SATEL

Mission-Critical Connectivity

SATEL RTK BRIDGE KIT

Installation guide V0.5

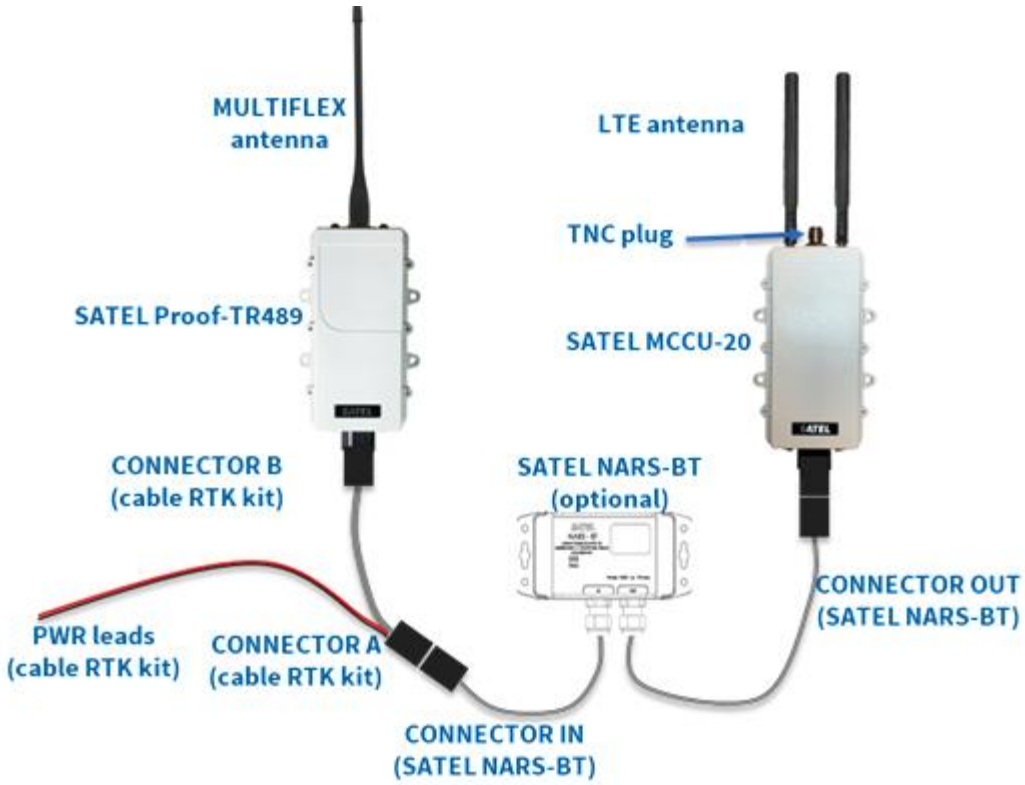
Contents

Step by step instructions on how to set up SATEL RTK Bridge kit

SATEL RTK Bridge kit content

SATEL RTK Bridge kit contains the following items:

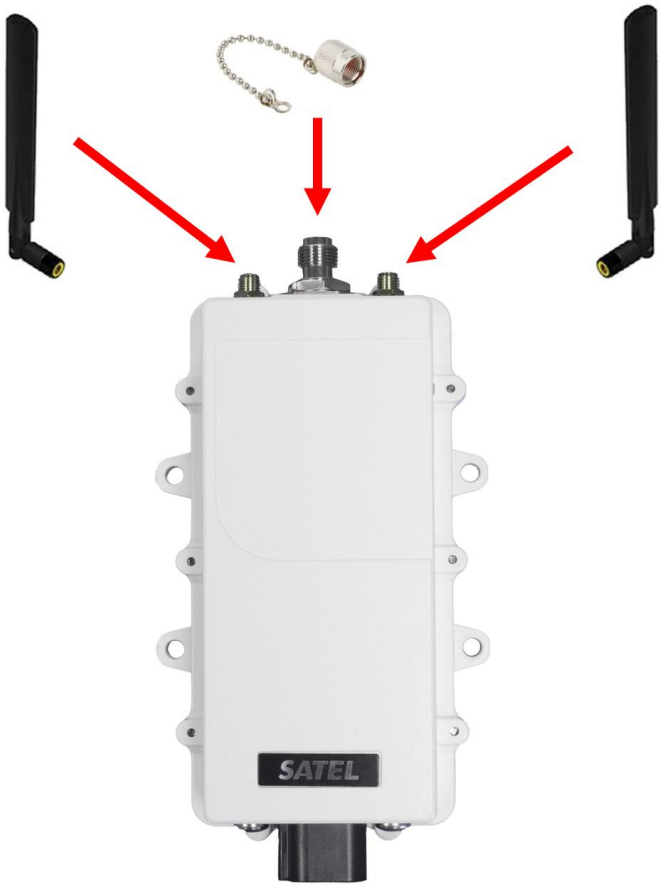
Product name, description	**Item code**	**Amount (pcs)**
SATEL MCCU-20, dual-technology RTK transceiver	YT02xx (exact code depends on the country variant)	1
SATEL NARS-BT, Bluetooth configuration device	YI0220	1 (optional)
SATEL Proof-TR489, multiband UHF radio modem transceiver	YM69xx (exact code depends on the country variant)	1
MULTIFLEX quarter wave antenna, 400 MHz frequency band	YA0101	1
LTE antenna, tilt & swivel whip antenna with SMA male connector	YA0614	2
TNC plug, for SATEL MCCU-20 UHF RF port	YA0500	1
Cable RTK Bridge, data /power (DT06-6S - DT06-6S with PWR split)	YC0285	1



Preparing SATEL MCCU-20

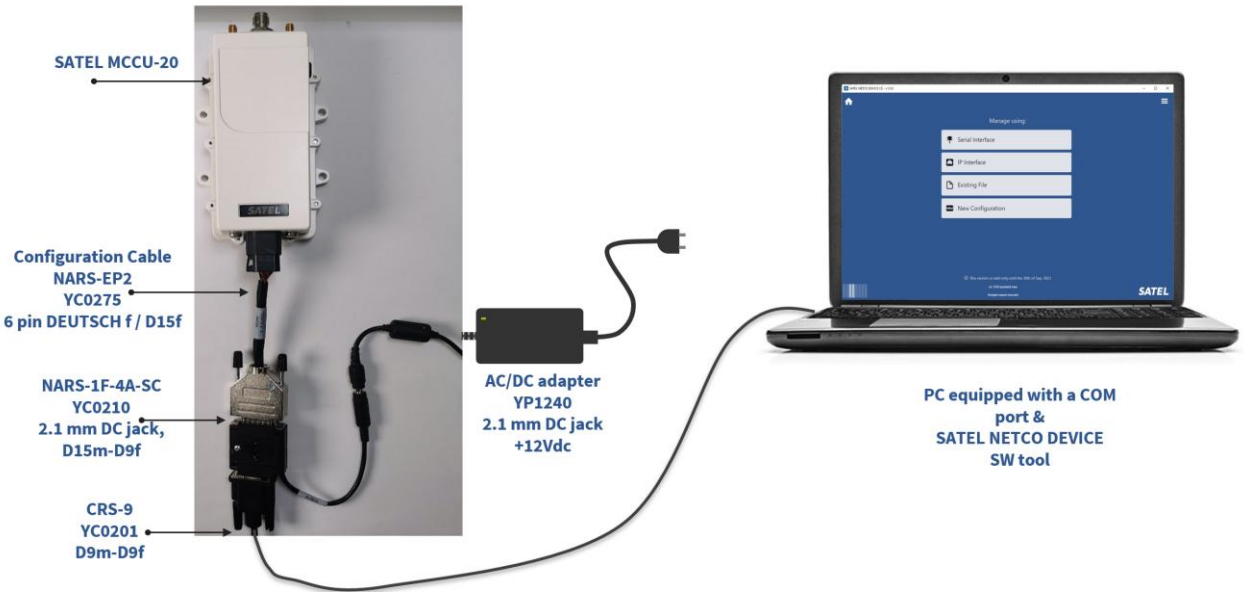
Antenna installations

1. Unbox SATEL MCCU-20
2. Install TNC plug (YA0500) on SATEL MCCU-20 TNC-connector
3. Install LTE antennas (YA0614) on SATEL MCCU-20 SMA-connectors

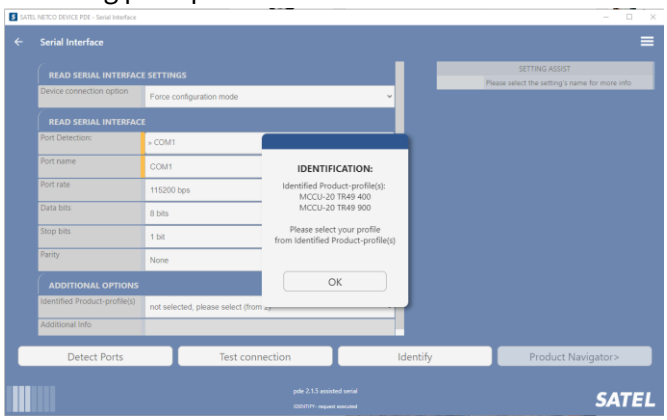


Powering up SATEL MCCU-20 and setting initial configurations

1. Plug in NARS-EP2 (YC0275, not included in RTK kit) and NARS-1F (YC0200, not included in RTK kit).
2. Plug NARS-1F into your computer RS232 interface. Plug in power source to NARS-1F and SATEL MCCU-20 powers up.



