

THE EARTH OBSERVATION CHALLENGE: SAFEGUARDING RADIO FREQUENCY SPECTRUM FOR A SUSTAINABLE FUTURE

Key Takeaways



Radio spectrum is a finite and increasingly congested resource utilised by public and private actors across a variety of spheres — from mobile communications to remote sensing.

Though often viewed as a niche topic outside of dedicated industries, spectrum is vital for a variety of day-to-day services in space and on Earth: from Wi-Fi availability to the work of emergency services. As the number of providers and end-users continues growing exponentially, **equitable distribution of spectrum** across its different applications has thus become a key question for industrial and governmental actors alike. **Fair and thoughtful spectrum allocation pursued through the World Radiocommunication Conferences (WRC) and national regulatory action must ensure continuous high-quality access and performance of essential systems.**

With a plethora of actors vying for this precious resource, however, **uninterrupted access of some services to their dedicated spectrum bands is increasingly challenged.** Of particular concern is **Agenda Item 1.7. of the upcoming WRC-27** which will assess whether **portions of the X-Band that are allocated for remote sensing purposes could be opened to International Mobile Telecommunications (IMT) future 6G mobile and fixed service.**

These frequency bands are currently used by almost every single one of the **roughly 1,200 Earth observation (EO) spacecraft** whose data is vital for key domains from security and defence to climate change monitoring, and who have no viable frequency alternative.

For space-to-Earth (downlink) communication, the X-band is the most critical spectrum segment for transmitting EO data from satellites. This is due to its favourable physical properties, coexistence with current co-primary services (including FS and FSS), and global harmonisation for remote sensing satellite applications. Currently, there is no large-scale alternative to X-band downlinking. The potential **interference from sharing the frequencies could put uninterrupted EO data sharing at risk if spectrum coordination is not pursued through a level-playing field.**

To address the subject, on 15 January 2024, the **European Space Policy Institute (ESPI) and the European Association of Remote Sensing Companies (EARSC) organised an event titled “The Earth observation challenge: Safeguarding radio frequency spectrum for a sustainable future”** in Brussels. The event promoted a discussion about the feasibility and alternatives to such sharing, as well as a broader conversation about the future of the radio spectrum and its accessibility for actors across the EO domains. Key takeaways from the event are presented below.



THE STATE OF PLAY: why EO needs a dedicated band

In the first half of the event, participants set the scene on the issues surrounding sharing the X-Band with actors beyond the EO community, regulatory challenges, and international differences in approaches to spectrum. Speakers highlighted the properties that make the X-Band uniquely valuable for the EO sector, discussed long planning times that make sharing with or reallocation to IMT infeasible and provided advice to companies who want to amplify their voices on the issue.



1 X-BAND IS VITAL FOR EO AND NEEDS TO BE DEFENDED

X-Band comprises 8025 - 8400 MHz and plays a crucial role in EO due to its physical properties, such as resistance to weather interference, its compatibility with other services, and its high data rate compared to other bands like S-Band (2GHz). This makes it particularly effective for EO applications, supporting **essential services like disaster response, environmental monitoring, and climate change tracking.**

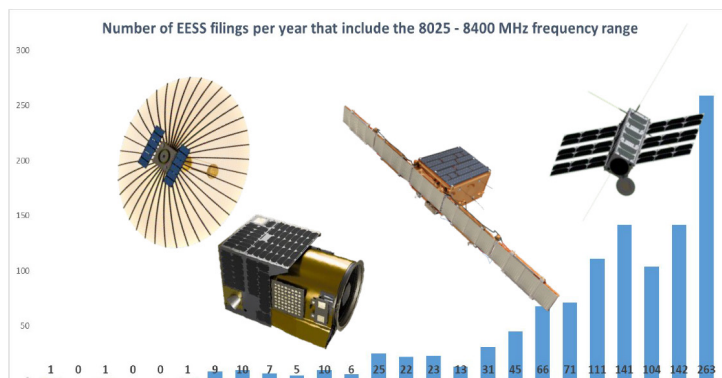
The continuous 375 MHz of protected bandwidth provided by **X-Band is the backbone of remote sensing**, as no viable alternatives

