

The time for protecting radio astronomy is now!

An update on the work of the Committee on Radio Astronomy Frequencies (CRAF)

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Swiss SKA Days 2024, September 2nd-4th

Allocation of spectral resources

- Assignments of frequency spectrum resources is the **sovereign right of national governments** (in Switzerland: Federal Office of Communications – OFCOM/BAKOM)
- International harmonization coordinated by the **International Telecommunication Union (ITU)**, agency of the United Nations
- Radio regulations revised every 3-4 years at **World Radiocommunication Conferences (WRC)**



Frequency Allocation Charts



Frequency Allocation Charts



Swiss Frequency Allocation Chart

Table RIRs DOCs
Frequency Allocation Plan v.3989/1.1.26

Presets: -- choose preset --
 Lower freq: 5 GHz
 Upper freq: 15 GHz
 Download
Reset columns

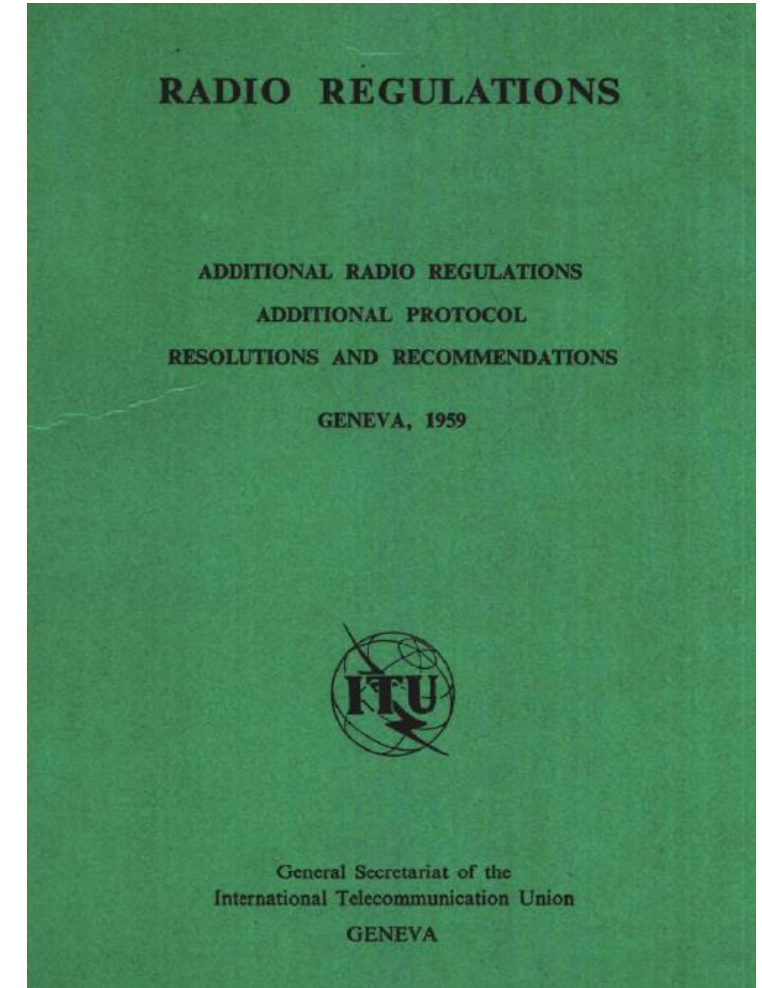
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 Table
 Allocations
 Applications
 Search

Swiss Allocations 5 - 15 GHz, Version of 1.1.2023					
Band	National Allocation	Main Use	CIV/MIL	Notes	Strategy
5000 - 5010 MHz	AERONAUTICAL MOBILE-SATELLITE (R) 5.443AA AERONAUTICAL RADIONAVIGATION RADIONAVIGATION-SATELLITE (Earth-to-space) Radio astronomy Space research (passive)		CIV	5000-5010 MHz (up) / 5010-5030 MHz (down): Possible use by RNSS (e.g. Galileo). UWB Applications, Annex 1	
5010 - 5030 MHz	AERONAUTICAL MOBILE-SATELLITE (R) 5.443AA AERONAUTICAL RADIONAVIGATION RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) 5.328B 5.443B Radio astronomy Space research (passive)		CIV	5000-5010 MHz (up) / 5010-5030 MHz (down): Possible use by RNSS (e.g. Galileo). UWB Applications, Annex 1	
5030 - 6425 MHz					
6425 - 6700 MHz	FIXED FIXED-SATELLITE (Earth-to-space) Earth exploration-satellite (passive) MOBILE 5.149 5.440 5.458	Fixed primary. FSS primary.	CIV	6425 - 7125 MHz: Fixed: RIR0302-07 , ERC/REC 14-02 5850-6650 MHz: FSS: VSAT: RIR0806-15 Feeder links GSO (E/S): RIR0805-01 UWB Applications, Annex 1	Fixed / FSS: Co-primary with the terms of sufficient geographical separation. 6650 - 6675.2 MHz: Radio astronomy according 5.149
6700 - 10500 MHz					
10.5 - 10.6 GHz		Fixed primary. 10.5-10.6 GHz Radiodetermination applications secondary.		10.50-10.65 paired with 10.15-10.30 GHz: Fixed: RIR0302-11 , ERC/REC 12-05 , ECC/DEC/(10)01 10.5 - 10.6 GHz: Short Range Devices: Radiodetermination applications: RIR1004-05 , ERC/REC 33-05	

