GNSS Setup

An Empirical Study with high precision location information

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10.07.2025

»"If people only talked about what they understood,
the world would be very quiet!"«

Albert Einstein (1879 - 1955)

1 GNSS SETUP WITH MOBILE PHONE

To receive GNSS (Global Navigation Satellite System) information at very high precision (cm resolution), an Emlid Reach M2 RTK (Real-Time Kinematic) GNSS-Modul (LINK) device is used. This device is setup in a yellow 3d printed casing (LINK, Figure 1). ATTENTION: Recharging the Emlid Reach M2 is possible with a thick USB-C cable only! Red LED is displayed when charging. The blue LED indicates the finish of charging. The casing is mounted to a bottle case at the MTB.

Figure 1: Emlid Reach M2 in a printed casing in a bottle casing at the mountain bike

The device requires a connection with a mobile phone. The Cubot Kingkong mobile phone does not work with Emlid Reach hardware. Due to the missing WPS PSK security protocol a connection cannot be established. Thus, a Samsung S22 mobile phone is used. The mobile phone is equipped with an SP Connect casing (LINK) or a universal phone clamp (LINK) and a stem mount connector (LINK).

1.1 ENABLING THE MOBILE PHONE

Switch the mobile phone on at the right side of the phone using the lowest bottom. Use an L texture for the code at the left side of the 3x3 matrix. The L is only the left and middle point at the bottom of the phone.

1.2 PREPARING THE ANDROID MOBILE PHONE

To prepare the mobile phone, the developer option needs to be enabled (Figure 2).

1. Open Settings: Locate and open the Settings app on your Android device.
2. Go to About phone: Navigate to the About phone section at the end of the list within Settings.
3. Scroll down and search for "Software information" and click on it.
4. Search for the "Build number". Tap it rapidly seven times.
5. Enter security credentials: If you have a lock screen set (PIN, pattern, or password), you will be prompted to enter it to enable Developer Options.
6. Access Developer Options: After successfully enabling Developer Options, you can find them under Settings > Developer Options (last entry).
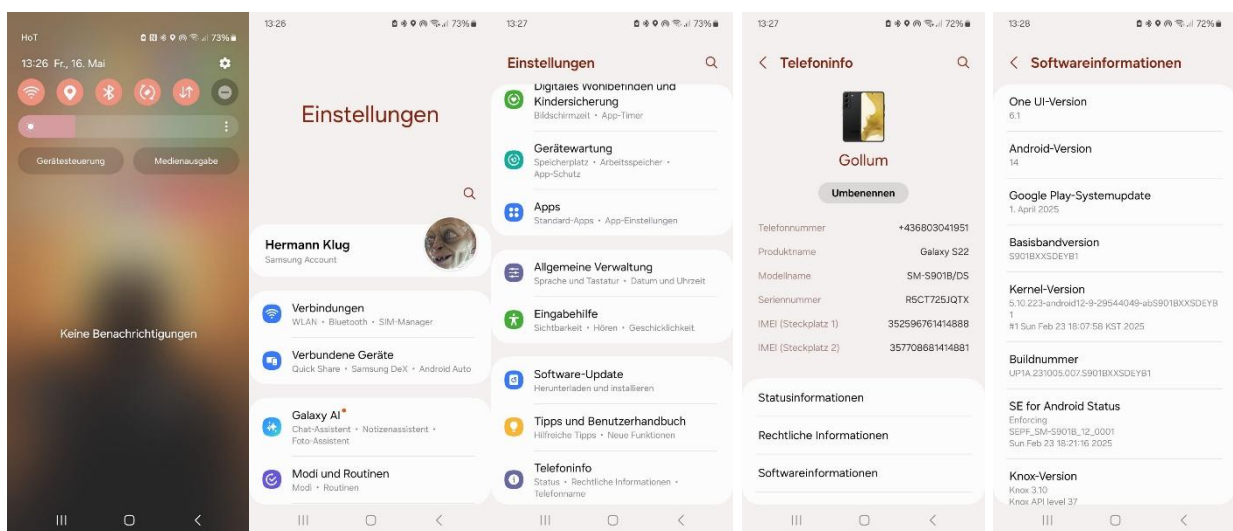

