GNSS signal interference by radio amateurs
(based on information from APOS / E. Zahn)

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Motivation

- Mr. Zahn (APOS network Austria) orally presented on the 4th EUPOS technical meeting in Bratislava recognized GNSS signal interference on WIEN (Vienna) APOS station caused by radio amateurs
Impression 4th Nov. 2017
APOS Vienna (Wien_3), Leica GR30, no Glonass solving / GPS tracking reduced
GPS L2 - mitigation

Septentrio POLARX5
(Auto Notch filter activated)

Vienna-Testbed (Wien/Wien3):
simultaneous GNSS-tracking with/without filtering

Leica GR 30 (No filter)
# of Sat. during Amateur radio activity (APOS Station Vienna)

DOY 018 / 2017 (Wednesday)

DOY 021 / 2017 (Saturday)
Impressions of Station Krahberg/Tyrol (12/2013):
Leica GRX 1200+GNSS without filtering / alternate radio
amateur activities

Glonass
GPS and GLONASS L2 frequency

- **GLO L2 Band**: 1242.9375 MHz to 1248.625 MHz
- **GPS L2 Band**: 1227.6 MHz with a bandwidth of 11 MHz
Radio amateur UHF (23cm) frequency

- The **23 centimeter, 1200 MHz or 1.2 GHz** band is a portion of the UHF (microwave) radio spectrum internationally allocated to **amateur radio** and **amateur satellite** use on a secondary basis. **The amateur radio band is between 1240 MHz and 1300 MHz.** The amateur satellite band is between 1260 MHz and 1270 MHz, and its use by satellite operations is only for up-links on a non-interference basis to other radio users.
Collision GPS/GLONASS L2 frequency and UHF 23cm frequency

Septentrio POLARX5 Spectrumview

(Testing on 10th Feb, 2017 at APOS Station **Vienna** simultaneously with interfered Leica GR30)

**Main freq. 1,230 GHz**

**Main freq. 1,275 GHz**

(detection of amateur radio before interference mitigation; interferes obviously the Glonass L2 - spectrum)
Interference caused by radio amateurs confirmed

- APOS colleagues contacted Trimble - the suspicion fell on radio amateurs

- Investigation confirmed assumption – unintentional L2 frequency interference caused by radio amateurs antenna directly oriented to WIEN station

- Solution – negotiation with radio amateurs
  - radio amateurs change used frequency and informed Slovenian (Maribor) colleagues as well to do it
Symptoms of L2 frequency interference by radio amateurs

- according to ESA white paper (https://www.researchgate.net/...Invited_Lecture/.../An-introductio...)

<table>
<thead>
<tr>
<th>Impact on GNSS receiver:</th>
<th>GNSS-user would notice:</th>
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<tbody>
<tr>
<td>• Degradation of C/N0</td>
<td>• Loss of tracking</td>
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<td></td>
<td>• Lower availability observables</td>
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<td></td>
<td>• Cycle Slips</td>
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<tr>
<td>• Higher noise on code and phase observables</td>
<td>• Degradation of accuracy</td>
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<tr>
<td>• Longer Acquisition Time</td>
<td>• Longer Time-To-First-Fix</td>
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Hint

- Septentrio receivers was not affected because they use special Adaptive Notch Filtering solution which helps to prevent interference or signal degradation.

Summary

- In case of problem with L2 frequency (especially on GLONASS) check possible interference by radio amateurs transmission

- contact radio amateurs society and ask them for used frequency change
Thank you for your attention

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