



# Galileo's View on Compatibility: Ensuring consistency between bilateral and multilateral coordination

## 1. Ensure Compatibility

## 2. Promote Interoperability

- But only once compatibility is ensured

**Compatibility:** ability of space-based PNT services to be used separately or together without interfering with each individual service or signal, and without adversely affecting national security (consistent with ICG definition):

1. The International Telecommunications Union (ITU) provides a framework for the radio frequency compatibility through various provisions of the Radio Regulations (see next slide)
2. To respect national security concerns, compatibility with the PRS requires spectral separation between it and all other signals

A fundamental principle of the Radio Regulations is that new systems should not cause harmful interference to those which came before, as enshrined in Articles:

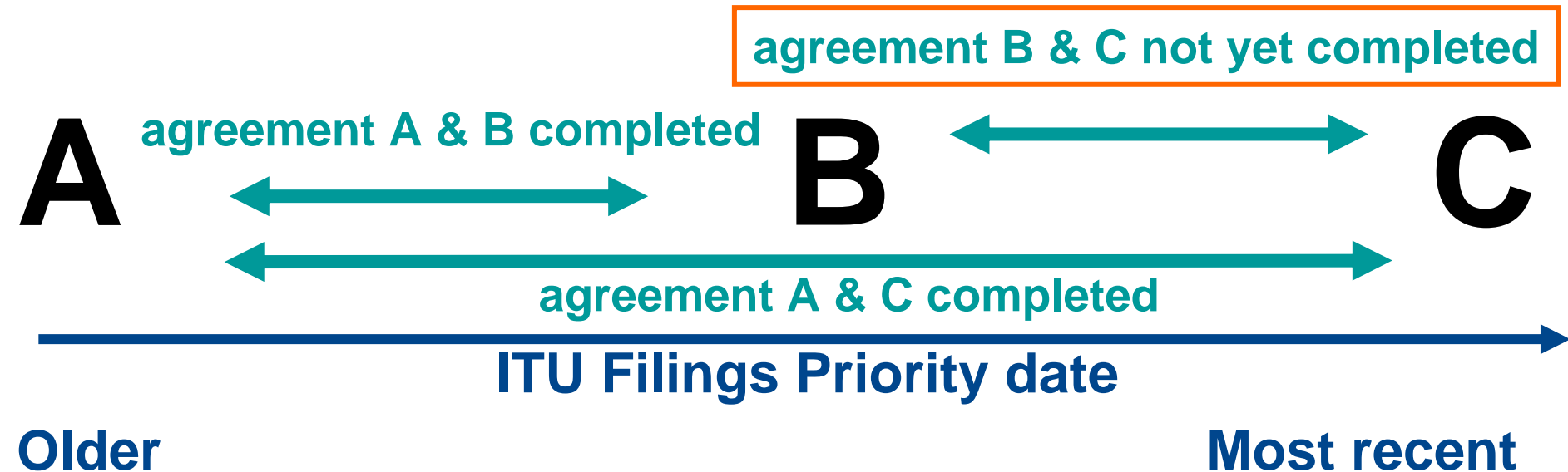
- ★ No. **4.3**: “Any new assignment or any change of frequency or other basic characteristic of an existing assignment (see Appendix 4) shall be made in such a way as to avoid causing harmful interference to services rendered by stations using frequencies assigned in accordance with the Table of Frequency Allocations in this Chapter and the other provisions of these Regulations, the characteristics of which assignments are recorded in the Master International Frequency Register”
- ★ No. **8.3**: “Any frequency assignment recorded in the Master Register with a favourable finding under No. **11.31** shall have the right to international recognition. For such an assignment, this right means that other administrations shall take it into account when making their own assignments, in order to avoid harmful interference. In addition, frequency assignments in frequency bands subject to coordination or to a plan shall have a status derived from the application of the procedures relating to the coordination or associated with the plan”

- EU performs bilateral and multilateral (UN ICG) coordination to ensure compatibility between Galileo/EGNOS and all current and future GNSS
- Achievements:
  - 2004 EU/US Agreement on GNSS guarantees positive coordination
  - Agreement in Feb. 2010 with JAXA on coordination between Galileo/EGNOS and QZSS-1 satellite

- Sufficient spectral separation between Galileo PRS and other GNSS signals in E1/L1 and E6 bands has not been achieved
  - Unacceptable frequency overlap remains
  - Frequency overlap burden to be shared amongst systems providers
- Declaration of Compatibility and Interoperability is subject to a signed bilateral Agreement between providers but **must** take other systems into account
  - GNSS providers deliver signals/services which are not completely independent from each other (eg some providers may be interested and benefit from other systems' signals/services)
- However, the increased number of systems using the same RNS bands causes compatibility (ICG definition) issues (see next slides)

# Example Issue (1/2)

- More than two systems wanting to use the same band is common place, example with 3 systems (A, B and C):





- What if a compatibility agreement (including ITU coordination) between systems B & C is **not possible** based on parameters (eg modulation, power levels) of prior compatibility agreements A & B and A & C?
  - How this issue can be resolved? Ex: should agreements A & B and A & C be updated? Can bilateral coordination be enough for that?
  - ITU Rec. 1831: *“it may be useful to address them [inter-system coordination], during multilateral meetings involving all parties, in addition to during bilateral meetings between two of them.”*
- As the GNSS community will face the issue described above, the EU requests recommendations from the United Nations ICG WG-A to solve it
  - GNSS operators have a common interest because other systems may yet come (systems D, E!), and priority order in each band is different
  - UN ICG is only forum gathering all providers around the same table



- EU proposed at ICG-4 to protect open signal performance by preserving the noise floor
  - Maximum permitted increase
    - ★ Protection of acquisition, tracking and demodulation
- Common interest in protection and balance
  - Possible agreement between Providers at ICG
    - ★ Noise floor increase limits (compatibility)
    - ★ DOP gain (interoperability)
- Example: protection of multi-GNSS interoperable L1/E1 MBOC users (see dedicated presentation)

- EU performs bilateral and multilateral coordination with other GNSS providers in order to ensure as a priority compatibility between Galileo/EGNOS and other systems
- EU has already achieved some results (with US and Japan) but faces challenges, which other current and future providers will also see
- In particular, a potential issue arises when coordination involves more than two providers, as we have highlighted
  - We request recommendation and guidelines from WG-A whose Workplan states that it will “Seek common understanding on appropriate methods to determine compatibility among all GNSS”
  - Should a kind of GNSS “code of good conduct” be promoted by the UN ICG so that GNSS continues to benefit the world?

A satellite constellation is shown in orbit around the Earth. The Earth is on the right side of the image, showing blue oceans and white clouds. Several satellites are visible, each with purple solar panels and a gold-colored body. Two prominent yellow lines represent orbital paths. The background is a dark space filled with stars.

**Thank you for  
your attention!**