THE EARTH OBSERVATION CHALLENGE: SAFEGUARDING RADIO FREQUENCY SPECTRUM FOR A SUSTAINABLE FUTURE

Key Takeaways



currently exist that offer similar levels of protection or bandwidth. Moreover, X-Band's broad adoption by satellites and ground stations has contributed to making it more affordable and accessible, fostering global participation in EO activities, especially in emerging commercial sectors. Its significance extends beyond scientific and governmental use, providing invaluable socio-economic and environmental benefits across various industries. Timely EO data is crucial for services like fire monitoring, where delays of several hours could significantly hinder emergency response efforts. Immediate data is essential for dispatching ground teams, and any delay could render the data ineffective, leading clients to abandon services.



Number of EESS filings per year that include the X-Band, per Matteo Emanuelli (Airbus). Each filing includes one or more satellites, and sometimes hundreds of them.

As EO companies become more reliant on real-time data for various applications, maintaining and increasing the current data flow is critical for operational efficiency and future growth. **Without timely data, the long-term viability of EO services is at risk, particularly as the volume of satellite data continues to increase.**

2 A STABLE REGULATORY ENVIRONMENT IS REQUIRED FOR INDUSTRY TO THRIVE

The potential of the X-Band being identified as suitable for IMT technology standards could relegate other users of the band to a "secondary allocation status," severely disrupting EO services, leading to expensive infrastructure changes and limiting access to essential EO data. Additionally, for satellites still in their planning stages, such an identification would necessitate extensive redesigns and lead to prolonged development timelines, potentially delaying their deployment by years. Given the 10–15-year governmental planning and 15–20-year operational lifecycle of GEO satellites, securing spectrum is critical for these long-term investments. **Though commercial lifecycles in LEO are faster, the sector would still be hit by uncertainty surrounding the issue.**



For example, for EO to move to higher frequencies like Ka-Band would require extensive new infrastructure, with some locations in the world entirely unsuitable for it. Ka-Band is severely susceptible to "rain fade" — a phenomenon where stations suffer significant performance degradation whenever there is rain or high humidity. Europe's regulatory approach may increase uncertainty.

The global approaches to spectrum regulation vary significantly. For example, the U.S. shares borders with just two countries and has enough internal landmass that its wireless activities mostly do not interfere with those of its neighbours. Therefore, it can adopt a more unilateral approach to spectrum solutions. In contrast, with its many

smaller neighbouring countries, Europe has evolved a regional-collaborative approach, ensuring harmonized regulations that are vital for satellite operations. **Considering this heightened need for collaborative spectrum approaches among European countries, a WRC-27 decision to identify the X-band for IMT may lead to years-long uncertainty** about the requirement's implementation. Such uncertainty could be detrimental to future planning of EO services, setting the European industry back years.

3 INDUSTRY SHOULD TAKE ACTION TO AMPLIFY THEIR VOICES

The urgency for collaboration and awareness in safeguarding EO services is amplified by the finite nature of radio frequency spectrum. The X-Band, essential for EO, is particularly vulnerable, and its potential identification for IMT could severely disrupt vital services. To address this, practical steps include proactive advocacy from smaller companies that face challenges due to limited resources and relationships with regulators. **Industry stakeholders must work together to raise awareness among policymakers and the public about the societal benefits of EO.** Particularly in areas like disaster management and climate monitoring. The focus must be on long-term collaboration to maintain EO services as a critical tool for global socio-economic and environmental wellbeing.

THE EARTH OBSERVATION CHALLENGE: SAFEGUARDING RADIO FREQUENCY SPECTRUM FOR A SUSTAINABLE FUTURE

Key Takeaways



ROAD TO WRC-27: implementing steps

Throughout the second half of the event, the participants underscored the **negative impacts the proposed X-band sharing under agenda item 1.7, as well as other WRC-27 agenda items**, will have on Europe's ability to provide timely, high-quality EO data. Concerning ESA alone, the decisions taken on agenda item 1.7 will affect 21 EO missions — one of the greatest threats in the WRC-27 workplan. In light of the situation's gravity, during the second panel, the discussion focused on the key steps required to ensure efficient coordination for and the most impact at WRC-27.

