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Frequency Allocations in Remote Sensing Technical Committee

Annual Meeting

8 July 2024

Athens, Greece

Introduction

The Frequency allocations in Remote Sensing Technical Committee goal is to *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.**

Annual Meeting Agenda

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1. Introduction
2. IGARSS 2024 events
3. Overview of recent and ongoing activities
4. World Radiocommunication Conference 2027 topics
5. NSF spectrum sharing initiative
6. Acknowledgments
7. Discussion
8. Any other business

FARS TC Leadership

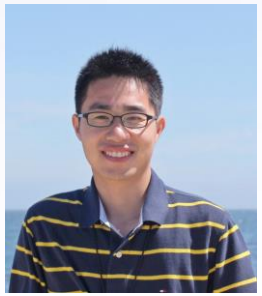
IEEE GRSS

Chair

Paolo de Matthaeis

NASA Goddard Space Flight Center

Co-Chairs



Ming-Liang Tao

Xi'an Northwestern Polytechnical University

Beau Backus

NOAA

Raúl Díez García

European Space Agency

Secretary

Aravind Venkitasubramony

University of Colorado

GRSS Activities

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- **Webinar on 21 June 2024:**
  - Standard development process to address the concerns for RFI caused degradation to remote active and passive sensors by FARS TC Co-Chair Beau Backus
  - Introduction to the problem of RFI and overview of the standard
  - Very well attended with lots of questions!


TECHNICAL COMMITTEES

PAOLO DE MATTHAEIS AND MINGLIANG TAO

Radio-Frequency Interference to Spaceborne Synthetic Aperture Radar Systems: Overview and Approaches to Its Management

IEEE Proof

- **GRSM article for Technical Committees column:**
  - Radio-Frequency Interference to Spaceborne Synthetic Aperture Radar Systems: Overview and Approaches to Its Management by FARS TC Co-Chair Mingliang Tao and FARS TC Chair Paolo de Matthaeis
  - It summarizes in which SAR frequency bands interference is observed and how it is dealt with
  - To be published in the 2nd 2024 issue

IGARSS 2024

IEEE GRSS

- Community Contributed Session: Radio Frequency Interference and Spectrum Management Issues in Microwave Remote Sensing, on Tuesday, 9 July, at 14:40-16:20 **(Marions)**
- Oral Session: RFI Detection and Mitigation for Active Microwave Sensors, on Tuesday, 9 July, at 11:40-13:20 **(Conference Hall 1)**
- Poster Session: Radio Frequency Interference Detection and Mitigation on Tuesday, 9 July, at 10:40-11:40 **(Poster Area 4)**

Other Conferences and Meetings

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- AMS Meeting 2024 in Baltimore
  - presentation on RFI Standard by FARS
- AT-RASC 2024: RFI session within Commission RFI and spectrum management related activities
- Update on FARS TC activities presented at the 2024 Spring Meeting of the Committee on Radio Frequencies (CORF) of the US National Academy of Sciences by Co-Chair Beau Backus

NATIONAL ACADEMY OF SCIENCES

PocketQube for K-band RFI monitoring

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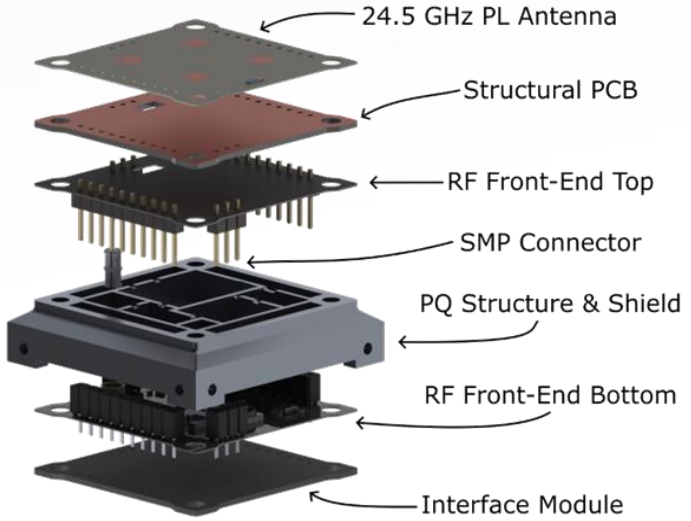
- Third of a series of PocketQube (PQ) systems designed and built by Universitat Politècnica de Catalunya (UPC) as part of an educational initiative
- Payload goal is to detect out-of-band emissions from 5G systems transmitting at 24.25-27.5 GHz
- PQ selected (as PoCat-LEKTRON) in ESA "Fly your Satellite" 4: ESA will fund testing, launch and operation!
- Oral session: "Integration and testing of the IEEE-GRSS Open PQ Kit" – Tue 9 17:20 (at TU4.R15)

UPC

NANOSAT LAB



RFI-5G payload architecture

PocketQube for K-band RFI monitoring

- Payload is being validated mounted on a drone
  - Two test campaigns for hardware validation performed in Spain in early December & May

- Results of the flights to be presented at IGARSS24: *"First experimental Results of a K-band RFI detection Payload for PocketQubes" by Gracia-Sola et al. (Tue 9 15:50, at TU3:R3)*
- RFI measuring campaign in planning stage (monitor early deployment of mmWave 5G from the ground)

Why a standard?

