



Frequency Allocations in Remote Sensing Technical Committee (FARS-TC)

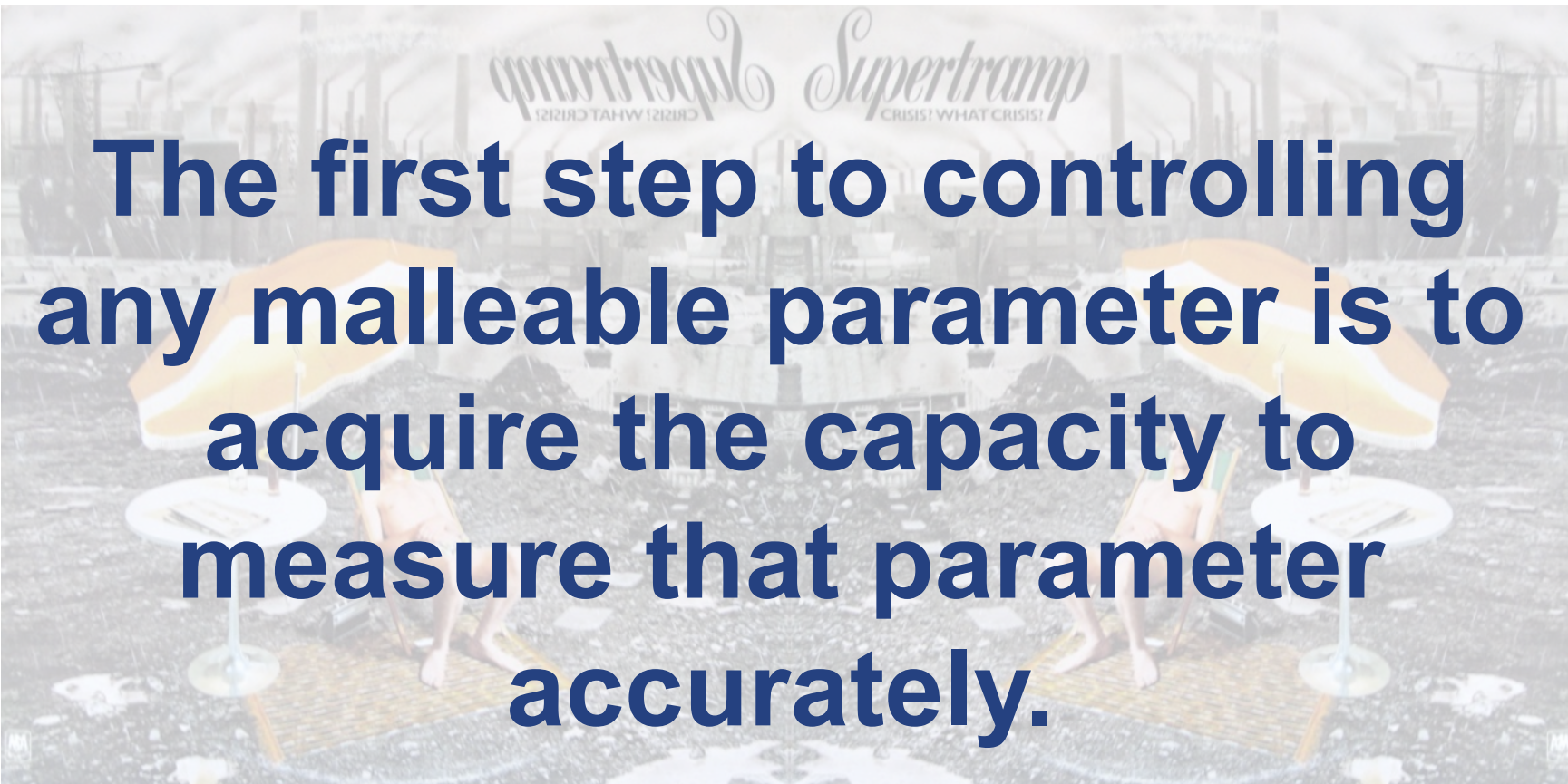
IEEE Standards for RFI Contamination Assessment



