



Three Ways Interference Affects GNSS

Disclaimer

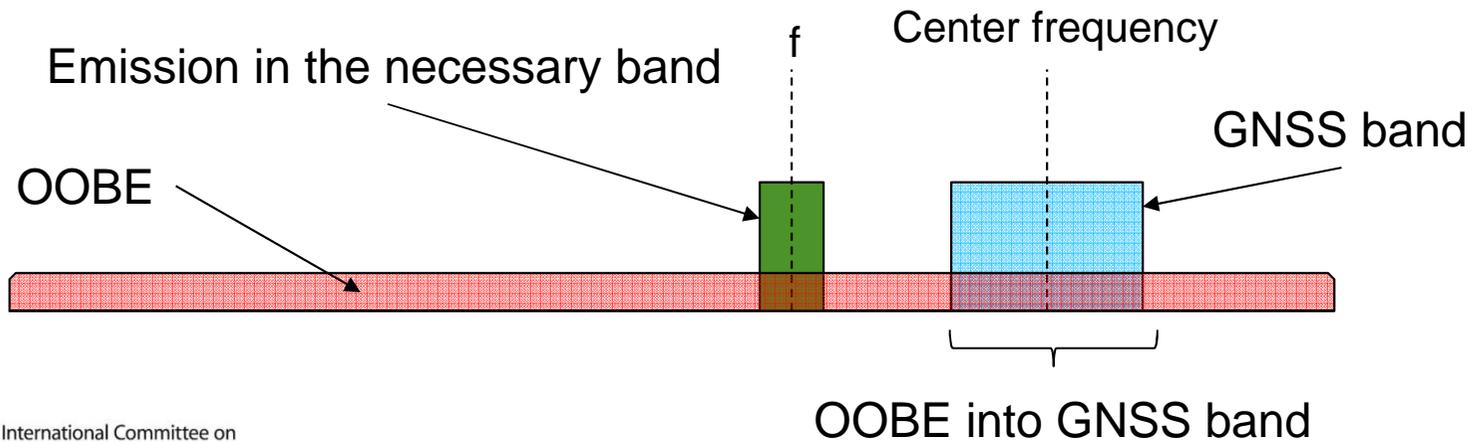
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Introduction

- In this presentation we describe three ways interference affect GNSS receivers
- Out-of-band emission (OOBE)
- Spurious emission
 - Harmonic vs Intermodulation Products
- Adjacent band interference

Out-of-Band Emission

- Out-of-band emission is an emission on a frequency or frequencies immediately outside the necessary bandwidth which results from the modulation process, but excludes spurious emissions
- It raises the noise floor of the GNSS receivers and the Carrier signal-to-Noise ratio (CNR) is reduced, impacting GNSS receiver performance

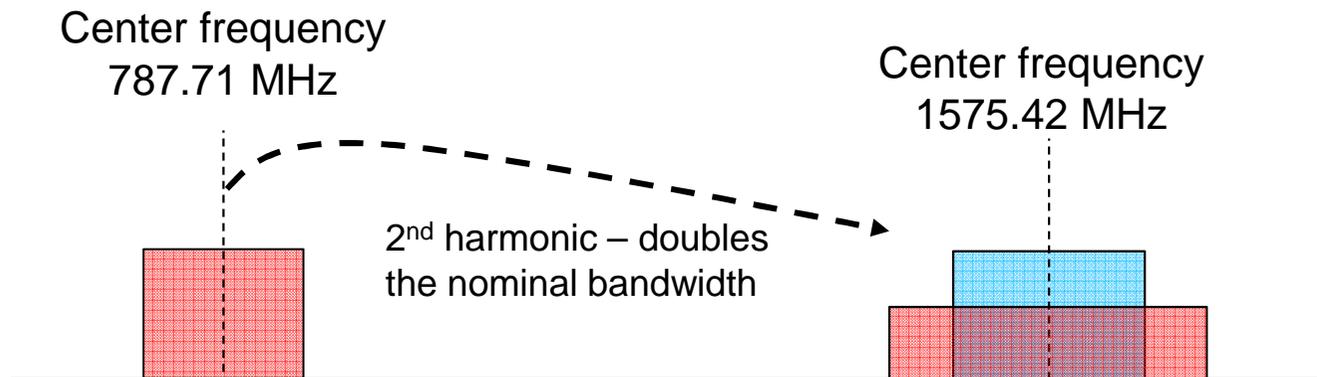


Spurious Emission

- Spurious emission is an emission not deliberately created or transmitted on a frequency or frequencies which are outside the necessary bandwidth
- Examples include harmonic emissions and intermodulation products
- These are described in the next two slides

