



Geoscience and Remote Sensing Society

Update on the Activities of the IEEE GRSS Frequency Allocations in Remote Sensing (FARS) Technical Committee



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Committee on Radio Frequencies (CORF) Meeting - May 8, 2020





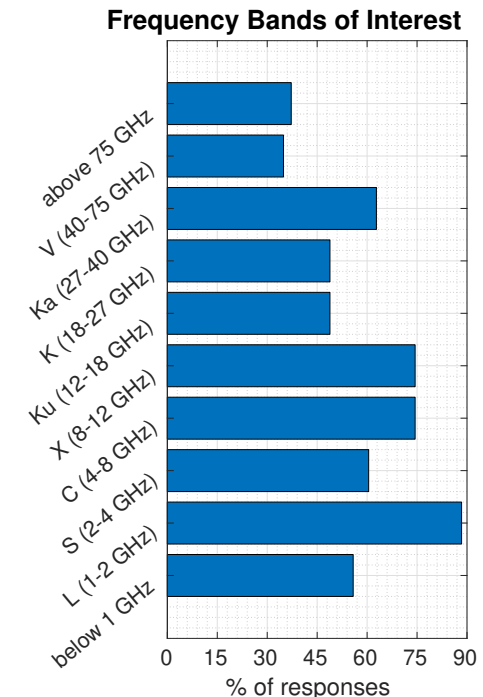
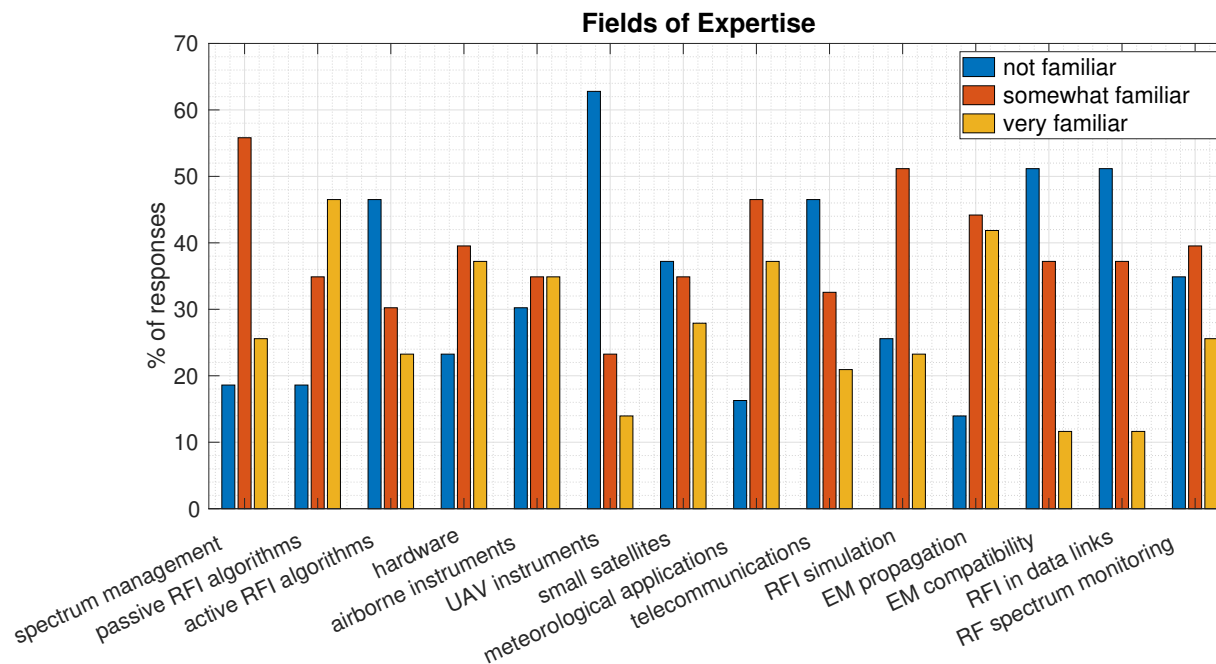
Mission

