



# Overview of EU Infrastructure for Resilience, Interconnectivity and Security by Satellite

UN/SKAO Workshop on Dark and Quiet Skies for Science and Society 2025

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# EU Policy context

- **Regulation (EU) 2023/588** establishes the **Union Secure Connectivity Programme**:
  - Objective: to deploy an **EU-owned satellite constellation for secure communications (IRIS²)**
  - Total cost: **€10.6bn**

€6bn		€550mn 	€4.1bn 
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- Procurement of the **IRIS² concession agreement** (Public-Private Partnership):
  - **Contract signature on 16 December 2024**



# The IRIS<sup>2</sup> vision

## Multi-orbit broadband global coverage

LEO and MEO, low latency, high throughput  
Combined with GOVSATCOM (GEO)

## Security by design

Dual-use nature to meet both the needs civilian and military needs  
State-of-the-art cryptographic mechanisms, cyber- and RF-threats resilient, assets located in EU, security accreditation  
Future Quantum Key Distribution service

## Open standards and interoperability

Lowering terminal costs through use of COTS, enabling application specific terminal development, interoperability with terrestrial systems

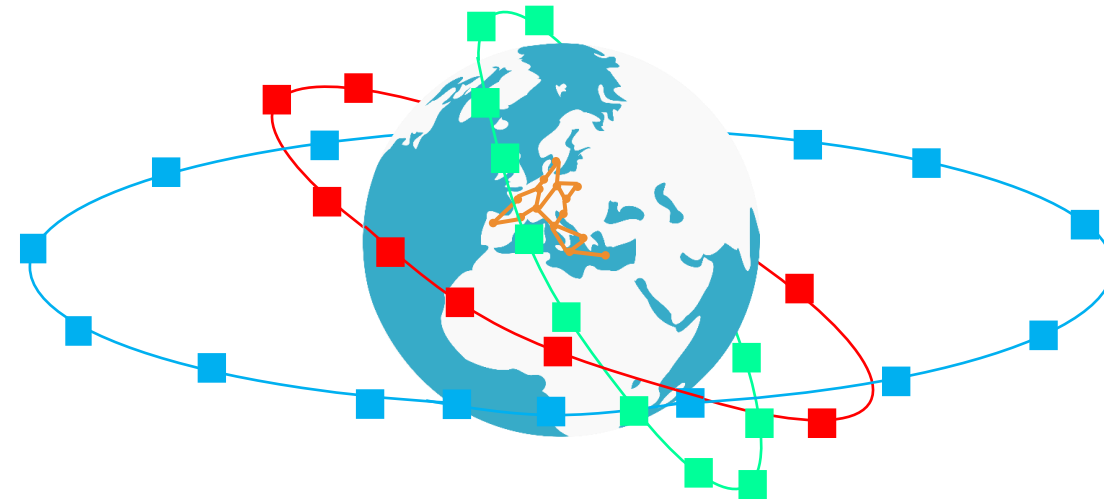
## Innovative

System must integrate innovative/disruptive technologies and services, participation of SMEs, New Space actors

## Environmental & Space sustainability

GHG minimisation and offset, space debris mitigation, anti-collision, **prevention of light pollution and radio interferences**

- LEO (new)
- MEO (new)
- GEO (GOVSATCOM, existing)
- EU ground infrastructure (new)