3. Open SATEL NETCO DEVICE software tool:
    a. Select Serial interface from SATEL NETCO DEVICE
    b. Setup Serial interface parameters. By default, SATEL MCCU-20 has the following serial interface parameters in place (change SATEL NETCO DEVICE parameters to match the following):
        i. Port rate: 115200 bps
        ii. Data bits: 8 bits
        iii. Stop bits: 1 bit
        iv. Parity: None
    c. Press Indentify -button, SATEL NETCO DEVICE connects to SATEL MCCU-20 and shows the following prompt with identification information



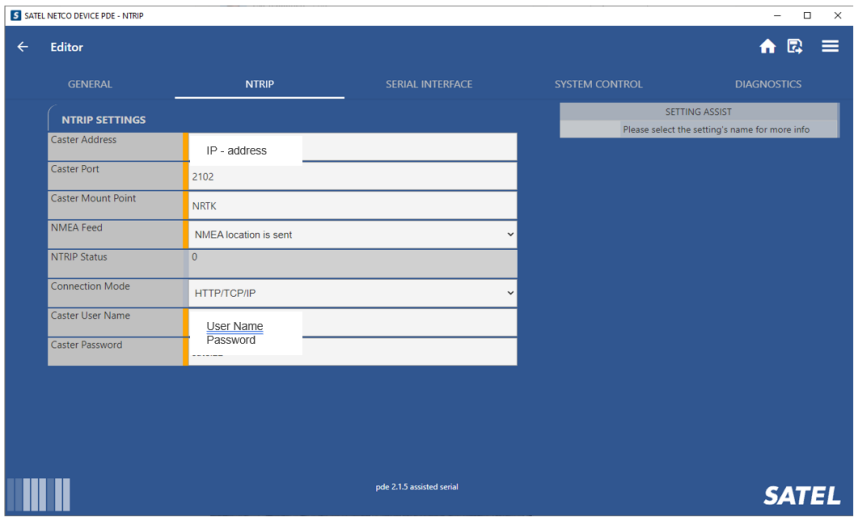
    d. Press OK and continue to “Product Navigator”.

e. SATEL NETCO DEVICE shows the following view

f. Select “MCCU-20 Host” and press Editor -button

g. Go to NTRIP tab and Set NTRIP – Caster settings (NTRIP Caster service provider provides the following information):

i. “Caster Address”, IP – address
ii. “Caster Port”, IP port
iii. “Caster Mount Point”
iv. “NMEA Feed”, ON/OFF (Caster specific)
v. “Connection mode”, normally TCP
vi. “Caster User Name”
vii. “Caster Password”



h. Finally remember to save and write your settings to SATEL MCCU-20 device!
Select “Write configuration to target” from upper right corner ( ) → Write configuration to “Serial Interface” → “Write” → “Synchronization done!” → OK.

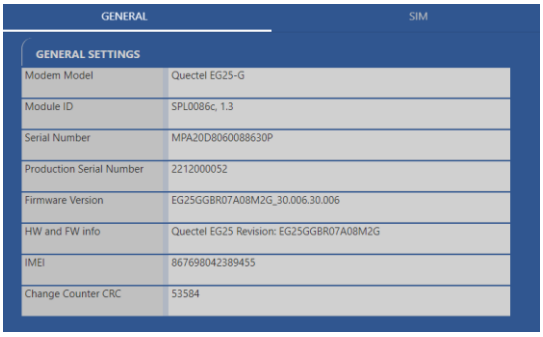
Setting initial LTE settings

NOTE: In case you are using SATEL Connect – Global Connectivity service, you can skip this phase, SATEL MCCU-20 by default has SATEL Connect settings in place.

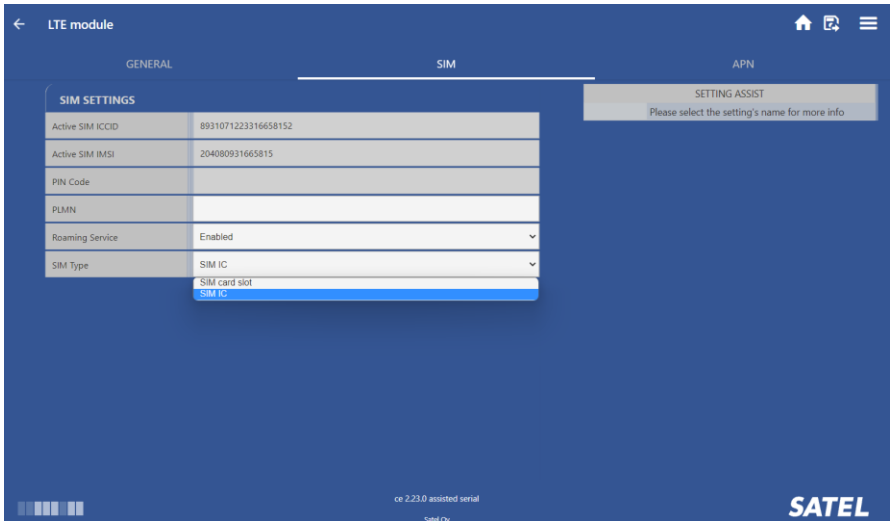
NOTE2: In case you are planning to use local SIM, please make sure that PIN request is disabled on SIM.

1. It is possible to navigate back to Product Navigator by clicking upper left corner arrow (“back button”) to previous menus.
2. Open SATEL NETCO DEVICE main menu page, select LTE module and press Editor

3. In General info section you check SATEL MCCU-20 details



4. Go to SIM tab and from SIM tab you find general SIM information, like ICCID number, if you would like to activate SATEL Connect – Global Connectivity service. ICCID number can also be found from product box identification sticker as QR code.
5. Change SIM slot setting (“SIM IC” setting is default) by using dropdown and selecting “SIM card slot”



6. Set APN settings (Your local cellular carrier provides the following information):
    a. APN name (default APN is satel.movedata.mobi)
    b. APN username (if not in use, leave the field blank)
    c. APN password (if not in use, leave the field blank)

7. Finally remember to save and write your settings on the SATEL MCCU-20 device!
   Select “Write configuration to target” from upper right corner ( ) → Write configuration to “Serial Interface” → “Write” → “Synchronization done!” → OK.
8. Press Home button on upper right corner of NETCO DEVICE. Plug off NARS-EP2 from SATEL MCCU-20, the device is now ready to be used in RTK bridge kit!

