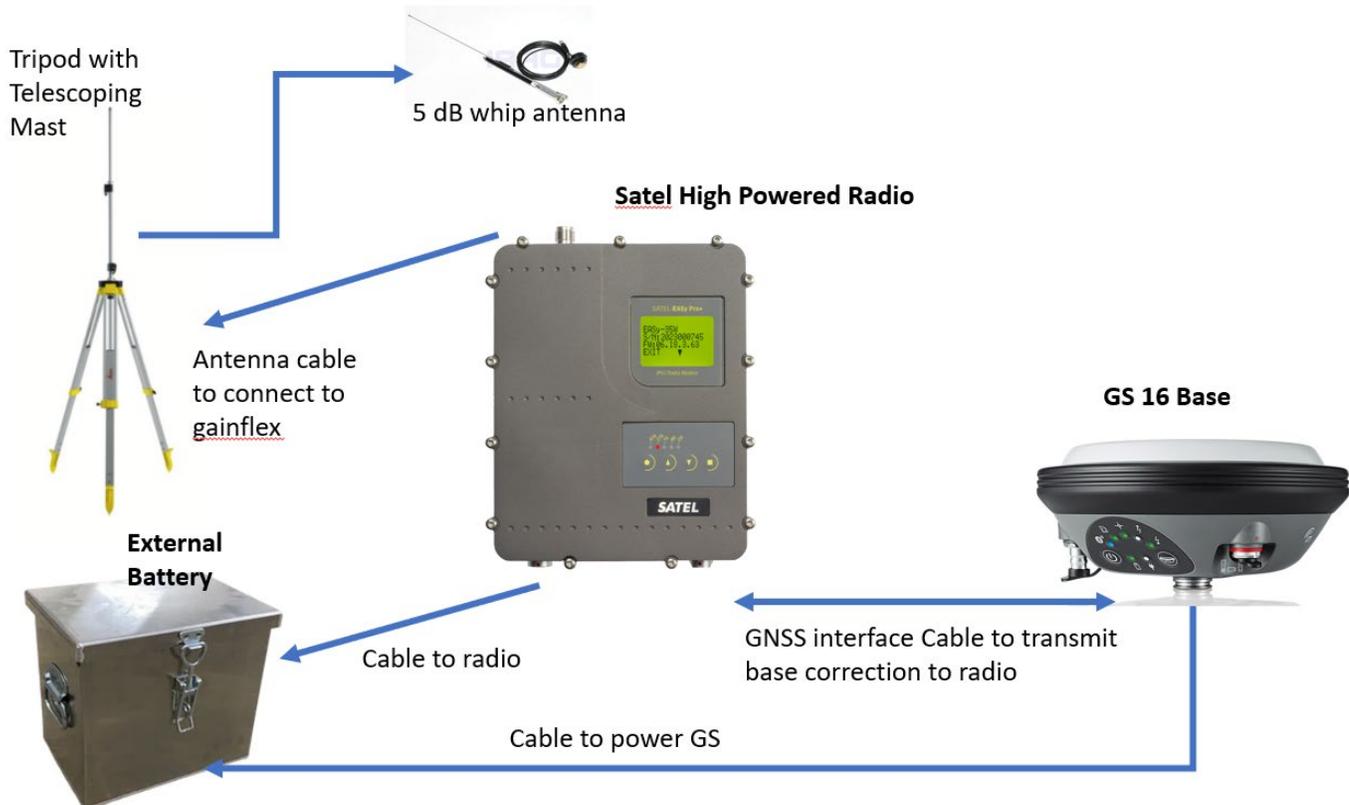
1. Ensure all the equipment to connect the Base sensor and the radio are present and connect them accordingly. Each UHF radio may be slightly different but refer to the diagram above.

2. In Captivate, select 'Switch to base' to activate the base station menu.
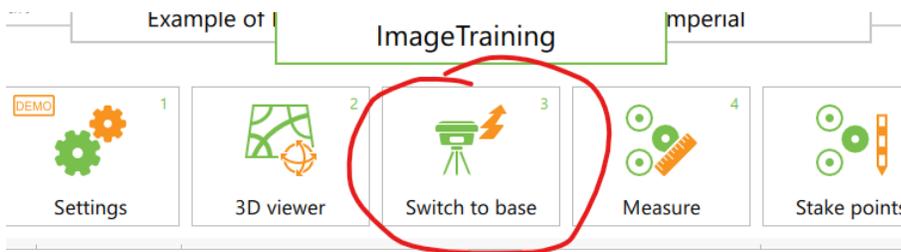
3. If no Bluetooth connection is established with the base antenna, go to 'settings' -> 'Connections' -> 'Connect to base' and run through the wizard to connect to the GS sensor

