



Report from the event supported by RadioNet

TITLE *DETECTION AND MEASUREMENT OF RFI IN RADIO ASTRONOMY*

DATE: *8TH – 9TH JUNE, 2017*

LOCATION: *YEBES, SPAIN*

MEETING WEBPAGE: *<http://www.oan.es/rfi2017/>*

HOST INSTITUTE: *YEBES OBSERVATORY, CDT, IGN.*

**RADIONET
BENEFICIARY / NO:** *UAH / 12*

Report:

1. SCIENTIFIC SUMMARY

The workshop on RFI detection and measurement has given the opportunity to many scientists and engineers to show their work in the field of RFI analysis, its detection and measurement and hardware and software solutions to minimize their unwanted effects on high sensitivity radio astronomy receivers, which are equipped with state-of-the-art components to carry out top-level scientific observations and measurements.

Important results have been shown in the field of high-temperature superconducting filters (HTS) (Fig. 1). These are very low loss filters that can be installed in front of the low-noise amplifiers. The penalty of a little increment in receiver noise produced by these filters is largely compensated with the benefits that they produce, as they allow the operation of amplifiers in the linear regime in the presence of RFI signals.

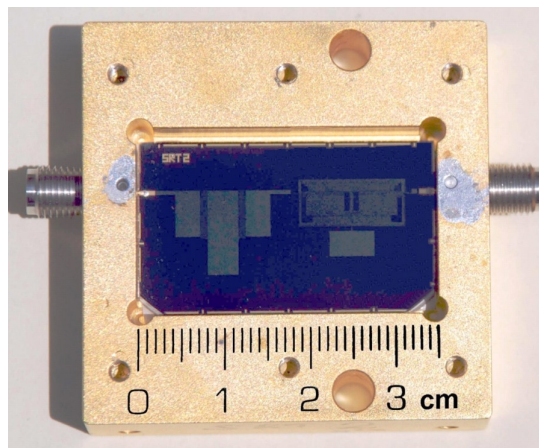


Figure 1: Example of HTS filter (Credit: S. Mariotti, IRA/INAF).

The attendees have learned how other observatories are facing RFI issues, so they have got new ideas on how to start or improve their work in this field. In addition, the workshop has been a good starting point for some collaboration among institutes/observatories. What's more, some of the works presented in this workshop could be considered to be implemented in current RadioNet work packages like BRAND.

The speakers have shown that RFI is a very common problem to all observatories so efforts against spectrum pollution have to be joined through the Committee on Radio Astronomy Frequencies (CRAF), whose frequency manager (Ms. Hezareh) gave an interesting talk about CRAF activities and future telecommunication services with impact on radio astronomy.

After the meeting, a tutorial was given to show attendees how to use the portable RFI equipment available at Yebes Observatory. It will allow other observatories without this instrumentation to carry out RFI measurements on their own with Yebes equipment, which can be borrowed.

The workshop web page is available at: <http://www.oan.es/rfi2017/>

The presentations are available at: http://www.oan.es/rfi2017/show_presentations.shtml

2. AGENDA OF THE EVENT

Day 8-June-2017

- 8:30 Bus departure from Guadalajara to Yebes Observatory.
- 9:00 Arrival and registration.
- 9:30 Workshop Opening and Logistics.
José A. López-Pérez (IGN).
- 9:40 Welcome and Yebes Observatory introduction.
José A. López-Fernández (Yebes Observatory Director, IGN).

Session 1 : Local RFI environments (Chairman: Reinhard Keller.)

- 10:00 The INAF RFI group: recent results in spectrum management & monitoring.
Pietro Bolli (INAF, Arcetri Observatory, Italy).
- 10:30 RFI measurements at the 65m Tianma Telescope.
Bin Li (Shanghai Astronomical Observatory, China).
- 11:00 Coffee Break.
- 11:30 RFI measurements in the framework of BRAND-EVN project.
José A. López-Pérez (Yebes Observatory, Spain).
- 12:00 RFI Survey for the Thai 40-m Radio Telescope.
Phrudth Jaroenjittichai (NARIT, Thailand).
- 12:30 RFI Measurements at the Argentine Institute of Radioastronomy I.A.R.
Guillermo Gancio (IAR, Argentina).
- 13:00 Lunch Break.