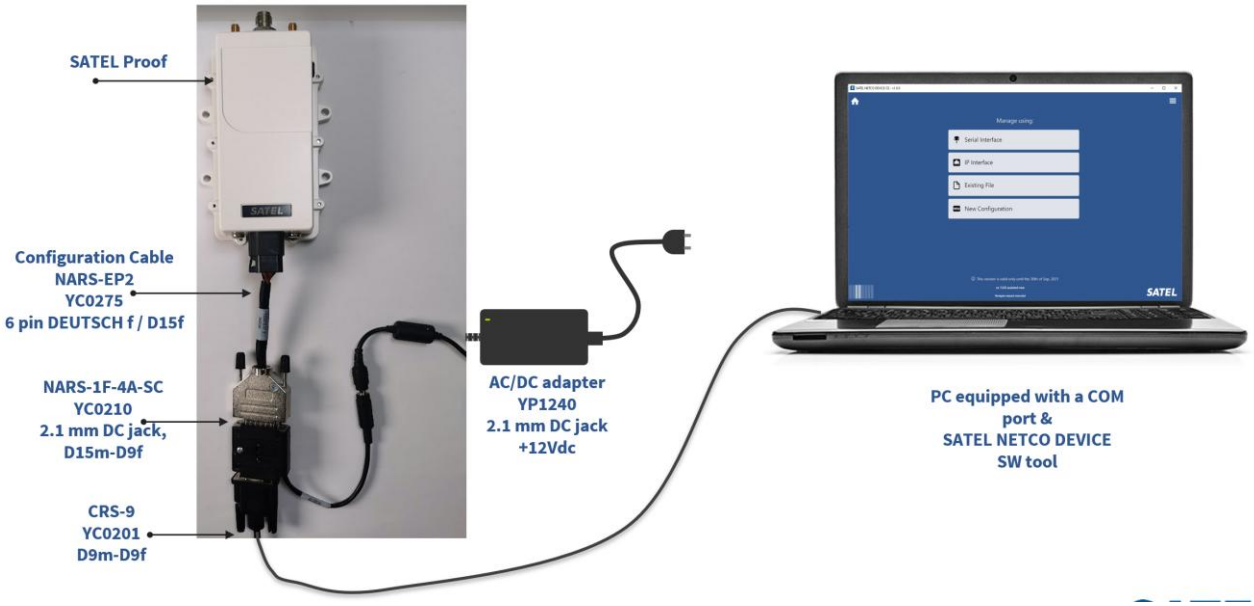
Preparing SATEL Proof-TR489

Antenna installation

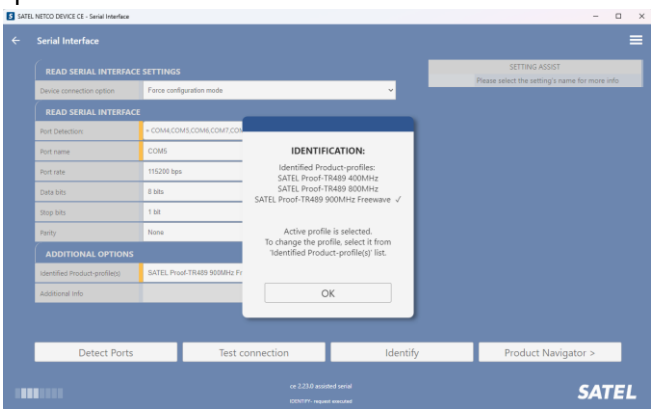
1. Unbox SATEL Proof-TR489
2. Install MULTIFLEX antenna on SATEL Proof-TR489 TNC-connector

Powering up SATEL Proof-TR489 and setting initial configurations

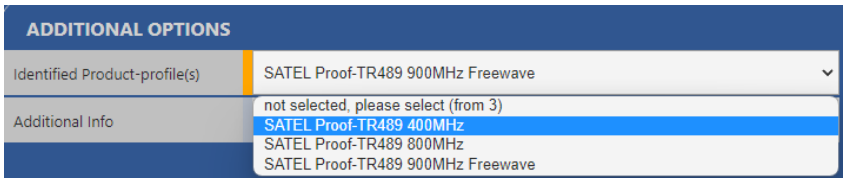
1. Plug in NARS-EP2 (YC0275, not included in RTK kit) and NARS-1F (YC0200, not included in RTK kit).
2. Plug NARS-1F into your computer RS232 interface. Plug in Power source to NARS-1F and SATEL Proof-TR489 powers up.



3. Open SATEL NETCO DEVICE software tool:
    a. Select Serial interface from SATEL NETCO DEVICE
    b. Setup Serial interface parameters. By default, SATEL Proof-TR489 has the following serial interface parameters in place (change SATEL NETCO DEVICE parameters to match the following):
        i. Port rate: 115200 bps
        ii. Data bits: 8 bits
        iii. Stop bits: 1 bit
        iv. Parity: None
    c. Press Indentify -button, SATEL NETCO DEVICE connects to SATEL Proof-TR489 and shows the following prompt with identification information:



d. Press OK. Select the desired product profile (available profiles depend on the country variant):



e. Select “Product Navigator” to continue to “Product Navigation”. Select “Editor to continue. SW reads radio parameters.

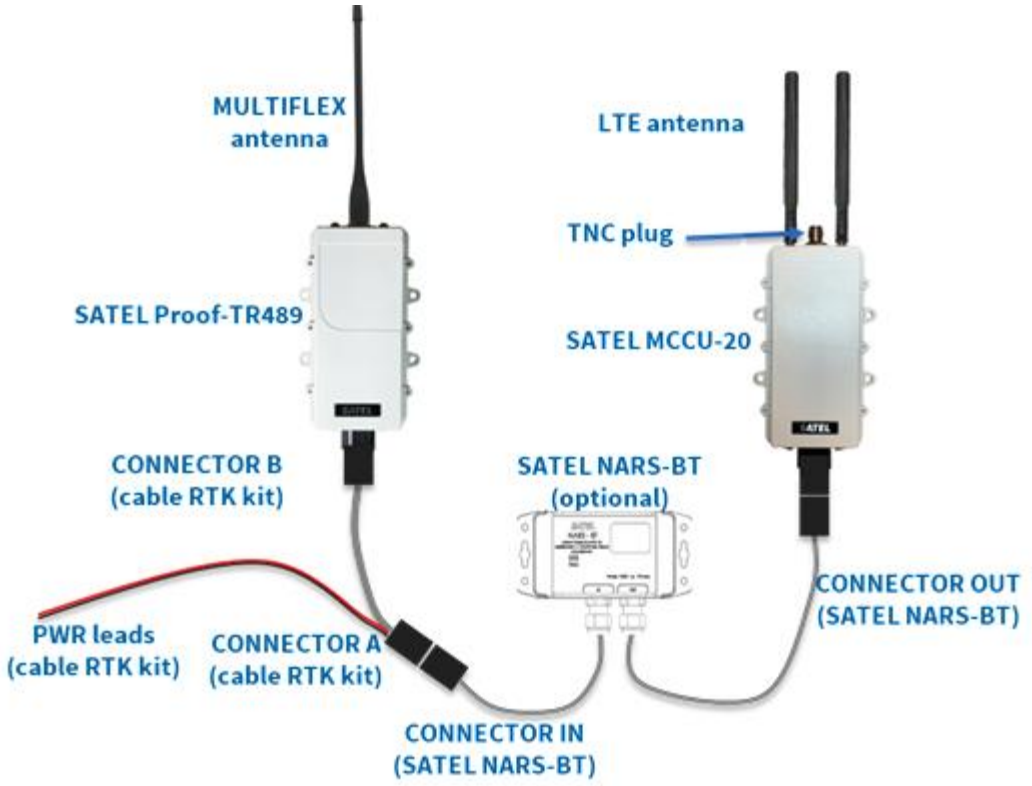
f. Set radio settings (check local authorities and your radio license to get correct information of locally approved radio parameters). Radio critical parameters depend on the used frequency band. 400/800MHz frequency bands:
   i. TX Frequency
   ii. Channel Spacing
   iii. Compatibility mode (default: SATELLINE-3AS)
   iv. FEC Mode (ON/OFF)

g. Finally remember to save and write your settings to SATEL Proof-TR489 device!
   Select “Write configuration to target” from upper right corner ( ) → Write configuration to “Serial Interface” → “Write” → “Synchronization done!” → OK.

h. Press Home button on upper right corner of NETCO DEVICE. Plug off NARS-EP2 from SATEL Proof-TR489, the device is now ready to be used in RTK bridge kit!