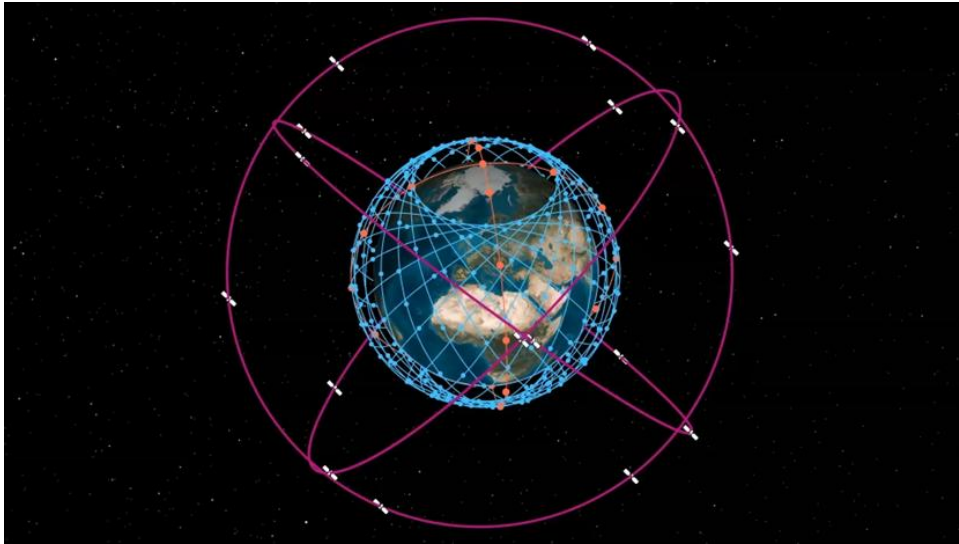


# Technical overview and service portfolio



# IRIS<sup>2</sup> technical overview

## Summary of features



### Space

- **264** satellites in **High-LEO** (1200 km) – **option 24 polar**
- **18** satellites in **MEO** (8000 km)
- **10+** satellites in **Low-LEO** (<750 km)

### Ground

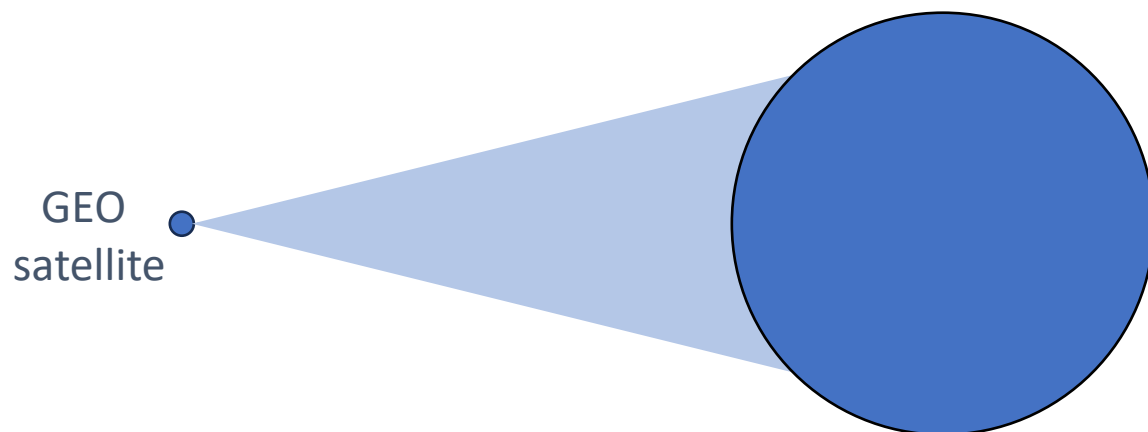
- **3 Ground Control Centers** (France, Italy, Luxembourg)
- **5 EU gateway sites** (2 of them including TT&C)
- **3 TT&C overseas stations**

### Connectivity

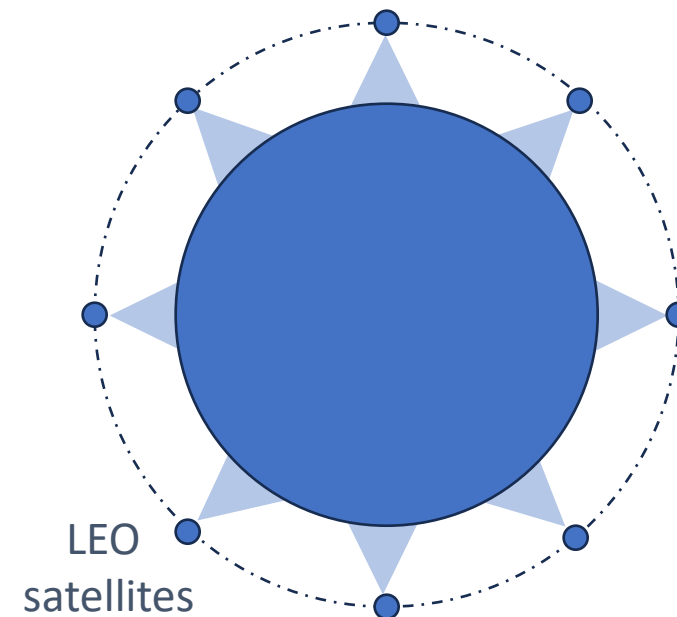
- **5G regenerative** capabilities in LEO and MEO
- Support for **transparent-mode services**
- Support for **direct UT-to-UT connectivity**