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Despite its acknowledged impact, some questions are still difficult to answer quantitatively:

- How contaminated is a certain frequency band?
- How RFI is globally evolving?
- Are spectrum enforcement policies enough?

A standard would help by:

- Comparing different sensors monitoring the same bands
- Monitoring RFI in a consistent and comparable way
- Providing quantitative and easy-to-evaluate metrics that trigger action

How to standardize RFI impact?

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P4006 Standard for Remote Sensing Frequency Band Radio Frequency Interference (RFI) Impact Assessment

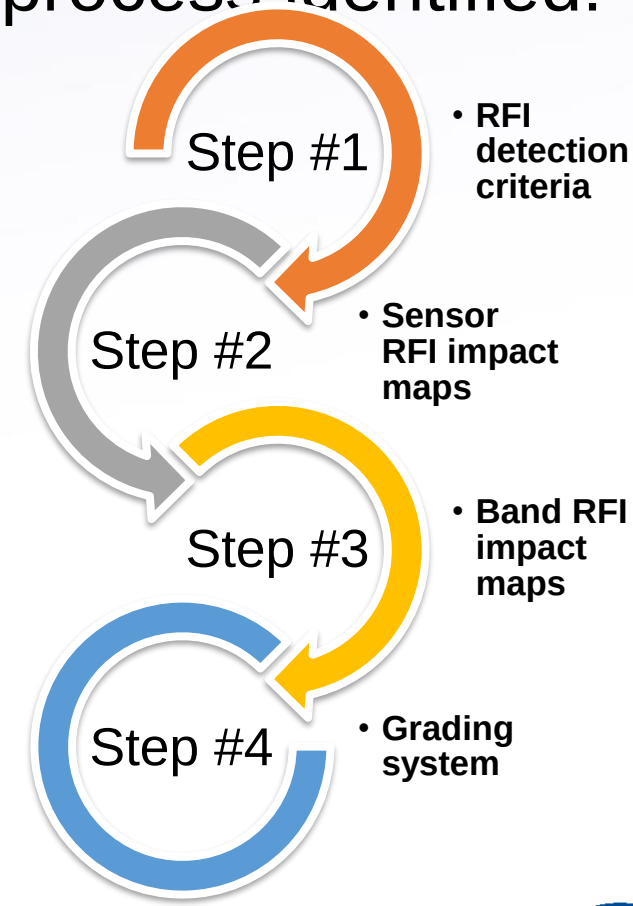
Challenges:

- RFI are strongly instrument dependent =>

  => Different sensors see contamination differently
- How to define “RFI impact”?
- The process should be instrument and band agnostic

Some of the technical details are still under discussion by the team!

- 4 step process identified:



P4006 RFI Impact Standard

IEEE GRSS

- Main objective: standardize the assessment of RFI for Earth observation remote-sensing satellites
- Current status: objectives & framework clear and technical details being discussed
- Looking for contributors!

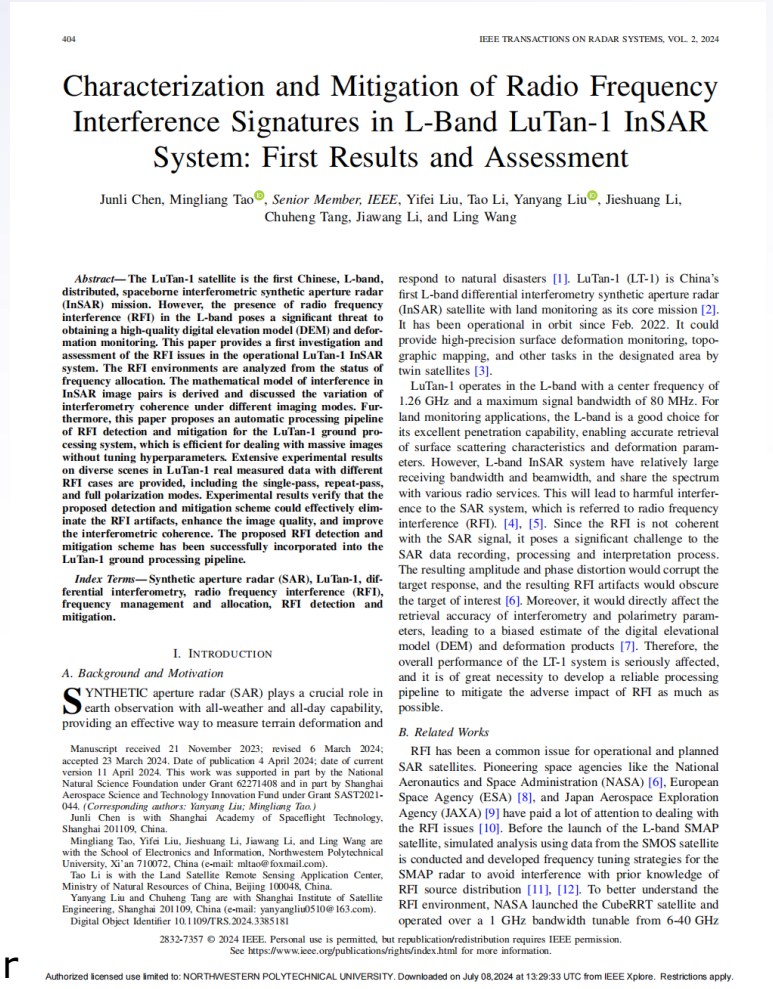
  This standard is open to anyone interested in the topic through the IEEE Standard Association.

