Spectrum Management
related to Nobeyama and Chile

Masaaki Hiramatsu
NAOJ Spectrum Management Office

NAOJ Spectrum Management Office

- ✓ Established in 2019 under NAOJ Public Relations Center

- ✓ Masatoshi Ohishi
- ✓ Masaaki Hiramatsu
- ✓ Maki Ozaki

GOAL

- ✓ Establish a healthy coexistence b/w radio astronomy and other radio application services.
- ✓ Maintain a beautiful starry sky by reducing light pollution.

- ✓ Radio application companies
- ✓ Administration（総務省）
- ✓ Delegates from other countries
- ✓ Satellite constellation operators

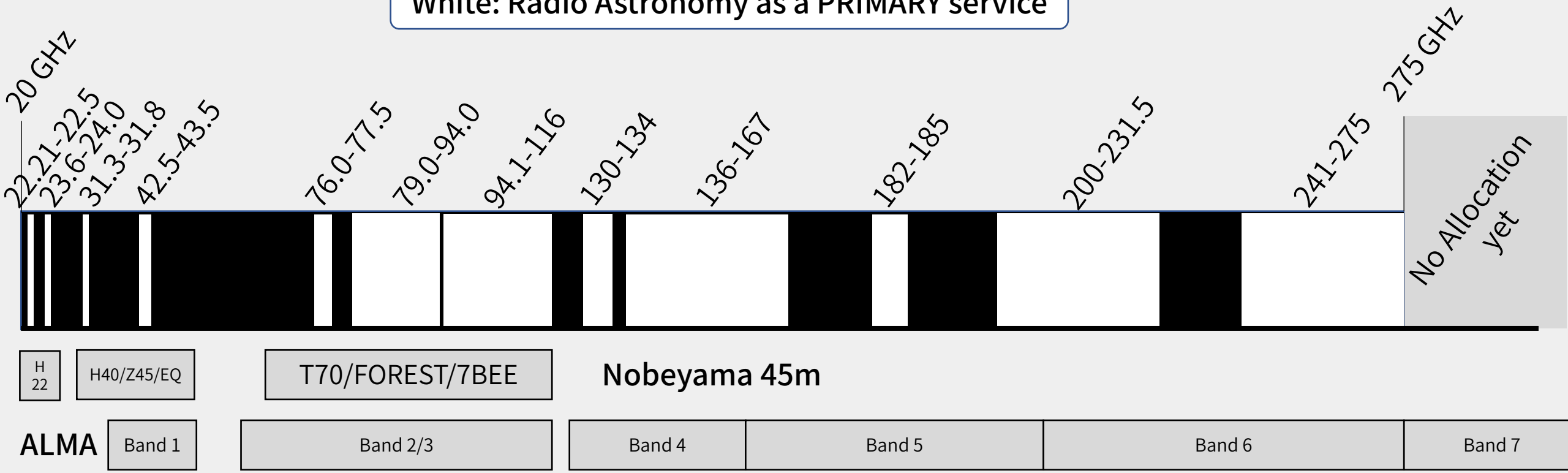
Our Principle

Radio astronomers want to observe all frequency range.
Other radio users may want to emit at all frequency range.

All radio users, including astronomers, have to SHARE the frequency resource.

