



# 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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*Disclaimer: Views expressed are those of the individual and do not necessarily represent official views of the European Commission.*

# Contents

**01 Introduction**

**02 Technical overview & Service portfolio**

**03 IRIS² - Sustainability requirements related to Dark and Quiet skies**

**04 Conclusions**



# EU Policy context

- Regulation (EU) 2023/588 establishes the **Union Secure Connectivity Programme**:
  - Objective: to deploy an **EU-owned satellite constellation for secure communications (IRIS<sup>2</sup>)**
  - Total cost: **€10.6bn**
- Procurement of the **IRIS<sup>2</sup> concession agreement** (Public-Private Partnership):
  - Contract signature on 16 December 2024



# The IRIS² vision

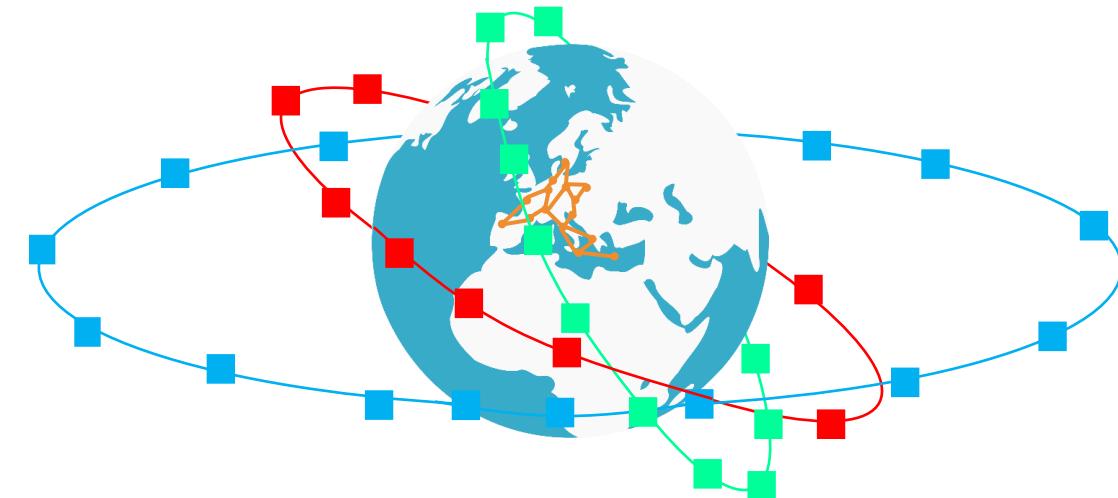
## Multi-orbit broadband global coverage