Contact details:

- WG Chair: Roger Oliva (roliva@ieee.org)

China Activities

- Investigation and reporting of potential mutual interference between X-band commercial satellites
- Development of a RFI Detection and Mitigation for the ground processing system of Lutan-1 InSAR mission (L-band), which is the first Chinese, L-band, distributed, spaceborne interferometric synthetic aperture radar (InSAR) mission
- Preliminary studies on RFI environment for future P-band SAR satellite missions



Characterization and Mitigation of Radio Frequency Interference Signatures in L-Band LuTan-1 InSAR System: First Results and Assessment

Junli Chen, Mingliang Tao, *Senior Member, IEEE*, Yifei Liu, Tao Li, Yanyang Liu, Jieshuang Li, Chuheng Tang, Jiawang Li, and Ling Wang

***Abstract*— The LuTan-1 satellite is the first Chinese, L-band, distributed, spaceborne interferometric synthetic aperture radar (InSAR) mission. However, the presence of radio frequency interference (RFI) in the L-band poses a significant threat to obtaining a high-quality digital elevation model (DEM) and deformation monitoring. This paper provides a first investigation and assessment of the RFI issues in the operational LuTan-1 InSAR system. The RFI environments are analyzed from the status of frequency allocation. The mathematical model of interference in InSAR image pairs is derived and discussed the variation of interferometry coherence under different imaging modes. Furthermore, this paper proposes an automatic processing pipeline of RFI detection and mitigation for the LuTan-1 ground processing system, which is efficient for dealing with massive images without tuning hyperparameters. Extensive experimental results on diverse scenes in LuTan-1 real measured data with different RFI cases are provided, including the single-pass, repeat-pass, and full polarization modes. Experimental results verify that the proposed detection and mitigation scheme could effectively eliminate the RFI artifacts, enhance the image quality, and improve the interferometric coherence. The proposed RFI detection and mitigation scheme has been successfully incorporated into the LuTan-1 ground processing pipeline.**

***Index Terms*— Synthetic aperture radar (SAR), LuTan-1, differential interferometry, radio frequency interference (RFI), frequency management and allocation, RFI detection and mitigation.**

I. Introduction

A. Background and Motivation

SYNTHETIC aperture radar (SAR) plays a crucial role in earth observation with all-weather and all-day capability, providing an effective way to measure terrain deformation and respond to natural disasters [1]. LuTan-1 (LT-1) is China's first L-band differential interferometry synthetic aperture radar (InSAR) satellite with land monitoring as its core mission [2]. It has been operational in orbit since Feb. 2022. It could provide high-precision surface deformation monitoring, topographic mapping, and other tasks in the designated area by twin satellites [3].

LuTan-1 operates in the L-band with a center frequency of 1.26 GHz and a maximum signal bandwidth of 80 MHz. For land monitoring applications, the L-band is a good choice for its excellent penetration capability, enabling accurate retrieval of surface scattering characteristics and deformation parameters. However, L-band InSAR system have relatively large receiving bandwidth and beamwidth, and share the spectrum with various radio services. This will lead to harmful interference to the SAR system, which is referred to radio frequency interference (RFI). [4], [5]. Since the RFI is not coherent with the SAR signal, it poses a significant challenge to the SAR data recording, processing and interpretation process. The resulting amplitude and phase distortion would corrupt the target response, and the resulting RFI artifacts would obscure the target of interest [6]. Moreover, it would directly affect the retrieval accuracy of interferometry and polarimetry parameters, leading to a biased estimate of the digital elevational model (DEM) and deformation products [7]. Therefore, the overall performance of the LT-1 system is seriously affected, and it is of great necessity to develop a reliable processing pipeline to mitigate the adverse impact of RFI as much as possible.

B. Related Works

RFI has been a common issue for operational and planned SAR satellites. Pioneering space agencies like the National Aeronautics and Space Administration (NASA) [6], European Space Agency (ESA) [8], and Japan Aerospace Exploration Agency (JAXA) [9] have paid a lot of attention to dealing with the RFI issues [10]. Before the launch of the L-band SMAP satellite, simulated analysis using data from the SMOS satellite is conducted and developed frequency tuning strategies for the SMAP radar to avoid interference with prior knowledge of RFI source distribution [11], [12]. To better understand the RFI environment, NASA launched the CubeRRT satellite and operated over a 1 GHz bandwidth tunable from 6-40 GHz

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Mingliang Tao, Yifei Liu, Jieshuang Li, Jiawang Li, and Ling Wang are with the School of Electronics and Information, Northwestern Polytechnical University, Xi'an 710072, China (e-mail: mltao@foxmail.com).

Tao Li is with the Land Satellite Remote Sensing Application Center, Ministry of Natural Resources of China, Beijing 100048, China.

