



GPS Innovation Alliance

Some European Telecom Administrations Express Intent To License Commercial Harmful Interferers In The RNSS Band – Despite Contravening An ITU Treaty and Being Illegal in the US and Europe

A Presentation to
the Position, Navigation, and Timing (PNT) Advisory Board

By Kurt R. Zimmerman, PhD
and F. Michael Swiek

On Behalf of
the GPS Innovation Alliance

May 19, 2016

Review Comments Evidence Intent To Implement ECC Recommendation 11(08) Despite Acknowledgment Of Harm To GNSS

- “[I]ndoor ... pseudolites may have the potential to cause”:
 - “**partial or total degradation** of the accuracy of ... **GNSS receivers**”
 - “... **interference to GNSS receivers in airport areas, or ... vicinity ...**”
 - » *ECC Recommendation 11(08), Framework for Authorisation Regime of Indoor GNSS Pseudolites in the Band at 1559-1610 MHz*
- “It is not possible to determine a reasonable separation distance ... between the PL [“pseudolite”] and a ... GNSS receiver located in the same building ... this ... **GNSS receiver cannot be protected**”
 - » *ECC Report 168, regulatory framework for indoor GNSS Pseudolites; underlies ECC Rec 11(08)*
- “[R]arely raised with pseudolites is ... monitoring
 - With distributed networks, the potential for **spoofing or deliberate relocation of pseudolites is high**”
 - » *European Commission’s (EC’s) Joint Research Centre (JRC) “Scoping Study on Pseudolites”*

Absent Intervention, Implementation May Occur Despite Acknowledgment Of Contravention Of An ITU Treaty And Of Illegal Status In Europe

- A European study on commercial PL operating in the RNSS band acknowledges this issue
 - “Legal: 1559-1610 MHz is reserved [allocated] for aeronautical use
 - **To use pseudolites transmitting in this band may require a change in legislation”**
 - » *EC JRC Scoping Study on Pseudolites*
- The ITU Table of Frequency Allocations of the international Radio Regulations allocates this band to ARNS and RNSS
 - Any other use of this spectrum is prohibited from causing interference to, or claiming interference protection from, users of the co-primary allocations
 - **Incompatible commercial pseudolite operations would be in contravention of the ITU Treaty**

Despite Being Illegal In The U.S.

- A commercial PL operating as an international terrestrial transmitter in the 1559-1610 MHz would be illegal under Section 301 of the Communications Act, and potentially Section 302a(b)
 - Section 301 prohibits use of a device in a manner that causes interference to licensed services
 - Section 302a(b) prohibits the manufacture, sale, or shipment (i.e., to the U.S.)
- A commercial PL operating in this band may be the result of intentional misuse (e.g., deliberate spoofing)
 - “With distributed networks, the potential for **spoofing or deliberate relocation of pseudolites is high**”
 - » *European Commission’s (EC’s) Joint Research Centre (JRC) “Scoping Study on Pseudolites”*
 - Section 333 prohibits intentional misuse
- “... [R]adio frequency transmitters that intentionally block, jam, or interfere with lawful communications, such as cell phone calls, text messages, GPS systems, and Wi-Fi networks.”
 - » *GPS.gov website*

Despite Acknowledgement Of Market Demand For Safe Pseudolite Operations *Outside* The RNSS Band

European reports acknowledge abandonment of in-band commercial PL

- Aviation
 - “It is interesting to note that by 2005 all references to pseudolites (at least on L1) had been removed from the RTCA’s LAAS in the U.S.”
- Commercial
 - “Out-of-RNSS-band pseudolite solutions could eliminate interference to RNSS entirely and examples exist of bespoke similar systems already using the 2.4 GHz ISM band”
 - “It is not unreasonable for GPS receivers built for pseudolite use to include a second RF tuner to receive out-of-band pseudolite signals. ... Imposing the cost of an additional RF tuner on a small, specialized market **seems preferable to imposing the cost of degraded and sporadically unavailable navigation on the rest of the civil GPS user community.**”
 - » *EC JRC Scoping Study on Pseudolites*

What is the European “small, specialized market” interest?

