FAULT EFFECTS AND CORRECTION METHODS

Accuracy of Geodetic GNSS Antennas

During the last decade, GNSS (Global Navigation Satellite System) technologies experienced an accelerated growth, both in terms of quantity in use and quality. The accuracy achieved by technology providers is still improving today. Apart from reliable receivers, the quality of the measuring results achieved mainly depends on the accuracy of GNSS antennas. Therefore, it is important to be aware of possible GNSS antenna faults, to know how to avoid them and â€“ last but not least â€“ to be familiar with the best calibration methods for GNSS antennas.

In order to achieve an accuracy of 1mm when measuring the continental drift with GNSS technology, surveyors need various different prerequisites at the same time: besides first-class receiver hardware and firmware plus highly accurate GNSS software, it is essential to use the best GNSS antenna available. Nevertheless, fault effects may still occur. The good news is that they can be avoided if there is sufficient awareness of them. It is also useful to know how to compare different antenna types.

Most common fault effects of GNSS antennas

If one of the satellites from which an antenna is receiving signals happens to be situated directly above an object in between (e.g. a tree or a building, or even just the edge thereof), this leads to diffraction of the GNSS signal and – since a diffracted wave is longer – produces a measuring result that is too high. In spite of that, the GNSS signal can be received with a good signal-to-noise ratio (S/N) and with equally good quality as a direct signal, while the receiver measures a longer distance. The fault stemming from this wrong information from the satellite can result in discrepancies ranging between few centimetres up to a couple of decimetres.

Avoiding diffraction is not easy. In practice, a good method is to extend the observation period. For real-time applications, very good GNSS software is needed. Another approach is to weight the overall, undifferentiated phase observations with the results from other satellites with a corresponding elevation. By comparing the expected S/N ratio with the current measuring results, diffraction may be anticipated or avoided.

Objects situated in direct vicinity of the antenna during the measuring process can also lead to incorrect results. These so-called ‘near-field’ effects may interfere with the GNSS signal and lead to differences of the phase centre of various centimetres. It is helpful to extend the distance between antenna and ground as much as possible. The latest-generation GNSS antennas do not have near-field effects when there is a minimum distance of 20cm to the ground – such as on the roof of a car, for example. In other cases, the respective antenna producers should be consulted for details.

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