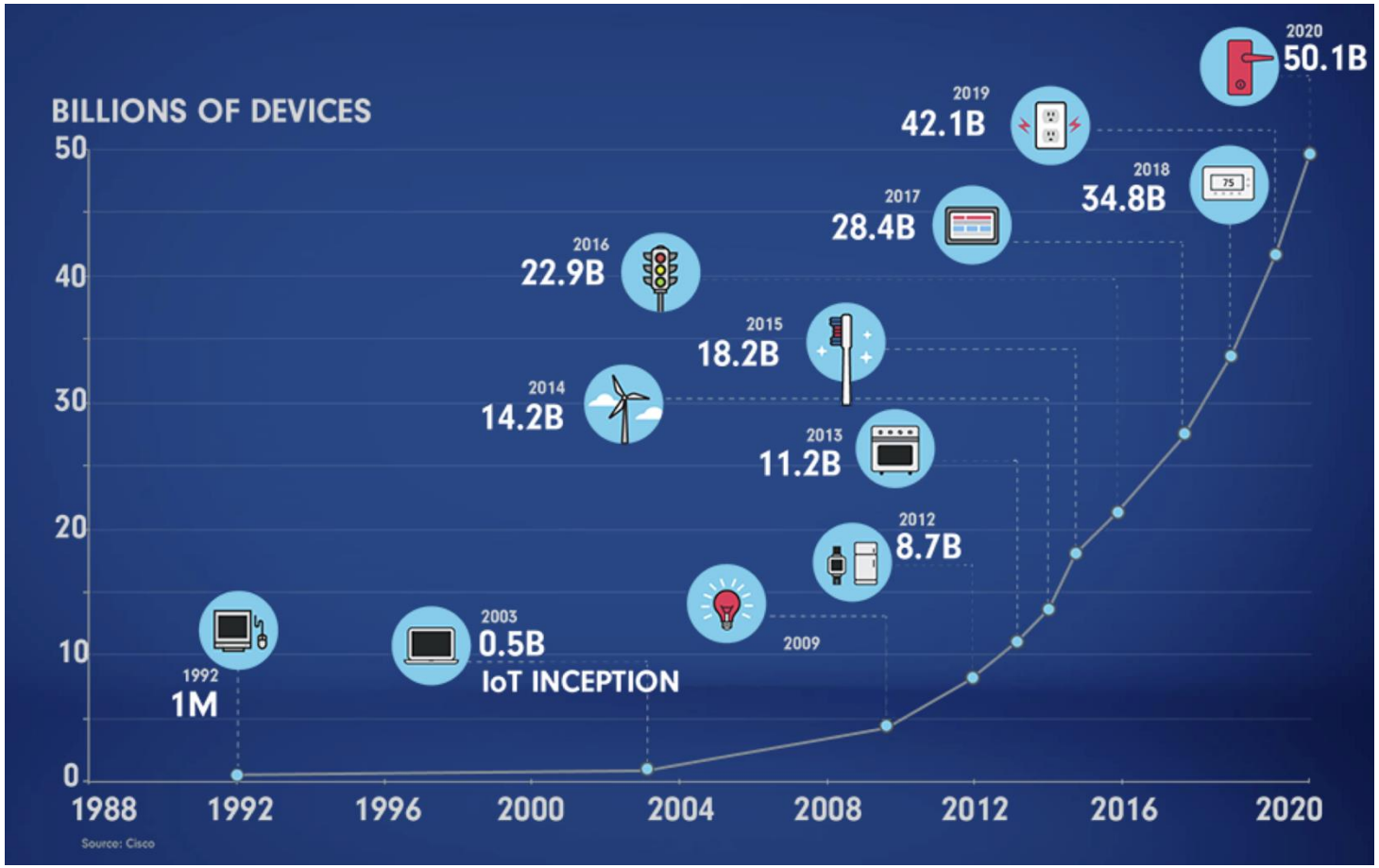
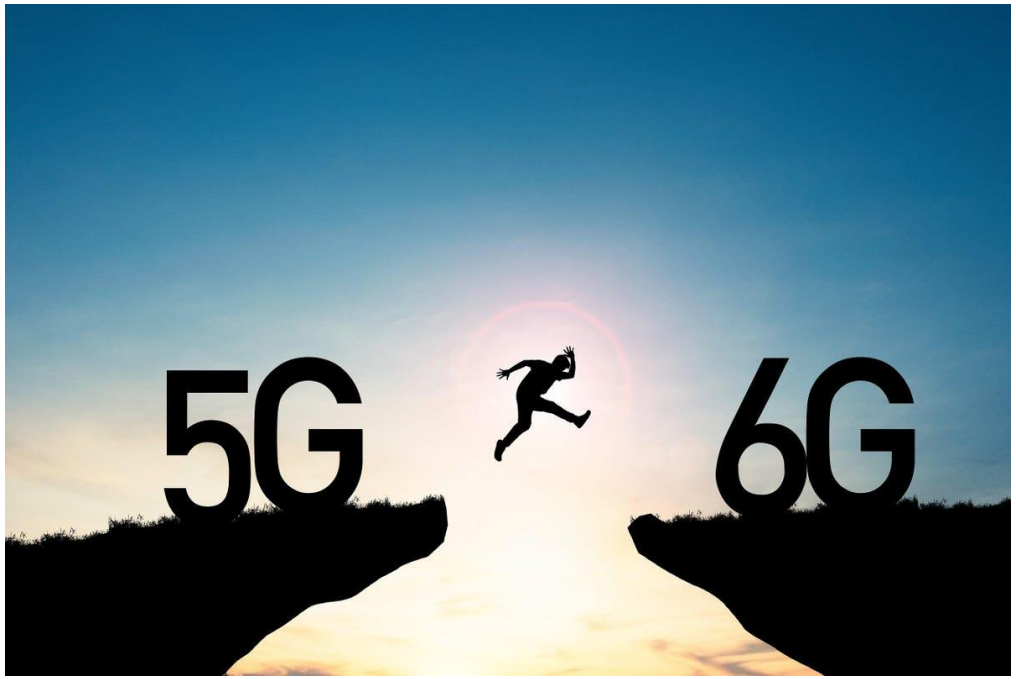
Committee on Radio Astronomy Frequencies (CRAF)