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

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

## 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**

GEO: Geostationary Earth Orbit

GHG: Greenhouse Gas

GOVSATCOM: Governmental Satellite Communications

LEO: Low Earth Orbit

MEO: Medium Earth Orbit

NTN: Non-Terrestrial Networks

RF: Radio Frequency

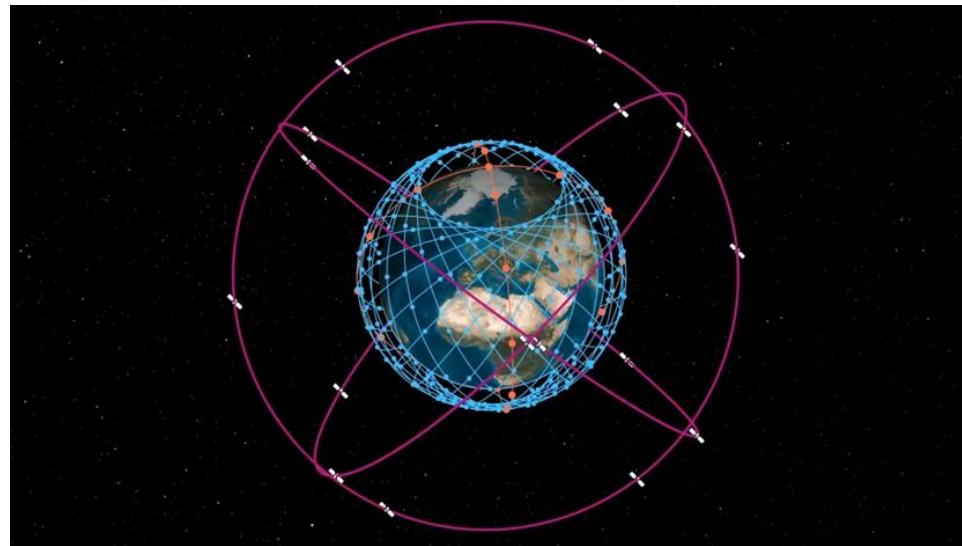
SME: Small and Medium Enterprise

# 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

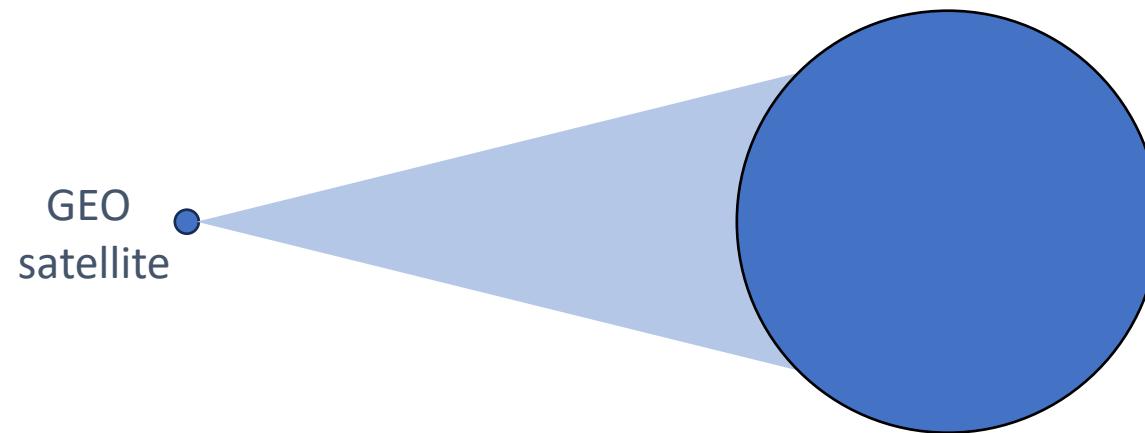
- **3 Ground Control Centers** (France, Italy, Luxembourg)
- **5 EU gateway sites** (2 of them including TT&C)
- **3 TT&C overseas stations**

### Connectivity

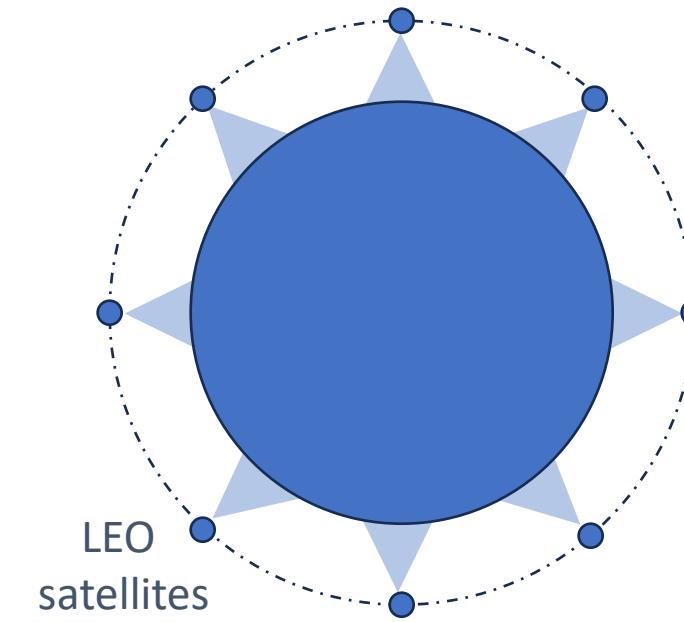
- **5G regenerative** capabilities in LEO and MEO
- Support for **transparent-mode services**
- Support for **direct UT-to-UT connectivity**