*Roger Oliva,
Thomas von Deak
Paolo de Matthaeis
Tobias Bollian*

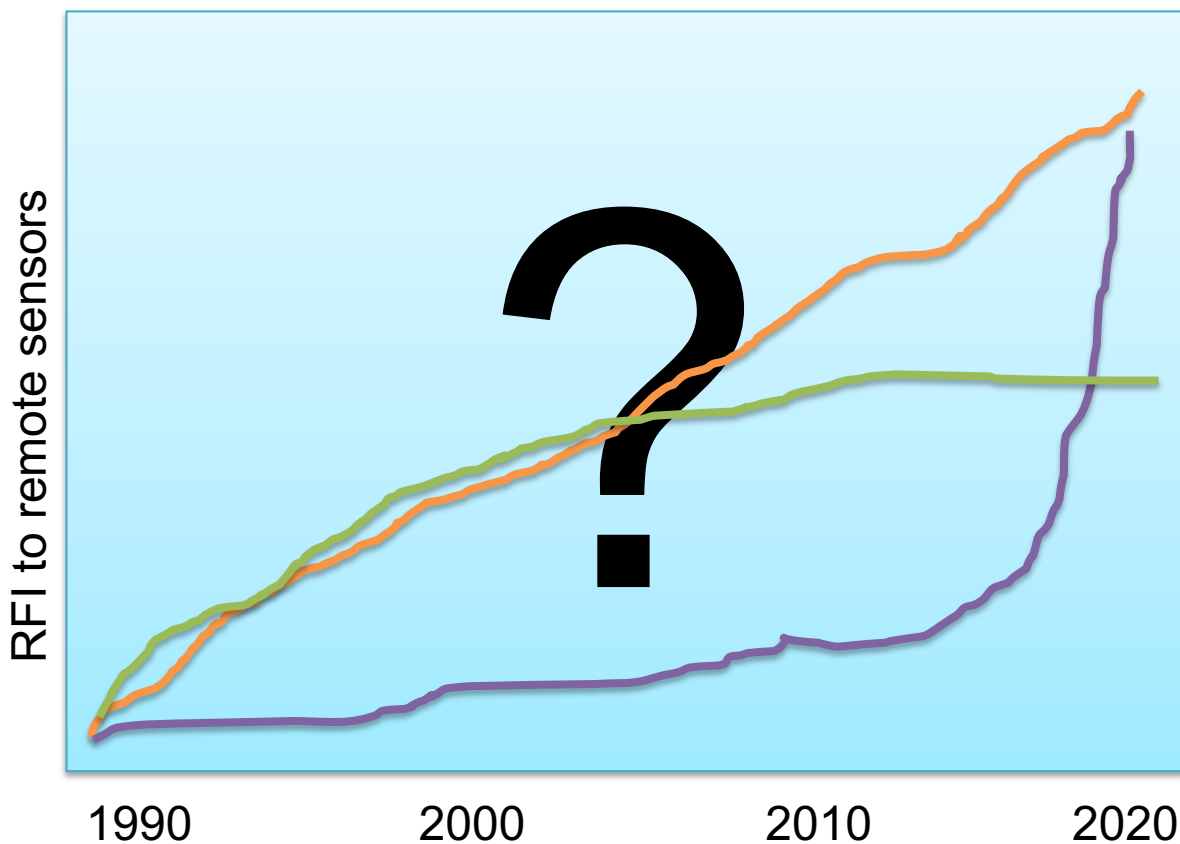
MicroRad 2020 Symposium
18 November 2020