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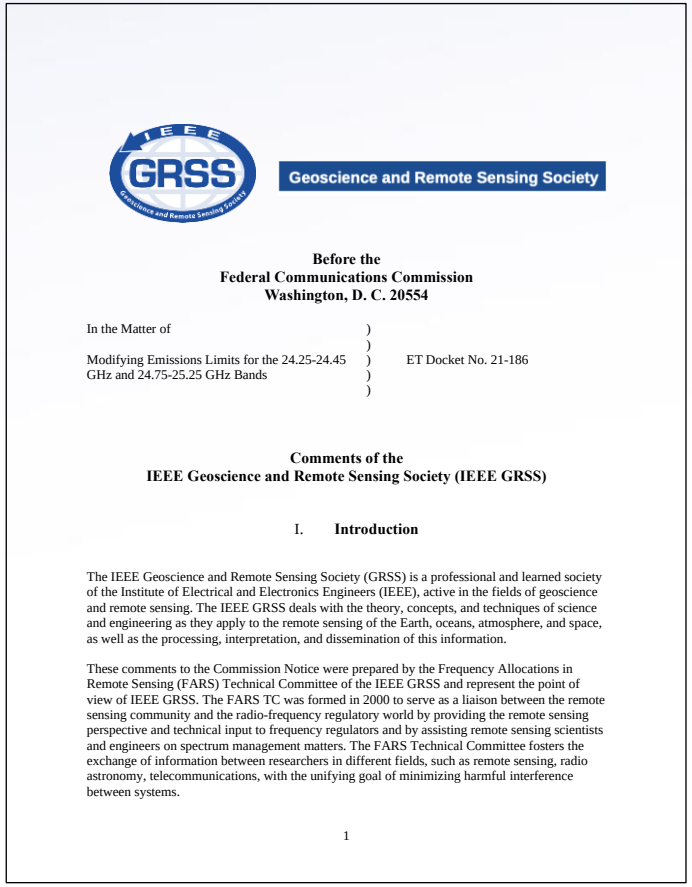
Comments to FCC

IEEE GRSS

- The FARS Technical Committee prepared and filed comments to the US Federal Communications Commission (FCC) on behalf of IEEE GRSS, in response to a Notice of Proposed Rulemaking (NPRM) on Out-of-Band Emissions (OOBE) limits for the 24.25-24.45 GHz and 24.75-25.25 GHz bands.
- This NPRM was issued as a follow up to the April 2021 FCC Public Notice requesting comments on whether and how to implement the emissions limits decided at WRC-19 in its Res. 750 within the US and solicits further input on this topic (comments also submitted at that time).
- Res. 750 sets OOBE limits for current IMT devices as well as more stringent limits starting by September 1, 2027. IEEE GRSS recommends adoption of the Res. 750 limits in the US and calls for an earlier switch to the second stricter set of limits.
- The document is available in the Consent Agenda.
- Many thanks to David Lubar for taking the lead in preparing the document!



Geoscience and Remote Sensing Society

Before the
Federal Communications Commission
Washington, D. C. 20554

In the Matter of	)	
	)	
Modifying Emissions Limits for the 24.25-24.45 GHz and 24.75-25.25 GHz Bands	)	ET Docket No. 21-186
	)	
	)	

Comments of the
IEEE Geoscience and Remote Sensing Society (IEEE GRSS)

I. Introduction

The IEEE Geoscience and Remote Sensing Society (GRSS) is a professional and learned society of the Institute of Electrical and Electronics Engineers (IEEE), active in the fields of geoscience and remote sensing. The IEEE GRSS deals with the theory, concepts, and techniques of science and engineering as they apply to the remote sensing of the Earth, oceans, atmosphere, and space, as well as the processing, interpretation, and dissemination of this information.

These comments to the Commission Notice were prepared by the Frequency Allocations in Remote Sensing (FARS) Technical Committee of the IEEE GRSS and represent the point of view of IEEE GRSS. The FARS TC was formed in 2000 to serve as a liaison between the remote sensing community and the radio-frequency regulatory world by providing the remote sensing perspective and technical input to frequency regulators and by assisting remote sensing scientists and engineers on spectrum management matters. The FARS Technical Committee fosters the exchange of information between researchers in different fields, such as remote sensing, radio astronomy, telecommunications, with the unifying goal of minimizing harmful interference between systems.

1

GRSS Views on WRC-23 Agenda Items

IEEE GRSS

- Document explaining the Views of IEEE GRSS on the WRC-23 Agenda Items of the World Communication Conference 2023 (WRC-23) related to remote sensing
- Concerns and opportunities from the GRSS perspective on the proposed modifications to the Radio Regulations are discussed
- It joins similar documents by the SFCG, WMO, CORF, etc., and gives the perspective of remote sensing scientists and engineers
- The document is available on the FARS TC webpage

Some Numbers for WRC-23 in Dubai

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The World Radiocommunication Conference 2023 (WRC-23) was held in Dubai at the end of last year:

- 3900 Delegates
- 163 Member States
- 141 Sector Members
- 4500 users – Webcast
- U.S. Delegation to WRC-23 – 200 participants
- DOC, DOD, FCC, NASA, FAA, NSF, DOE, OSTP, State Department, and U.S. telecommunications and technology sectors

Relevant WRC-27 Agenda Items

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1.1: Fixed Satellite service (FSS) aeronautical and maritime ESIMs in the 47.2-50.2 GHz and 50.4-51.4 GHz bands

1.2: FSS smaller antennas in the 13.75-14 GHz band

1.3: FSS gateways in the 51.4-52.4 GHz band transmitting to non-GSO systems

1.4: FSS and BSS downlinks in the 17.3 to 17.8 GHz range

1.6: Equitable access for FSS in the 37.5 to 51.4 GHz range

1.7: International Mobile Telecommunications (IMT) in the 4.4-4.8 GHz, 7.125-8.4 GHz and 14.8-15.35 GHz bands