Despite Failure Of Proposed In-band, Indoor Pseudolites To Solve Commercial Indoor Navigation

- “One of the most striking aspects ... of the EU indoor pseudolite proposals is not only how much damage they can do but also, **how little capability** they actually bring to bear on the problem of indoor navigation.
 - **Knowing where you are [is] just one aspect of the problem. Figuring out where you want to go (e.g., which restaurant, which aisle) and how to get there is also important.**
 - **Standalone navigation systems won’t provide these capabilities. Smart phones will.**
- **Trying to cram incompatible signals into the GNSS bands** is not only unwise from an interference perspective, it also **fails to comprehend commercial realities**. In light of rapidly advancing smart phone capabilities, pseudolites and IMES are as dated as pagers.
- “Why take the risk?”
 - » *From a public comment by Logan Scott, on an article on IMES by Don Jewell, submitted to the GPS World website, October 8-9, 2014 (<http://gpsworld.com/danger-will-robinson-beware-the-imes-of-japan/#comment-332442>)*

Despite An Unexamined Aviation Use Case

- We did not find examination of this aviation use case in an urban environment
 - ***What is the aggregate effect on outdoor GNSS operations from multiple networks of indoor pseudolites operating on several floors of a tall building and including similar operations in and among several buildings within the same area?***
- What ECC technical (128) and regulatory (168) reports underlying ECC Rec 11(08) examined:
 - ECC Report 128, a compatibility study of commercial pseudolite operations in RNSS
 - Considered an airport terminal as the worst case aviation scenario
 - ECC Report 168, a regulatory framework report on *indoor* pseudolites in RNSS
 - Limited the technical analysis to the operational effect on GNSS receivers operating indoors
- We did find introduction of consideration of “no fly zones” in ECC Report 183, a regulatory framework report on *outdoor* pseudolites in RNSS
 - Examined the aggregate effect of distributed networks of outdoor pseudolites on GNSS and creation of “exclusion zones” and “no fly zones” on aeronautical charts

Would technical analysis of this unexamined aviation use case result in consideration of “no fly zones” on aeronautical charts from distributed networks of commercial GNSS pseudolites operating indoors in the RNSS band?

Despite An Objection To GNSS Pseudolites Operating Outdoors In The RNSS Band

The Electronic Communications Committee adopted ECC Report 183 on outdoor GNSS pseudolites in the band 1559-1610 MHz over the following objections of an ECC participant, the U.K.:

- **“No detailed work and analysis of real proposed systems and operational concepts has occurred on the impact to actual GNSS signal reception, beyond CEPT radio spectrum management overview studies on these devices.”**
- **“There is no evidence from industry on conducted or analyzed details and specifications for real systems.** The interaction of the Galileo programme management office and GPS industry would be an integral part of such analysis.”
- **“The United Kingdom has no real evidence of a market demand for these devices and we do not support further CEPT work on outdoor GNSS pseudolites.”**
 - » *From the United Kingdom comment, from the Document in Annex 7 (Rev 1) to FM44(12)051-Approved Minutes and Annex of 24th meeting FM44; 17/01/2013*

Real-World Consequence Of Legalization

- Serious real world ramifications of authorizing interfering technology
 - Partial or total degradation of accuracy of indoor GNSS receivers and/or
 - Real potential for malicious misuse for spoofing
 - Aviation
 - Shipping
 - Transportation
 - Critical infrastructure
 - National security

ECC Recommendation 11(08) Is Under CEPT Review

- Regulation

- “*Framework For Authorisation Regime of Indoor Global Navigation Satellite System (GNSS) Pseudolites in 1559-1610 MHz Band*”
 - Known as CEPT ECC Recommendation 11(08)

- Organization

- CEPT (Conference of European Postal & Telecom Administrations)
 - Includes 48 CEPT Telecom Administrations
- ECC (Electronic Communications Committee), organization within CEPT
 - Responsible for compatibility studies, regulatory framework reports, and tasking the European Telecommunications Standards Institute (ETSI) to develop spectrum use equipment standards

- Status of CEPT review (as of May 2016)

- 14 Yes
- 2 Committed
- 1 See remarks
- 3 Under study
- 7 No
- 21 No information

Status: CEPT Review Of ECC Recommendation 11(08)

YES (14)

1. **Andorra (8/26/2015)**
2. **Austria (8/26/2015)**
3. **Denmark (7/10/2012)**
4. **Estonia (1/23/2014)**
5. **Germany (3/16/2012)**
6. **Liechtenstein (8/26/2015)**
7. **Luxembourg (8/26/2015)**
8. **Montenegro (8/26/2015)**
9. **Netherlands (8/26/2015)**
10. **Norway (10/20/2015)**
11. **Serbia (8/26/2015)**
12. **Slovenia (1/30/2014)**
13. **Switzerland (8/26/2015)**
14. **United Kingdom (8/26/2015)**

REMARKS (1)

1. **Sweden (9/15/2015)**
(Recommendation would be followed as applicable.)