Session 2: RFI surveys and mitigation (Chairman: Jose A. López-Pérez)

- 14:00 An evaluation of local interferences in the 0-3 GHz band. A case study in Meco (Spain).
Pablo Lopez-Espí (UAH, Spain).
- 14:30 Radio Environment of NSRT and RFI Mitigation.
Qi Liu (Xinjiang Astronomical Observatory, China).
- 15:00 Wideband RFI mitigation.
Jan-Willem W. Steeb (Stellenbosch University, South Africa).
- 15:30 Coffee Break.
- 16:00 ESAC RFI Survey in the SMOS 1400–1427MHz Passive Band.
Ekhi Uranga (ESAC, ESA, Spain).
- 16:30 RFI measurements with Yebes VGOS broad-band receiver
Pablo García (Yebes Observatory, Spain).
- 17:00 Visit to the 40-meter radio telescope.
- 18:30 Bus departure to Guadalajara.
- 20:15 Meeting point for social dinner.
Hotel Alcarria, C/ Toledo 39, Guadalajara.
- 20:30 Social dinner at restaurant.

Day 9-June-2017

- 8:30 Bus departure from Guadalajara to Yebes Observatory.

Session 3: RFI management (Chairman: Pietro Bolli)

- 9:00 Spectrum management for Radio astronomy in Europe and beyond.
Talayah Hezareh (CRAF, Germany).
- 9:30 RFI Protection Activities in IAA RAS.
Aleksy Tsaruk (Institute of Applied Astronomy, Russia).
- 10:00 An RFI Mitigation Project at the Italian Radio Telescopes
Giampaolo Serra (INAF, Astronomical Observatory of Cagliari, Italy).
- 10:30 RFI mitigation tests conducted at GGAO.
Lawrence M. Hilliard (NASA, USA).
- 11:00 Coffee Break.

11:30 High Temperature Superconductor microwave filters for the Sardinia Radio Telescope.
Sergio Mariotti (INAF-IRA, Bologna Observatory, Italy).

Session 4: Hardware for RFI detection (Chairman: Jose A. López-Pérez)

12:00 Effective solutions for detection and measurement of RF & uW spectrum using Real-time Spectrum analyzer solution.
Andrew Benn (Keysight Technologies).
12:30 Industry solutions for RFI monitoring, detection and location.
Thomas Krenz (Rohde-Schwarz).
13:00 Lunch Break.

Session 5: Yebes RFI portable equipment tutorial (Speaker: José A. López-Pérez)

14:00 RFI equipment tutorial. RFI measurement demo.
16:00 Coffee Break.
16:30 Workshop closure.
17:00 Bus departure to Guadalajara.

3. PARTICIPANTS

Forty-one attendees from several countries came to the workshop, mainly from Europe (80.5% from Germany, Italy, Spain, Sweden, Latvia, Russia and Poland), but also from Asia (12.2% from China and Thailand), America (4.9% from USA and Argentina) and Africa (2.4% from South Africa).

In relation to the gender of the attendees, the fraction of women attending the workshop was 19.5%, and 22% were young researchers and students.

Invited experts gave very interesting talks about RFI detection and measurement (Pietro Bolli), HTS filters development (Sergio Mariotti) and frequency management (Talayeh Hezareh).

The global feeling of the attendees about the workshop was very good as it was a great opportunity to meet with experts in this field.