The purpose of the Frequency Allocations in Remote Sensing Technical Committee is to serve as an interface between GRSS and the radio-frequency regulatory world by

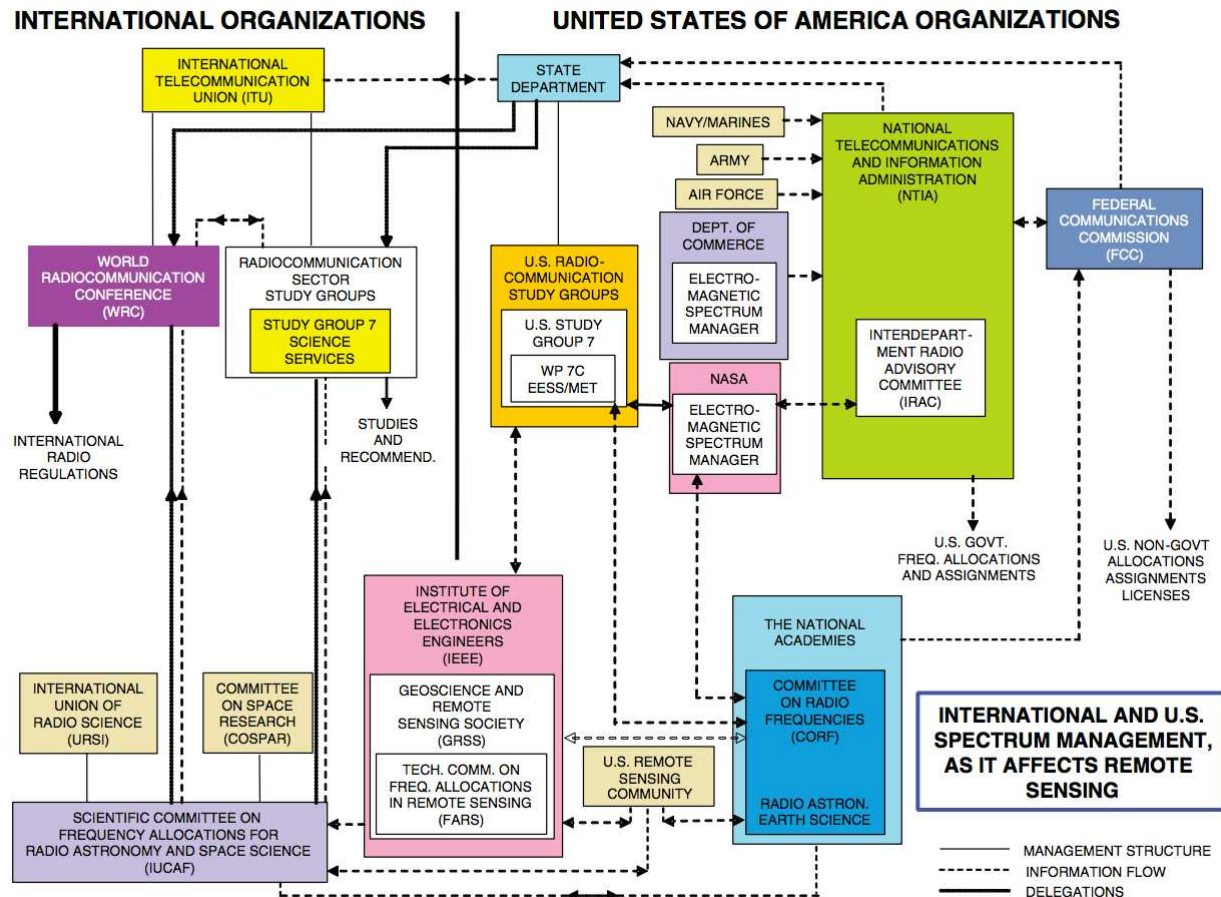
- educating the remote sensing community on spectrum management processes and issues
- promoting the development of radio frequency interference detection and mitigation technology
- organizing technical sessions at conferences, workshops, etc. on the above processes, issues and technologies
- providing spectrum managers and regulators with technical input and perspective from remote sensing scientists and engineers
- fostering the exchange of information between researchers in different fields, such as remote sensing, radio astronomy, telecommunications, etc., with the common scope of minimizing harmful interference between systems