# With global coverage, LEO/MEO systems can best be realised in partnerships

GEO systems offer the possibility  
for **REGIONAL** coverage



LEO/MEO system coverage is  
**always GLOBAL**



The global coverage nature of constellations favours  
partnerships enabling optimisation of system usage

# Service portfolio

- IRIS<sup>2</sup> targets **governmental** and **commercial** use cases: compliant with the Secure Connectivity Regulation (EU) 2023/588 and Commission Implementing decision (EU) 2023/1053



Governmental use cases

Commercial use cases

<span style="color: red;">■</span>	Hardgov
<span style="color: orange;">■</span>	Lightgov
<span style="color: gray;">■</span>	Potential (e.g., UHF, IoT)
<span style="color: blue;">■</span>	Commercial service

## Robust Services

1 **Robust Worldwide Low-Latency**

2 **Robust Space Data Relay**

## Assured Services

3 **Assured Worldwide Low-Latency**

4 **Assured Worldwide Narrowband**

## Commercial Services

**Commercial satellite services**  
(e.g., residential broadband, transportation, B2B satellite trunking, etc.)



# Sustainability requirements related to Dark & Quiet skies

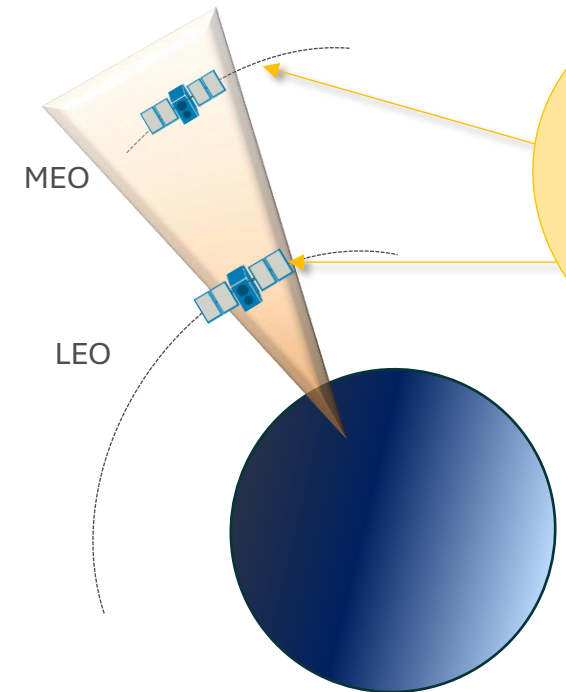
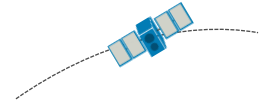


# Dark Sky

## Mitigating light pollution

### Key physical effects (wrt. Altitude)

- **Brightness** ↘ with distance<sup>2</sup>
- **Sun illumination time** ↗ (less or no Earth shadow at MEO/GEO)
- **Visible pass duration** ↗ from a fixed observer
- **Ground area covered** ↗ (larger footprint)

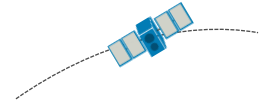


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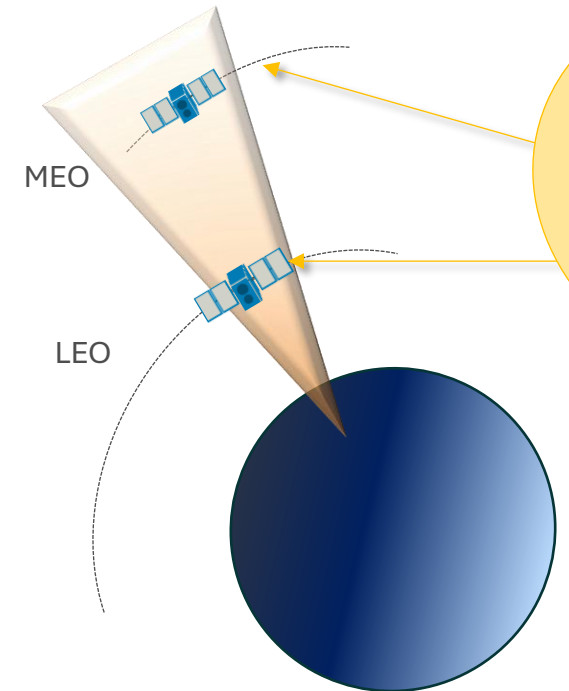