Engineering Principle

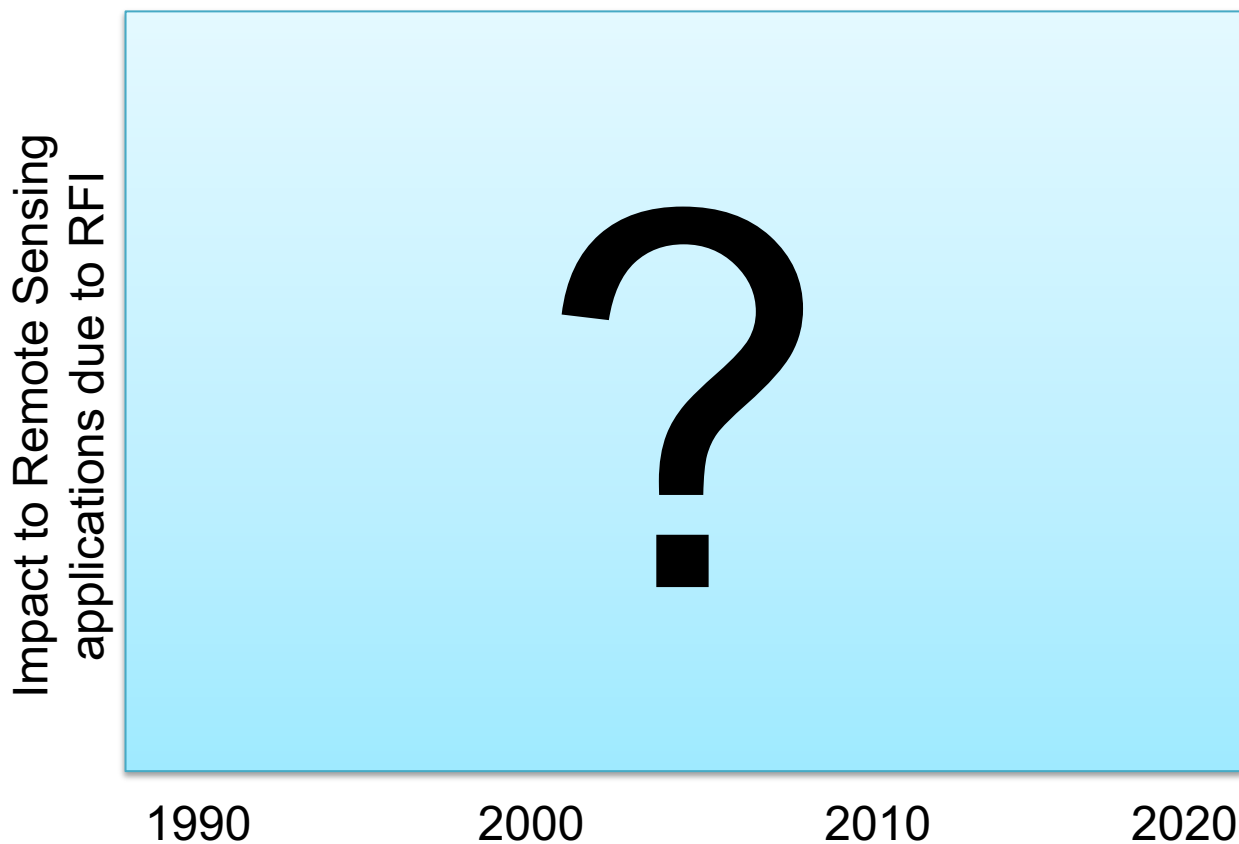
The background image is a composite. In the foreground, there is a beach scene with two people sitting on lounge chairs under yellow umbrellas. In the background, a city skyline is visible, with the word "Supertramp" and the phrase "CRISIS! WHAT CRISIS!" overlaid in a stylized font.

The first step to controlling any malleable parameter is to acquire the capacity to measure that parameter accurately.