FARS TC Membership

- 162 members from 22 countries
- majority (56%) is from USA, working in academic institutions and space agencies
- more members joining lately from Asia
- expertise in all frequency bands



Role of FARS-TC



Source: Handbook of Frequency Allocations and Spectrum Protection for Scientific Uses, National Academies Press, 2007.



IGARSS 2020

- The International Geoscience and Remote Sensing Symposium (IGARSS) is the main annual GRSS conference.
- IGARSS 2020 will (hopefully) take place in Waikoloa, Hawaii, on July 19-24, 2020.
- FARS-TC has organized a special invited session on *Radio Frequency Interference (RFI) in Microwave Remote Sensing* with presentations on interference detection and mitigation techniques for passive/active remote sensing, status of missions dealing with RFI, and spectrum management issues, particularly WRC-23.



<https://www.igarss2020.org>

RFI Workshop

- very successful RFI 2019 Workshop held in Toulouse, France, on September 23-26, 2019
- 80 participants mostly from radio astronomy and remote sensing communities, but also in the fields of GNSS, meteorology and space link communications
- 11 oral sessions, 1 poster session and 2 panel discussions
- follow-on tentatively planned next year in the United Kingdom on September 27-30, 2021



FARS TC Chapter in China

- new chapter acts as a liaison between the main FARS TC leadership and the Chinese technical/scientific community
- inaugurated in August 2019 with a one-day seminar in Xi'an with lectures on various RFI and spectrum management issues and particular attention to the local national situation
- activities have been delayed by the current pandemic but are now resuming, with a focus on:
 - using local expertise on SAR systems to detect and localize RFI in ALOS-2 data
 - analysis of RFI at 10.65 and 18.7 GHz in HY-2B and FY-3D measurements





Spectrum Management School for Remote Sensing

- modeled after the successful IUCAF School on Spectrum Management for Radio Astronomy whose 5th edition was recently held in South Africa in March 2020
- the FARS TC has received interest and support for the idea by the remote sensing community and is now moving into the organization
- two locations are currently being considered for around February or March 2021
- in the process of identifying potential lecturers, attendees (students) and sponsors
- input and advice from CORF well accepted



IEEE Standards Association Initiative

- initiative funded by the IEEE Standards Association to explore:
 - potential standards/recommendations for RFI measurements
 - quality assessment of EESS bands with respect to presence of interference
- complemented by coordination with space agencies, ITU-R, etc.
- two meetings tentatively planned, at IGARSS 2020 in July and at the MicroRad 2020 Symposium in November



International Spectrum Management Activities

- GRSS is an international society, and FARS-TC can represent only the remote sensing community without having to compromise its position with other interests
- FARS-TC spectrum management international involvement:
 - ITU-R Study Groups
 - GRSS participates under IEEE
 - FARS-TC has started attending meetings in Geneva in 2018
 - Space Frequency Coordination Group (SFCG)
 - IEEE GRSS is an observer
 - number of contributions have been increasing over the years
 - FARS-TC will attend SFCG-40 in Cairns, Australia, now postponed to 2021