M. Lindqvist, Onsala

- Introduction
- Spectrum management & CRAF
- World Radio Conference 2023 and beyond
- The way forward

Satellites, 5G, IoT, 6G





Pressure on radio spectrum is dramatically increasing

Spectrum is money and politics

Leaders | Internet from the sky

Starlink's performance in Ukraine has ignited a new space race

Never mind the moon; look to low-Earth orbit

Sweden bans Huawei and ZTE from 5G telecoms networks

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European Science Foundation

How do we solve it?

- Remote locations of telescopes, Radio Quiet Zones (RQZs)
- Robust designs – receivers and filters
- RFI mitigation, machine learning
- Spectrum management

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The importance of International Bodies

- The radio spectrum is a limited natural resource equally available in every country.
- Radio waves do not respect national borders - international regulations are required!
- An efficient use of the radio spectrum can only be obtained by rules agreed on a worldwide basis.
- Making the regulations work/making new regulations is called "spectrum management".

The importance of International Bodies

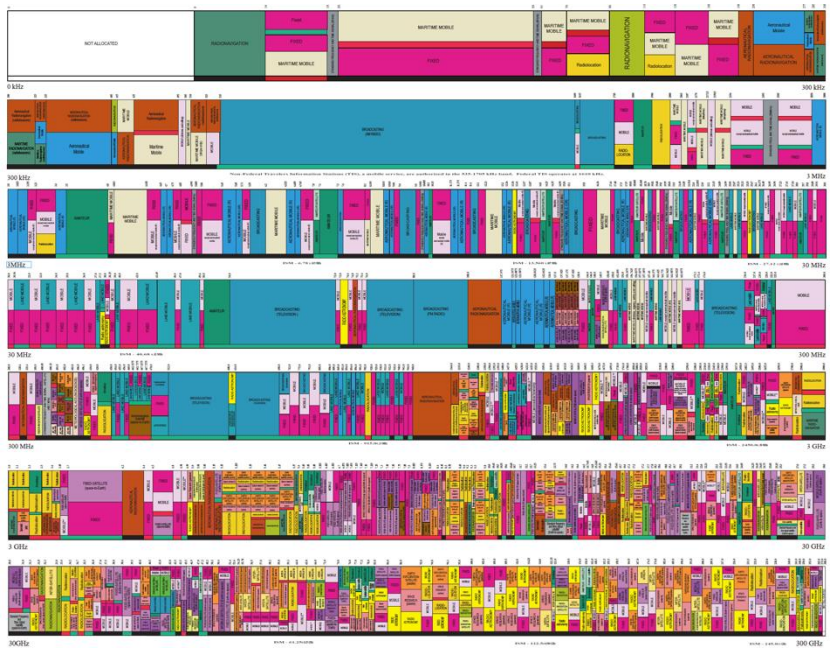
- The rules are established by International Bodies tasked to promote the harmonisation of Radio Spectrum according to a top-down approach:

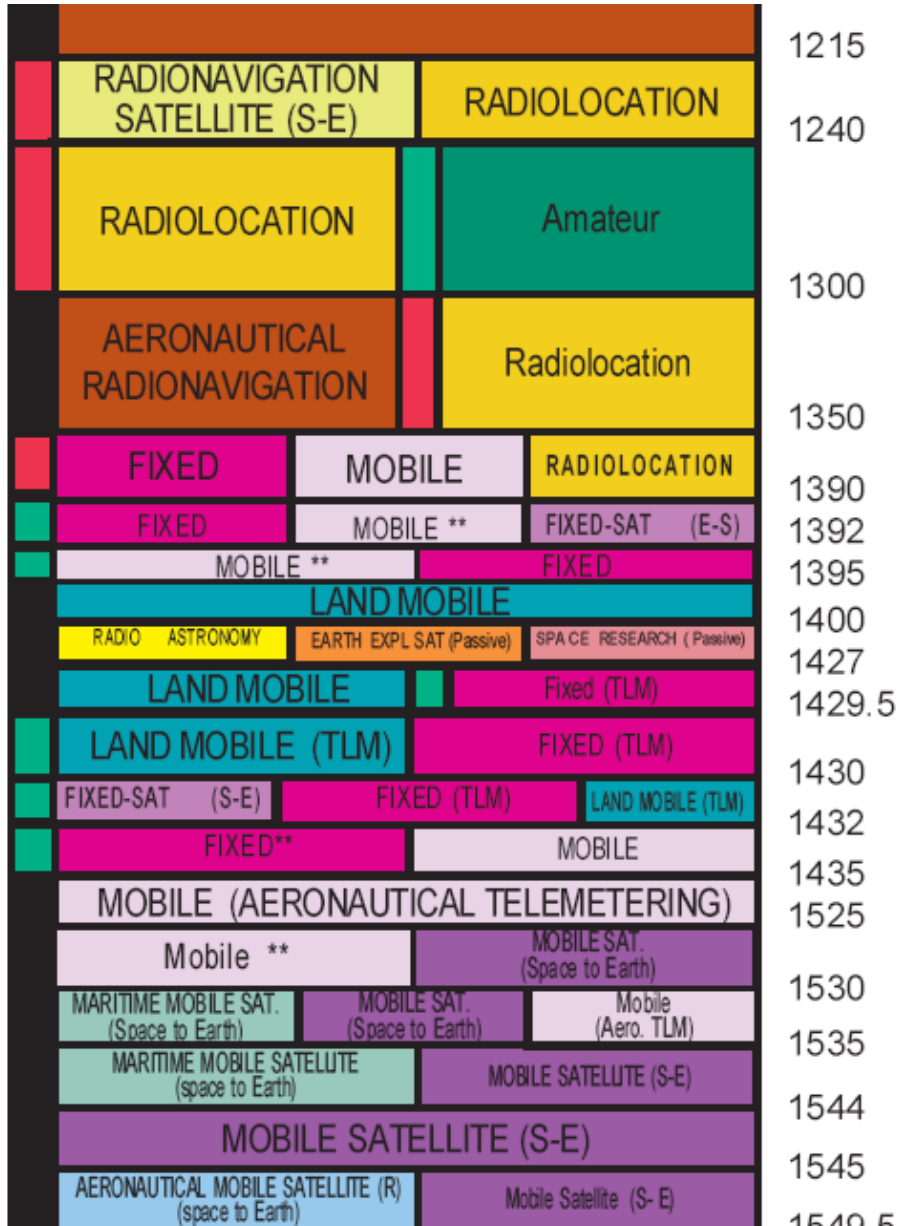
- ITU-R (International Telecommunication Union, Sector Radiocommunications), an agency of the United Nations

- The European Conference of Postal and Tele-communications Administrations (CEPT) of 46 European regulatory administrations (~~Russia, Belarus~~) administers radio spectrum in Europe. In Sweden, PTS.

- **Administrations DECIDE!**

Spectrum allocation





Spectrum bands are allocated to 'services'

- Service = purpose or application
- Most services are 'active' – they transmit
- PRIMARY and secondary allocations
- Radio astronomy service (RAS) is 'passive'
- Fragmented

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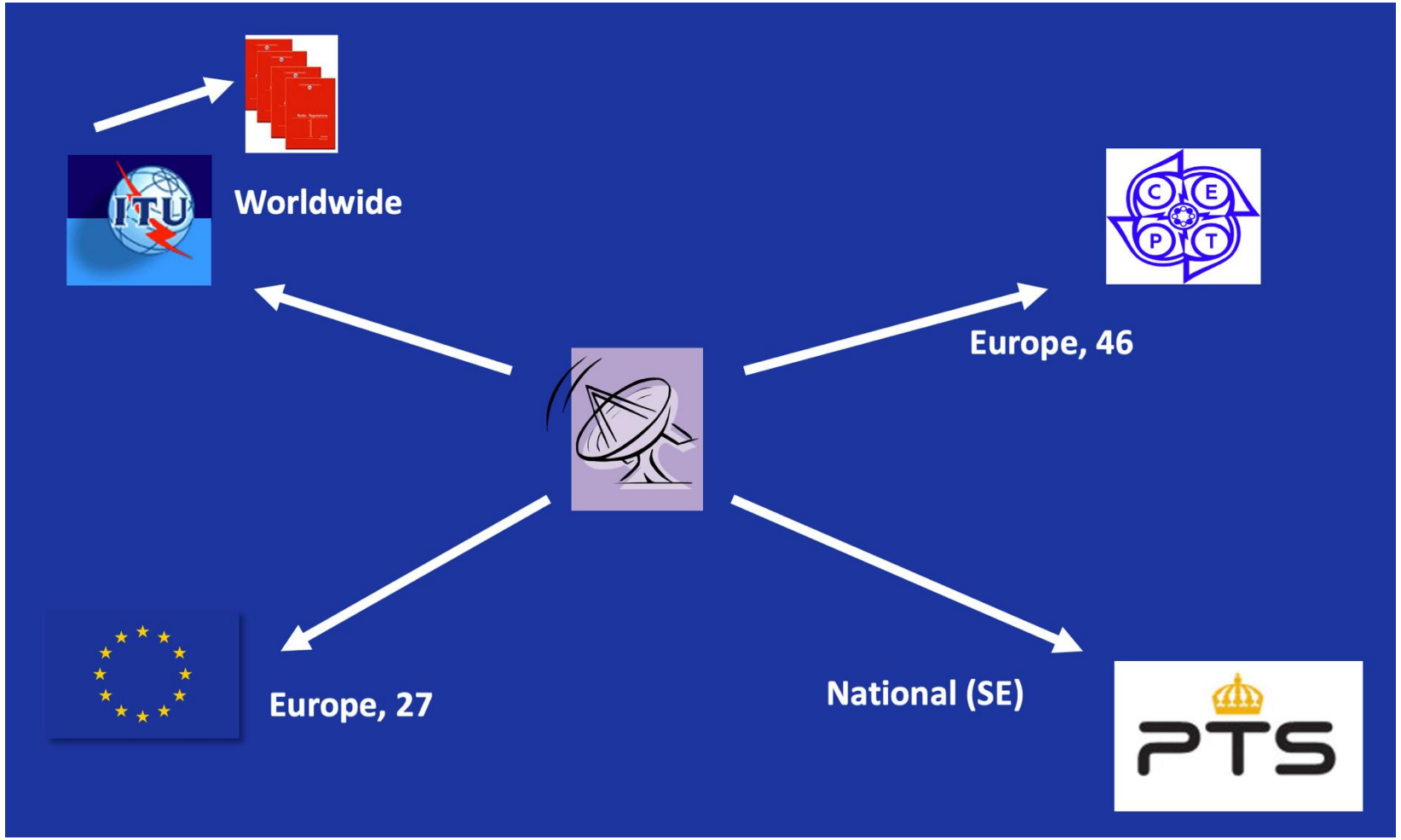
Spectrum Management