RFI by RS band over time



Degradation of Remote Sensing Products due to RFI Over Time



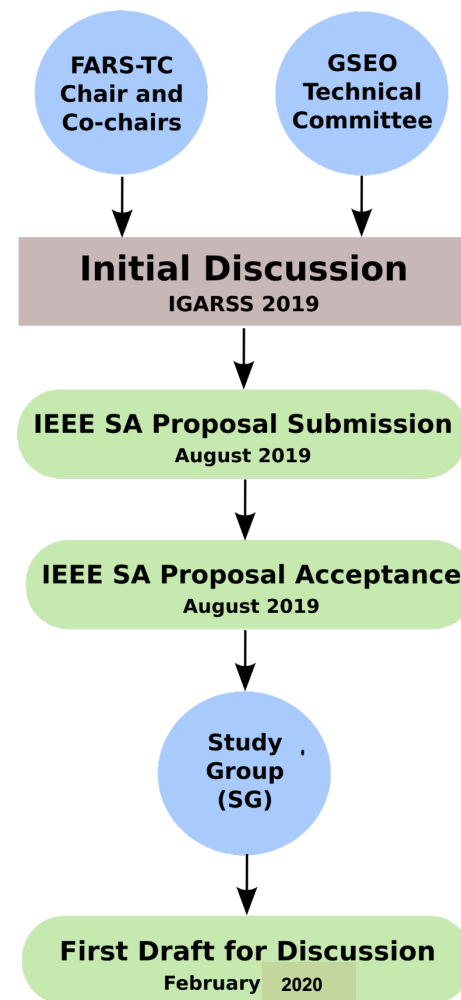
FARS-TC and Standards for RFI

Goal:

- to develop standards for methodologies to consistently evaluate the quality of frequency bands with respect to RFI

Timeline:

- first proposal at 2019 FARS-TC Annual Meeting
- discussion with GRSS Technical Committee on Standards for Earth Observations (GSEO) on activities that can support monitoring and mitigation of the RFI problem by means of standardization.
- submission of a proposal (accepted) to the IEEE Standards Association Board of
- formation of Study Group (SG) and generation of first draft document to present to FARS membership and rest of community for further discussion.
- previous plans for this first open meeting in March or July 2020 postponed due to Covid-19 outbreak



Purpose

- This standard will provide criteria to assess RFI impact on remote sensing in the frequency bands and also a methodology for remote sensing missions to document man-made RFI.
- A further goal is to ensure a continuing and consistent measure of the impinging RFI and its impact in each of the considered remote sensing frequency bands over a long timeframe.
- This recorded information is to be used to inform policy decision makers and the public regarding the impact of man-made RFI in any given remote sensing frequency band on remote sensing operations and products.



Developing a Standard: Project Authorization Request (PAR)

- The first steps in developing an IEEE Standards are
 1. forming a Working Group (WG).
 2. submitting a Project Authorization Request (PAR) to IEEE SA.
- The PAR states the reason for the project and what the WG intends to do.
- The WG will then develop the Standard with inputs and feedback from the stakeholders.
- Officially, a standard needs to be developed within 4 years after IEEE SA Board of Governors acceptance of the PAR
- IEEE Standards association has a web portal to support the WG development of the Standard

Types of IEEE Standards

Standards

Documents with mandatory requirements

Recommended practices

Documents in which procedures and positions preferred by the IEEE are presented

Guides

Documents in which alternate approaches to good practice are suggested but no clear-cut recommendations are made

Currently Identified Issues

- Quantification of RFI impact vs RFI characteristics (intensity, extent, peak/average, etc.)
- Consideration of the different RFI impact on a variety of technical characteristics and applications for instruments operating in the same band
- Global RFI vs Regional RFI
- Examination of mission criteria
- Relationship with Recommendation ITU-R RS.2017
- Interaction with ITU and spectrum managers from space agencies
- RFI measurements: BT vs EIRP