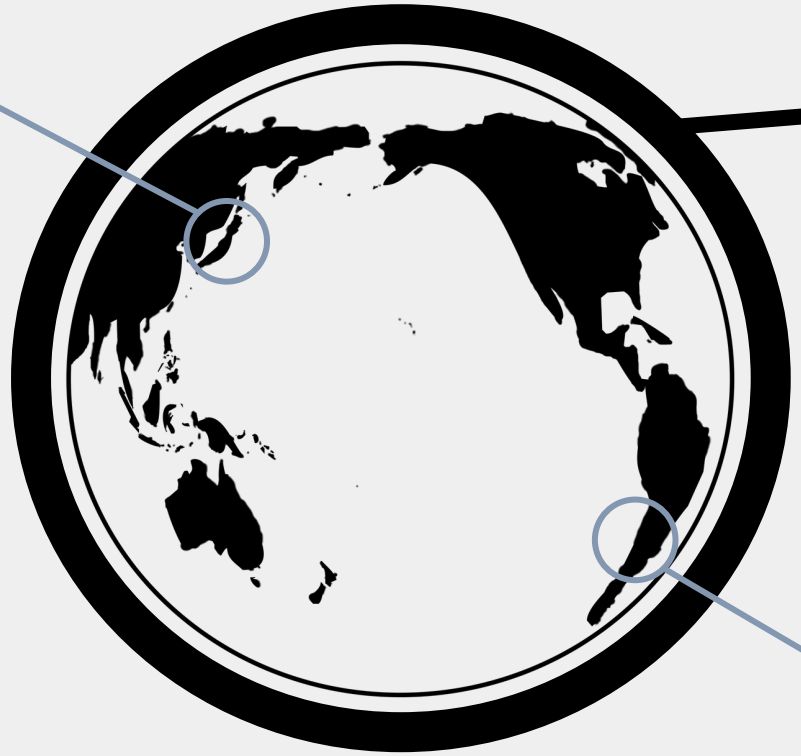
Frequency Allocation in mm-wave band

White: Radio Astronomy as a PRIMARY service



Overall Structure of Spectrum Management

総務省
(MIC)

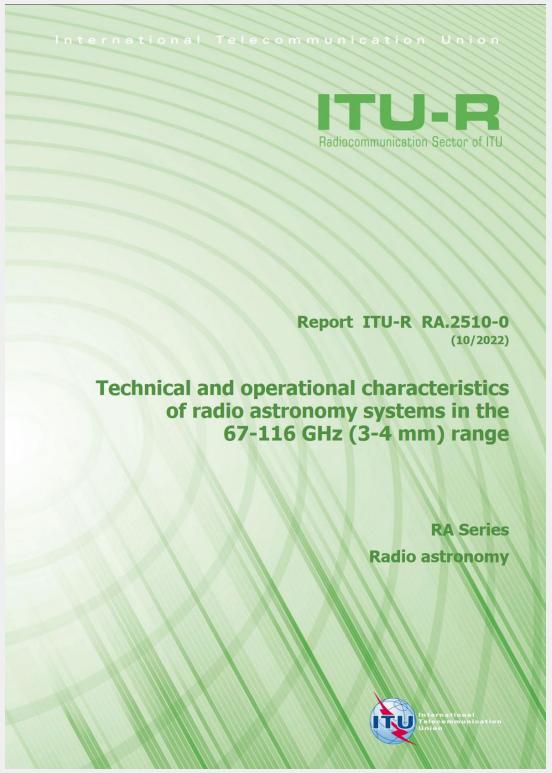


Radiocommunication Sector, the International Telecommunication Union (ITU-R)