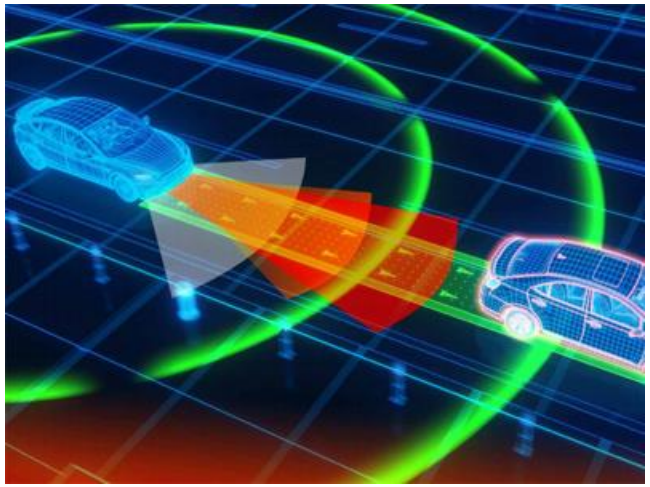
CRAF –
The Committee on Radio Astronomy Frequencies

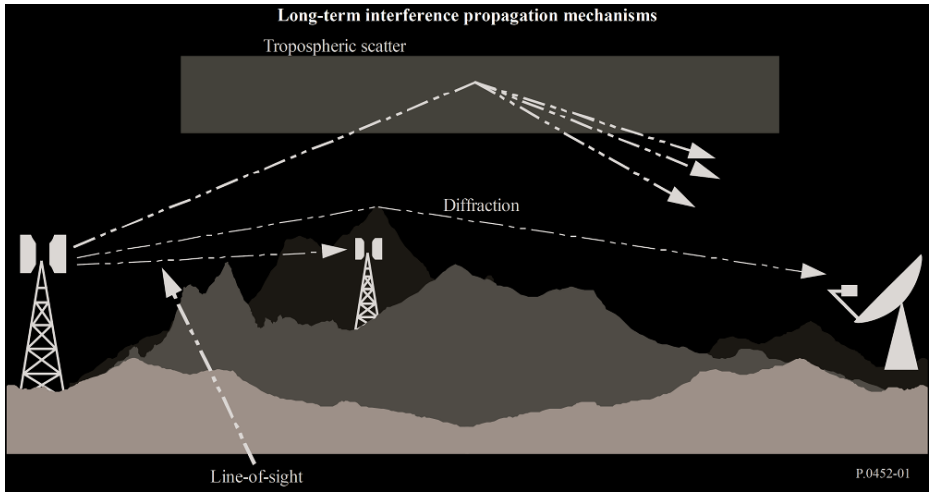
- Complicated landscape – radio astronomy needs to coordinate. Synergy effects.
- CRAF is the expert committee on radio astronomy frequencies of the European Science Foundation (ESF).
- CRAF represents all European radio observatories at the European and global level. Cooperate with IUCAF, CORF, RAFCAP, SKAO, CPS.
- CRAF has member institutes in 22 countries + observers.
- Full-time frequency manager, Waleed Madkour, JIVE, the Netherlands.
- ITU-R sector member & observer status in CEPT.
- CRAF submit input documents (usually on compatibility studies for new proposed frequency allocations for active spectrum use) – pycraf (GitHub).