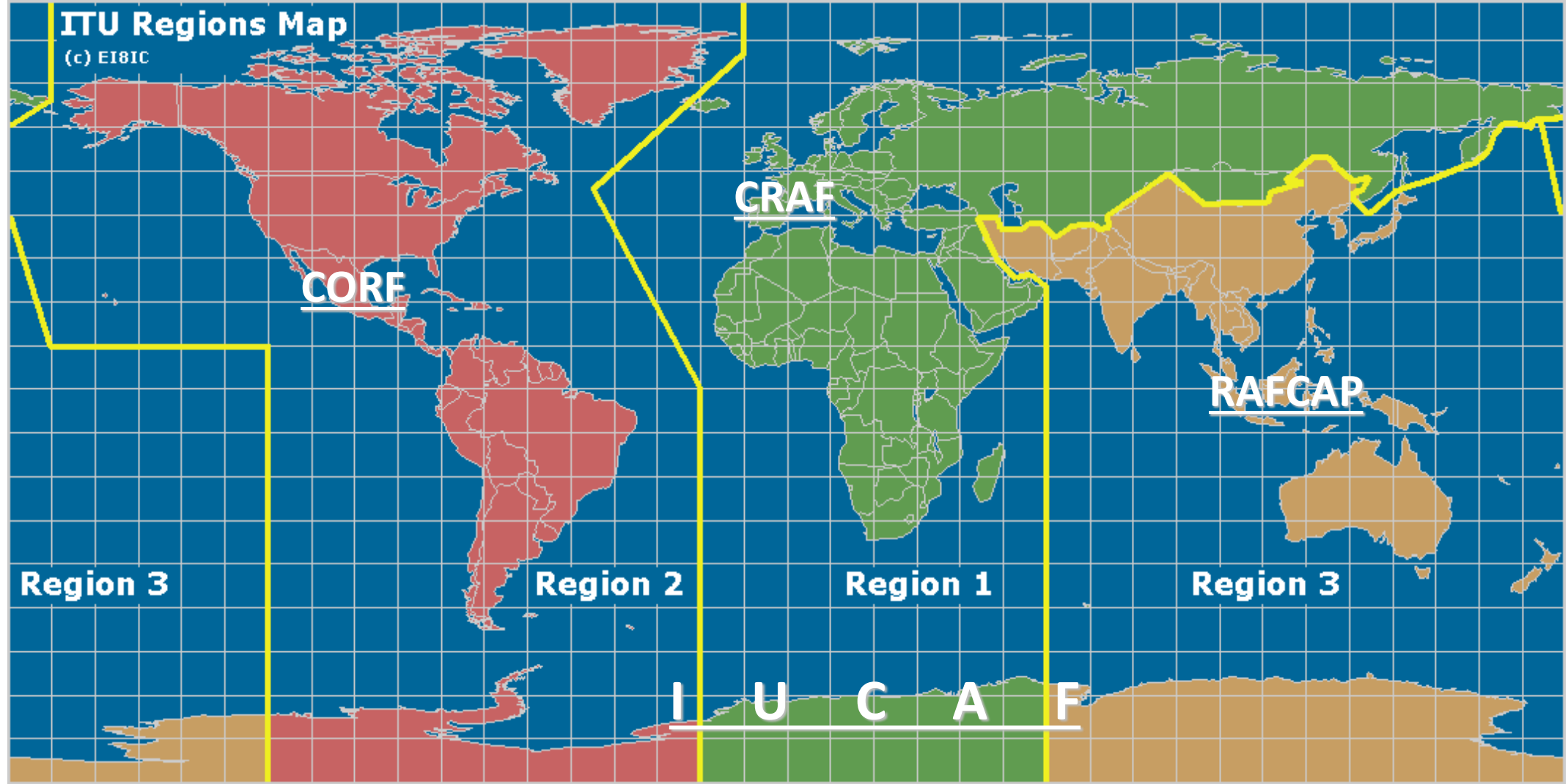
<https://www.bakom.admin.ch/bakom/en/homepage/frequencies-and-antennas/national-frequency-allocation-plan.html>