Figure 2: Enabling the Android developer options

Go to Developer Options in settings and choose full GNSS setting at the end of the list (Figure 3).
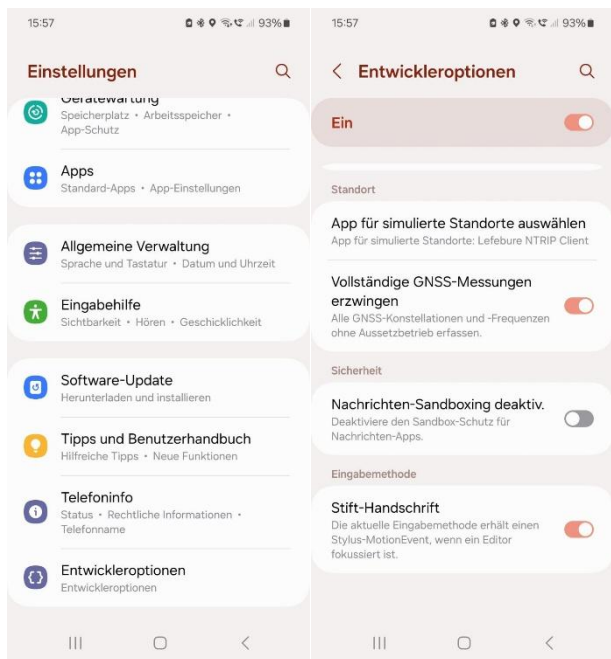
Figure 3: Developer options and enable full GNSS measures at the very end of the list (locations)

1.3 SAMSUNG S22 MOBILE PHONE CONNECTION TO GNSS

To connect the Emlid Reach RS2 to the Android mobile phone the following guideline is used.

1. Enable Hotspot and set "Network name" to "emlid" and "Password to "emlidreach". WPA-PSK (WPA2-Personal) security protocol (Figure 4, LINK). Bandwidth (2,4Ghz). This established a connection between the GNSS hardware and the mobile phone.
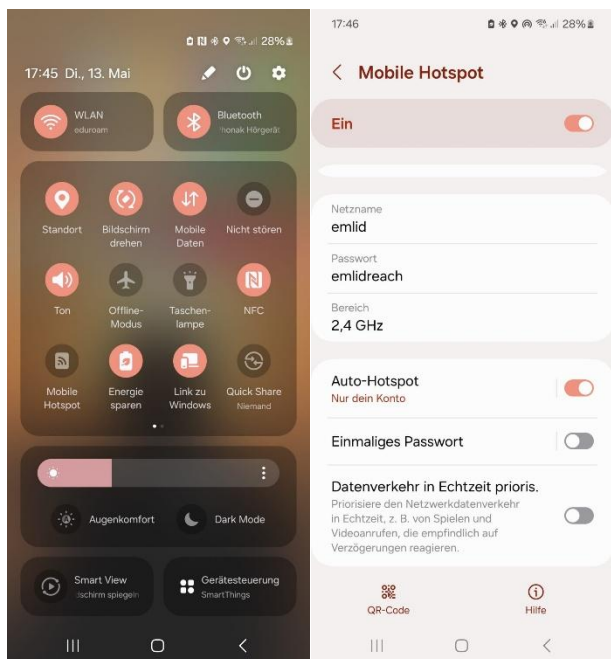

Figure 4: Enabling Mobile Hotspot

2. Switch on GNSS hardware (Figure 5). Watch out for the orange button. If nothing is displayed, load the GNSS with a thick (!) USB-C cable. If LED to the side of the plugin is red, GNSS is recharging. If it turns to blue, recharging is finished. If after approximately 15 seconds the second LED (blue) and afterwards he third LED (green) is blinking, wait for the "fix".