1.8: Radiolocation service in the 231.5-275 GHz and 275-700 GHz ranges

1.11: Space-to-space links in bands allocated to the MSS in the 1518 to 1675 MHz range and the 2483.5-2 500 MHz band

1.12: Mobile Satellite service (MSS) in the 1427-1432 MHz, 1645.5-1646.5 MHz, 1880-1920 MHz and 2010-2025 MHz bands for low data rate non-GSO systems

1.13: MSS in the 694 to 2700 MHz range for direct connectivity to IMT user equipment

1.14: MSS in the bands 2 010-2 025 MHz, 2120-2160 MHz and 2 160-2 170 MHz

1.17: Regulatory provisions and protection of receive-only space weather sensors

1.18: Protection of EESS (passive) sensors from active services in adjacent bands above 86 GHz

1.19: New primary allocations to the EESS (passive) in the 4.2-4.4 GHz and 8.4-8.5 GHz bands for SST measurements

7: Satellite regulatory procedures

10: Preliminary agenda for WRC-31

WRC-27 Agenda Item 1.7 (IMT in the 4.4-4.8 GHz, 7.125-8.4 GHz and 14.8-15.35 GHz bands)

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- There are already a good number of bands identified for IMT, including the newly identified bands, 6425-7125 MHz in Region 1 and 7025-7125 MHz in Region 3, there was still a large majority of countries at WRC-23 insisting to study more bands for International Mobile Telecommunication (IMT). As a result agenda item 1.7 was established.

- Under this new agenda item for IMT, sharing and compatibility studies will have to be performed, with a view to ensuring the protection of services to which the frequency band is allocated on a primary basis, without imposing additional regulatory or technical constraints on those services, and also on services in adjacent bands.

- **Of concern to the remote sensing community regarding this IMT focused agenda item is the directly adjacent passive band 15.35-15.4 GHz.**

- **GRSS/FARS is concerned with the impact of IMT operations in the frequency ranges 4 400-4 800 MHz and 8 215-8 400 MHz on the potential new EESS (passive) allocations under agenda item 1.19 be taken into consideration.**

- Many current and future MetSat and EO missions use one of the above bands in the 7/8 GHz range for downlink/broadcast of data. Thus, studies for a possible identification for IMT concern most all these missions.

WRC-27 Agenda Items 1.8 (Radiolocation service in the 231.5-275 GHz and 275-700 GHz ranges)

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- For these new applications in the Radiolocation service (RLS) two components are considered, a receive-only use, which is similar to passive sensors, detecting the extremely weak power that is naturally radiated by objects, and an active use. For this active component compatibility with passive sensors has to be ensured.

- **Sharing and compatibility studies (in-band and adjacent bands) will need to be performed for active millimetric and sub-millimetric wave RLS systems in bands above 231.5 GHz with passive sensors. This is relevant for many planned remote passive sensors.**

- **GRSS/FARS is concerned about new allocations to the radiolocation service in the frequency band 250-252 GHz where footnote RR No. 5.340 applies.**

  - 5.340: All emissions are prohibited in the following bands: … 250-252 GHz.

- **GRSS/FARS supports protection of the current allocations to EESS (passive) and EESS (active), from both in-band and out-of-band emissions resulting from possible new radiolocation service applications.**

WRC-27 Agenda Items 1.18 (Protection of EESS (passive) sensors from active services in adjacent bands above 86 GHz)

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- The work under this WRC-27 Agenda item 1.18 is split into two topics, protection of particular bands for EESS (passive) and particular bands for Radioastronomy. The primary interest of FARS is related to the protection of EESS (passive) from unwanted emissions of active services operating in frequency bands adjacent to the EESS (passive) allocations where RR No. 5.340 applies.
  - Additionally, Resolution 750 (Rev. WRC-19) has been updated and may apply should any regulatory measures be required to ensure the protections of the EESS (passive).
- Further establishment of unwanted emission limits in Resolution 750 in the Radio Regulations to include the passive bands 86-92 GHz, 114.25-116 GHz, 164-167 GHz, 200-209 GHz, all covered by 5.340 (all emissions are prohibited), proactively before the active services are deployed, would be beneficial for many operational and planned passive microwave sensors.
- **GRSS/FARS encourages regulatory provisions applicable to active services to ensure protection and long-term usability of the EESS (passive) frequency bands 86-92 GHz, 114.25-116 GHz, 164-167 GHz and 200-209 GHz and thus supports the update of Resolution 750 (Rev.WRC-19) accordingly.**
- This issue needs to be addressed by WRC-27 prior to expected widespread deployment of active services in the bands to be studied.

WRC-27 Agenda Items 1.19 (Possible new primary allocations to the EESS (passive) in the 4.2-4.4 GHz and 8.4-8.5 GHz bands for SST)

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- As a result of the WRC-23 Agenda item 1.2 for IMT identification in the 6/7 GHz range and its possible impact on SST measurements, WRC-23 also established agenda item agenda item 1.19 addressing possible new frequency allocations for EESS (passive) in the bands 4200-4400 MHz and 8400-8500 MHz.