- **IRIS<sup>2</sup> requirement:**

*The **visual brightness** of the Satellites design shall be **quantified by analysis**, and operational and design **mitigation actions** shall be proposed and implemented to mitigate their impact on ground astronomy.*

*/ **Note 1** The goal for the Satellites design is on average to appear fainter than  $7,0 V_{mag} + 2,5 \times \log(\text{Sat}_{Altitude} / 550 \text{ km})$*

*/ **Note 2** In case the goal cannot be met by the 1<sup>st</sup> increment design, the contributors for the visual brightness shall be identified and a development plan with an incremental approach proposed for the 2<sup>nd</sup> increment and 2<sup>nd</sup> generation*



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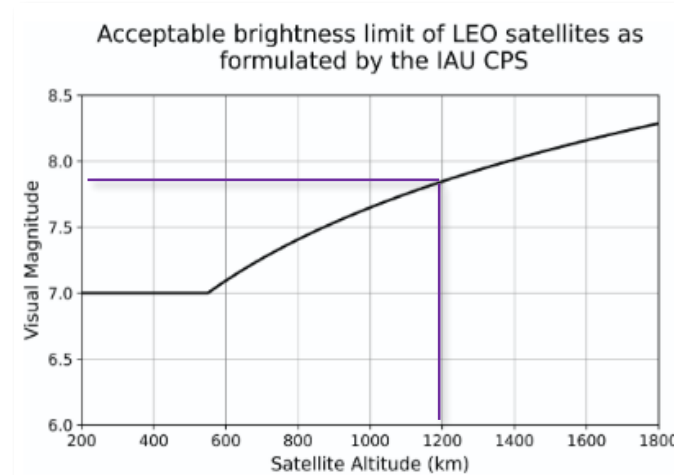
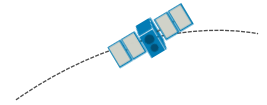
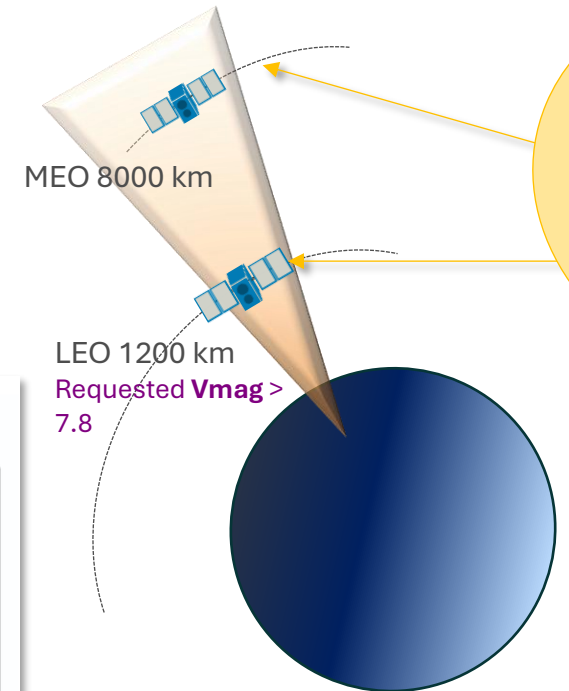


Figure 3: Brightness limit of LEO satellites as proposed by the IAU. The vertical axis denotes  $V_{mag}$  [31]