Radio Astronomy «Service» (RAS)

- Radio Astronomy recognized as (passive) *radiocommunication service* in 1959 creating **legal basis to seek protection** from interference
- Series of frequency **bands allocated to RAS**. Some bands provide exclusive allocation (“all emissions prohibited”), some do not.
- RAS interests have to be **continuously protected** as new or higher frequency applications become available



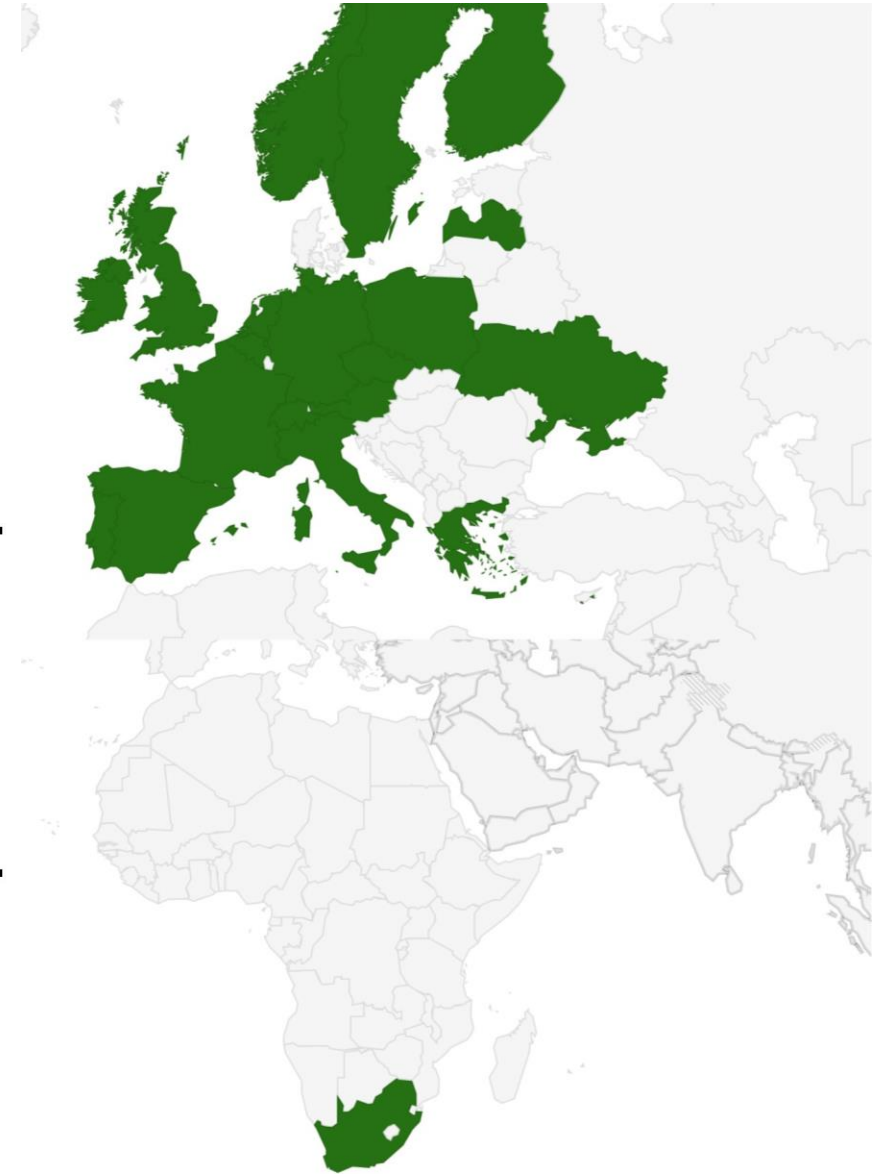
Radio Astronomy represented by regional committees



What is CRAF?