- **The study goals under WRC-27 agenda item 1.19 is to determine the conditions for usage of the frequency bands 4.2-4.4 GHz and 8.4-8.5 GHz by the EESS (passive) which would then be used in conjunction with the 6/7 GHz frequency range. In this context also the merits of a remote sensing multichannel instrument for future SST measurements has to be studied and assessed.**

- **Note the relationship of ITU WRC-27 AI 1.7 with AI 1.19 with respect to the 4200-4400 and 8400-8500 MHz bands.**

- **GRSS/FARS is supportive of this agenda item and the possible new allocations for EESS (passive) in the 4.2-4.4 and 8.4-8.5 GHz bands.**

Spectrum Management Activities

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Involvement in international regulatory processes is one of the core missions of FARS-TC:

- GRSS in the unique position of representing only the remote sensing community without having to compromise its position with other interests
- GRSS can become relevant in frequency allocations and similar matters only through active participation in high-level international meetings

The most relevant entities with which FARS-TC needs to interact are:

- The International Telecommunication Union – Radiocommunication sector (ITU-R), that, through its Working Parties, holds periodical meetings to collect and coordinate input from ITU Member States and Sector Members (such as IEEE) on spectrum allocations
- The Space Frequency Coordination Group (SFCG), composed by all space agencies and related organizations, whose goal is to provide a less formal and more flexible environment to discuss and find agreement on frequency management problems

FARS Role in Spectrum Management

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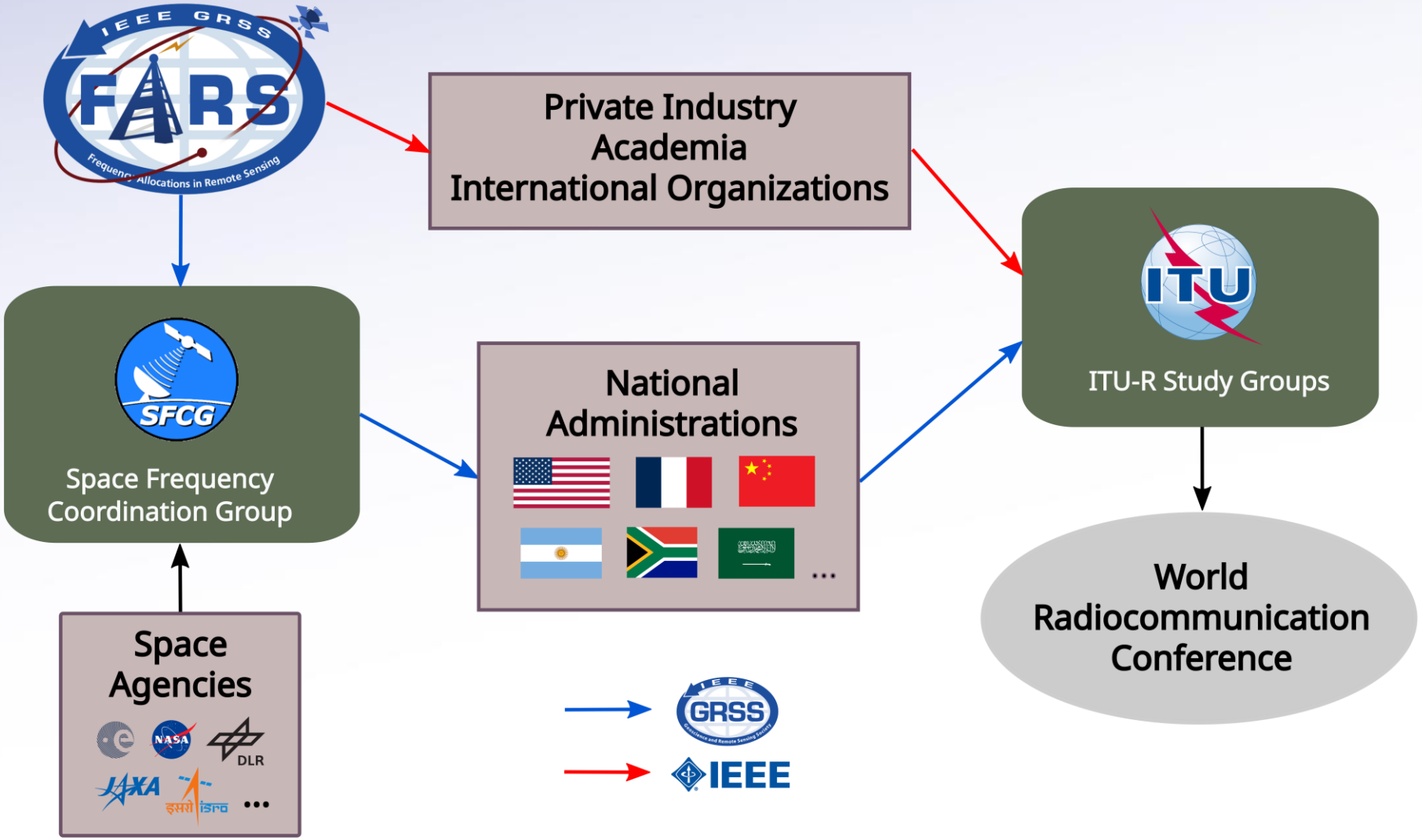
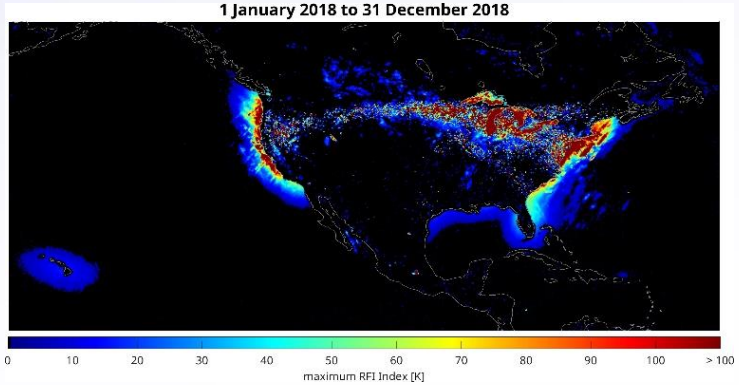