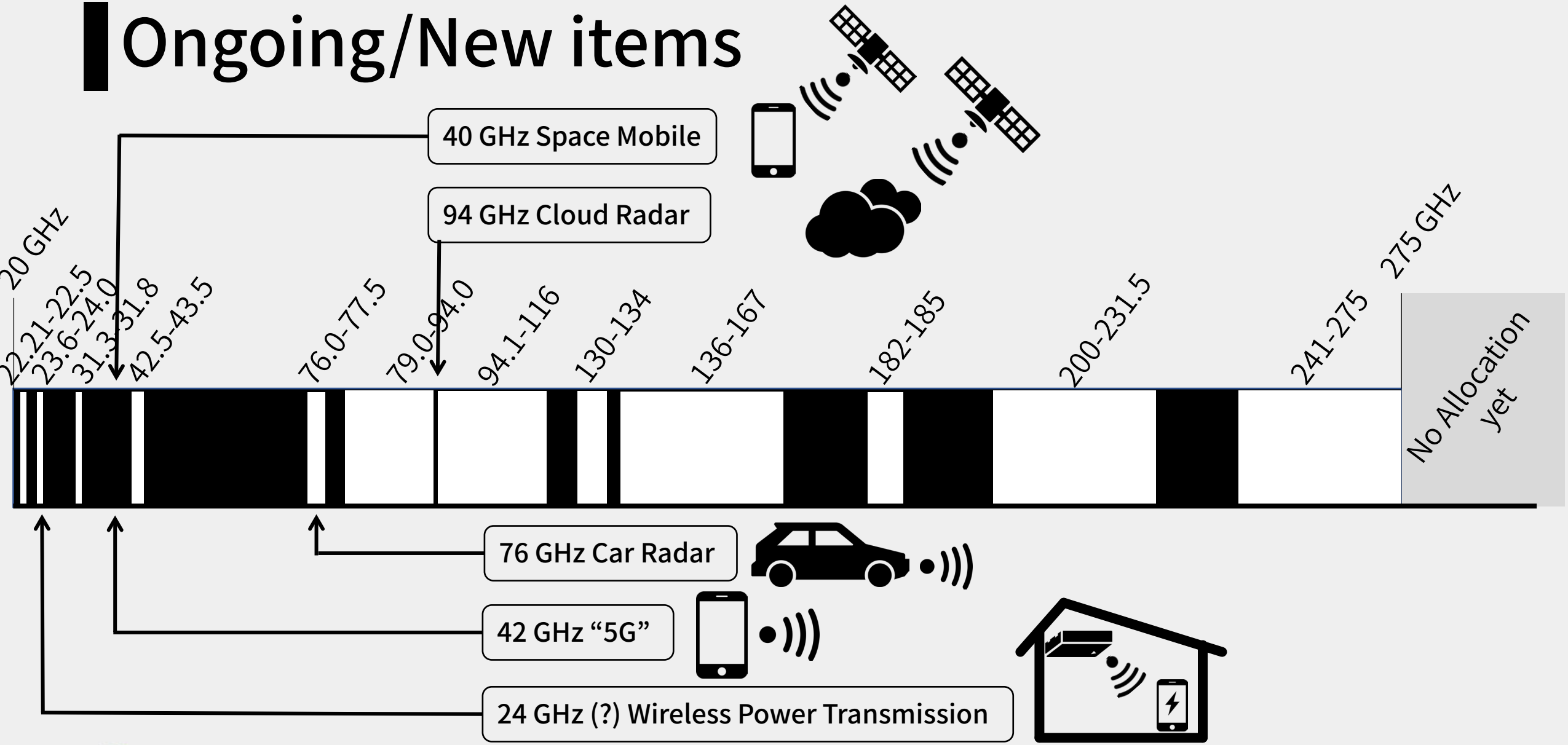
Subsecretaría de Telecomunicaciones (Subtel)

Activities in ITU-R

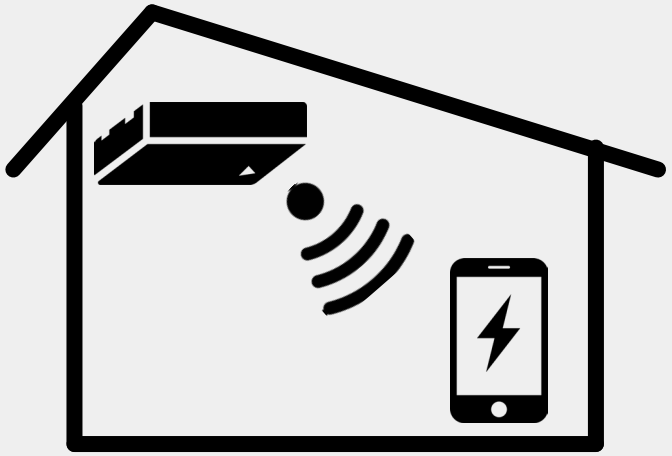
- Working Party 7D: Radio Astronomy
  - Discussion to produce reports and recommendation, to make comments on documents from other WPs in order to preserve radio quiet environment.
- New ITU-R Reports:
  - ✓ **RA.2508**: Widely-distributed radio astronomy array systems operating above 200 GHz
  - ✓ **RA.2509**: Technical and operational characteristics of radio astronomy systems operating below 350 MHz (85 cm)
  - ✓ **RA.2510**: Technical and operational characteristics of radio astronomy systems in the 67-116 GHz (3-4 mm) range
  - ✓ **RA.2512**: Technical and operational characteristics of broadband, background-limited detectors operating in the millimetre-wave regime