Preparing SATEL NARS-BT(optional)

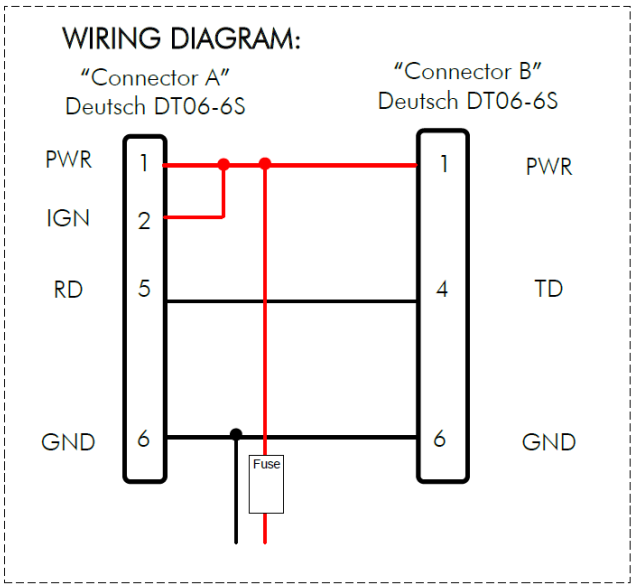
Please see “SATEL NARS-BT Quick Guide“ document for detailed information.



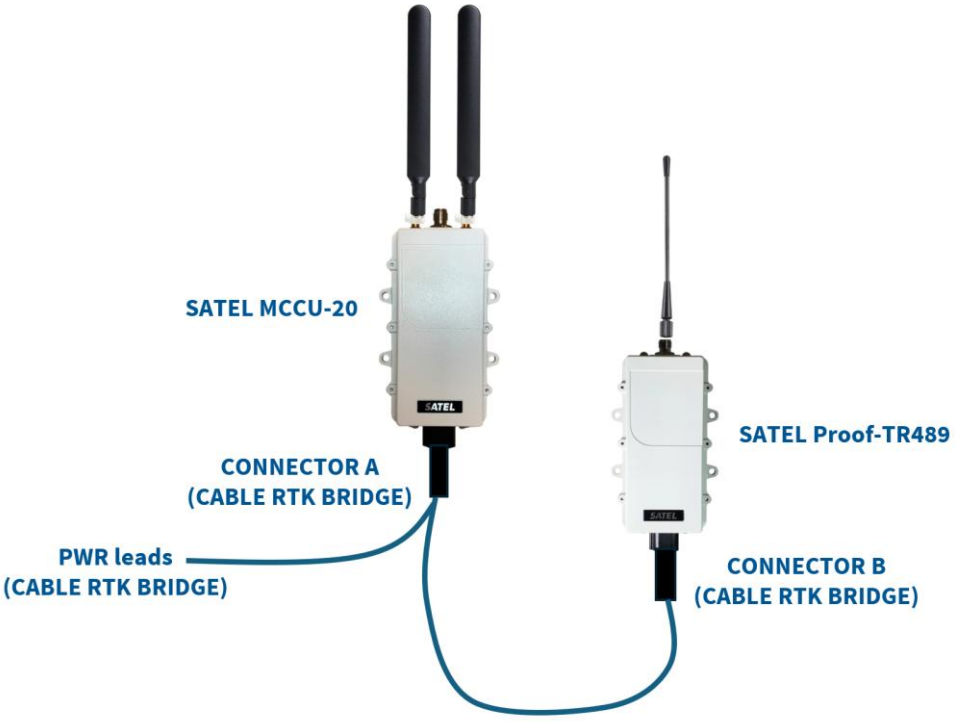
Assembling SATEL RTK Bridge kit

Electrical installations without SATEL NARS-BT

1. Take SATEL MCCU-20 and plug in Cable RTK Bridge (DT06-6S - DT06-6S with PWR split) Connector A to SATEL MCCU-20 DT-connector
2. Take SATEL Proof-TR489 and plug in Cable RTK Bridge (DT06-6S - DT06-6S with PWR split) Connector B to SATEL Proof-TR489 DT-connector
3. Cable RTK Bridge has PWR leads with fuse, plug Cabel PWR leads into power source. Cable has built-in glass tube 2,5A fuse. The recommended output voltage of power source is between 9-36V and recommended minimum output power of the power source is 12W. Cable wiring diagram is shown below:

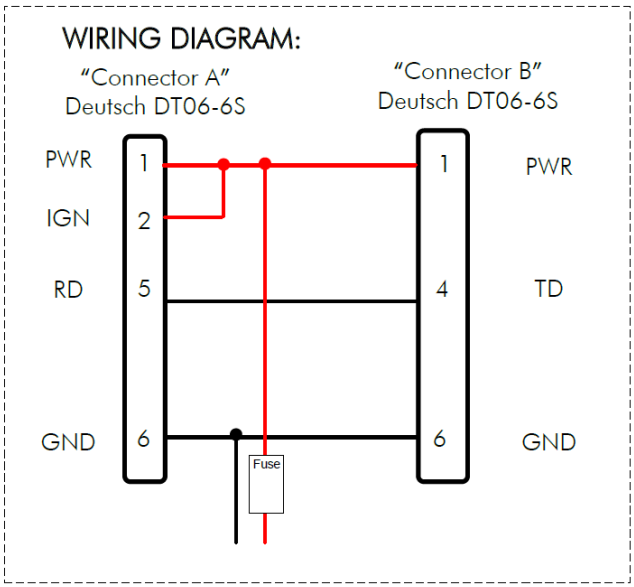


4. The final setup is shown below:

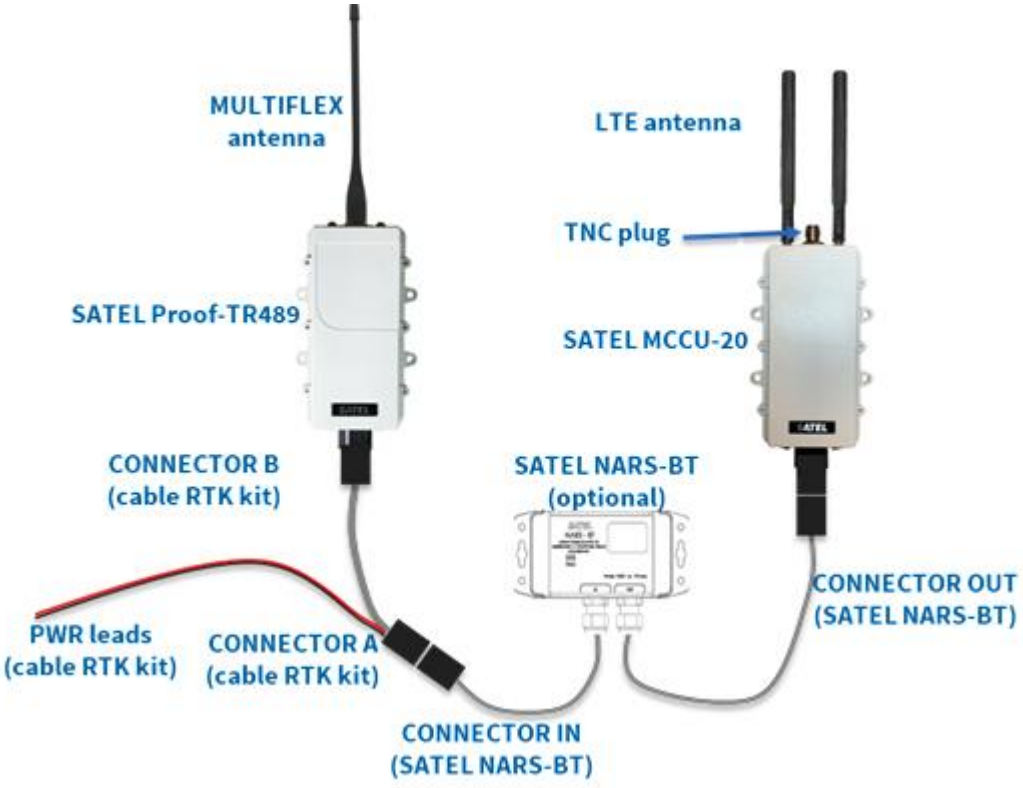


Electrical installations with SATEL NARS-BT

1. Take SATEL MCCU-20 and plug in SATEL NARS-BT Connector IN to SATEL MCCU-20 DT-connector
2. Take Cable RTK Bridge (DT06-6S - DT06-6S with PWR split) and plug Connector A to SATEL NARS-BT Connector OUT
3. Take SATEL Proof-TR489 and plug in Cable RTK Bridge (DT06-6S - DT06-6S with PWR split) Connector B to SATEL Proof-TR489 DT-connector
4. Cable RTK Bridge has PWR leads with fuse, plug Cabel PWR leads into power source. Cable has built-in glass tube 2,5A fuse. The recommended output voltage of power source is between 9-36V and recommended minimum output power of the power source is 12W. Cable wiring diagram is shown below:



5. The final setup is shown below:



Installation of SATEL RTK Bridge kit

Mounting SATEL RTK Bridge kit on surveying tripod

SATEL RTK Bridge Kit can be mounted several ways, for example on surveying tripod. On surveying tripod, the installation is done by using SATEL bag (YN0102). All devices shall be put inside the bag and PWR leads can be led outside bag to power source. The bag can be set hanging on suitable spot on a tripod, where tripod can still be used together with GNSS equipment, like Total Station and other measurement equipment.