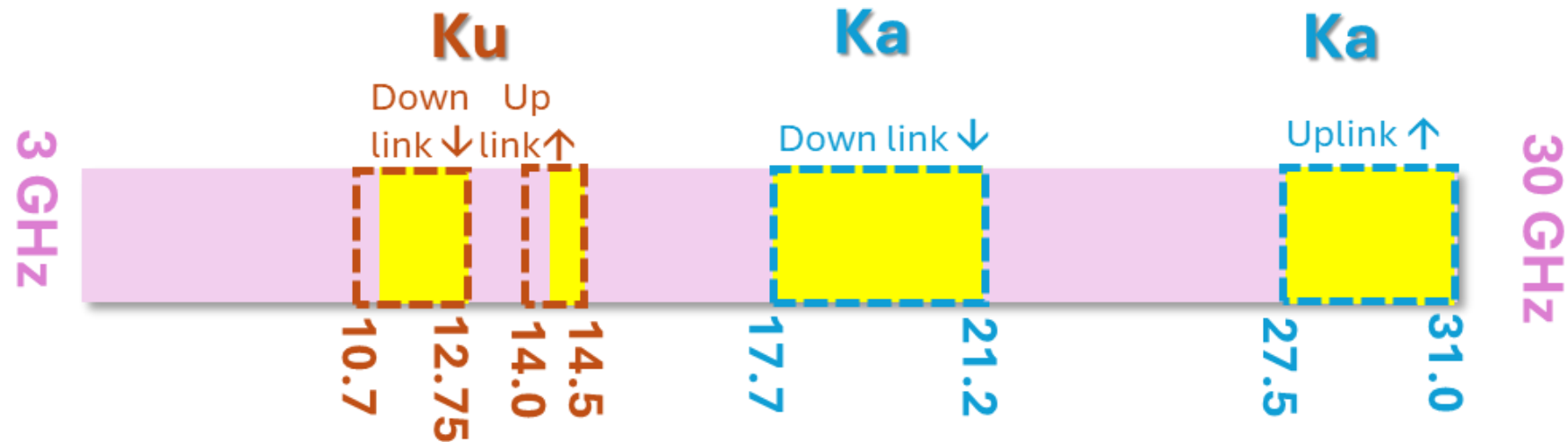
MEO ~ 10 < Vmag < 14





# Quiet Sky

## Potential radio interferences

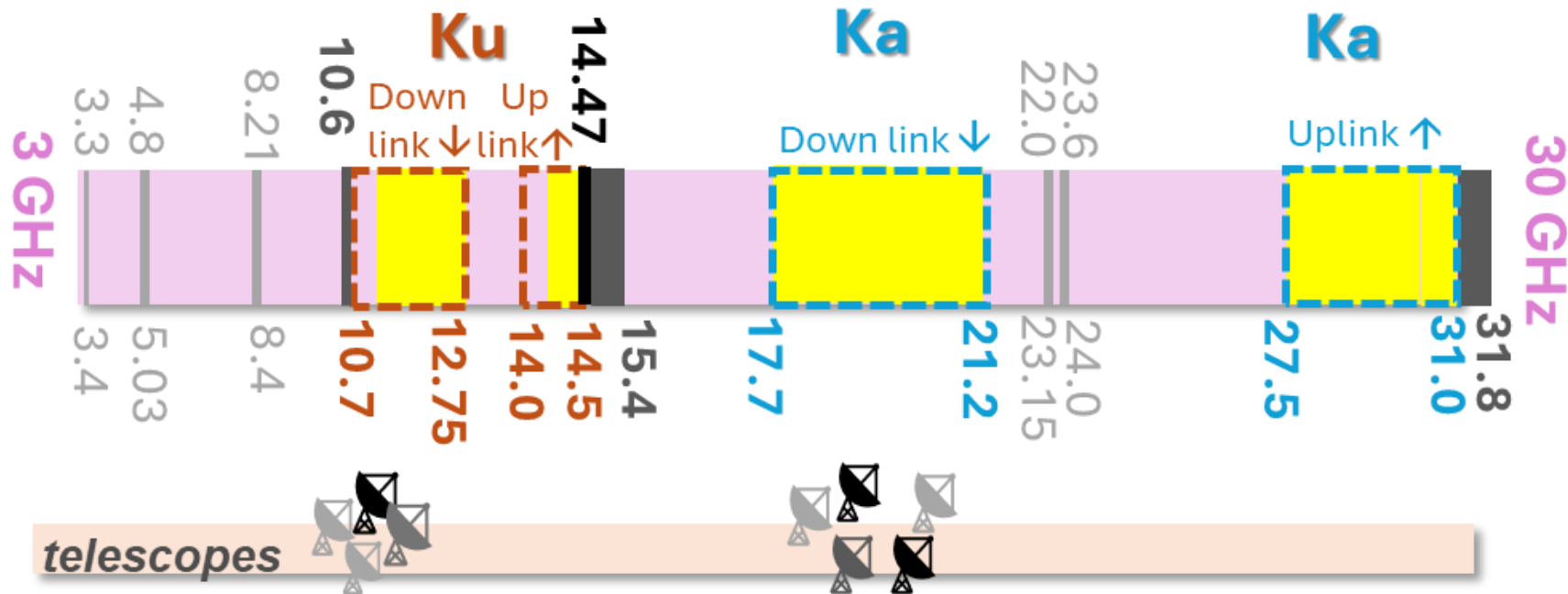


Caption:

 IRIS<sup>2</sup> Ku/Ka band use

# Quiet Sky

## Potential radio interferences



Caption:

- Radio astronomy allocated bands
- Adjacent allocated bands
- IRIS² Ku/Ka band use
- Potential overlap

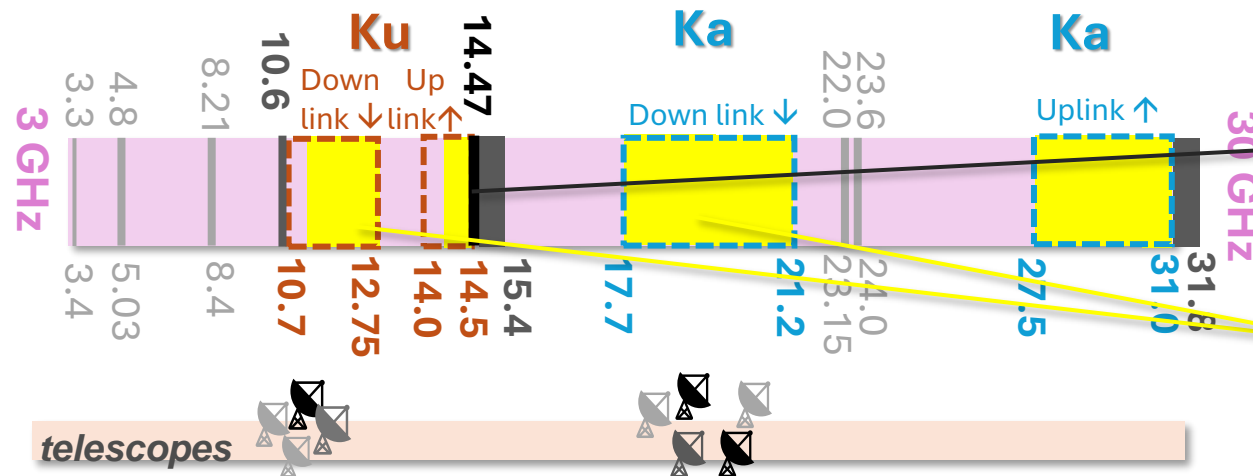
# Quiet Sky

## Potential radio interferences

- IRIS<sup>2</sup> requirements:

>> The satellite design shall integrate functions to permanently interrupt all radio transmission capabilities as part of End-of-Life operations.

>> The mission shall avoid direct illumination with radio frequency payloads of known operational radio telescopes and radio-quiet zones in **frequency bands allocated to radio astronomy**.



### Potential mitigation measures

- **Uplink:** Ensure sufficient distance between the ground stations and the radio telescopes to avoid potential reflections
- **Downlink:** Share accurate constellation's satellites ephemeris to avoid interference with planned observations

Caption:

- Radio astronomy bands
- Adjacent bands
- IRIS<sup>2</sup> Ku/Ka band use
- Potential overlap

# Conclusions

## Three key takeaways

- ⇒ **IRIS<sup>2</sup> is the new flagship constellation of the EU Space Programme**
  - A **strategic asset** for the **security of the EU** and its **Member States**
  - Backed by strong **ESA support**, in full cooperation with the **European Commission**
- ⇒ **One-of-a-kind Public-Private Partnership for space**
  - Allows **high level of mutualisation** to help **optimise development, deployment and operation costs**
- ⇒ **Sustainability at the core of IRIS<sup>2</sup> development**
  - A resource-efficient constellation aligned with **ecodesign principles**
  - A safe, secure, and responsible approach to space operations, aiming to **minimise environmental footprint, light pollution, and radio interferences**



# Thank you

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