4 ANTICIPATE FUTURE NEEDS TO MAINTAIN EUROPE'S EDGE IN EO

Today, **Europe is at the forefront of EO technology, quality and capacity** in the world. But with other actors like China and the U.S. steadily bridging the gap, **merely having the best satellites will not be enough to maintain this primacy**. As European and worldwide space industries and economies continue their exponential growth, **concerted efforts to make European companies competitive throughout the globe will be required to stay ahead**. These efforts must include planning for and anticipating future spectrum requirements for industries across Europe to ensure a thoughtful balancing of interests among different stakeholders.

In the EO sector, **the ability of European providers to share increasingly more data with less and less latency will be critical to their future development**. Thus, aside from maintaining frequency access the industries already have, **they must plan for and anticipate future needs and start negotiating with relevant stakeholders early**. Such conversations can and should start even before some of the relevant technologies competing for spectrum access have fully matured — as is happening right now with the anticipation of 6G networks being launched for the mass market as of 2030. Several preliminary agenda items for WRC-31 relevant to EO have also already been proposed, allowing the EO community to assess what those items might mean for its future development.

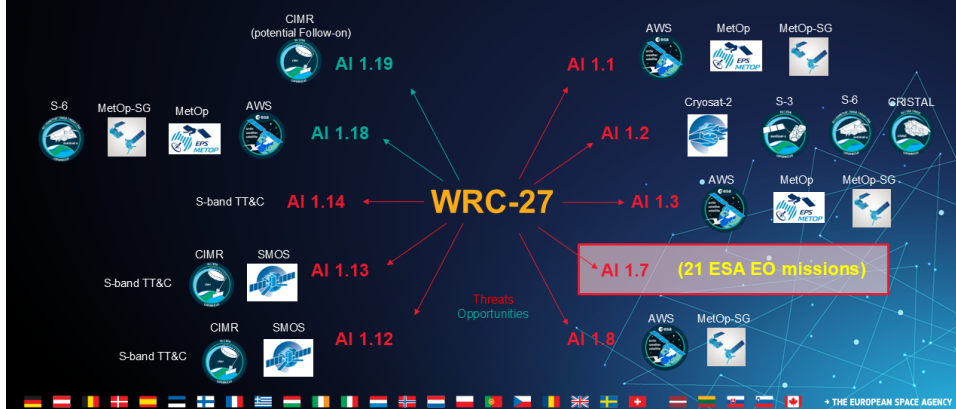
5 INVOLVE AS MANY STAKEHOLDERS AS YOU CAN, AS EARLY AS YOU CAN

At the EU level, DG CNECT is in charge of formulating a legally binding EU-wide negotiating position for each forthcoming WRC, focused on Agenda Items under EU competence. The position is initially drafted at the Radio Spectrum Policy Group (RSPG), which then invites stakeholders to provide comments prior to producing the second draft, which will ultimately be further amended by Member States before becoming a legally binding Council decision. Despite the consultation campaign, all RSPG drafts remain confidential to allow the EU to negotiate at the WRC from a position of strength. Relevant policy actors like DG DEFIS, are greatly involved in the RSPG process. Alongside the process at the Commission level, the Conference Preparatory Group of the European Conference of Postal and Telecommunications Administrations (CEPT) prepares its own position. The Group comprises representatives from both national spectrum authorities and industry. The Council decision is normally released prior to the finalisation of CEPT's process — though the decision remains confidential until after the relevant WRC. This suggests that CEPT's work largely cannot be included in the Council's formulation of its position.

With such a complex procedure and system of relevant stakeholders, incorporating everyone's voices and desires may be difficult: as one speaker said, the goal of the process is "a compromise that leaves everyone equally unhappy". **Yet, involving different relevant parties**, including industry, as early as possible and giving stakeholders from different industries a forum to engage on their differences before the final decision is published **may help them find more stable and efficient compromises**. Such an approach would ultimately strengthen the Union's negotiating position.

World Radiocommunication Conference 2027 (WRC-27)

Several Agenda Items (AI) of WRC-27 may impact ESA-EUMETSAT EO missions, both for the **sensors** and for the **communication links**.