ITU-R Study Groups and SFCG Contributions

- contributions have focused on interference issues at 18.6-18.8 GHz
 - WP7C May 2018: document on WRC-19 Agenda Item 1.5 (Earth Stations in Motion)
 - WP4A July 2018: contribution on draft CPM text for Agenda Item 1.5
 - WP7C September 2018: modifications to draft report on "Analysis of reflected RFI caused to EESS (passive) in the 18.6-18.8 GHz band"
 - WP3J May 2019: contribution on Model for reflections from water surfaces in the 18.6-18.8 GHz band
 - WP7C May 2019: further modification to draft report on RFI caused by reflections in the 18.6-18.8 GHz band"
- more topics will be addressed in the WRC-23 study cycle

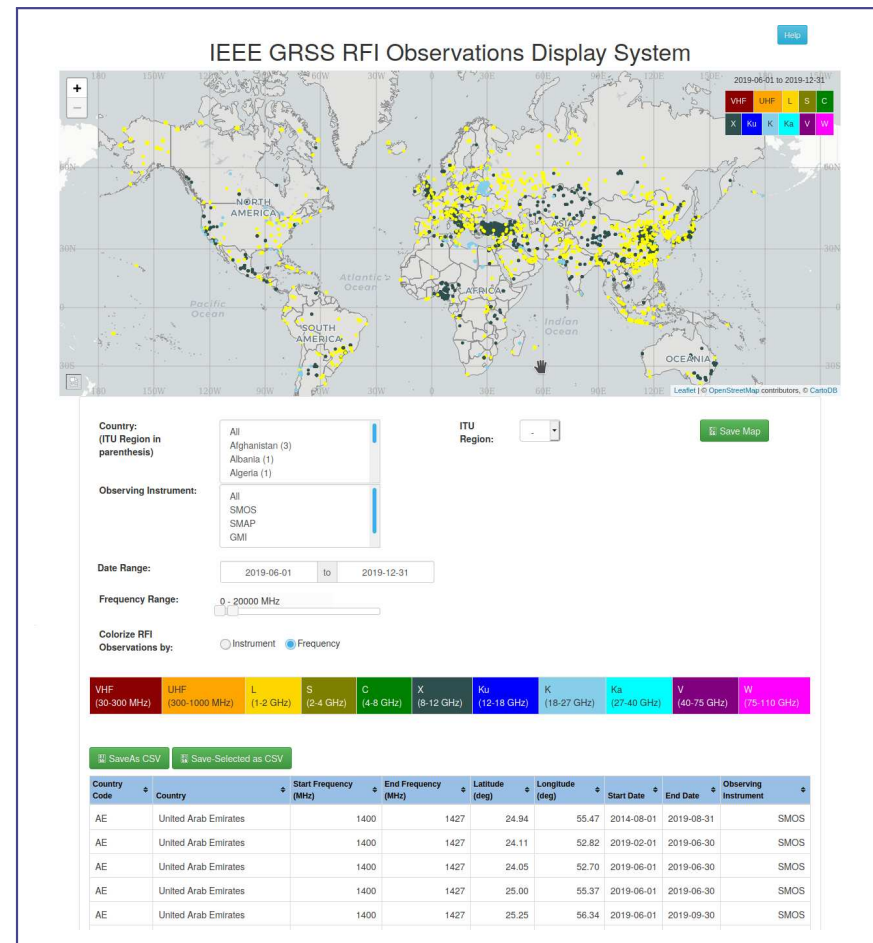
RFI Observations and Frequency Allocations Tools

- Motivation:
 - to increase awareness for the increasingly tight regulations for remote sensing bands and allowable interference levels, along with the actual interference observed in those bands
 - to pinpoint regulation enforcement for different regions and countries and allow a free exchange of information between remote sensing scientists and engineers regarding potential interference hazards
 - to be used by a community broader than IEEE GRSS
 - to aid local authorities in mitigation of non-primary interfering sources globally
- The online interface still under development includes two distinct tools:
 - a searchable database of interference observed by some remote sensing instruments
 - a display system for frequency allocations, with particular focus on remote sensing (EESS) bands
- On the FARS-TC webpage <https://tinyurl.com/fars-tc> under “TOOLS” tab