# 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



Connecting key infrastructures



Crisis management and external actions



Surveillance



Global satellite connectivity

Governmental use cases

Commercial use cases



## 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

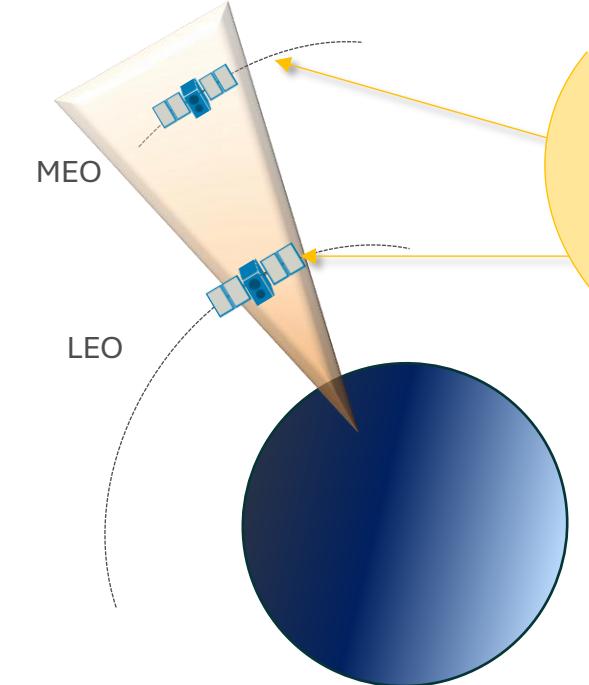
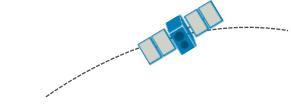


# Dark Sky

## Mitigating light pollution

### Key physical effects (wrt. Altitude)

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



# Dark Sky

## Mitigating light pollution

### Key physical effects (wrt. Altitude)

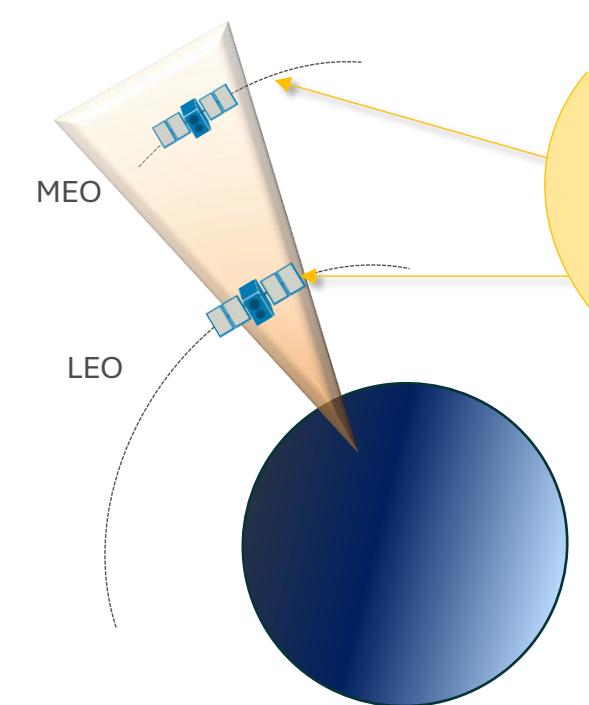
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- IRIS<sup>2</sup> requirement:

*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  $7,0 V_{mag} + 2,5 \times \log(Sat_{Altitude} / 550 \text{ km})$