ITU-R Study Groups

- **ITU-R Working Party 7C (Remote Sensing Systems)**
  - Input contributions on:
    - Preliminary new draft report on 18 GHz RFI caused by surface reflections of telecommunication signals
    - Revision of Recommendation ITU-R RS.1166 *Performance and interference criteria for active spaceborne sensors*
  - Participated in the discussions on:
    - WRC-23 Agenda Item 1.12 on new secondary allocation at 40-50 MHz for radar sounder

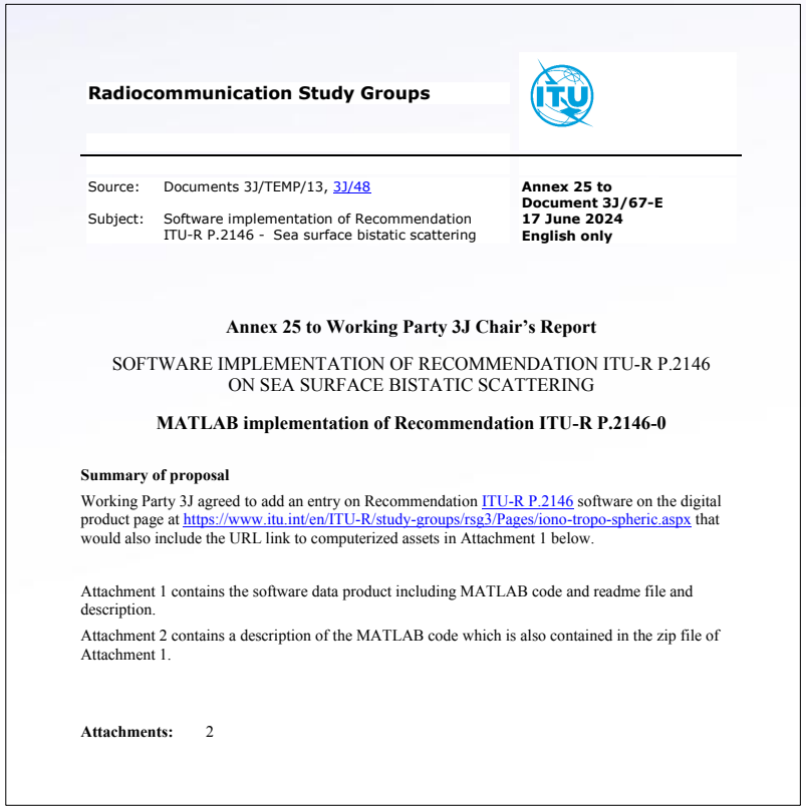


ITU-R Study Groups

IEEE GRSS

ITU-R Working Party 3J (Propagation Fundamentals)

- MATLAB implementation of scattering coefficient model in Recommendation ITU-R provided to ITU for use in sharing and compatibility studies
- continuing activities on Earth surface scattering models in CG 3J-17



Radiocommunication Study Groups

Source: Documents 3J/TEMP/13, 3J/48

Subject: Software implementation of Recommendation ITU-R P.2146 - Sea surface bistatic scattering

Annex 25 to Document 3J/67-E
17 June 2024
English only

Annex 25 to Working Party 3J Chair's Report

SOFTWARE IMPLEMENTATION OF RECOMMENDATION ITU-R P.2146 ON SEA SURFACE BISTATIC SCATTERING

MATLAB implementation of Recommendation ITU-R P.2146-0

Summary of proposal

Working Party 3J agreed to add an entry on Recommendation ITU-R P.2146 software on the digital product page at https://www.itu.int/en/ITU-R/study-groups/rsg3/Pages/iono-tropo-spheric.aspx that would also include the URL link to computerized assets in Attachment 1 below.

Attachment 1 contains the software data product including MATLAB code and readme file and description.

Attachment 2 contains a description of the MATLAB code which is also contained in the zip file of Attachment 1.