Database of RFI Observations

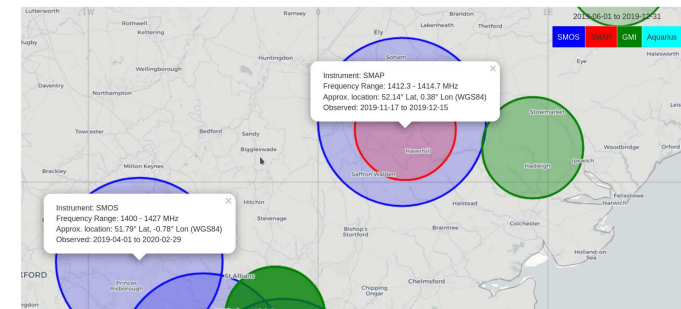
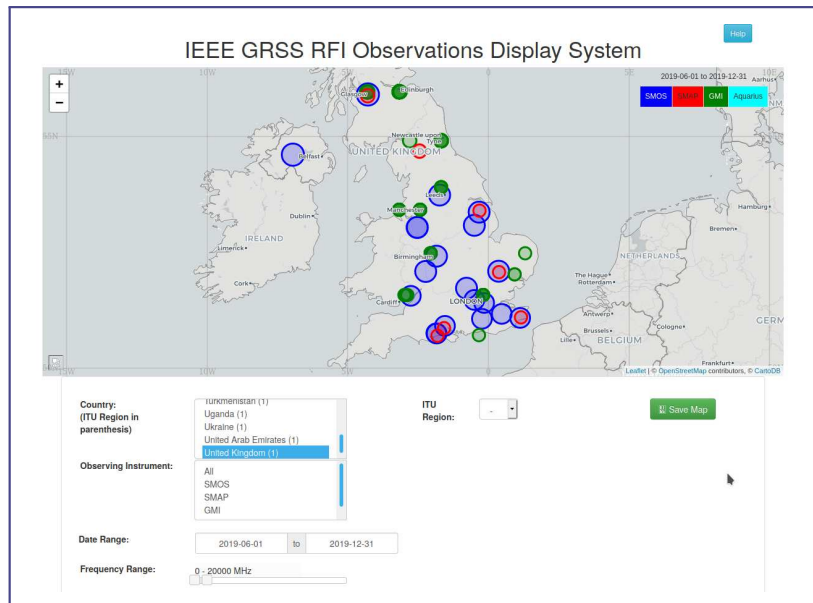
- online repository of RFI observations by remote sensing instruments
- RFI data can be selected by observing sensor, country or ITU region, frequency and time range
- RFI locations are shown on a map and listed in a table
- currently contains the following data:
 - SMOS until March 2020
 - SMAP until December 2019
 - GMI (10 and 18 GHz) from January 2019 to April 2020
- under development:
 - Aquarius (historical)
 - AMSR-2

http://www.grss-ieee.org/rfi_observations.html



RFI Observations: Graphic User Interface

- table corresponding to displayed locations can be ordered by column
- small pop-up window for location(s) selected on map or table
- list can be saved as a CSV file for entire dataset or only the selected RFI locations