Figure 5: GNSS hardware in a 3D printed housing

3. Open Emlid Flow App (Software LINK) and wait until the hardware shows up (Figure 6). Connect to the hardware.
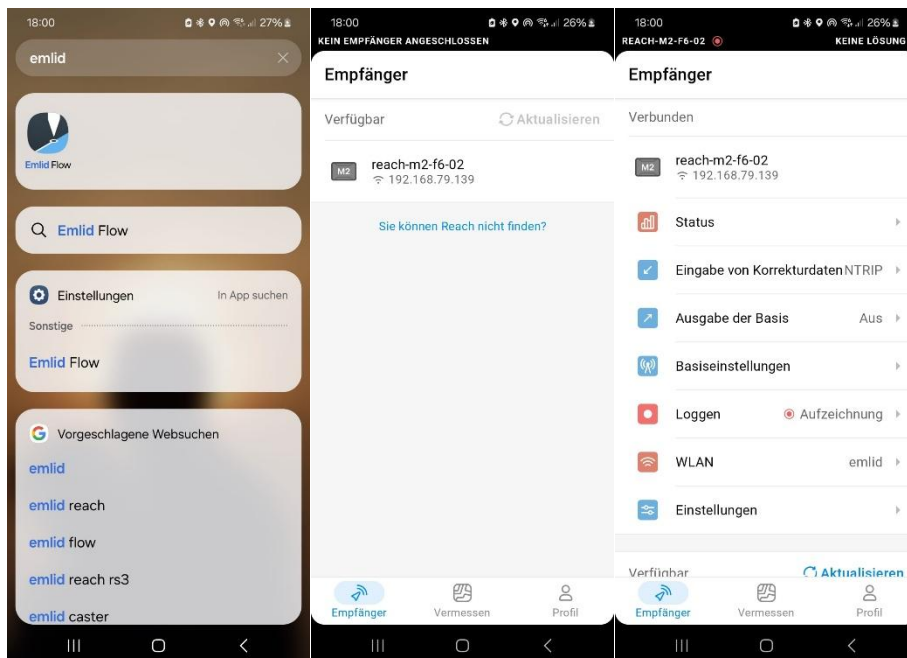

Figure 6: The Emlid Flow App

4. Check the Wifi connection to the "emlid" hardware (Figure 7). Check the "Correction input" values are received. Wait about fifteen seconds to receive satellite signals, return to main menu and check the "Status" from the menu.
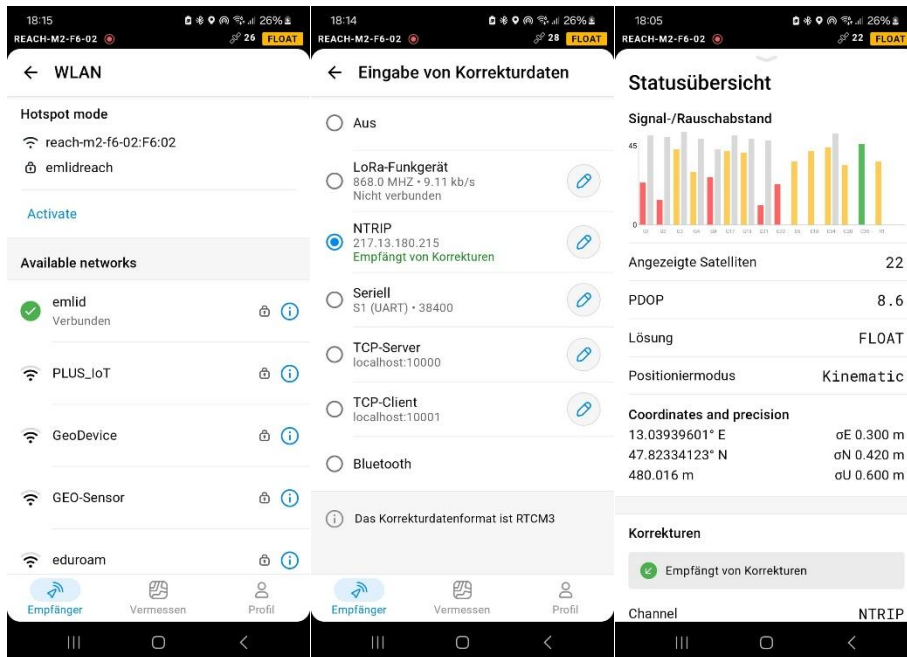