CRAF

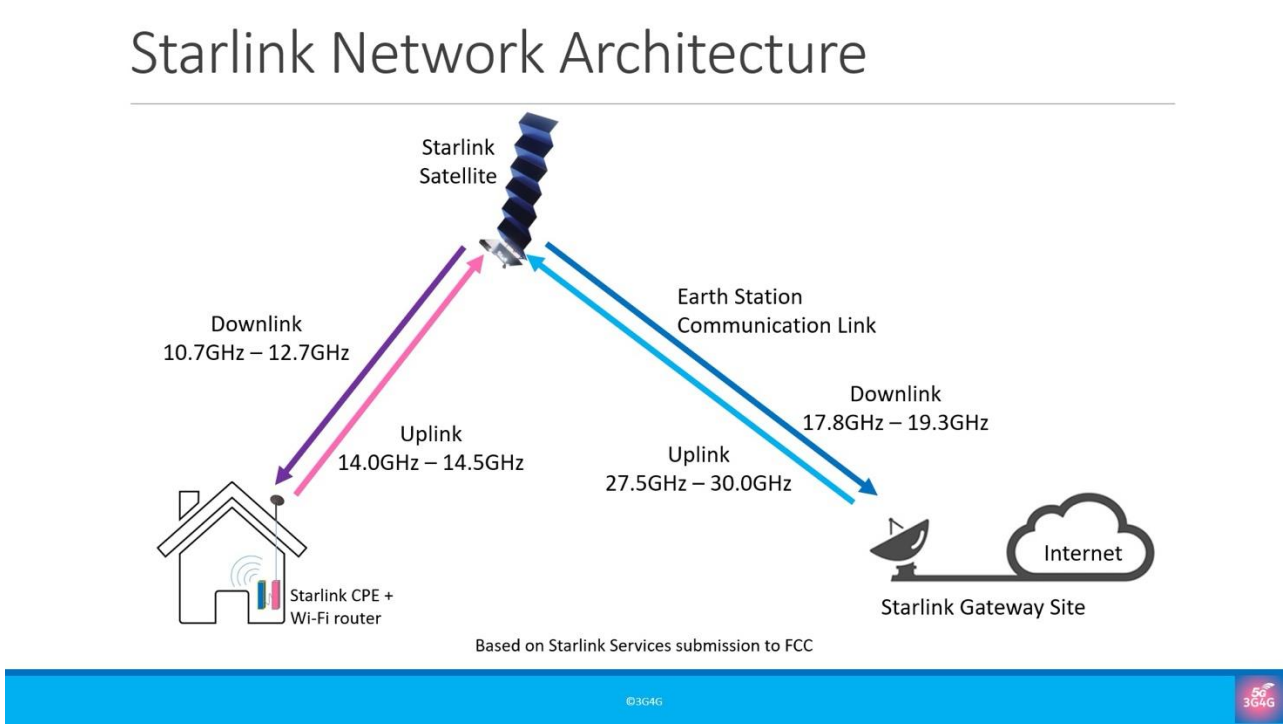
- Re-structuring in 2018/2019
  - ✓ Stakeholder's Forum
  - ✓ Management Team
  - ✓ Work Item (WI) Teams

WI team	
SEnn	Spectrum engineering topics in CEPT, in particular ECC groups SE7, SE24, SRD/MG
SAT	Satellite systems at CEPT and ITU-R, in particular ECC Groups SE40, FM44, and ITU-R SG 4
IMT	IMT-related topics in CEPT and ITU-R, in particular ECC Groups PT1, and ITU-R WP 5D
VGOS	VLBI Global Observing System; organise future protection at ITU-R; active at ITU-R WP 7D
SWS	Space weather sensors under WRC23 A.I. 9.1a; mainly at ITU-R WP 7C
MONIT	Spectrum monitoring and RFI measurements at CRAF observatories
PO	Public outreach activities