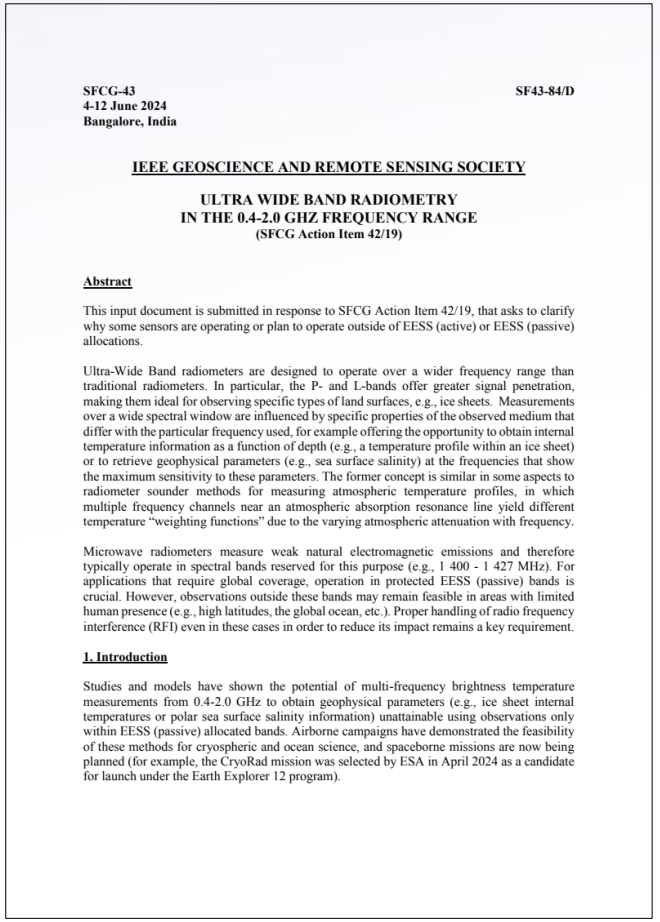
Attachments: 2

Space Frequency Coordination Group (SFCG)

IEEE GRSS

SFCG-43 Annual Meeting on 4-12 June 2024

- two input documents submitted for discussion in response to Action Item AI 42/19 on *Operations of sensors outside of ITU allocations*
  - SF43-84/D, *Ultra Wide Band Radiometry in the 0.4-2.0 GHz Frequency Range*
  - SF43-85/D, *Overview of GNSS Reflectometry (GNSS-R)*
- submission of more material on these two topics encouraged to be included in new report at SFCG-44 meeting next year
- contributing to AI 42-1 on the *Commercial Satellite Spectrum Management Association (CSSMA) Liaison and Workshop*
  - GRSS given a presentation slot at CSSMA/SFCG Workshop in December



SFCG-43
4-12 June 2024
Bangalore, India

SF43-84/D

IEEE GEOSCIENCE AND REMOTE SENSING SOCIETY

ULTRA WIDE BAND RADIOMETRY
IN THE 0.4-2.0 GHZ FREQUENCY RANGE
(SFCG Action Item 42/19)

Abstract

This input document is submitted in response to SFCG Action Item 42/19, that asks to clarify why some sensors are operating or plan to operate outside of EESS (active) or EESS (passive) allocations.

Ultra-Wide Band radiometers are designed to operate over a wider frequency range than traditional radiometers. In particular, the P- and L-bands offer greater signal penetration, making them ideal for observing specific types of land surfaces, e.g., ice sheets. Measurements over a wide spectral window are influenced by specific properties of the observed medium that differ with the particular frequency used, for example offering the opportunity to obtain internal temperature information as a function of depth (e.g., a temperature profile within an ice sheet) or to retrieve geophysical parameters (e.g., sea surface salinity) at the frequencies that show the maximum sensitivity to these parameters. The former concept is similar in some aspects to radiometer sounder methods for measuring atmospheric temperature profiles, in which multiple frequency channels near an atmospheric absorption resonance line yield different temperature "weighting functions" due to the varying atmospheric attenuation with frequency.

Microwave radiometers measure weak natural electromagnetic emissions and therefore typically operate in spectral bands reserved for this purpose (e.g., 1 400 - 1 427 MHz). For applications that require global coverage, operation in protected EESS (passive) bands is crucial. However, observations outside these bands may remain feasible in areas with limited human presence (e.g., high latitudes, the global ocean, etc.). Proper handling of radio frequency interference (RFI) even in these cases in order to reduce its impact remains a key requirement.

1. Introduction

Studies and models have shown the potential of multi-frequency brightness temperature measurements from 0.4-2.0 GHz to obtain geophysical parameters (e.g., ice sheet internal temperatures or polar sea surface salinity information) unattainable using observations only within EESS (passive) allocated bands. Airborne campaigns have demonstrated the feasibility of these methods for cryospheric and ocean science, and spaceborne missions are now being planned (for example, the CryoRad mission was selected by ESA in April 2024 as a candidate for launch under the Earth Explorer 12 program).

US Spectrum Focused Research Opportunities

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US National Science Foundation operating the **“spectrum innovation initiative” (SII)** that provides multiple spectrum-focused research opportunities

https://new.nsf.gov/funding/opportunities/spectrum-wireless-innovation-enabled-future/505858/nsf23-567

Sharing between active and passive users (often radio astronomy sites) is one of the motivating factors of the SII (as well as 6G, industry needs, mm-wave technologies, etc.)

- One major outcome of the SII is the multi-university “SpectrumX” center: https://www.spectrumx.org/
- Center welcomes new affiliate members and provides opportunities to propose seed projects that develop new collaborations in spectrum research
- The development of a “National Radio Dynamic Zone” (NRDZ) is also of interest
- Multiple projects in progress to explore this concept
- Other single/multiple investigator type opportunities also available under the “Next era of wireless and spectrum” program
- First cycle of proposals was due 5/28/24; expected to repeat

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Thank you for all your support!

Reach us for a small present ;)

- Thank you for your attention!
- For more information on the FARS Technical
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- For any questions, please write to
- fars_chairs@grss-ieee.org.