**/ 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



# Dark Sky

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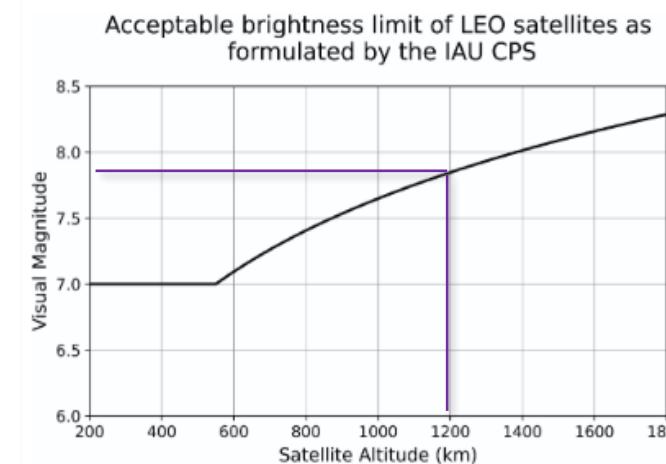
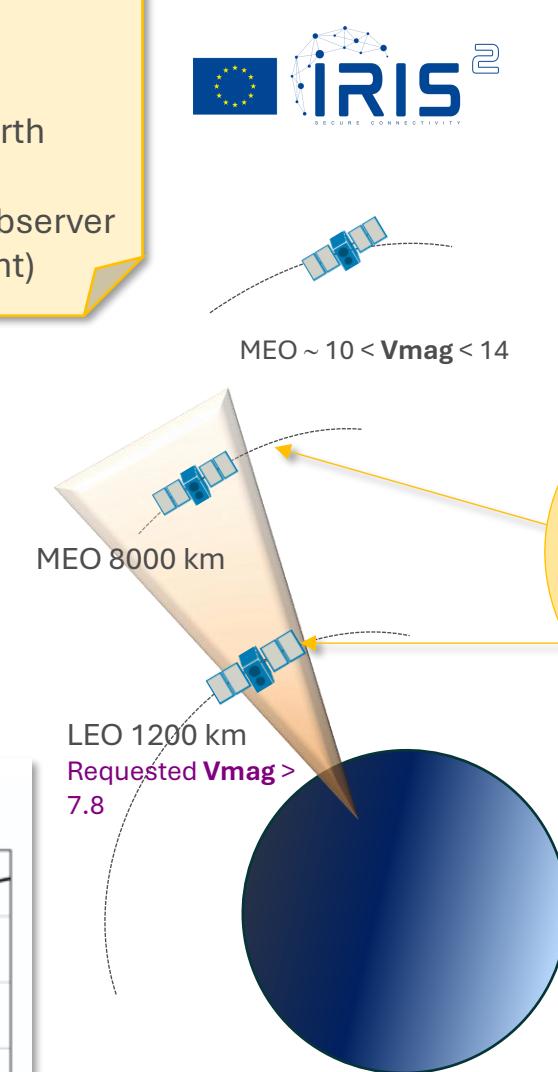
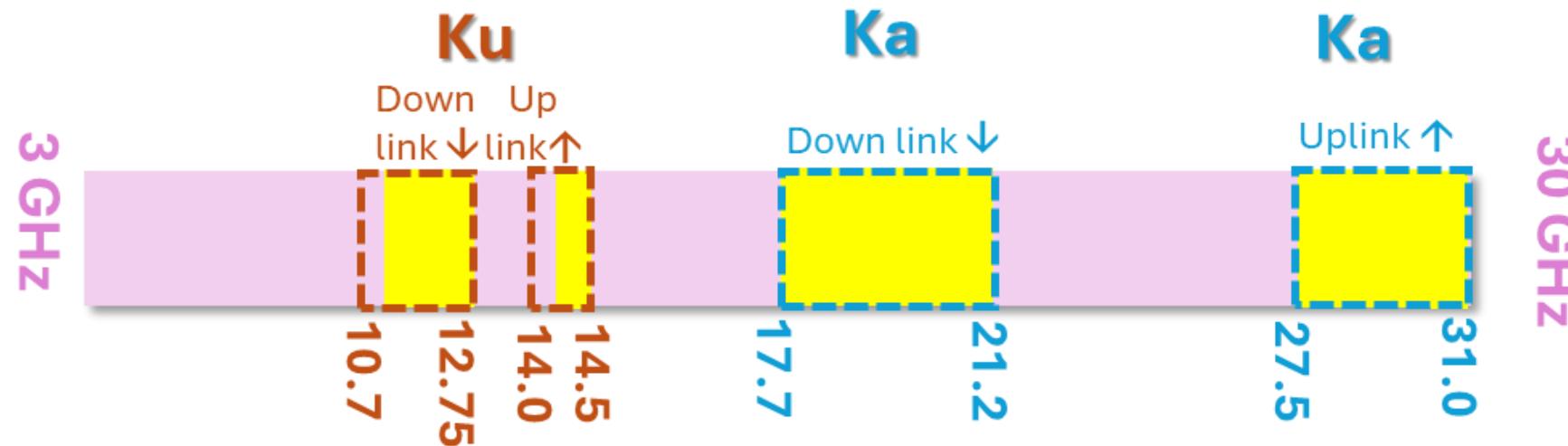


Figure 3: Brightness limit of LEO satellites as proposed by the IAU. The vertical axis denotes  $V_{\text{mag}}$  [31]