Figure 7: The Emlid Flow App status

5. In case no grey bars below the coloured ones are visible, correction values from NTRIP are not received. Thus, select the NTRIP App (LINK, 217.13.180.215)(Figure 8). Look up the "Receiving connections" to be highlighted in green.
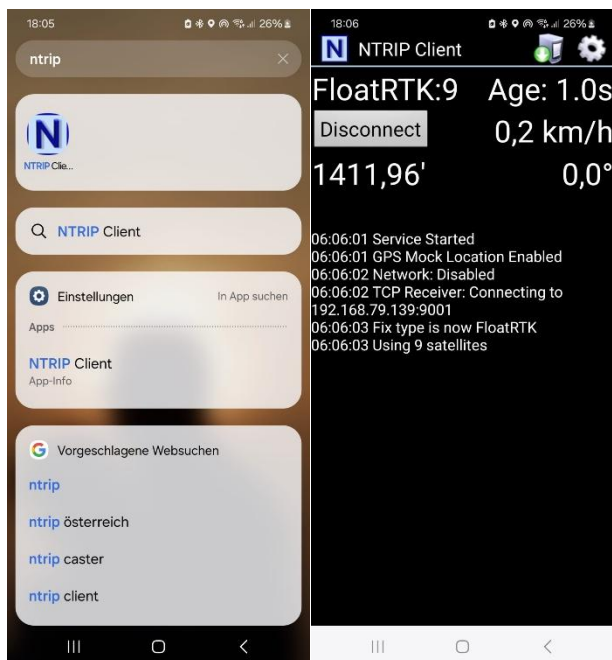

Figure 8: The NTRIP App

6. Wait until the top-right corner sign switches from "Single" (red) to Float (orange). Fix (green) will be displayed, when cm accuracies are reached (Figure 9).
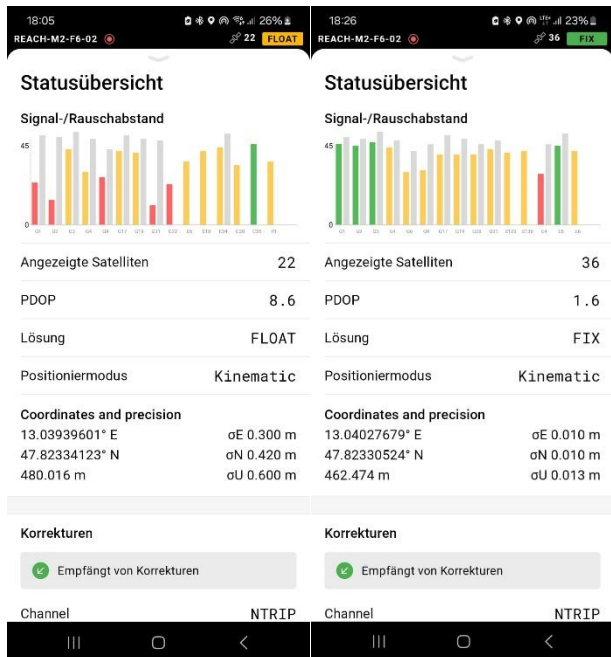