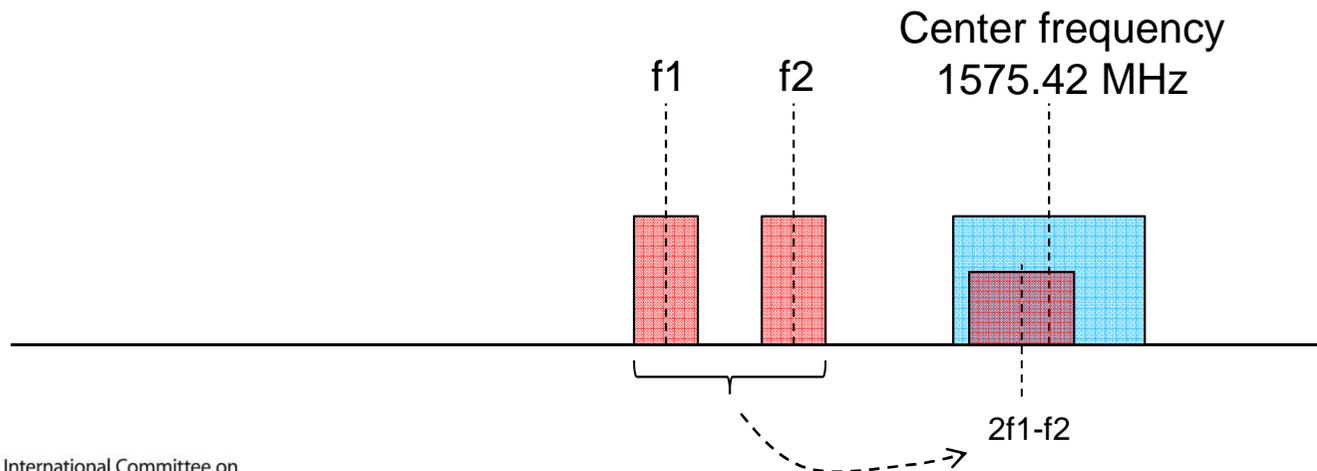
Harmonic Emission

- N -th harmonics for a signal whose fundamental frequency is f , has a frequency $N \cdot f$
- Generally not a significant interference mechanism
- Example: WRC-15 Agenda Item 1.2 – signal plan A4 could have caused potential 2nd harmonic interference into the L1 band from mobile user equipment



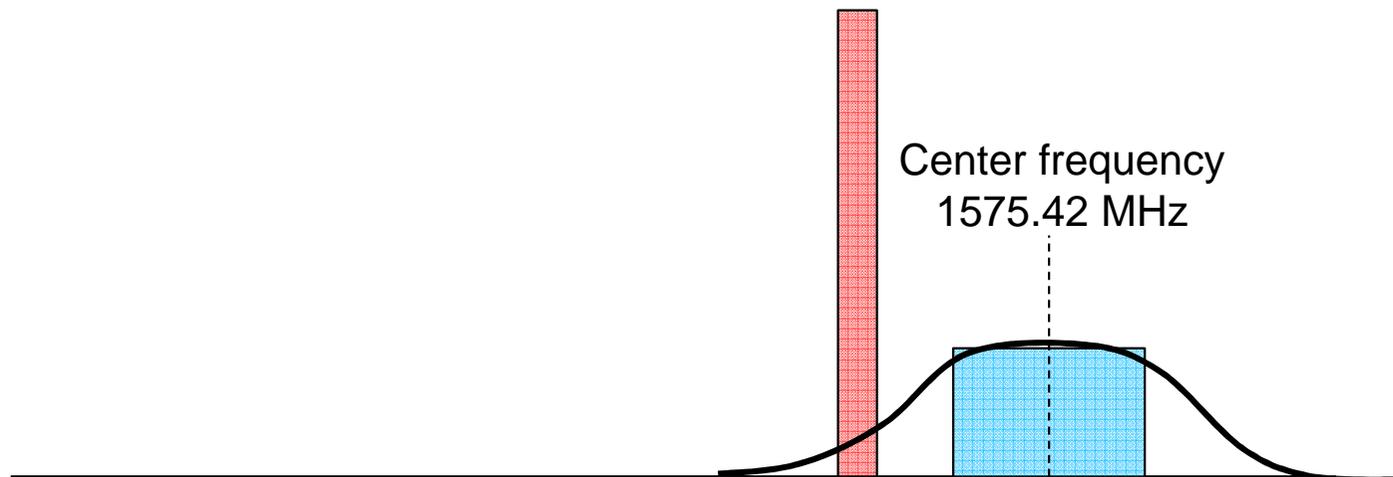
Intermodulation Products

- Intermodulation products is caused by amplitude modulation of signals containing two or more difference frequencies, caused by non-linearities in the front end of a GNSS receiver
- Intermodulation products can end up in the GNSS band and desensitize a GNSS receiver frontend
- Example: 3rd Intermodulation products from an adjacent band signal plan



Adjacent Band Interference

- Applicable in cases when high powered “terrestrial” service is planned adjacent to the quiet “satellite” bands to create overload
- The frontend of the receiver is compressed or overloaded
- Front-end filtering can help reduce this effect which can be difficult with high power adjacent band source



Summary

- This presentation described three possible source of interference to GNSS
 - Out of band emission
 - Spurious emission
 - Adjacent band interference
- They can all cause performance degradation and must be carefully considered to ensure interference-free environment for current and future GNSS.