By using SATEL bag, SATEL RTK Bridge kit is easy to remove and moved to another location.

Mounting SATEL RTK Bridge kit on moving vehicle

SATEL RTK Bridge Kit can also be mounted on a vehicle, for example directly to heavy machinery like excavators, bulldozers and such. On these environments it is strongly recommended to follow mounting instructions for each SATEL RTK Bridge kit device.

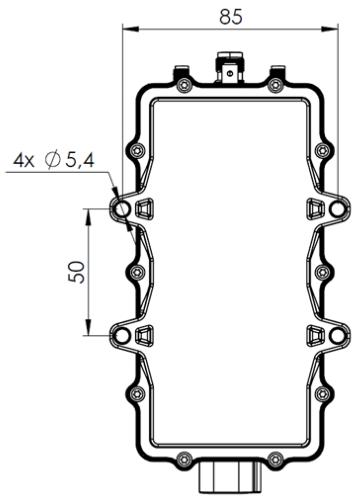
Mounting SATEL RTK Bridge kit on fixed position

SATEL RTK Bridge Kit can also be mounted in a fixed location, for example directly to wall or electrical cabinet. On these environments it is strongly recommended to follow mounting instructions for each SATEL RTK Bridge kit device.

SATEL RTK Bridge kit, device specific mounting instructions

SATEL MCCU-20 and SATEL Proof TR-489

SATEL MCCU-20 has four (4) fixing screw positions on its housing, which are used to attach the device to a structure, using M5 sized bolts or screws. Maximum torque for the bolts or screws is 5Nm. It is recommended to use M5 washer together with bolt/screw. The structure should be solid and even. There should be no curvature or bumps between device and the installation structure.



Electronic devices are sensitive to external influences which should be taken into consideration while taking the device into operation. Proper place for assembling is necessary for good performance and long lifespan. Even though SATEL devices are built to withstand external vibrations, shocks, temperature fluctuations and high/low temperatures still those occurrences should be avoided as much as possible to maximize the durability and longevity of the product. High temperature decreases the lifespan of the components whereas vibration and shocks weaken the mechanical structure and can drastically affect the performance in use.

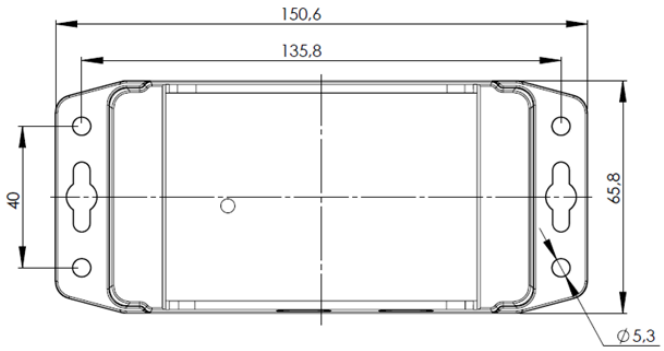
Grounding of SATEL devices

SATEL MCCU-20 and SATEL Proof-TR489 transceivers are equipped with grounding terminals. It is recommended to connect a ground wire from the grounding terminal to the earth ground and that all other interconnected devices share the same electrical ground potential. Besides the mains voltage safety, proper grounding is essential also for the error free operation of radio links and the protection against over-voltages and lightning. Although SATEL devices incorporate a robust internal surge protection, the surge spikes and power transients caused by lightning, ESD or other electrical systems must be discharged to earth ground.

Perform grounding of the system in accordance with local and national regulations. Check the grounding related information of other products in the system. Use short low impedance cables. Although DC resistance of a ground cable may be a fraction of an ohm, its impedance may be thousands of ohms on the radio frequency. Wide copper straps are the best. The ground connection should be connected directly to the power supply, not the ground connection of the load, to isolate the radio from voltage drops across the ground return for the load. Equipment for the radio system should be grounded in a star ground configuration. The center of the star should be usually connected directly to a good external earth ground scheme. The mast installations require special measures in the construction of ground electrodes and equipotential bonding – consult professional installation providers.

SATEL NARS-BT (optional)

SATEL NARS-BT is recommended to be mounted to fixed position by using 4 pcs max. M5 size mounting bolts/screws. Mounting bolt/screw template is shown below. Mounting bolts/screws are not included in the package. Recommended mounting direction of SATEL NARS-BT is cable glands downwards.



Preparing SATEL Command for SATEL RTK Bridge kit with SATEL NARS-BT

Please, before proceeding to pairing of devices, check that your mobile device has Bluetooth ON and Bluetooth connection set to be discoverable. Also check that SATEL RTK Bridge kit is powered ON.

Pairing SATEL Command with SATEL NARS-BT

Ensure that SATEL NARS-BT LED is blinking Blue (At first LED will lit as solid Green for a while, and after boot up turns Blue (blinking/solid), when paired devices can connect with SATEL NARS-BT and if none of paired devices are discoverable, LED starts blinking when SATEL NARS-BT device is discoverable and connection between mobile device and SATEL NARS-BT can be established).

NOTE: SATEL NARS-BT can be paired with new devices within 30 seconds after it has been Powered on. You can always connect to SATEL NARS-BT with paired devices, but for new connections, SATEL NARS-BT is discoverable only for 30 seconds.

SATEL Command application indicates the steps of device pairing with following views:

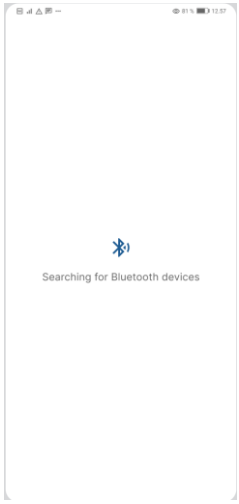


Figure 1. SATEL Command indicates when it is searching new SATEL NARS-BT devices

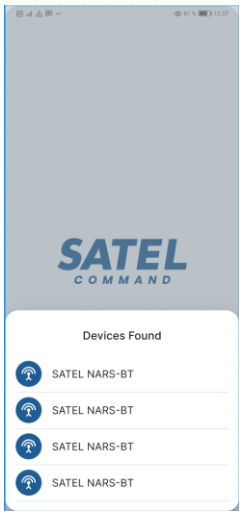


Figure 2. After seach, SATEL Command gives a list of devices (in case there are several units discoverable at the same time) and end user is expected to select the correct devices from list

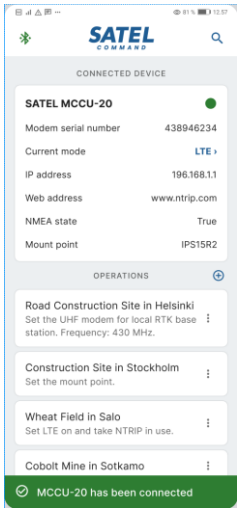


Figure 3. After selecting the device, SATEL Command indicates successful pairing

In case there are no discoverable SATEL NARS-BT devices available or somehow pairing procedure goes wrong, SATEL Command application indicates the lack of Bluetooth connection with following view:

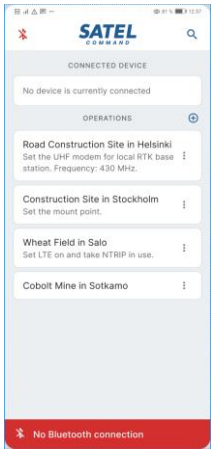


Figure 4. SATEL Command indicates if there are no connected devices

How to set SATEL Command for SATEL RTK Bridge kit?

General instructions regarding operation sets

Operations are based on SL commands and available SL Commands can be found from SATEL device manuals or integration guides. Multiple operation commands (SL commands) can be set with one operation set.