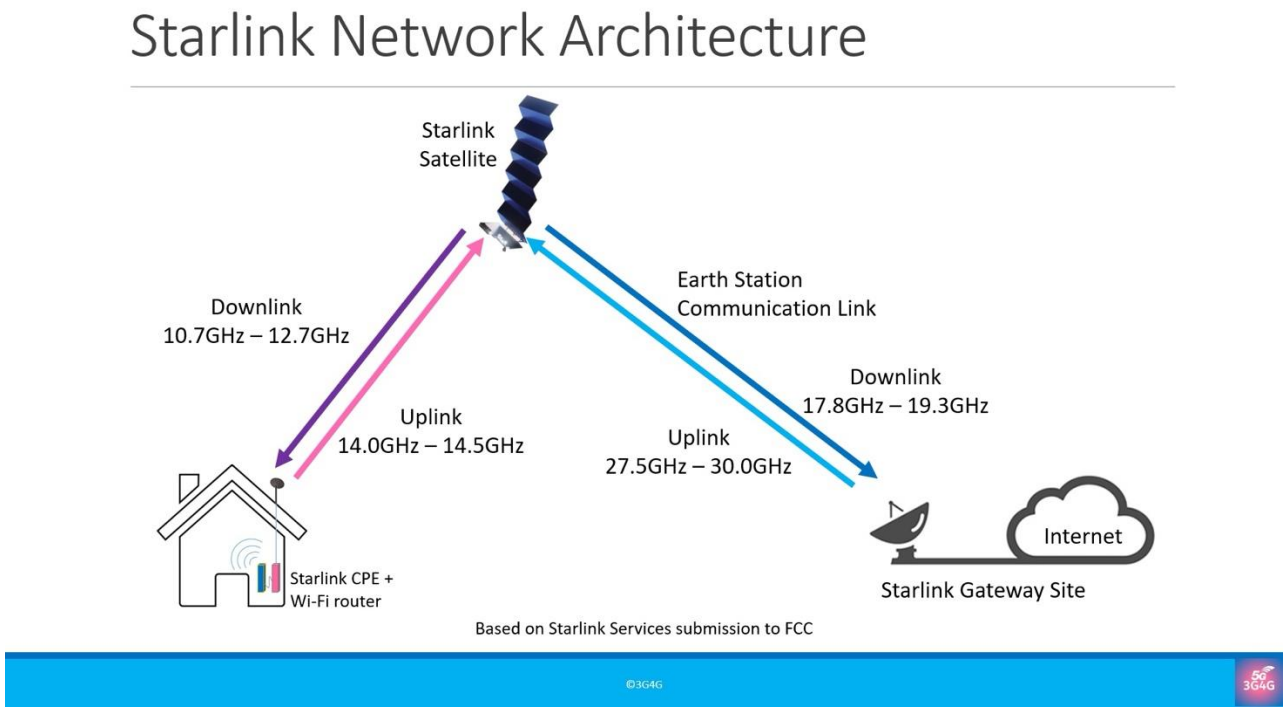


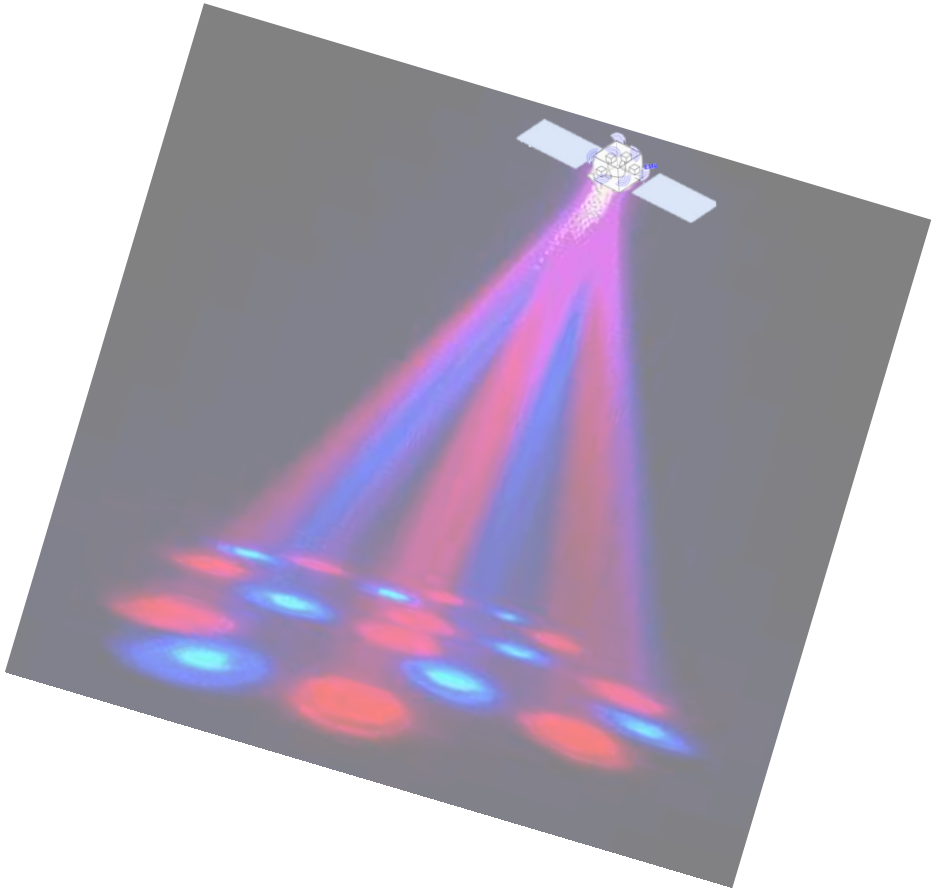
Non-geostationary satellite systems



CRAF+SpaceX monitoring collaboration

Non-geostationary satellite systems





CRAF+SpaceX monitoring collaboration

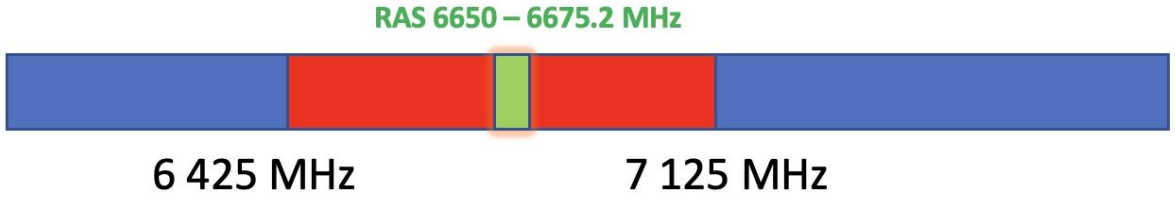
WRC-23

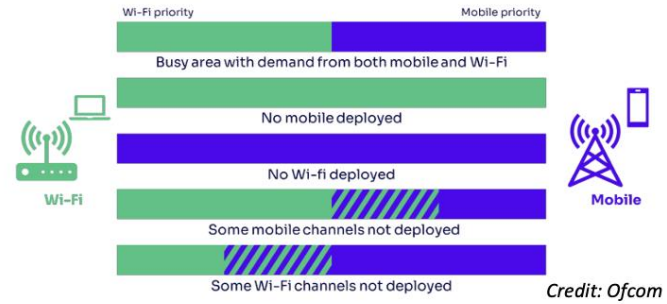
WRC-23


World Radiocommunication Conference 2023 (WRC-23)
Final Acts
ITUWRC
DUBAI2023
20 November - 15 December 2023
Dubai, United Arab Emirates


ITUWRC
DUBAI 2023

AI 1.2 : IMT identifications (Region 1)





- The frequency bands 6 425-7 125 MHz is identified for IMT in Region 1.
- The IMT identification footnote includes recognition that the frequency bands are also used for WAS/RLANs.
- RAS protection requires further steps at the CEPT level.

