



Protect GNSS Availability And User Operations Worldwide
- Recommend Seamless Spectrum Regulation Of GNSS Pseudolites

Global Positioning System Innovation Alliance (GPSIA)

Presentation to the
International Committee on GNSS (ICG)
Prague, Czech Republic

November 11, 2014

GNSS Depends On Sustaining Global User Trust

- **“It’s all about user trust.”**
 - Jack Ma, Chairman and CEO, Alibaba
 - Comment to 60 Minutes Interviewer, September 28, 2014
- By the Alibaba metric – earning user trust – GNSS is a success:
 - GNSS innovation is *user-driven* investment
 - Two billion GNSS users and growing
 - Praise for building user trust belongs to:
 - National GNSS Programs
 - Operators
 - ICG
 - National (and regional) spectrum regulators
 - Seamless spectrum protection of GNSS availability to users

A Seamless User Experience Worldwide Validates Trust In GNSS Authorities

- Global user experience validates trust in:
 - National GNSS policies on availability and access;
 - Operator implementation.
- ICG agreement on GNSS is successful!
 - GNSS interoperability is enabling seamless adoption of multiple GNSS operator signals in user equipment worldwide.
- GNSS spectrum regulation should ensure seamless GNSS availability worldwide.

How GNSS Pseudolites Are Regulated

Impacts GNSS Availability, Uses, and Global Trust

- A pseudolite is a ground-based transmitter of GNSS-like signals.
- Pseudolites can be in-band or out-of-band to GNSS, and can be developmental/experimental or commercial.
- Regulatory treatment of in-band GNSS pseudolites requires special consideration to ensure the avoidance of harm to GNSS availability and applications.
 - These considerations include operations under controlled conditions to limit interference to civilian applications:
 - Test the GNSS signals prior to launch;
 - Test receivers and production lines indoors;
 - Military applications.
- Recommend regulatory treatment that allows specialized, non-commercial uses of in-band GNSS pseudolites under strict control to support GNSS, avoid potential harm to users, and sustain trust in GNSS.

How Commercial GNSS Pseudolites Are Regulated Could Impact GNSS Availability And Uses

- Regulatory treatment of GNSS pseudolites allowing commercial operations in an ARNS/RNSS radiofrequency band would contravene the ITU International Table of Frequency Allocations and could disrupt seamless worldwide GNSS availability and user operations.
- Regulatory treatment of GNSS pseudolites guiding commercial operations outside of the ARNS and RNSS bands would avoid interference to user operations:
 - Multiple international providers of commercially available pseudolite systems broadcast their PL ranging signals outside of the RNSS band.
 - “A current trend in PL development serves to address these complications by moving off L1 frequency and using more robust signal structures.” (See Kanali “Limitations of Pseudolite Systems Using Off-The-Shelf GPS Receivers,” 2004.)
- Recommend regulatory treatment of commercial GNSS pseudolites that guides operation outside of the ARNS and RNSS bands for seamless GNSS availability worldwide to avoid potential harm to GNSS users.

Recommend Seamless Spectrum Regulation Of GNSS Pseudolites

- Recommend compliance with the ITU International Table of Frequency Allocations that allocates these GNSS radiofrequency bands:
 - 1559-1610 MHz; 1164-1200 MHz on a co-primary basis to:
 - Aeronautical Radionavigation Service (ARNS)
 - Specialized terrestrial service restricted to safety-of-life use
 - Radionavigation Satellite Service (RNSS)
 - For space-to-Earth use and space-to-space use
 - 1215-1300 MHz is allocated to RNSS uses
- Any other use of this spectrum is prohibited from causing interference to, or claiming interference from, users of either co-primary allocation.
- Ground radio transmitters that do not have an allocation in the ARNS and RNSS bands are required to demonstrate non-interference to co-primary GNSS user operations.
 - This burden of proof extends to low-power devices.

Recommend ICG Issue A Statement To Regional Spectrum Regulators

- An ICG statement could recommend that spectrum regulators worldwide:
 - Assure compliance with the ITU International Table of Frequency Allocations when considering the use of radiofrequency bands allocated to ARNS and RNSS;
 - Recommend regulation of:
 - GNSS pseudolites in-band for specialized, non-commercial uses under strict license control;
 - Ensure commercial GNSS pseudolite operations remain outside of the ARNS and RNSS bands.
 - Transmit the ICG Statement to regional spectrum regulators.

In Summary

- Allowing commercial GNSS PL operations in the 1559-1610 MHz band cannot guarantee absence of interference with GNSS receivers.
- Guiding commercial GNSS PL operations outside of the band at 1559-1610 MHz would eliminate interference to RNSS entirely.
- Engage the GNSS community to act to ensure seamless protection of GNSS availability worldwide.

On behalf of GNSS users worldwide, thank you!