Figure 9: The "FIX" status with cm resolution accuracy checked at the control point at TechnoZ and in Field Maps

1.4 NTRIP CLIENT

1. Check the web address of the GNSS hardware on the front screen of the Emlid Flow App (192.168.79.139 is changing)(Figure 10).
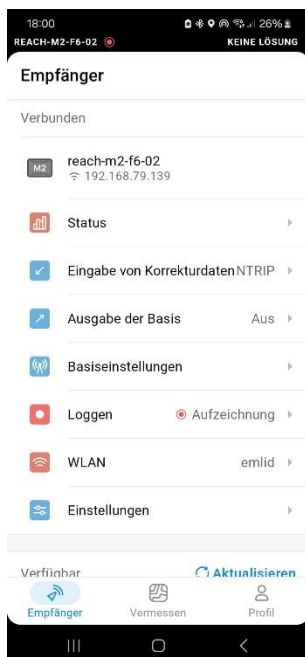

Figure 10: The web address of the GNSS hardware

2. Open the NTRIP App (Figure 11). Select the system properties. Go to "Receiver Settings". Select "External via TCP (Beta)". In Receiver IP address enter 192.168.79.139. The "Receiver Port" is 9001. Check GPS Mock locations. Mock Location Elevation to "Ellipsoid Height (Android default)".
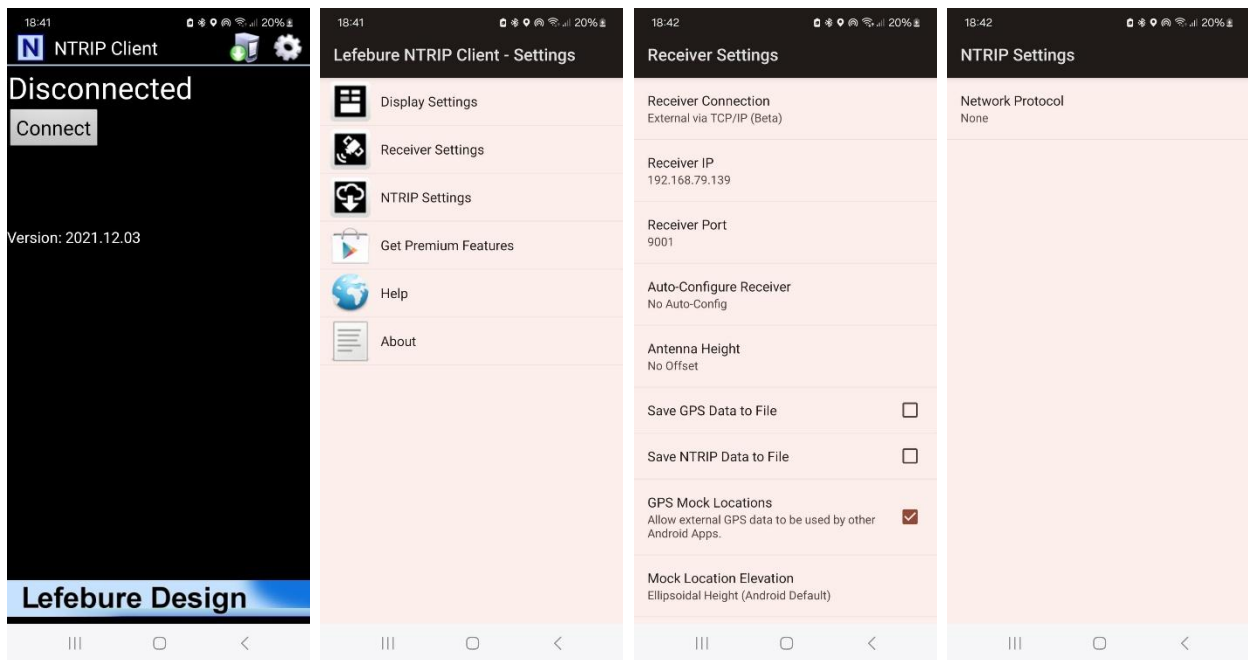