RESOLUTION 220 (WRC-23)

considering

f) that, in the frequency band 6 650-6 675.2 MHz, radio astronomy observations are carried out under No. **5.149** for measurement of methanol spectral lines;

invites administrations

3 to take all practical steps to protect the radio astronomy service (RAS) from harmful interference in the frequency band 6 650-6 675.2 MHz, which covers spectral lines of importance for current astronomical investigations, in accordance with No. **5.149**,

invites the ITU Radiocommunication Sector

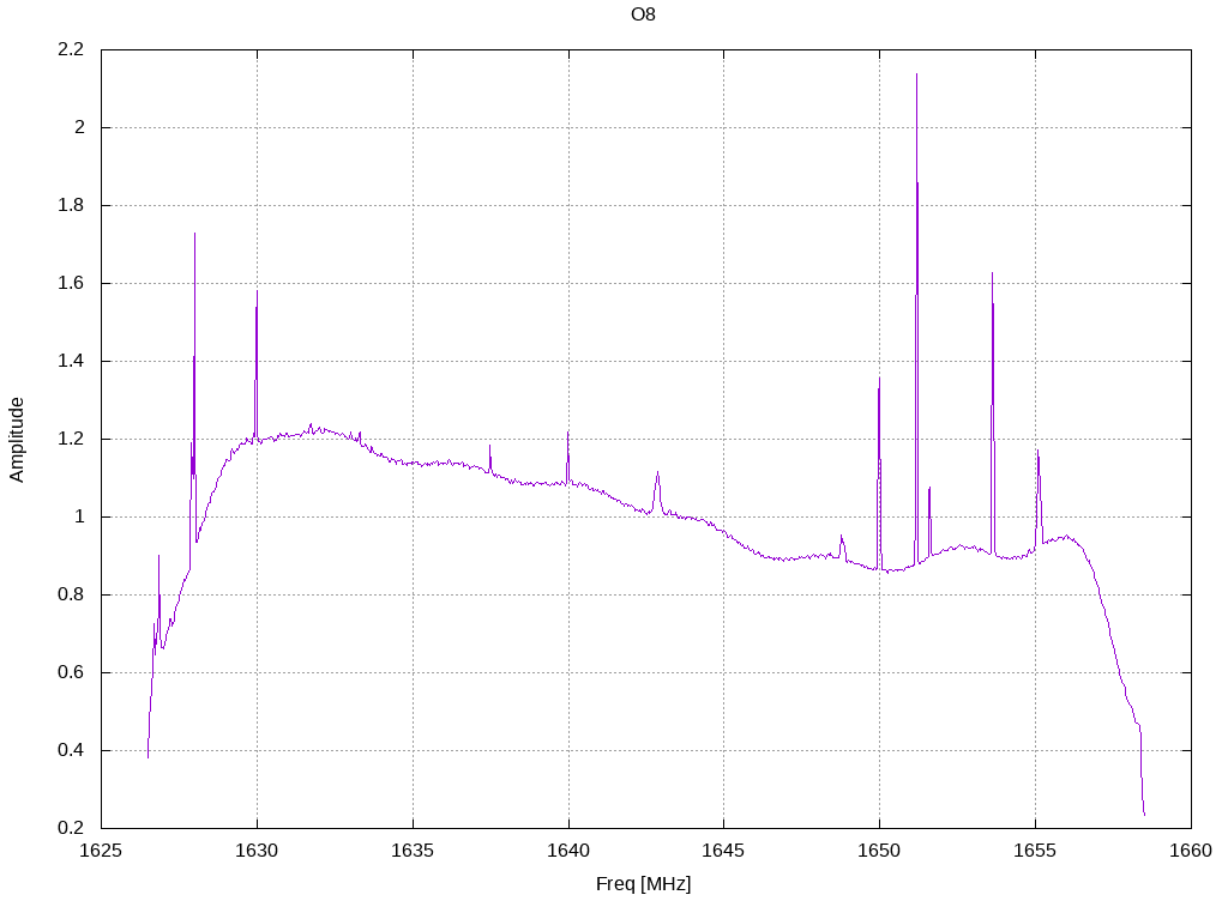
6 to develop an ITU-R Recommendation to address methods for the determination of the protection area around existing RAS stations from IMT stations in the frequency band 6 650-6 675.2 MHz;