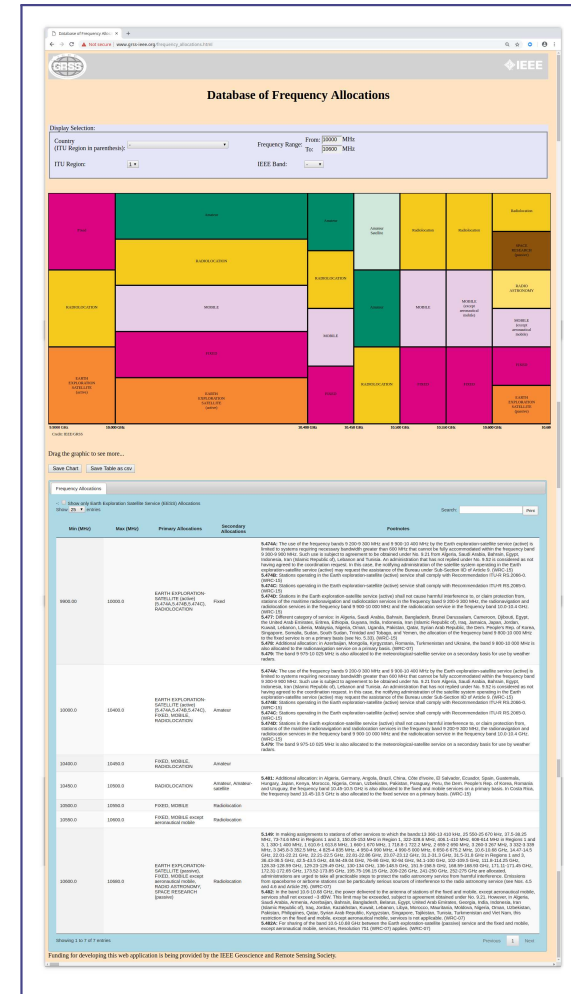
SaveAs CSV

Save-Selected as CSV

Country Code	Country	Start Frequency (MHz)	End Frequency (MHz)	Latitude (deg)	Longitude (deg)	Start Date	End Date	Observing Instrument
GB	United Kingdom	1412.3	1414.7	50.73	-1.81	2019-09-08	2019-10-06	SMAP
GB	United Kingdom	10600	10700	51.64	-0.19	2019-11-30	2019-12-30	GMI
GB	United Kingdom	1400	1427	51.79	-0.78	2019-04-01	2020-02-29	SMOS
GB	United Kingdom	10600	10700	52.09	0.93	2019-06-30	2019-07-30	GMI
GB	United Kingdom	10600	10700	52.09	0.93	2019-09-30	2019-10-30	GMI
GB	United Kingdom	1412.3	1414.7	52.14	0.38	2019-11-17	2019-12-15	SMAP
GB	United Kingdom	1400	1427	52.16	0.36	2018-12-01	2020-03-31	SMOS