Figure 11: NTRIP settings

3. Start the NTRIP connection. The status message should display the number of satellites visible

FIGURE MISSING HERE

Figure 12: The running NTRIP client showing the number of satellites used

1.5 FIELD MAPS

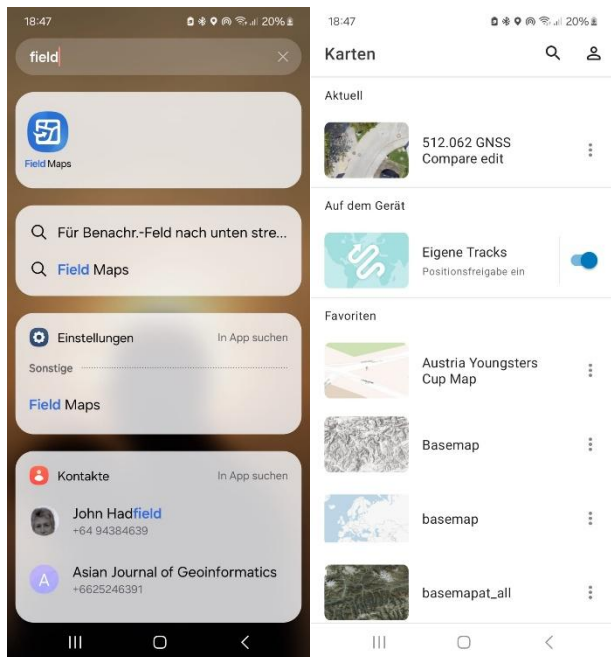1. Open FieldMaps and start an appropriate "Basemap" to check (Figure 13).

Figure 13: Field Maps

2. Select to your profile and add a new profile Apos 4258 to 3857 if necessary (Figure 14). During the process zoom in to the map to reduce the number of transformation criteria (Figure 15). In the final step activate the new transformation (!) with click (long press) on the button.
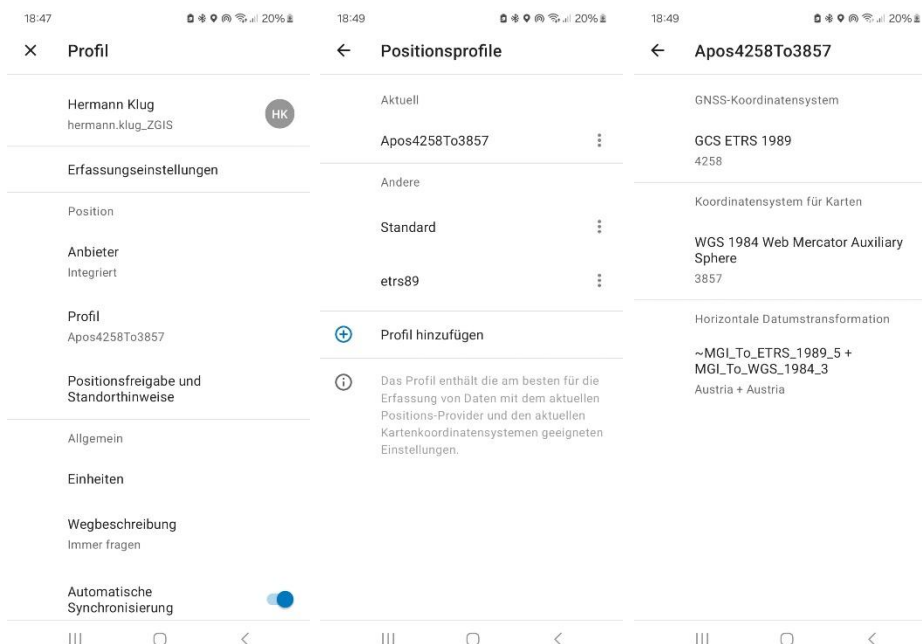