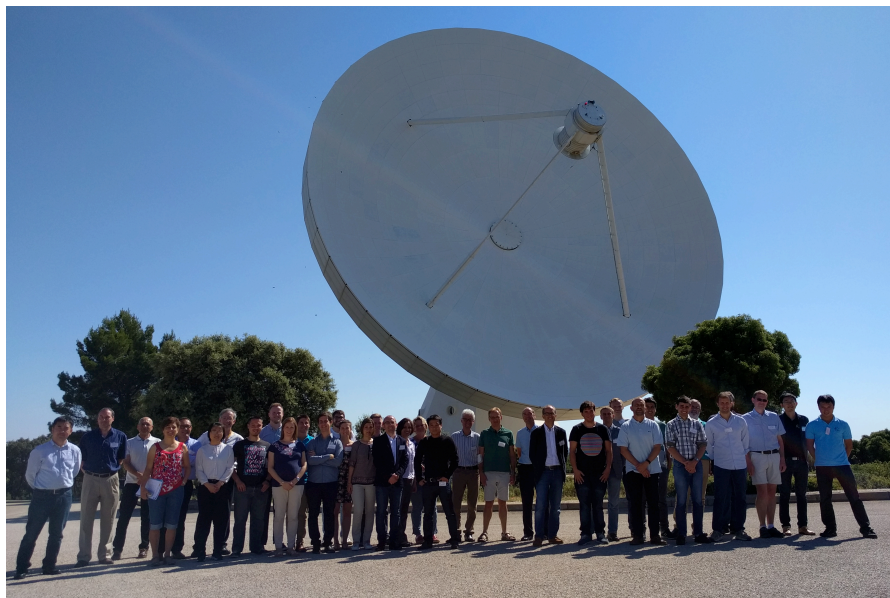


Figure 2: Yebes RFI workshop attendees.



Detection and measurement of RFI in radio astronomy

	Surname	Name	Institution	Country	Signatur 8 th June	Signatur 9 th June
1.	Arribas Alonso	J. Julián	Keysight Technologies	Spain		
2.	Avalos	Jaime	Leipzig University	Germany		
3.	Bandudej	Kamorn	National Astronomical Research Institute of Thailand	Thailand		
4.	Barbas	Laura	IGN - Yebes Observatory	Spain		
5.	Beltrán Martínez	Francisco J.	IGN - Yebes Observatory	Spain		
6.	Benn	Andrew	Keysight France SAS	France		
7.	Bleiders	Marcis	VIRAC	Latvia		
8.	Bolli	Pietro	INAF - Arcetri Astrophysical Observatory	Italy		
9.	Cabrero	Juan F.	ISDEFE-INTA	Spain		

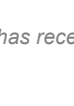
Yebes, Spain, June 8-9th, 2017



Detection and measurement of RFI in radio astronomy

	Surname	Name	Institution	Country	Signatur 8 th June	Signatur 9 th June
10.	Carreno	Héctor	Keysight Technologies Spain	Spain		
11.	Castill-Fraile	Manuel	European Space Astronomy Center	Spain		
12.	Flygare	Jonas	Onsala Space Observatory, Chalmers University of Technology	Sweden		
13.	Gamella	Carmen	ESA	Spain		
14.	Gancio	Guillermo	Instituto Argentino de Radioastronomía	Argentina		
15.	García Álvaro	Sonia	IGN - Yebes Observatory	Spain		
16.	García Carreño	Pablo	IGN - Yebes Observatory	Spain		
17.	García Miro	Cristina	Madrid Deep Space Communications Complex	Spain		
18.	García Pérez	Oscar	IGN - Yebes Observatory	Spain		

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Surname	Name	Institution	Country	Signatur 8 th June	Signatur 9 th June
19. Gomez	Miguel	IGN - Yebes Observatory	Spain		
20. Gordillo Pintor	Cecilia	ISDEFE-INTA	Spain		
21. Hezareh	Talayeh	CRAF (Committee on Radio Astronomy Frequencies)	Germany		
22. Hilliard	Lawrence	NASA	United States		
23. Iacovone	Domenico	e-geos s.p.a. - asi (italian space agency)	Italia		
24. Jaroenjittichai	Phrudth	National Astronomical Research Institute of Thailand	Thailand		
25. Keller	Reinhard	Max-Planck-Institut für Radioastronomie	Germany		
26. Krenz	Thomas	Rohde & Schwarz	Germany		
27. Krishnan	Harisharan	Indian Institute of Astrophysics	India		