Ongoing/New items

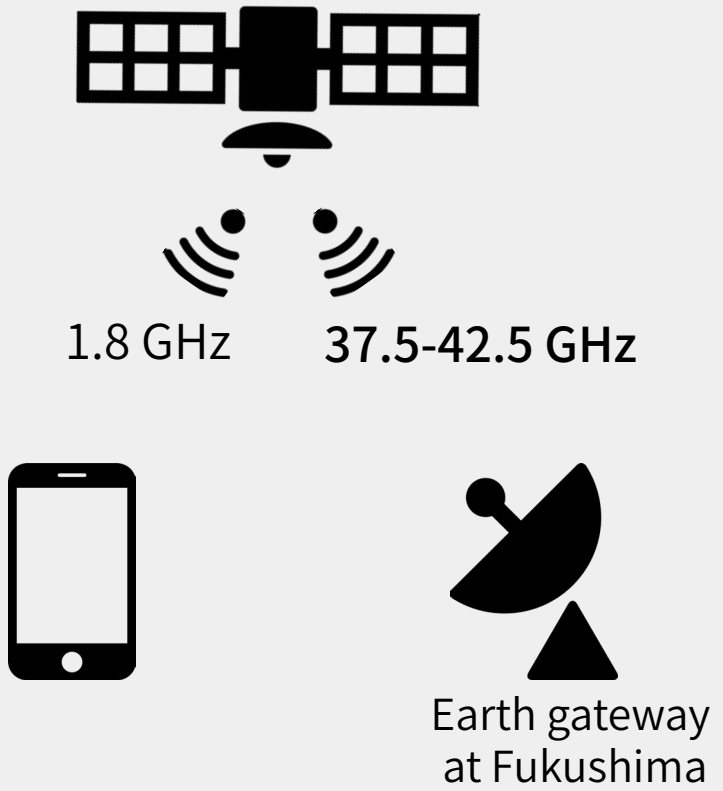


24 GHz (?) Wireless Power Transmission



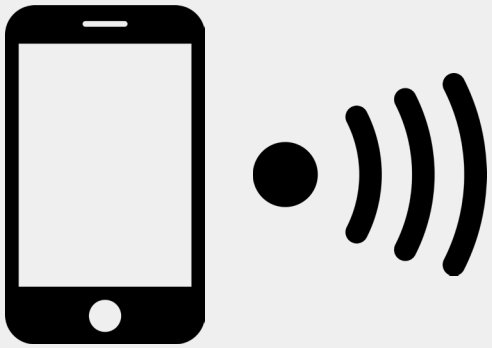
- ✓24 GHz: adjacent to Radio astro. band (23.6-24.0GHz)
- ✓Background: 920 MHz/2.4 GHz/5.7 GHz WPT was approved in 2022 in Japan. → Some companies are interested in ~24 GHz.
- ✓Current Status:
  - ✓ITU-R WP declines studies in 24 GHz in response to the comments from radio astronomy and earth observation, but technical development research is ongoing.

40 GHz Space Mobile



- ✓42.5 GHz: adjacent to Radio astro. band (42.5-43.5GHz)
- ✓Background: AST SpaceMobile launched a test satellite BlueWalker 3 (64m^2 antenna)in 2022. Direct-to-Mobile communication is planned.
- ✓Current Status:
  - ✓Rakuten Mobile obtained test license in Japan.
  - ✓Doubts about legal legitimacy: direct-to-mobile comm. in 1.7 GHz is not assumed in Radio Regulation.
  - ✓Detailed arrangement in sharing conditions is needed.

42 GHz “5G” mobile phone

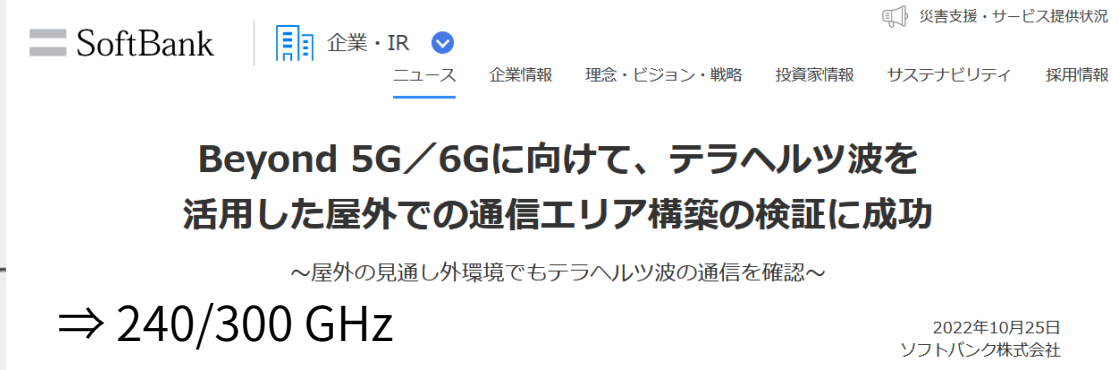


✓39.5-43.5 GHz: adjacent to/included in Radio astro. band (42.5-43.5 GHz)

✓Background: 37-43.5 GHz was identified for “5G” in 2019.
→ MIC considers to allocate 39.5-43.5 GHz to “5G” .