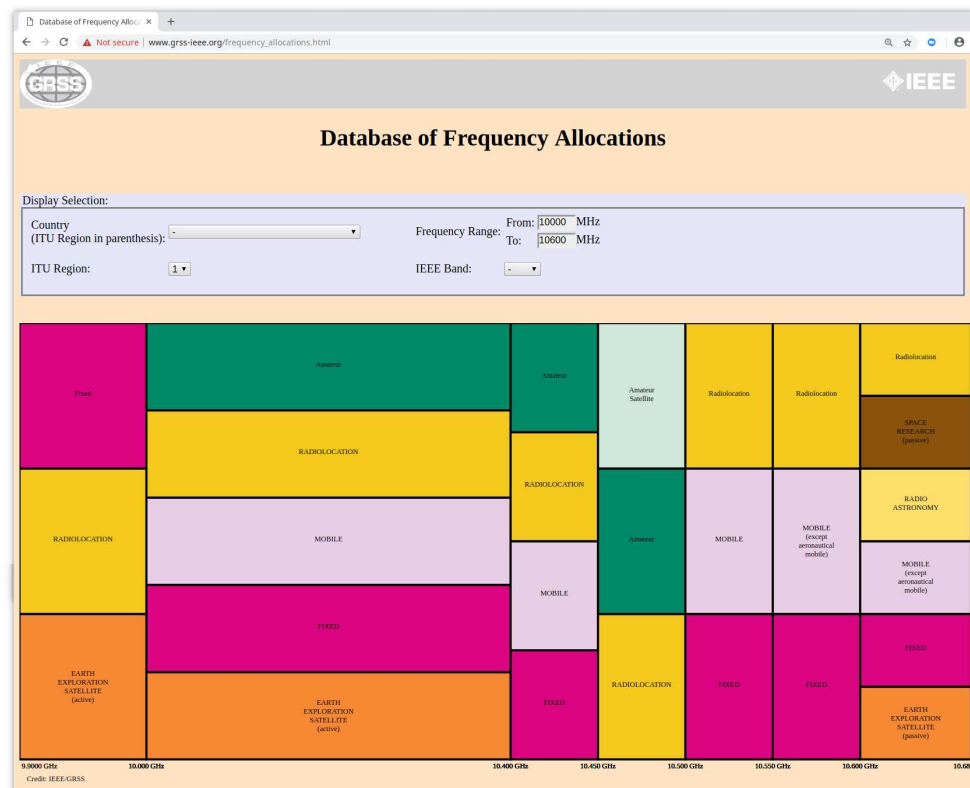
Frequency Allocations Tool

- displays and lists frequency allocations from the Radio Regulations
- selection is possible by:
 - ITU region
 - frequency range
- footnotes are also included
- option to see only EESS band with adjacent allocations
- available on the GRSS website at http://www.grss-ieee.org/frequency_allocations.htm



Frequency Allocations Chart

- new graphical display for allocation bands
- chart can be saved as an image file



Frequency Allocations Table View

Frequency Allocations				
-: ☐ Show only Earth Exploration Satellite Service (EESS) Allocations Show 25 entries				
Min (MHz)	Max (MHz)	Primary Allocations	Secondary Allocations	Footnotes
9900.00	10000.0	EARTH EXPLORATION-SATELLITE (active) (5.474A, 5.474B, 5.474C), RADIOLOCATION	Fixed	5.474A: The use of the frequency bands 9 200-9 300 MHz and 9 900-10 400 MHz by the Earth exploration-satellite service (active) is limited to systems requiring necessary bandwidth greater than 600 MHz that cannot be fully accommodated within the frequency band 9 300-9 900 MHz. Such use is subject to agreement to be obtained under No. 9.21 from Algeria, Saudi Arabia, Bahrain, Egypt, Indonesia, Iran (Islamic Republic of), Lebanon and Tunisia. An administration that has not replied under No. 9.52 is considered as not having agreed to the coordination request. In this case, the notifying administration of the satellite system operating in the Earth exploration-satellite service (active) may request the assistance of the Bureau under Sub-Section IID of Article 9. (WRC-15) 5.474B: Stations operating in the Earth exploration-satellite (active) service shall comply with Recommendation ITU-R RS.2066-0. (WRC-15) 5.474C: Stations operating in the Earth exploration-satellite (active) service shall comply with Recommendation ITU-R RS.2065-0. (WRC-15) 5.474D: Stations in the Earth exploration-satellite service (active) shall not cause harmful interference to, or claim protection from, stations of the maritime radionavigation and radiolocation services in the frequency band 9 200-9 300 MHz, the radionavigation and radiolocation services in the frequency band 9 900-10 000 MHz and the radiolocation service in the frequency band 10.0-10.4 GHz. (WRC-15) 5.477: Different category of service: in Algeria, Saudi Arabia, Bahrain, Bangladesh, Brunei Darussalam, Cameroon, Djibouti, Egypt, the United Arab Emirates, Eritrea, Ethiopia, Guyana, India, Indonesia, Iran (Islamic Republic of), Iraq, Jamaica, Japan, Jordan, Kuwait, Lebanon, Liberia, Malaysia, Nigeria, Oman, Uganda, Pakistan, Qatar, Syrian Arab Republic, the Dem. People's Rep. of Korea, Singapore, Somalia, Sudan, South Sudan, Trinidad and Tobago, and Yemen, the allocation of the frequency band 9 800-10 000 MHz to the fixed service is on a primary basis (see No. 5.33). (WRC-15) 5.478: Additional allocation: in Azerbaijan, Mongolia, Kyrgyzstan, Romania, Turkmenistan and Ukraine, the band 9 800-10 000 MHz is also allocated to the radionavigation service on a primary basis. (WRC-07) 5.479: The band 9 975-10 025 MHz is also allocated to the meteorological-satellite service on a secondary basis for use by weather radars.
10000.0	10400.0	EARTH EXPLORATION-SATELLITE (active) (5.474A, 5.474B, 5.474C), FIXED, MOBILE, RADIOLOCATION	Amateur	5.474A: The use of the frequency bands 9 200-9 300 MHz and 9 900-10 400 MHz by the Earth exploration-satellite service (active) is limited to systems requiring necessary bandwidth greater than 600 MHz that cannot be fully accommodated within the frequency band 9 300-9 900 MHz. Such use is subject to agreement to be obtained under No. 9.21 from Algeria, Saudi Arabia, Bahrain, Egypt, Indonesia, Iran (Islamic Republic of), Lebanon and Tunisia. An administration that has not replied under No. 9.52 is considered as not having agreed to the coordination request. In this case, the notifying administration of the satellite system operating in the Earth exploration-satellite service (active) may request the assistance of the Bureau under Sub-Section IID of Article 9. (WRC-15) 5.474B: Stations operating in the Earth exploration-satellite (active) service shall comply with Recommendation ITU-R RS.2066-0. (WRC-15) 5.474C: Stations operating in the Earth exploration-satellite (active) service shall comply with Recommendation ITU-R RS.2065-0. (WRC-15) 5.474D: Stations in the Earth exploration-satellite service (active) shall not cause harmful interference to, or claim protection from, stations of the maritime radionavigation and radiolocation services in the frequency band 9 200-9 300 MHz, the radionavigation and radiolocation services in the frequency band 9 900-10 000 MHz and the radiolocation service in the frequency band 10.0-10.4 GHz. (WRC-15) 5.479: The band 9 975-10 025 MHz is also allocated to the meteorological-satellite service on a secondary basis for use by weather radars.