4. From the base main menu go to 'Settings' –> ' Connections' -> 'All other connections' then highlight 'GS internet' and press F3/Edit
   a. Uncheck 'Use Internet connection on GS'

5. Highlight 'Base RTK 1' then press F3/EDIT. Check the box that says 'Transmit RTK Base info'
   a. Set the 'connect using' to 'GS port 1' (*Note: on GS10/15, the GS Port# may vary depending the port in which the cable is plugged in*)
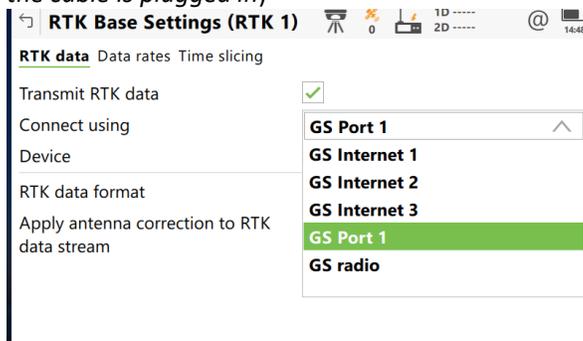
   b. Set Device by selecting F5 <Device> to the appropriate UHF external radio used:
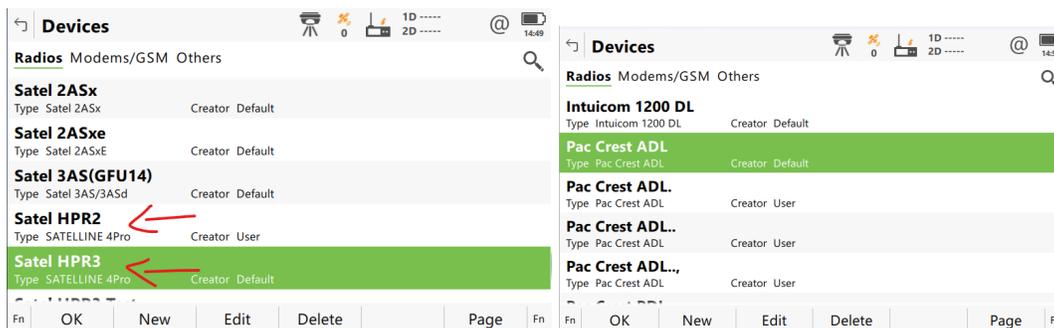
   Note: ensure that type: <GS radio> is not selected as the device option.

   Please note if the following message pops up:
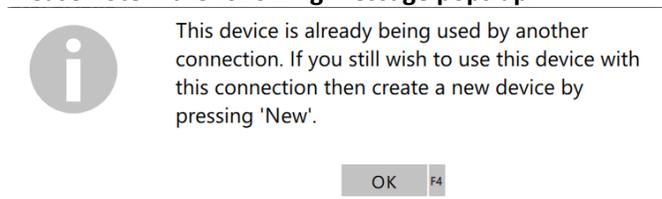
Follow the message and press 'NEW' and rename the *Device* to a unique name leaving all the parameters the same.
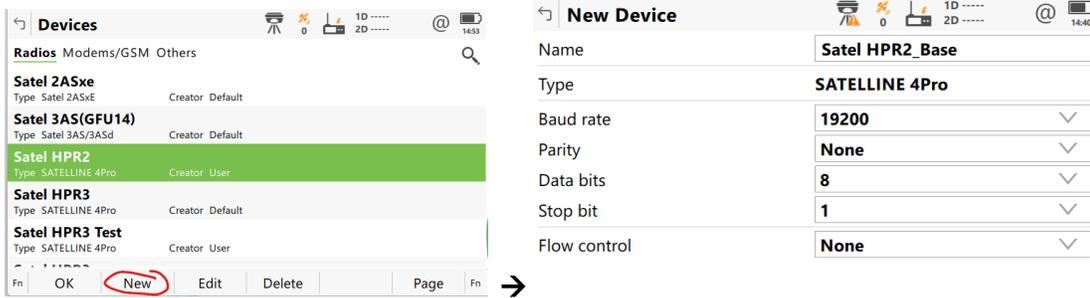
Press STORE, and select the newly created device.

  c. Set 'RTK data format' as '*RTCM v3(MSM)'* or '*Leica 4G'*,
  d. Page/F6 to Data rates, and left all information as default. Make note of RTK base ID. Then press OK.