✓Current Status:

- ✓~40 km separation is needed to protect radio astronomy.
- ✓Ongoing research in even higher frequency range (> 100 GHz) for “6G” !?



⇒ 240/300 GHz

76 GHz automobile radar

76 GHz

✓76 -77 GHz: Co-primary with Radio Astronomy

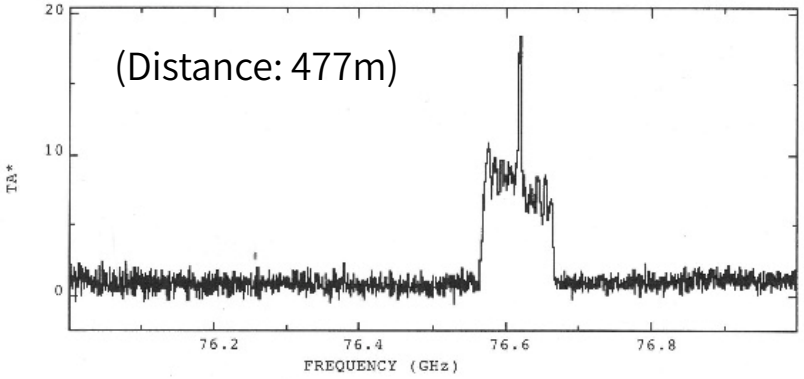
EIRP: Equivalent Isotropic Radiated Power

✓Background: Maximum EIRP in the current regulation in Japan is lower than in US/Europe.
→ Companies want to raise the limit.

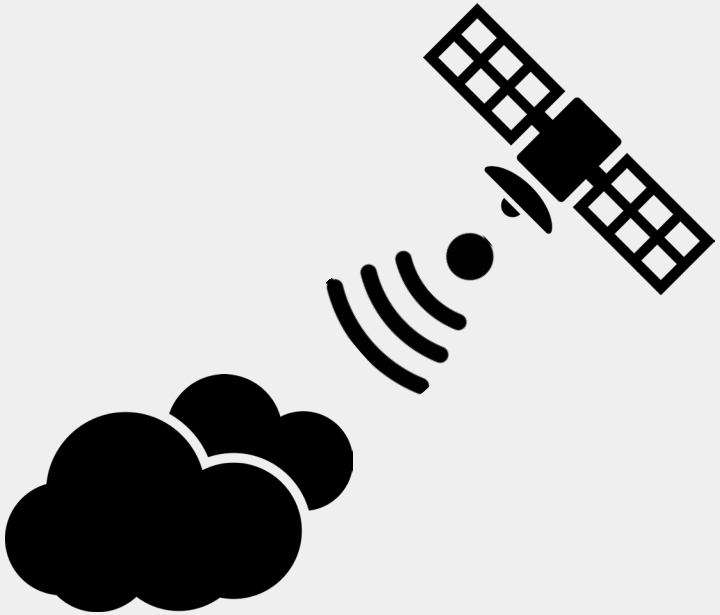
✓Current Status:

- ✓ Discussion with radar companies is ongoing.
- ✓ Calculated necessary separation around Nobeyama and VERA.
  → a few – several x 10 km?

Radar experiment at NRO45m (May 2015)



94 GHz Cloud Radar



- ✓94-94.1 GHz: adjacent to Radio astro. band (79-94 and 94.1-116 GHz)
- ✓Background: CloudSat reactivated in 2021 with unstable attitude control (several degrees uncertainty).
- ✓Current Status:
  - ✓CloudSat regularly publishes information on the expected time it will pass over the radio astronomy stations.
  - ✓Coordination with the new satellite (ESA/JAXA EarthCARE, 2024) has been made in 2022. Radar will be in silent state above observatories (including ALMA and Nobeyama).

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