Initial step is to update this table

IEEE Band	Frequency Range	Passive Sensors	RFI
L	1.400-1427 MHz	Soil moisture, sea surface salinity, sea surface wind, vegetation index	High; out of band emissions mostly from air surveillance radars
C	6425-7.250 MHz	Soil moisture, sea surface salinity, precipitation	Moderate (especially over the U.S.A.)
X	10.6-10.7 GHz	Precipitation, cloud liquid water, sea surface wind speed, sea surface temperature	Moderate (especially over Europe)
Ku	18.6-18.8 GHz	Precipitation, cloud liquid water, snow cover, sea surface wind speed, sea ice	Moderate; potentially from satellite TV service signals.
K	22.21-22.5 GHz	Atmospheric water vapor, Sea surface wind speed, sea ice, precipitation, snow cover	Moderate; vehicle anti-collision radars
K	23.6-24 GHz	Atmospheric water vapor, Sea surface wind speed, sea ice, precipitation, snow cover	Moderate; vehicle anti-collision radars
Ka	31.3-31.8 GHz	Precipitation, cloud liquid water, snow cover, sea surface wind speed, sea ice	Low; new sources observed off oil platforms near the Indian subcontinent
Ka	36-37 GHz	Precipitation, cloud liquid water, snow cover, sea surface wind speed, sea ice	Low; new sources observed off oil platforms near the Indian subcontinent
V	50.2-50.4 GHz	Atmospheric temperature profiling	Moderate: potential for RFI due to spectrum sharing rules at 55-57
V	51.4-59.3 GHz	Atmospheric temperature profiling	Moderate: potential for RFI due to spectrum sharing rules at 55-57

Adapted from S. Misra and P. de Mattheais, "Passive remote sensing and radio frequency interference (RFI): An overview of spectrum allocations and RFI management algorithms", *IEEE Geoscience and Remote Sensing Magazine*, vol. 2, no. 2, pp. 68-73, June 2014.

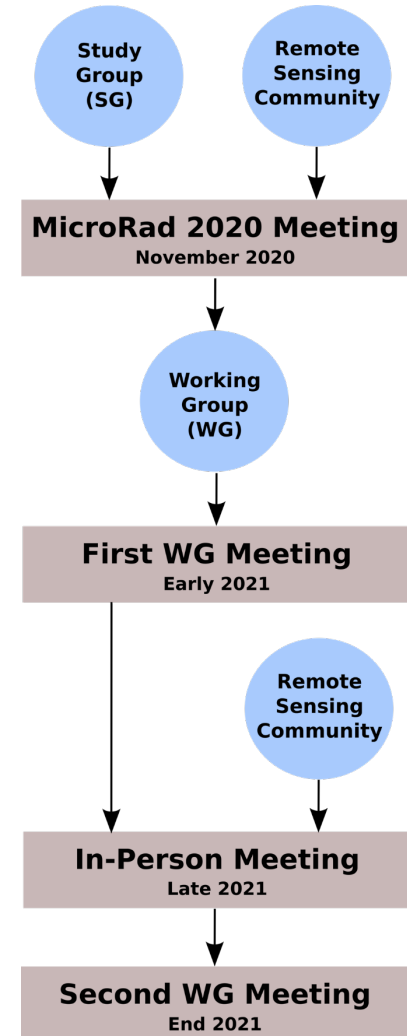


and to fill this table

IEEE Band	Frequency Range	Active Sensors	RFI
P	432-438 MHz	Imaging radar	
L	1215-1300 MHz	Imaging radar, scatterometer	
S	3100-3300 MHz	Imaging radar, scatterometer, altimeter	
C	5250-5570 MHz	Imaging radar, altimeter	
X	8550-8650 MHz	Imaging radar, scatterometer, altimeter	
	9300-9900 MHz	Imaging radar, scatterometer, altimeter	
Ku	13.25-13.75 GHz	Scatterometer, altimeter, precipitation radar	
	17.20-17.30 GHz	Scatterometer, precipitation radar	
K	24.05-24.25 GHz	Precipitation radar	
Ka	35.5-36 GHz	Scatterometer, altimeter, precipitation radar	
W	78-79 GHz	Cloud profiling radar	
	94-94.1 GHz	Cloud profiling radar	
mm	133.5-134 GHz	Cloud profiling radar	
	237.9-238 GHz	Cloud profiling radar	

Work Plan

- Initial discussion with RS community (today)
- Formation of the WG (end Nov 2020)
- Sharing draft PAR with WG (Dec 2020)
- First virtual WG meeting (early 2021)
- In-person meeting with RS community in late 2021 to share WG progress (Covid-19 permitting)



Feedback and Participation Needed!

FARS welcomes input from the remote sensing community on:

- **general interest for this initiative**
- **willingness of people to actively contribute**
- **other aspects and challenges to consider**
- **related parallel activities that could be incorporated into this standard**