6. Press F4/Control (Radio Settings).
    a. Set 'Channel' to a desirable channel '1, 2,etc. ', *NOTE: Please make note of the actual frequency which will be displayed*
    b. Set 'Radio protocol' to '**Satel 4-FSK' with FEC on.**
    c. Press OK twice to return to the main menu.
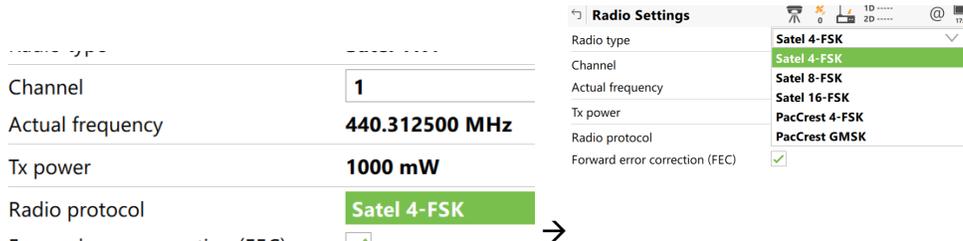
7. Set up the base station using normal procedure (any position, known point, or last point)
8. You should notice the UHF icon in the status bar with an arrow pulsing upwards , a flashing on the BASE upward LED on the GS sensor, and lastly, a transmit LED on the external RADIO itself.
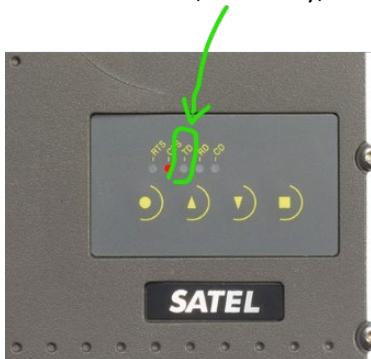
Setting up the rover

1. Ensure that any rover GS sensor used is turned on, and the radio antenna is connected to the GS sensor.
2. From the main menu, select 'Switch to rover'
3. If no Bluetooth connection to the rover GS is present, go to 'Settings' -> 'Connections' -> 'GS connect wizard' and

follow the prompts for the Bluetooth connection.

4. Go to 'Settings' -> 'Connections' -> 'All other connections', then select the 'GS connections' tab, highlight 'RTK rover', then press F3/Edit, and then check the box 'Receive RTK data'. Also set the following fields.

   a. 'Connect using' as 'GS radio'
   a. Set RTK Device by selecting *F5/Device.*
      - For GS14 select *Satel OEM22 or 20 (M3-TR3*)
      - For G16/18i,t select Satel M3-TR4, TR4, or TR4+
      Note: ensure that type: <GS radio> is not selected as the device option.
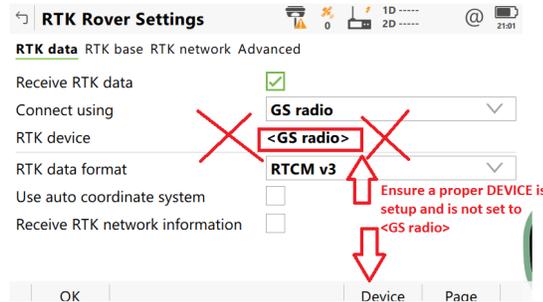
   Note: If message pops up "This is device is already being used…", press OK, high a device, and press F2/New, and enter a Name that is unique and press STORE, and then OK to pick the device.

   b. Set 'RTK data format' as 'RTCM v3' or '**Leica 4G**' (As long as it matches what was set up in step *5c* of the base setup:
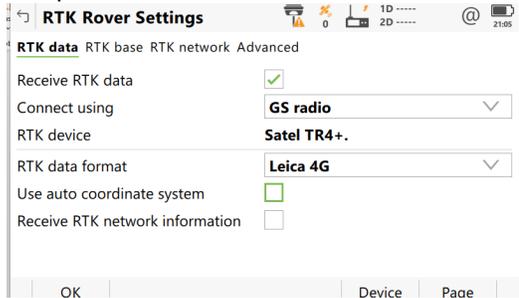
   c. Leave all boxes below should be left unchecked. (Use auto-coordinate…Receive RTK….,)

5. Select the 'RTK base' tab, and ensure that 'Automatically detect' is used for the fields, and unique ID is unchecked. (Or is matched by BASE ID set in step *5d*)

6. Select the 'RTK network' tab and ensure that all boxes are unchecked, then press OK.

7. Press F4/Control to review the Radio Settings:
   a. Set 'Channel' to a desirable channel '1, 2,etc. ', *NOTE: The Channel and Actual frequency should match what was set up in step 6a in the Base Settings.*
   b. Set 'Radio protocol' to '**Satel 4-FSK' with FEC on**.
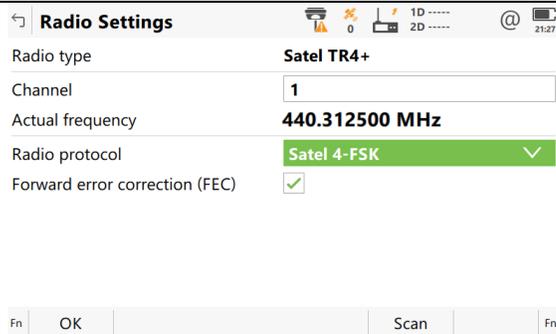
    c.   Press OK twice to return to the main menu.

