

## Considerations for Using the CEESCOPE-RTK Echo Sounder with an RTK Base Station and UHF Radio.

*When using the CEESCOPE™ echo sounder with built-in RTK GNSS, ensuring the echo sounder can communicate with the RTK base station is a critical consideration. Often, there is confusion about compatibility between GNSS systems from different manufacturers and there is a view, partly resulting from GNSS manufacturer marketing, that users must keep “within the brand” for base station / rover pairs communicating via UHF radios. While this is not the case, there may be advantages to doing so in some circumstances.*

Compatibility between the CEESCOPE-RTK “all in one” echo sounder with built-in GNSS (or for that matter any GNSS rover receiver) and an RTK base station comes down to matching two parameters on the base station and rover receiver:

### **RTK Correction Message:**

This is the format of the corrections data itself. The RTK correction message is simply a time adjustment for each satellite in view that shifts the rover receiver measurements to account for errors. The non-proprietary output format from an RTK base station is RTCM 3.x, and every base and rover will be able to communicate using this format. Every GNSS system can be set to use this format by the operator. The Trimble messages CMR and CMR+ are also now available on most GNSS systems so a Trimble base station outputting CMR+ will be compatible with – for example - a Hemisphere or NovAtel GNSS rover receiver set up for CMR+ format corrections. The Trimble CMR format essentially became non-proprietary when the other manufacturers incorporated it into their equipment.

The latest Trimble CMRx corrections format is proprietary and can only be used by Trimble equipment. A Trimble base station broadcasting CMRx will NOT communicate with a NovAtel or Hemisphere-equipped CEESCOPE-RTK. Only the Trimble variant CEESCOPE will be able to successfully decode these corrections messages. The CMRx format reduces base station power requirements as the message is compressed, and it offers better radio range for RTK surveys however the accuracy of the position data is not improved. So, you don't necessarily need to use CMRx even if you have it available – you could always get a more powerful radio or a bigger battery. If the user can choose the corrections data message format, then message format compatibility will never be an issue for CEESCOPE-RTK users. None of the “open” format messages will be discontinued, and other land survey rovers on the same base station can be set to receive the same message.

## Radio Format:

The UHF receive-only radio used in the CEESCOPE-RTK and any base station transceiver has a radio transmission signal format, which needs to be configured the same way on both ends of the radio link. Nowadays, UHF radios are multi-format and allow the use of various standards including:

- Satel
- Pacific Crest
- Trimble TDL Trimtalk

It is useful to remember that the radio system is not actually part of the GNSS electronics but a separate component – even though it might be in the same enclosure. A Satel radio will have the Pacific Crest format option and vice versa, as users need interchangeability. A Satel radio will have the Trimble format and the Trimble will likely have the Satel format. But it does not matter which format is selected if the receive radio has the transmitted format option, communications should be successful.

The Satel receive radio used in the CEESCOPE-RTK is a wide frequency range 400-470MHz and will be matched with any base station radio from a frequency standpoint. The channel width may be set at 12.5MHz or 25MHz to match the base station, and it offers the three **radio** formats above. If the **data** format matches too (eg CMR+ at either end), then RTK corrections should be properly received.

Here are the radio formats available for the CEESCOPE RTK in more detail:

- SATELLINE-3AS      Original SATELLINE-3AS data transfer mode (Default)
- PacCrest-4FSK      Transparent mode/FEC ON/Scrambling ON (Option 1)
- PacCrest-GMSK      Transparent mode/FEC ON/Scrambling ON (Option 2)
- TrimTalk450s(P)      Trimtalk450s GMSK Rx fitted to PacCrest transmitters (Option 3)
- TrimTalk450s(T)      Trimtalk450s GMSK Rx fitted to Trimble transmitters (Option 4)
- PacCrest-FST      (Option 5)

In summary, selecting the GNSS type in the CEESCOPE-RTK is more about user interface consistency than actual compatibility. However, we always request that we can review proposed base station equipment to determine any potential issues.