In SATEL Command operation set is based on .json -file, which can be created with any available text editor, but preferably Notepad, Notepad ++ or such. The format of operation set is shown below, which can be copied and pasted for example to Notepad text editor:

```
{
"name": "<free text>",
"description": "<free text>",
"commands": [
{
    "name": "<free text>",
    "command": "<SL-command>"
                    }
          ]
}
```

Attribute	Description
“name”	Free text field, write any descriptive name for operation set
“description”	Free text field, write more details for operation or operation set
“command”	SL-command which is supported by SATEL device

Figure 5. Attributes and descriptions which are present in configuration

After “name”, “description” and “commands” attributes comes [-

Example:

```
{
"name": "UHF configuration",
"description": "Configuring with UHF settings",
"commands": [
{
"name": "Select UHF mode",
"command": "SL&L=I200,SUHF"
},
{
"name": "Set frequency band to 400MHz",
"command": "SL&M=1"
},
{
"name": "Set active frequency",
"command": "SL&F=433525000"
},
{
```

"name": "Save parameters",
"command": "SL&L!I10"
},
{
"name": "Reboot the device",
"command": "SL&L!I1010"
}
]
}

When creating operation sets, which changes parameters or such and user expects these parameters to be saved and taken into use immediately, please remember to add save and reboot commands into operation set as well. Relevant SL-commands can be found from SATEL device manual.

In Notepad, write the operation set by using relevant SL command, save the file and give the file some descriptive name and remember to save file in .json -format. The steps of creating operation with Notepad are explained in following views:

Figure 6. Open Notepad and write the operation set, as explained in previous paragraphs

Figure 7. After operation set is having all the details needed, go to "File" and select "Save as"

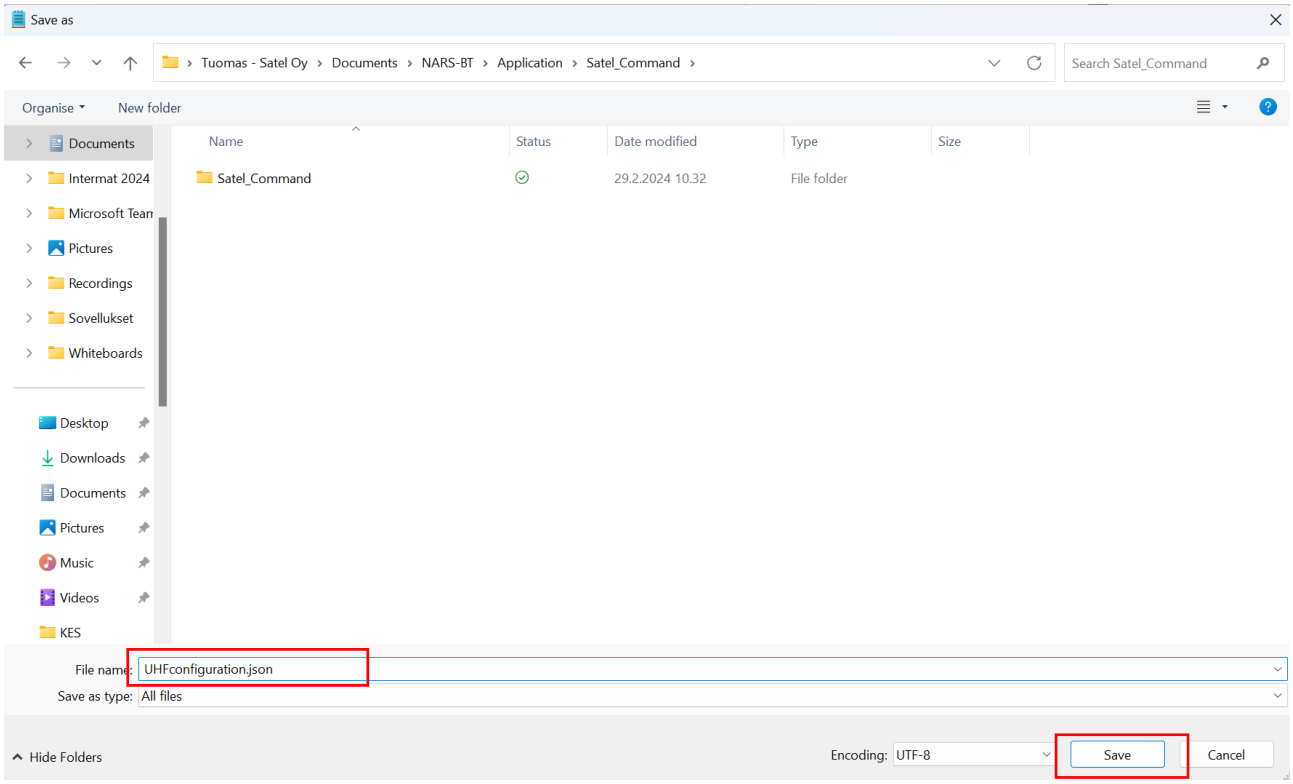


Figure 8. Select desired folder where to save the file and give the operation file a descriptive name. After the name, write ".json" to indicate the file format. After that, select "Save"

After saving the operation, you can send the operation set to desired user by e-mail, instant message etc.

Create operation set for SATEL Command to send static NMEA message to NTRIP caster

Several NTRIP caster services require static NMEA location message to be sent to caster before the data stream is capable to start. SATEL MCCU-20 can send static NMEA message, but message must be given by using specific SL-command.

- Set static NMEA position: *SL&L=I5002,S<NMEA>*
    - Example: SL&L=I5002,S$GPGGA,083827.813,6022.776,N,02306.326,E,1,12,1.0,0.0,M,0.0,M,,*62

Above coordinates marked as yellow, are coordinates which defines the desired location. In this example, the coordinates mark location of SATEL, in Salo, Finland.

Query the set (and saved) static NMEA position, command: *SL&L?I5002*

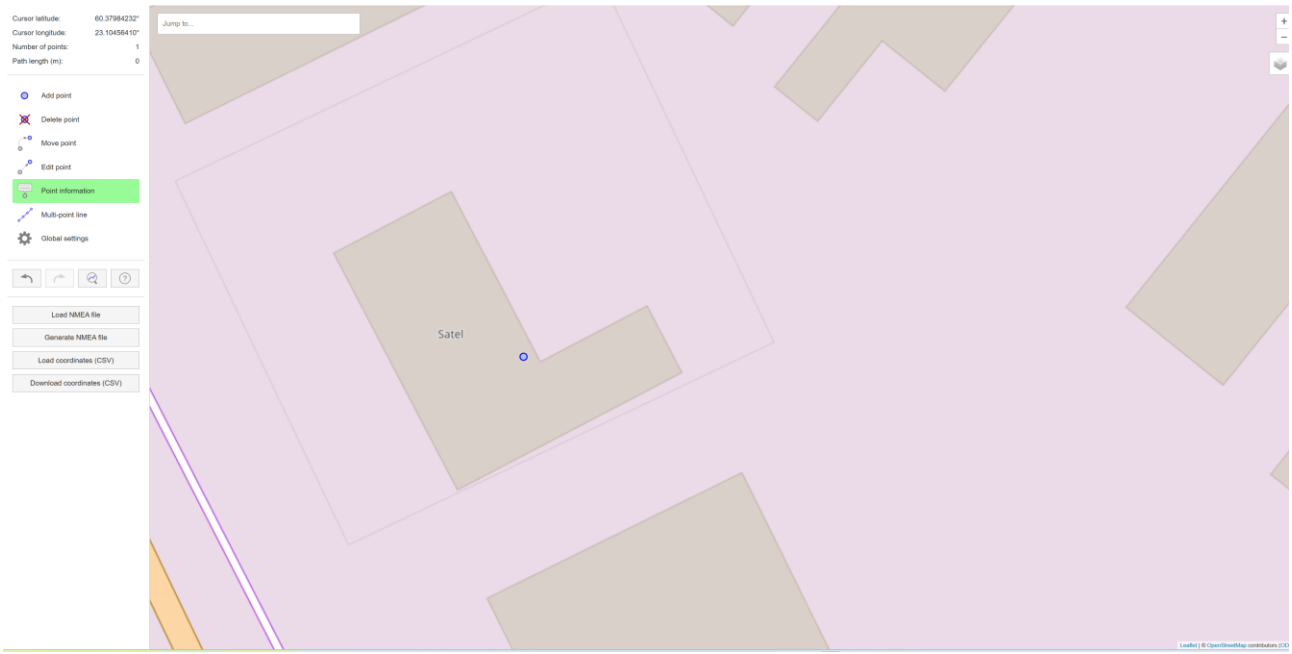
Set empty NMEA static position (i.e. "reset" static position), command: *SL&L=I5002,S*

Save (*SL&L!I10*) and reboot (*SL&L!I1010*) commands required for the new parameters to be taken into use.