Topics for WRC-27

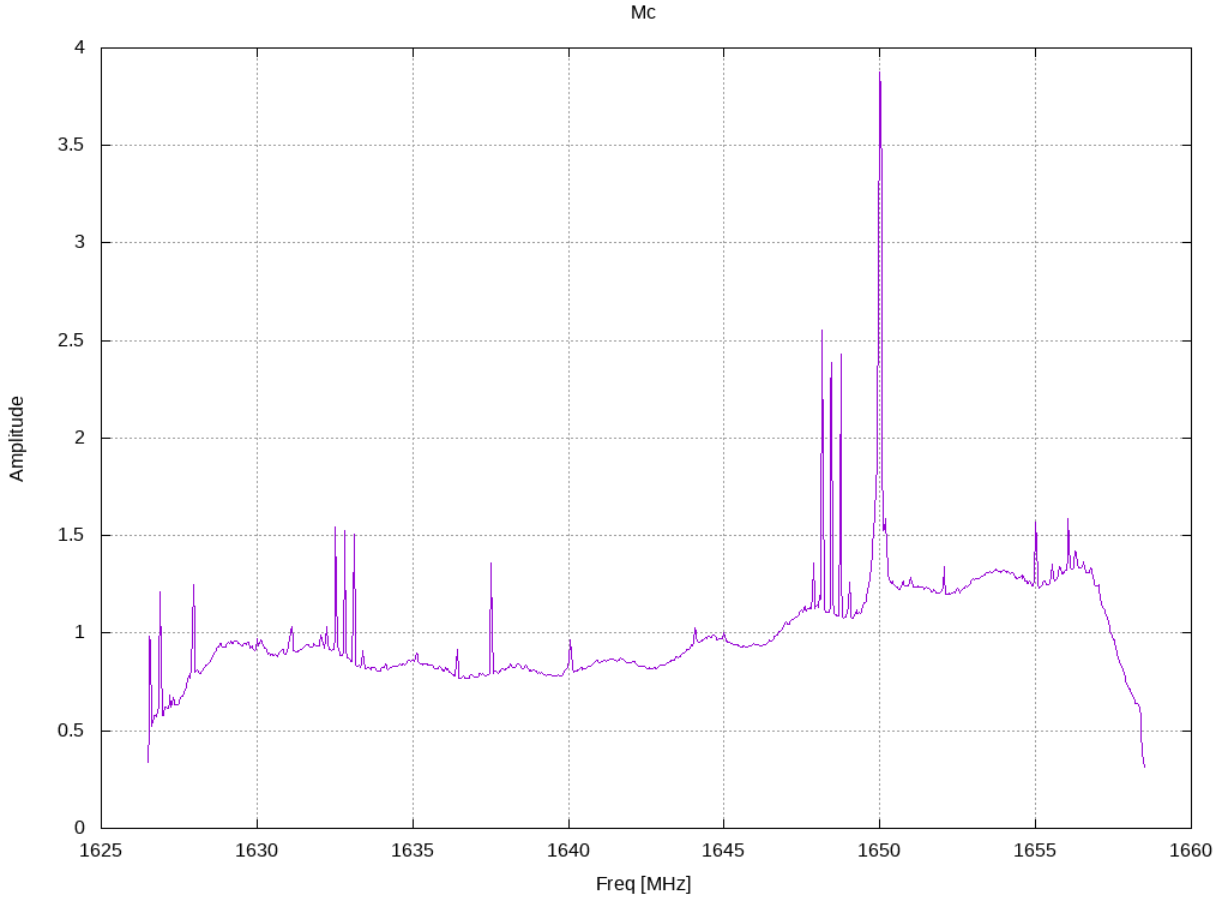
- Many satellite Agenda Items (AIs); most important:
  - Putting cell-phone base stations onboard satellites
    AI 1.13
- Science topics
  - Radio astronomy and (large) satellite constellations
    AIs 1.16 & 1.18 Once in a ‘life-time’ chance for RAS (SKA-Mid & ALMA)
  - Passive space weather sensors (also relevant to LOFAR et al.)
    AI 1.17
  - Communication networks on the moon (for science)
    AI 1.15

RFI-info at/from JIVE

N24L2 O8



N24L2 MC



So, the way forward…

- Operate as much as possible in remote locations (but this may the place where e.g. internet via satellites is needed…).
- Radio quiet zones around radio telescopes are important for continued radio astronomical exploration (but note that even RQZs will not escape satellite interference). But note WRC27 AI 1.16.
- Build “robust” receivers, mitigation.
- Keep good contact with the administrations – they decide.
- A lot of work in preparation for WRC-27
- RFI-info at/from JIVE

Thank you for your attention!