COMMITTED (2)

1. **Finland (2/26/2014)**
(According To Market Demand)
2. **Lithuania (1/24/2014)**

UNDER STUDY (3)

1. Belarus
2. Czech Republic
3. Italy

NO (7)

1. Bulgaria
2. Croatia
3. Hungary
4. Ireland
5. Latvia
6. Malta
7. Turkey

NO INFORMATION (21)

1. Albania
2. Azerbaijan
3. Belgium
4. Bosnia and Herzegovina
5. Cyprus
6. France
7. Georgia
8. Greece
9. Iceland
10. Macedonia
11. Moldova
12. Monaco
13. Poland
14. Portugal
15. Romania
16. Russian Federation
17. San Marino
18. Slovak Republic
19. Spain
20. Ukraine
21. Vatican City

When A Regulation Acknowledges Harm To GNSS Applying “Complementary” Is False

- Complementary = “combining in such a way as to enhance or emphasize the qualities of each other or another”
 - Synonym: “harmonious, **compatible**”
 - Example: eLoran is proposed as a PTA (“protect, toughen, augment”) complement to GNSS
 - eLoran operates on frequency bands outside of the RNSS band
- “Pseudolites ... are intended to **complement** systems in the Radionavigation Satellite Service (RNSS) by **transmitting on the same frequencies in the bands ...**”
 - » *From ECC Report 168 on indoor PL in the band at 1559-1610 MHz, Executive Summary*

Commercial pseudolites operating in the RNSS band are not complementary to installed GNSS operations when the regulation acknowledges the potential harm to GNSS uses.

A Rationale For Withdrawing Or Modifying ECC Rec 11(08) “Only PL With Dedicated Codes Will Be Authorized” And The US Does Not Support Confirmation

- CEPT:
 - “[P]otential **degradation and interference . . . may be significantly increased if indoor PL do not use dedicated codes** for PLs as reserved in the ICD published by the GNSS system operators”
 - » *ECC Rec 11(08)*
 - “Individual authorizations **should only authorize PL with dedicated codes**”
 - » *ECC Report 168, supporting ECC Rec 11(08)*
 - “The national administration **must have a confirmation from the applicant that the PRN code requested is one of those that are dedicated to PLs** (i.e., one that has been assessed for its cross-correlation compatibility within the RNSS system, by the RNSS programme managers)”
 - » *ECC Report 183*
- US:
 - “**2.3 SMC/GP does not support civil/commercial terrestrial transmissions in the GPS frequency bands due to the potential to degrade GPS performance.**”
 - » *Global Positioning Systems Directorate (SMC/GP) Pseudorandom Noise (PNR) Code Assignment Process, “6 March 2015.”*

Recommendations To Protect Access To GPS/GNSS In Europe

Departments and Agencies

- Seek withdrawal or modification of ECC Recommendation 11(08)
 - US to seek EC, EU Member States cooperation, including for example, in the European Radio Spectrum Committee (RSCOM), to work with CEPT to withdraw or modify ECC Rec 11(08) and encourage commercialization of pseudolites outside of the RNSS band
 - CEPT processes for withdrawal and/or modification of ECC approved recommendations are publicly available

Congress

- Protect GPS and ensure legitimate, truly complementary PNT
 - The U.S. shall require that any complementary PNT system not cause degradation of the spectrum environment utilized by the Global Positioning System
 - The U.S. shall not acquire or use complementary PNT systems that fail to protect the spectrum environment upon which the Global Positioning System relies

Complementary PNT proponents

- Collaborate with the international GNSS community
 - Public outreach to the CEPT Telecom Administrations to take prompt action to withdraw or modify Rec 11(08)
 - Inform CEPT on how legitimate PNT complements GNSS

Follow-up Questions

- State: 1) How do you view this risk in the context of the 2004 US-EU Agreement?
2) Do the EU Member States understand this risk to European and U.S. citizens?
3) Has the U.S. position on the ICD PRN codes been communicated? Respectfully request that the State Department contact EU Member States having Telecommunication Administration that expressed “Yes” on ECC Recommendation 11(08) to withdraw or modify based on US information.
- FAA: Are your European CAA counterparts aware of this risk and unexamined aviation use case and are they concerned? Do they contemplate action?
- NCO: Is this issue being raised to the PNT Ex-Com and what actions can be taken to coordinate an effective interagency response?
- DOD: Do you see the proliferation of these commercial in-band PL posing a risk to US and NATO operations?