8.   You should notice the UHF icon at the top has a downward flashing lightning bolt, which should match the GS sensor download lightning LED.

PLEASE NOTE:

The above radio settings are configured to recommended defaults that we use/tested in most typical cases. However, there are other options have can be selected that can affect communication.

Radio protocols are selected in the **Radio Settings** panel (same panel as where the radio channel is selected)
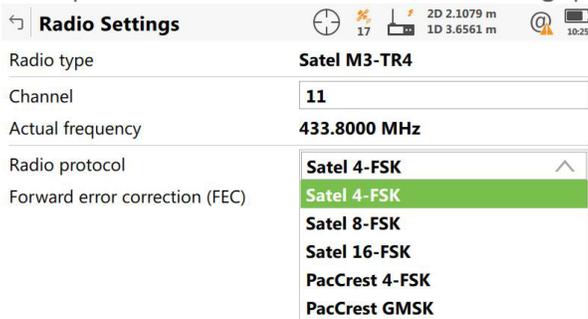
There are many factors which play a role in transmitting and receiving data between digital radios. (e.g. Height of base radio antenna above the surface, Forward Error Correction (FEC), Output power (Tx)…and much more)

NOTE: All Radio Settings (radio protocol, FEC) must be identical on the transmitting and receiving radio to communicate with each other.

Additional Note (Pac Crest External radios)
It is highly recommended to always use a Satel High Powered UHF radio as the external UHF source. However, while not recommended if a user choose to use a Pacific Crest External radio, here are the settings to pay close attention to:
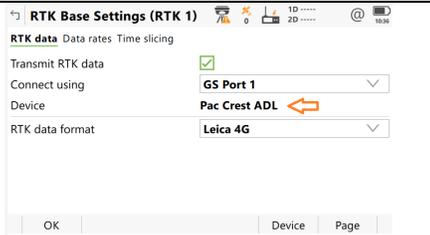
Change to the device to reflect the Pac Crest type
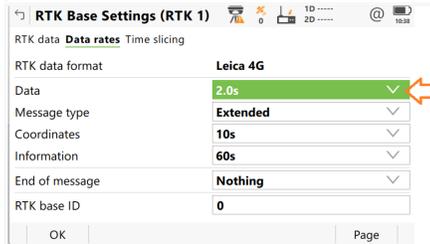
GNSS is constantly improving with increasing number of satellites and increasing number of signals. This means the amount of correction data is also constantly increasing. Oftentimes, if 20+ satellites or more are tracked then data speeds may not sufficient with the use of Pacific Crest radios. It is not enough to transmit the whole correction message within one second. With Pac Crest GMSK, there could possibly be a bigger latency in the transmission, it is suggested to change to **2.0s rate**
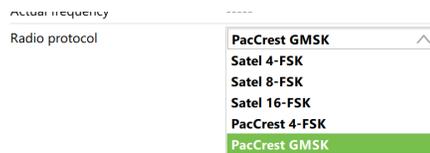
Ensure on the Rover radio is set to receive the Pac Crest GMSK Radio protocol format

Radios purchased/rented from Spatial Technologies will generally have the following settings (as seen in the chart below) It important to note that we do **NOT** recommend making settings changes (such as protocol, modulation, FEC, on-air baud, serial baud) to the radio on the displays manually as they can affect communication between base/rover. Captivate has settings pre-configured and these are the typical settings found.

Radio	Protocol	Modulation	FEC	Air baud rate (25 kHz)	Serial Port baud rate:
Satel HPR2	Satel 3AS	4-FSK	On	19200 bps	19200 bps
Satel HPR3	Satel 3AS	8-FSK	On	19200 bps	19200 bps
Pac Crest ADL	Transparent EOT/EOC	GMSK	On	9600 bps	38400 bps
Pac Crest PDL	Transparent EOT/EOC	GMSK	On	9600 bps	9600 bps

For more information on UHF Radio communication, please visit support.stpg.ca or contact a local Spatial Technical Support personnel (support@stpg.ca)