Frequency Allocations for EESS

- option to show only EESS bands with information on allocation of neighboring bands

Frequency Allocations							
-: ☒ Show only Earth Exploration Satellite Service (EESS) Allocations Show 25 entries							
Search: Print							
Min (MHz)	Max (MHz)	Primary Allocations	Secondary Allocations	Lower Freq Band (MHz)	Lower Freq Band Allocations	Upper Freq Band (MHz)	Upper Freq Band Allocations
9900.00	10000.0	EARTH EXPLORATION-SATELLITE (active) (5.474A,5.474B,5.474C), RADIOLOCATION	Fixed	9800.00-9900.00	RADIOLOCATION, Earth exploration-satellite (active), Fixed, Space research (active)	10000.0-10400.0	EARTH EXPLORATION-SATELLITE (active) (5.474A,5.474B,5.474C), FIXED, MOBILE, RADIOLOCATION, Amateur
10000.0	10400.0	EARTH EXPLORATION-SATELLITE (active) (5.474A,5.474B,5.474C), FIXED, MOBILE, RADIOLOCATION	Amateur	9900.00-10000.0	EARTH EXPLORATION-SATELLITE (active) (5.474A,5.474B,5.474C), RADIOLOCATION, Fixed	10400.0-10450.0	FIXED, MOBILE, RADIOLOCATION, Amateur
10600.0	10680.0	EARTH EXPLORATION-SATELLITE (passive), FIXED, MOBILE except aeronautical mobile, RADIO ASTRONOMY, SPACE RESEARCH (passive)	Radiolocation	10550.0-10600.0	FIXED, MOBILE except aeronautical mobile, Radiolocation	10680.0-10700.0	EARTH EXPLORATION-SATELLITE (passive), RADIO ASTRONOMY, SPACE RESEARCH (passive),
Showing 1 to 3 of 3 entries							
Previous 1 Next							