# Quiet Sky

## Potential radio interferences

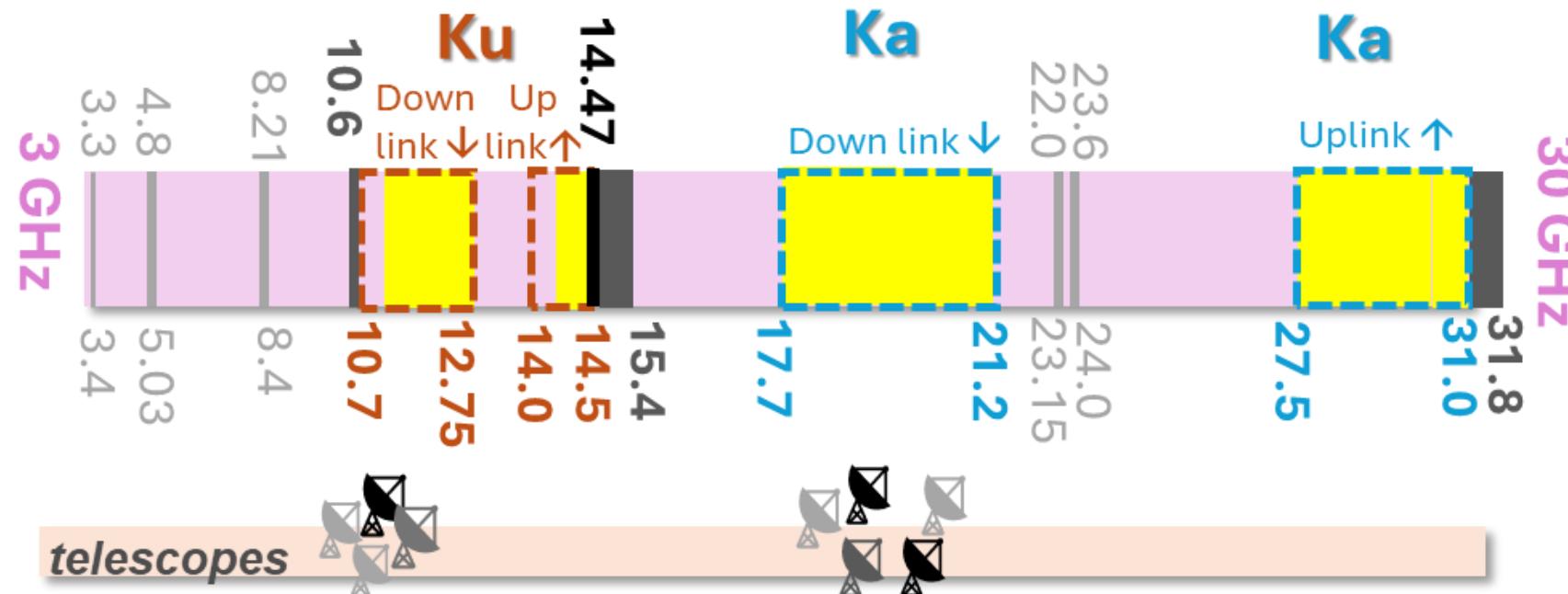


Caption:

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

# Quiet Sky

## Potential radio interferences



### Caption:

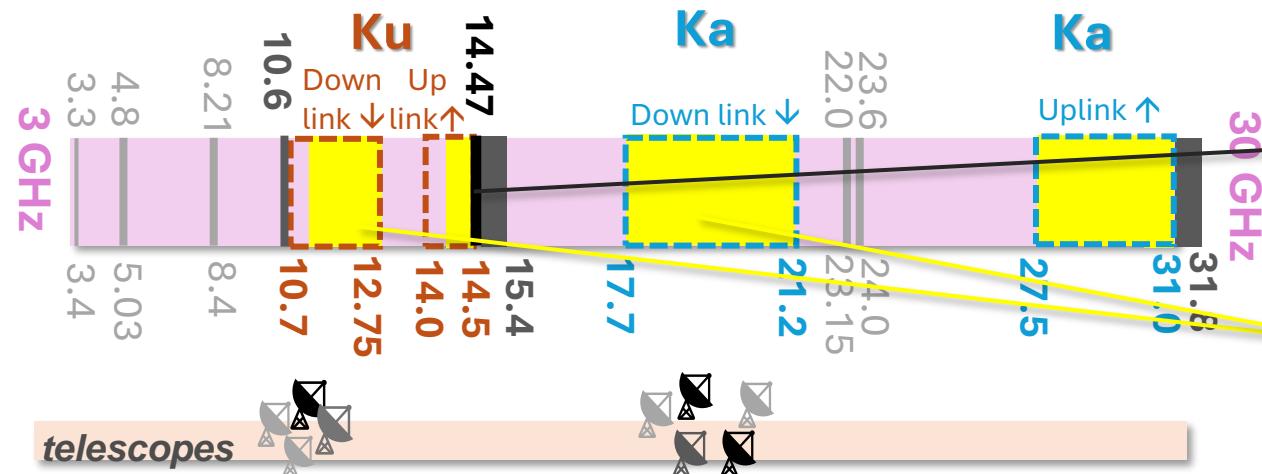
- Radio astronomy allocated bands
- Adjacent allocated bands
- IRIS<sup>2</sup> Ku/Ka band use
- Potential overlap

# 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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