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	Surname	Name	Institution	Country	Signatur 8 th June	Signatur 9 th June
28.	Li	Bin	Shanghai Astronomical Observatory	China		
29.	Liu	Qi	Xinjiang Astronomical Observatory, Chinese Academy of Sciences	China		
30.	Llorente	Álvaro	ESA	Spain		
31.	Lopez Ruiz	Samuel	IGN - Yebes Observatory	Spain		
32.	Lopez-Espí	Pablo-Luis	Universidad de Alcalá	Spain		
33.	Lopez-Fernandez	Jose Antonio	IGN - Yebes Observatory	Spain		
34.	Lopez-Perez	Jose Antonio	IGN - Yebes Observatory	Spain		
35.	Marín	Rubén	Rohde & Schwarz	Spain		
36.	Mariotti	Sergio	INAF-IRA	Italy		

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	Surname	Name	Institution	Country	Signatur 8 th June	Signatur 9 th June
37.	Muñoz Vilches	Antonio	M ^o Industria - DG Telecomunicaciones	Spain		
38.	Patino	María	IGN - Yebes Observatory	Spain		
39.	Razzak	MD Abdur	High Energy company Ltd	Bangladesh		
40.	Sackey	Joseph	Jetcom Enterprise	Ghana		
41.	Sánchez Montero	Rocio	Universidad de Alcalá	Spain		
42.	Serna	José Manuel	IGN - Yebes Observatory	Spain		
43.	Serra	Giampaolo	INAF-Observatory of Cagliari	Italy		
44.	Singwong	Dan	National Astronomical Research Institute of Thailand	Thailand		
45.	Steeb	Jan-Willem	Stellenbosch University	South Africa		

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NACIONALES



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	Surname	Name	Institution	Country	Signatur 8 th June	Signatur 9 th June
46.	Sun	Yunxia	Shanghai Astronomical Observatory	China	<i>Yunxia Sun</i>	<i>Yunxia Sun</i>
47.	Sundaram	GA Shanmugha	Amrita Vishwa Vidyapeetham University	India		
48.	Tercero	Félix	IGN - Yebes Observatory	Spain		
49.	Teuber	Ute	Max-Planck-Institut for Radio Astronomy	Germany	<i>Ute Teuber</i>	<i>Ute Teuber</i>
50.	Thomas	Ivan	Paris Observatory	France		
51.	Tsarnk	Aleksey	Institute of Applied Astronomy of the Russian Academy of Sciences	Russia	<i>Алексей</i>	<i>Алексей</i>
52.	Uranga	Ekhi	European Space Agency	Spain	<i>Ekhi</i>	
53.	Wolak	Pawel	Torun Centre for Astronomy	Poland	<i>Pawel</i>	<i>Wolake</i>

54 Vicente
Pablo Observatorio de Yebes Spain. Pablo
Pablo

Yebes, Spain, June 8-9th, 2017

4. RADIONET FINANCIAL CONTRIBUTION

A portion of RadioNet funds were devoted to support the travel expenses (300 € each) of two experts in the RFI field:

- Pietro Bolli (INAF Arcetri Astrophysical Observatory / Italy) - Italian responsible for RFI and former CRAF secretary. His expertise in the topic of the workshop is high. He will give a talk about RFI measurements and hardware,
- Sergio Mariotti (INAF – Bologna Astronomical Observatory / Italy) - Responsible at Bologna Observatory for the implementation of superconductive filters for RFI. He has a long term expertise in the topic of the workshop. He will give a talk about superconducting filters

As a result, the total financial support given by RadioNet was intended to be used as follows:

Cost description	Allocated amount
Funding applicant #1	300 €
Funding applicant #2	300 €
Two-day lunch costs	900 €
Total Cost	1.500 €

However, one of the funding applicants (Sergio Mariotti) has finally declined to accept his assigned funds, because his administration has decided to pay all his expenses.

Therefore, the financial support will be distributed according to the following table:

Cost description	Allocated amount
Funding applicant #1	300 €
Two-day coffee break costs	300 €
Two-day lunch costs	900 €
Total Cost	1.500 €

It can be seen that the funds assigned to Mr. Mariotti will be used to reduce the contribution from Yebes Observatory, who was going to pay the transportation (bus) costs and part of the meals and coffee break costs.

5. PUBLICATIONS

The workshop presentations have been uploaded to the workshop home page at:

http://www.oan.es/rfi2017/show_presentations.shtml