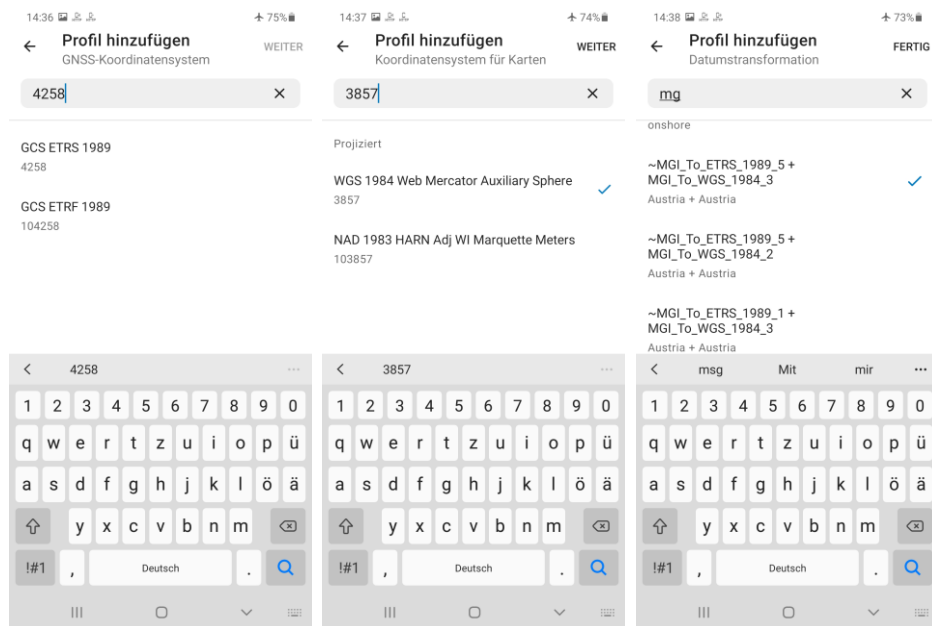Figure 14: Enter a new profile for the GNSS coordinate system

Figure 15: The transformation parameters for high precision in FieldMaps

1.6 CHECKPOINT

Use the checkpoint at TechnoZ pond to verify the accuracy of the measurement. Place the GNSS hardware to the middle of the table (Figure 16) and check the FieldMap display (Figure 17).

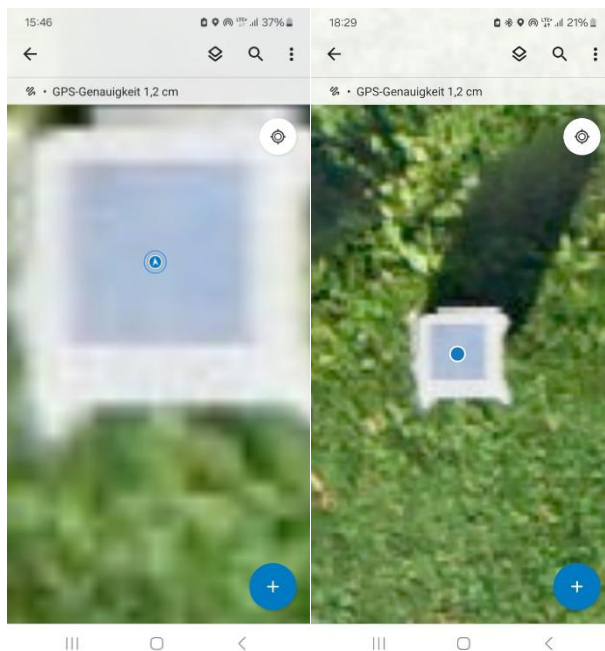Figure 16: GNSS hardware in the middle of the verified location point table

Figure 17: FieldMap display of point is accurately in the centre of the table

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