List of ESA missions impacted by WRC-27, Simonetta Cheli, Director of Earth Observation, ESA



THE EARTH OBSERVATION CHALLENGE: SAFEGUARDING RADIO FREQUENCY SPECTRUM FOR A SUSTAINABLE FUTURE



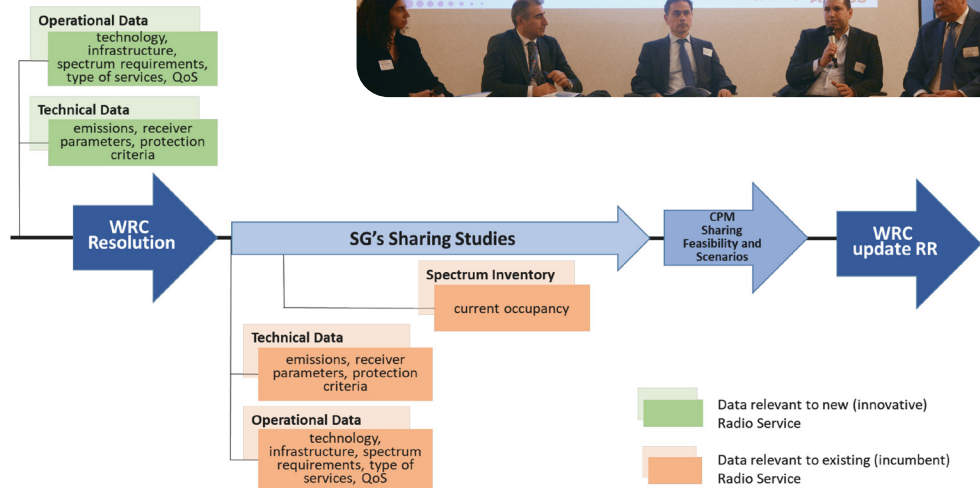
Key Takeaways



6 FOCUS ON SOCIO-ECONOMIC, NOT JUST TECHNICAL, EFFICIENCY

As stakeholders prepare for the WRC, they rely on studies prepared by study groups — work that often focuses on the technical feasibility of propositions in various agenda items. With spectrum as congested and contested as it is today, however, **the studies should focus more on the socio-economic impact of proposed changes.** Socio-economic studies and considerations can allow the spectrum community to have more clarity on certain issues that go beyond purely technical considerations. Though such socio-economic analysis is already being applied in the discussions of the EU's common negotiating position, pushing to streamline it throughout the WRC and Member States' process could help ensure the most efficient spectrum allocation from a humanity-centred perspective.

From an EO standpoint, for a long time, the perception of EO's relevance was low compared with that of telecommunications. Yet, that view is increasingly changing as EO proves critical for disaster management, climate change, food security, and other key issues. Further increasing the visibility of the positive policy and economic impacts of EO will help cement it as a critical tool for humanity's future and, thus, a cornerstone of the human benefit-oriented perspective on spectrum allocation. **Such socio-economic analysis would be disruptive in the hands of decision-makers, and would put the EO segment in a different light even in economic terms when compared to terrestrial telecom.**



Overview of WRC Procedure, Vadim Nozdrin, ITU

7 DEFEND EUROPEAN CAPABILITIES AND LEADERSHIP

The only way to protect Europe's autonomy and non-dependence in space is to have uninterrupted access to its infrastructure, which includes access to timely and continuous data. The decisions taken on the X-band, as well as other agenda items, at the WRC-27 may impact such access, as they could affect the feasibility of future deployment and development of ground stations in Europe, forcing industry to seek other locations for its relevant terrestrial infrastructure to prevent interference.

This outcome would have dire consequences for European leadership in space — and with autonomy and resilience becoming critical for Europe over the past years, **Europe cannot afford to take a step back.** The political aspect of spectrum access for EO, therefore, should not be shunned away and instead used as an argument to defend the EO community's positions.



Event enabled by:



ESPI and EARSC plan to continue contributing to the ongoing debate, tackling several challenges that will be addressed in the current study cycle, at WRC-27 and beyond. Please reach out to us if you would like to know more.