- Committee on radio astronomy frequencies is an expert committee of the European Science Foundation established in 1988
- 23 member countries and several international organizations with observer status - including the SKAO!
- More information: www.craf.eu

CRAF - COMMITTEE ON RADIO ASTRONOMY
FREQUENCIES



Swiss Representation

Swiss Commission for Astronomy (SCFA) of Swiss Academy of Sciences (SCNAT)

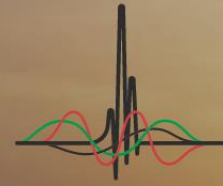


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ITU World Radiocommunication Conference 2023



ITUWRC
DUBAI 2023
20 November - 15 December 2023
Dubai, United Arab Emirates

- WRC-23 recommended agenda items for the WRC-27
- For the first time in over a decade, radio astronomy stakeholders managed to have **new radio astronomy agenda item** accepted
- Several other topics are also important for radio and mm observatories

Why now?

While decisions are taken at the WRCs, a large fraction of the **actual work (studies, reports) takes place in between the WRCs**. Studies can take a lot of time, and deadlines for contributions have to be respected.

With the number of satellites in **mega constellations increasing** almost monthly, the pressure on our telescope facilities increases quickly.

Typically, **observatories have to demonstrate that they are affected**, but our facilities are not built to do so (tracking, loss of observing time).

Radio Astronomy Agenda Item (1.16)

“To consider studies on the technical and regulatory provisions necessary to **protect radio astronomy operating in specific Radio Quiet Zones and, in frequency bands allocated to the radio astronomy service on a primary basis globally, from aggregate radio-frequency interference caused by non-geostationary satellite orbit systems,** in accordance with Resolution 681 (WRC-23).”

Specific Radio Astronomy Quiet Zones: **SKAO** and ALMA

<https://www.itu.int/en/ITU-R/study-groups/rcpm/Pages/wrc-27-studies.aspx>

Other topics

1.18: “To consider, based on the results of ITU Radiocommunication Sector studies, possible regulatory measures regarding the protection of the Earth exploration-satellite service (passive) and the radio astronomy service in certain frequency bands above 76 GHz from unwanted emissions of active services, in accordance with Resolution 712 (WRC-23)”

Access to methanol 6.65 GHz might be lost (WRC-23 result)

WRC-31 preliminary items (such as new 275-325 GHz allocations)

Unintended emission, harmonics, lunar protection, space weather sensors, ...

What does CRAF do?

- Represented in working parties with potential impact on radio astronomy
- Carrying out studies and preparing contributions in work item teams:
 - Spectrum Engineering
 - Satellite Services
 - IMT (Mobile)
 - RFI/Spectrum Monitoring
 - Geodetic VLBI (VGOS)
 - Space weather
 - Public Outreach
- Exchange with national administrations, decision makers, partners (like SKAO), radio astronomy community

On-going activities

- CRAF, SKAO & SKACH submitted request to OFCOM for **measurements** of satellite constellation emission (under consideration)
- Active participation in the Working Parties related to radio astronomy, perform **studies**, and compile reports and input documents
- Preparing positions for WRC-27 and explaining radio astronomy matters to **national administrations**
- **Raising awareness** with astronomers and general public

20min/Newscout



Challenges and Opportunities

- (Wo-)men power on astronomy side very limited
- Difficulty arguing the case for dark and quiet skies (astronomy often perceived as “just for fun” science by politicians and general public). Satellite infrastructure & cell phone coverage on the other hand important for emergency services and economy
- Several administrations – including Switzerland! – are aware which topics affect radio astronomy and take concerns into account
- Strong network of radio astronomy partners (IUCAF, IAU CPS, SKAO etc.)
- We have a lot of expertise!

Why should you care?

- Protecting existing or future **Swiss observatories** (Bleien, student telescopes)
- Relevance for the **facilities you are using outside of Switzerland**:
Need support of national administrations for radio astronomy concerns and requests – changes are typically consensus-based
- If you are a millimeter astronomer: **(sub-)millimeter regime is probably next!**
(IEEE: “Frequencies from 100 GHz to 3 THz are promising bands for the next generation of wireless communication systems because of the wide swaths of unused and unexplored spectrum.”)
- Number of satellites rapidly increasing – **radio quiet zones no longer offer same level of protection**

Newsletter and Socials

Annual Newsletter

Subscribe or download on the website:
<https://www.craf.eu/newsletter/>

Social media

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Handbook

CRAF offers a “Handbook for Radio Astronomy”
(update under way, 2005 version on web)



Conclusions

- Spectrum use for radio astronomy is **constantly under pressure**. The radio astronomy community needs to stand up for it and allocate resources!
- Satellite megaconstellations are changing the game – local radio quiet zones are no longer sufficient for protecting an observatory. New agenda item for WRC-27 is an **opportunity to seek better protection!**
- **Partnering** among entities working on protection of frequencies for radio astronomy (e.g. IAU CPS, SKAO, CRAF) is **crucial as we are working with very limited resources** compared to other radiocommunication services