Emlid Surveying White Paper – Innovelec

Until recently, owning Centimetre (CM) level GNSS RTK survey equipment was out of reach to a lot of users. This was primarily due to the high purchase price for the initial hardware and ongoing subscriptions to correction services. A single unit of a GNSS RTK Rover would typically cost the user in the region of $20,000 USD. Combine this with the cost of RTK subscription services at around $3600 a year and you have a cost prohibitive solution.

Emlid's Reach RS3 or Reach RS2+
The Emlid Reach RS3 or Reach RS2+ enables land surveying at a remarkably low cost. With a single Reach RS3 or Reach RS2+ Multiband GNSS RTK unit with LTE costing $2199/£1832.50 and two units which can be used in a base / rover configuration for cm level accurate RTK positioning costing $4398/£3665.

Once the Emlid Reach RS3 or Reach RS2+ hardware is purchased, the free ReachView 3 app allows the Reach RS3 or Reach RS2+ to be used with any apple / android phone or tablet. This is especially useful for survey point collection and stakeout.

The Reach RS3 or Reach RS2+ removes the need to purchase additional specialist hardware such as data collectors. That said, it can be used with specialist hardware such as ground penetrating radar (GPR) equipment, providing extremely reliable positioning information.

The Reach RS3 or Reach RS2+ provides a position output in NMEA, LLH and XYZ, supplied via Bluetooth or hard wired via a cabled connection.

Some users do choose to purchase an additional tablet of their preference in order to provide them with a separate, exclusive device to use in conjunction with the Reach RS3 or Reach RS2+.

Reach RS3 or Reach RS2+ for Topographical surveys
With the right app downloaded onto an android, apple or windows tablet, the Reach RS3 or Reach RS2+ can be used for topographic surveys. Whether it is for roads, railways or other civil engineering projects, the Reach RS3 or Reach RS2+ provides the answer. It can be used anywhere in the world, with apps offering access to basic maps, cartographic maps or even, with an internet connection, web-based maps.

Reach RS3 or Reach RS2+ for Archaeology
The meticulous recording of artifacts is paramount for the successful archaeological assessment of a site. A Reach RS3 or Reach RS2+ which is configured as a 'base' can be positioned in a static location on the dig site. This location could be a known location or the Reach RS3 or Reach RS2+ can be left for a period of time (30 minutes or more) to get an averaged position. The averaged position is only suitable when you do not need to know the position in relation to everything else in the world, it will give cm accuracy relative to where the base 'thinks' it is.

Reach RS3 or Reach RS2+ for Agriculture
There are many applications for which GPS / GNSS can be used within the agricultural environment. These include: crop scouting, farm planning, soil sampling, machinery guidance, variable rate applications and yield mapping. The Reach RS3 or Reach RS2+ is capable of providing a position output via Bluetooth or a cabled connection. This output could be used to simply guide a lightbar function or provide position information to machinery.

Accuracy – Relative or Absolute
Whether using a competitive brand or trying Emlid for the first time, all surveys using a base / rover setup will be cm accurate relative to where the base is located. The best way to achieve absolute accuracy relative to everything else on the planet is to position the base on a known point.
Reverse Survey to Position the Base

The beauty of the Emlid Reach RS3 or Reach RS2+ units, is they can be set to be a base or a rover very easily. This is done by changing settings within the Emlid Flow app. This can be useful for setting the RTK base for a survey project where tying to the real GNSS location is necessary. The intended rover unit can be temporarily set as a base and placed on a nearby benchmark / known point. The location of the known point can be fed into the unit and corrections can be sent to the intended base, providing it with an accurate fix of where it is positioned.

Post Processing to Position the Base
For a survey where there is no local bench mark / known point a survey can be carried out using the local base positioned over a marker. This survey will still be cm accurate relative to where the base is. Within a few hours of conducting the survey, the base data can then be post processed using OS Net RINEX data available from Ordnance Survey. This will provide an accurate location for the base unit after the event.

The Reach RS3 or Reach RS2+ is a multi-band GNSS receiver when used in conjunction with another Reach RS3 or Reach RS2+ can provide a cm accurate RTK setup. Alternatively, a single unit can make use of Emlid's built in modem and hassle free NTRIP setup to achieve cm accuracy by receiving GNSS corrections over the internet. For the second option cellular network will be required.

Correction Services (NTRIP)
What is NTRIP?
NTRIP or the Networked Transport of RTCM via Internet Protocol allows a GPS / GNSS rover to receive corrections over the internet without the need for a local base.
NTRIP Caster

There are Free P2P services, such as that offered by Emlid, This Free Emlid service allows for a base / rover setup consisting of two Reach RS3 or Reach RS2+ units over a baseline of 60km.

NTRIP services
When it comes to NTRIP Services, there are alternatives to spending $3600 a year.
When using a single Reach RS3 or Reach RS2+ unit, there are subscription services available for receiving corrections. Such as those offered by RTKFnet. At the time of writing, such services are offering daily yearly subscriptions for less than $1200 USD

Baseline
Whether using an NTRIP service or an NTRIP caster. It is important to note the baseline. The baseline is the term given to the distance between the base station and the GNSS RTK Rover (Reach RS3 or Reach RS2+). The baseline is important, because the atmospheric conditions will be different at different locations. Therefore, there will be less accuracy the further the rover gets from the base.
Conclusion

The Emlid Reach RS3 or Reach RS2+ provides a multi-band, low cost GNSS RTK Rover / Base (it can be set to rover or base mode). This provides surveyors a low cost, out of the box solution, that can be mounted onto a survey pole / tripod of a user's choosing and provide a cm accurate solution. It is a simple, easy to use surveying solution, that performs its functions incredibly well.
Emlid's products remove the prohibitive costs associated with owning GPS / GNSS Survey Equipment.