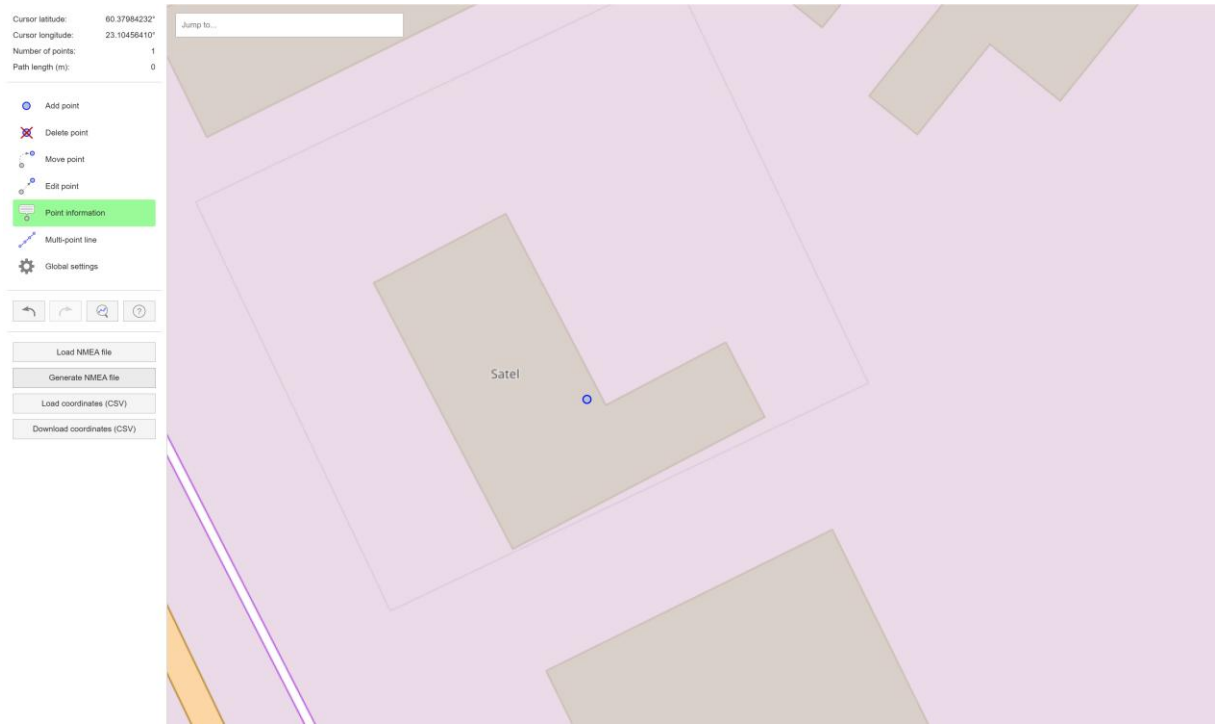
How to generate correct NMEA message?

1. Go to nmeagen.org -website
2. Find your location, and zoom in to correct location from where you would like to generate the NMEA message

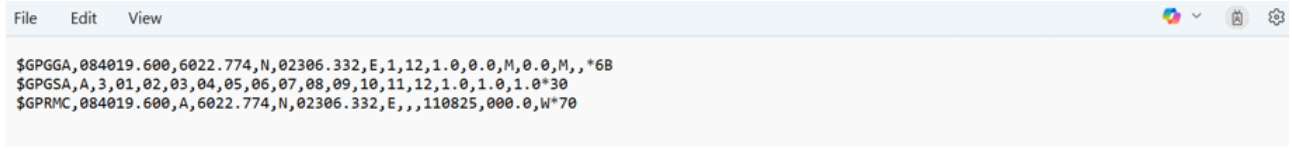
3. Select location by using your mouse and left click to location.
4. Go directly to left menu bar and select “Point Information”



5. On left menu bar, select “Generate NMEA file”



6. Your browser automatically downloads a file named “output.nmea”. Go to your download folder and find file “output.nmea”
7. When you find the file, click the file once with right button of your mouse and select “Open with” and open file for example with Notepad.
8. On Notepad, the file content looks like this:



9. Select the row, which starts $GPGGA... and copy the row. If your NTRIP Caster service requires NMEA message to be sent in $GPGSA or $GPRMC format, you select those from this file as well, but $GPGGA is the most common one.
10. Now you can paste the $GPGGA message directly to operation set file and use with SL-command, replace <NMEA> with copied $GPGGA message: *SL&L=I5002,S<NMEA>*
11. SATEL Command operation file with static NMEA location message looks like this:

```
{
        "name": "Set location 1",
        "description": "Static NMEA location message to NTRIP caster",
        "commands": [
                {
                        "name": "SATEL HQ coordinates",
                        "command":
"SL&L=I5002,S$GPGGA,083827.813,6022.776,N,02306.326,E,1,12,1.0,0.0,M,0.0,M,,*62"
                },
                {
                        "name": "Save coordinates",
                        "command": "SL&L!I10"
                },
                {
                        "name": "Reboot RTK kit",
                        "command": "SL&L!I1010"
                }
        ]
}
```

By using SATEL Command, end user can easily select the desired locations or locations where SATEL RTK kit is used. And when all the desired locations are prepared properly such that SATEL Command application has the desired locations stored as operation sets (operation buttons), user can easily command the kit to send new location to NTRIP caster by using the application.

After preparing the static NMEA location operation file properly, the file can be sent to end user by e-mail, or instant message.

Receiving operation set

When receiving operation set by e-mail, or instant message, open the e-mail or instant message with the device where SATEL Command is installed and targeted to be used. Save the operation set to your device into location which is easily accessible and can be found.

With iPhone, the Files app stores files on your iPhone, which can be accessed without an internet connection. When you receive an email with an attachment, you can use the Mail app to save it onto your iPhone or view the attachment.

To save file to Files app:

- Tap the preview to open the attachment full screen
- Tap the “Share” icon to open the Share options panel and choose “Save to Files” as the sharing option
- Check that “On My iPhone” is highlighted. Tap to highlight if it isn't
- Tap “Save”. When the Share options panel slides away, the file is saved to your iPhone.

With Android, you can store files to your phone, which can be accessed without an internet connection. On your Android phone, to save file to your phone:

- Open the e-mail app.
- Open the specific e-mail message where operation is sent
- Tap “Download”. Operation is being downloaded to your phones Download-folder.

Create operation button in SATEL Command

After receiving operation set, you can easily create operation button in SATEL Command.

After SATEL NARS-BT is powered on, and pairing procedure is finalised, in SATEL Command main view, in operations subsection, press “add” icon.

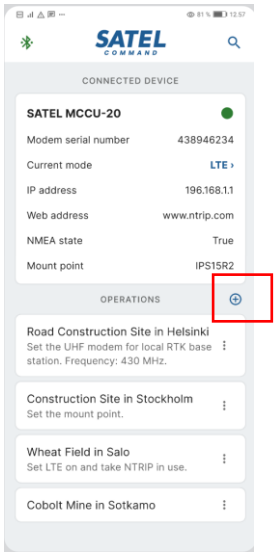


Figure 9. Add icon in SATEL Command main view

SATEL Command opens Files app, when using iPhone and default file manager application when using Android. Select the location where operation set is downloaded and select the desired operation set. Make sure the operation set is saved in .json -format. After selecting the operation set, new operation button appears under operations subsection.

If operation set is saved in wrong file version, SATEL Command gives an error, which states that operation cannot be added.

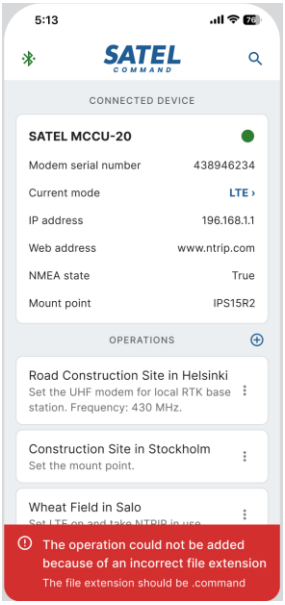


Figure 10. Error in SATEL Command, if operation set file format is wrong.

Using SATEL Command and operation buttons

Main view

SATEL Command -application main view gives user basic details of SATEL device, which is connected to SATEL Command -application through SATEL NARS-BT device.

Main view has the following basic information available:

- SATEL device type
- On upper left corner, green dot indicates that connection between SATEL Command -application and SATEL device is OK
- Modem serial number
- Current operation mode of SATEL MCCU-20 device

If SATEL MCCU-20 device is in LTE mode, the following information is given:

- IP address of NTRIP caster service
- Port of NTRIP of NTRIP caster service
- NMEA state of SATEL MCCU-20 device
- Mount point of NTRIP caster service, which is currently in use

If SATEL MCCU-20 device is in UHF mode, the following information is given:

- RX/TX Frequency
- Channel width
- FEC State
- Compatibility mode

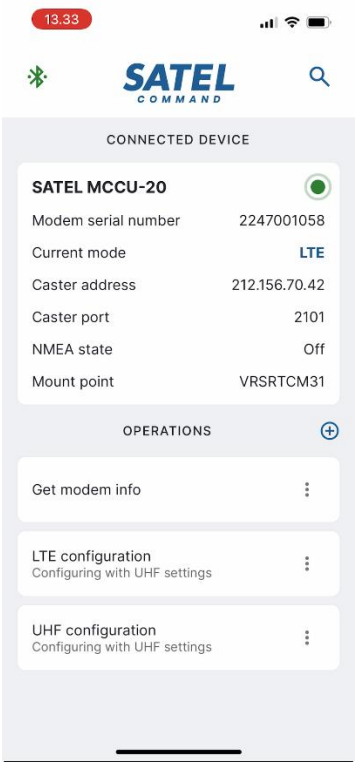


Figure 11. Main view when LTE Mode is on for SATEL MCCU-20.

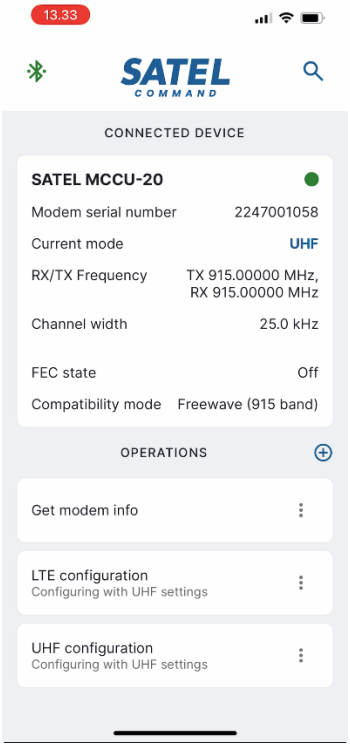


Figure 12. Main view when UHF Mode is on for SATEL MCCU-20.

Operation buttons

When having operations available as operation buttons in SATEL Command main view, executing operations are easy. Press desired operation button in SATEL Command main view and confirm the operation execution by pressing “OK”, when confirmation prompt is being showed. Operation can be cancelled as well in confirmation prompt, and SATEL Command directs the user back to SATEL Command main view.

Example: User wants to set change the settings of SATEL MCCU-20 to be correct for Road Construction Site in Helsinki

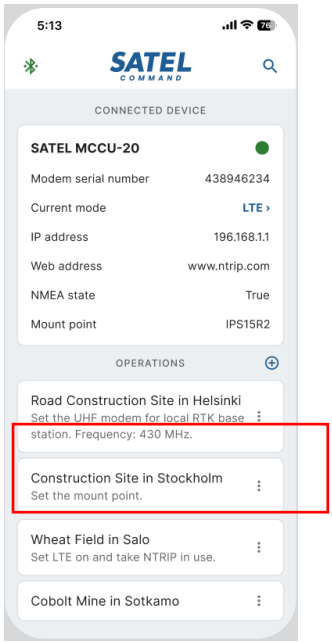


Figure 13. Select the desired operation to be executed, by pressing the operation button

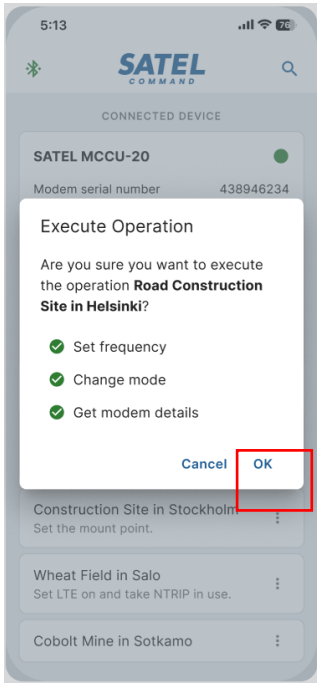


Figure 14. Confirm the operation by pressing "OK". By pressing "Cancel", you can cancel the operation.

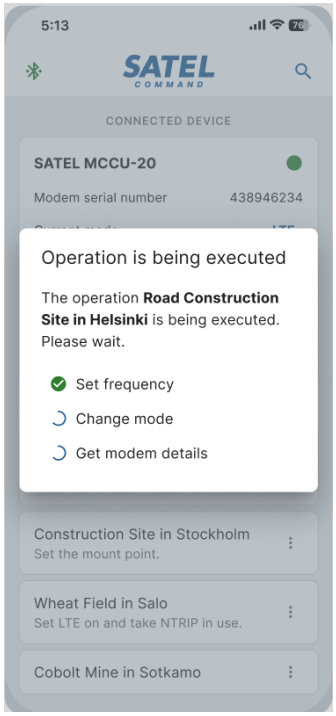


Figure 15. SATEL Command reports the progress while executing the operation.

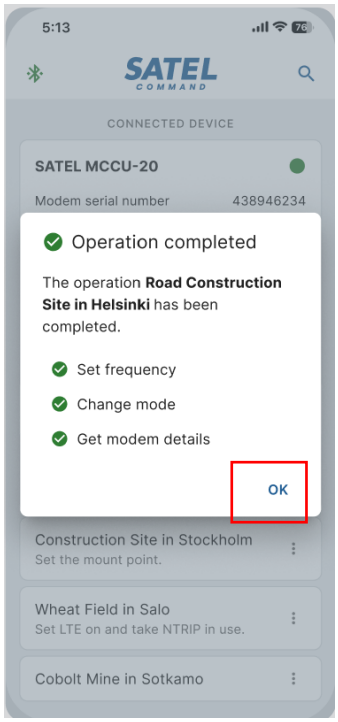


Figure 16. When operation is executed, SATEL Command reports "Operation Completed". If user waits for a while, SATEL Command also reports back, which return values it has got from SATEL device. If user don't want to wait for return values, by pressing "OK", application will direct user back to main view.

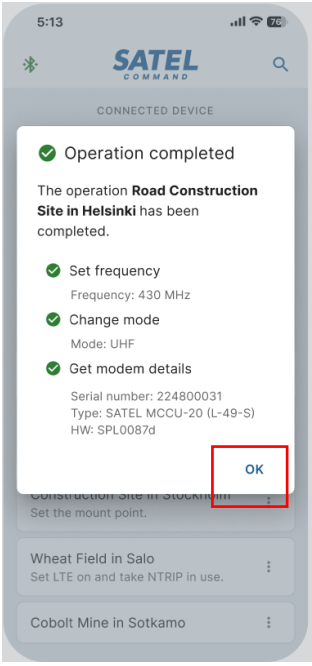


Figure 17. SATEL Command presents the return values after operation is fully executed. By pressing "OK", application will reload information from the device and return to application main view.

How to use SATEL RTK Bridge kit on daily basis

Using SATEL RTK Bridge kit on daily basis is very easy! This section presents the procedure how to set up the kit on principle level:

1. Set up the kit on desired location and power it up
2. Open SATEL Command application (pair your device with SATEL RTK Bridge kit, if not done yet)
3. Select the desired location button from SATEL Command application
4. SATEL Bridge kit is now ready and will provide the RTK correction to your system!