

## Article

# Radio Frequency Interference Measurements to Determine the New Frequency Sub-Bands of the Coaxial L-P Cryogenic Receiver of the Sardinia Radio Telescope

Luca Schirru <sup>\*</sup> , Adelaide Ladu and Francesco Gaudiomonte

National Institute for Astrophysics (INAF), Cagliari Astronomical Observatory, Via della Scienza 5, 09047 Selargius, Italy; adelaideladu@inaf.it (A.L.); francesco.gaudiomonte@inaf.it (F.G.)

<sup>\*</sup> Correspondence: lucaschirru@inaf.it

**Abstract:** Radio frequency interference (RFI) represents all unwanted signals detected by radio receivers of a telescope. Unfortunately, the presence of RFI is significantly increasing with the technological development of wireless systems around the world. For this reason, RFI measurement campaigns are periodically necessary to map the RFI scenario around a telescope. The Sardinia Radio Telescope (SRT) is an Italian instrument that was designed to operate in a wide frequency band between 300 MHz and 116 GHz. One of the receivers of the telescope is a coaxial cryogenic receiver that covered a portion of the P and L bands (i.e., 305–410 MHz and 1300–1800 MHz) in its original version. Although the receiver was used for years to observe bright sources with sufficient results, its sub-bands can be redesigned considering the most recently evolved RFI scenario. In this paper, the results of a RFI measurement campaign are reported and discussed. On the basis of these results, the new sub-bands of the L-P receiver, together with the design of the new microwave filter selector block of the SRT receiver, are presented. In this way, SRT will cover up to 120 MHz and 460 MHz of  $-3$  dB bandwidth at the P-band (290–410 MHz) and L-band (1320–1780 MHz), respectively. The bands of these filters are selected to reject the main RFI with high levels of amplitude and optimize the estimated antenna temperature and sensitivity of the receiver during the research activities, such as pulsar observations, very long baseline interferometer applications and spectroscopy science.

**Keywords:** radio telescope; radio frequency interference (RFI); cryogenic radio receivers; ultra-high frequency (UHF); L-band; P-band



**Citation:** Schirru, L.; Ladu, A.; Gaudiomonte, F. Radio Frequency Interference Measurements to Determine the New Frequency Sub-Bands of the Coaxial L-P Cryogenic Receiver of the Sardinia Radio Telescope. *Universe* **2023**, *9*, 390. <https://doi.org/10.3390/universe9090390>

Academic Editor: Hideoyuki Kobayashi

Received: 6 August 2023

Revised: 20 August 2023

Accepted: 27 August 2023

Published: 28 August 2023



Copyright: © 2023 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

## 1. Introduction

Radio frequency interference (RFI) consists of unwanted human-made signals detected by a receiver (i.e., radio telescope), such as self-produced spurious signals and harmonics from lower frequency bands, and spread-spectrum signals generated by devices installed in the surrounding area or on space-to-ground transmissions [1]. Currently, the presence of RFI is increasing because of the extensive abuse of wireless technologies around the world [2]. Although the International Telecommunication Union (ITU) assigned several specific frequency bands to the radio astronomy service (RAS) [3], the radio receivers for telescopes are designed and developed with the widest bandwidth as much as possible. In this manner, astronomers can analyze a larger amount of data at several frequencies with respect to the narrow bands dedicated to the RAS. In the receiver design stage, or more generally in a radio telescope development, a trade-off needs to be found in order to have a wide bandwidth with the least number of unwanted signals [4–7].

The unavoidable presence of RFI in the telescope frequency bands increases the estimated antenna temperature, leading to a degradation in the sensitivity of the system. Consequently, the monitoring and mitigation of RFI represents one of the most important aspects to consider for the optimal functioning of a radio telescope. With regards to the monitoring operations, dedicated measurement campaigns are periodically necessary [7–9].

# Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library

**Library of Congress**



**Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library:**

*Library of Congress Catalogs* Library of Congress,1983     Monographic Series Library of Congress,     *Subject Catalog*,  
1982 Library of Congress,1982     National Union Catalog ,1983     *Subject Catalog, 1981* Library of Congress,1981  
**National Union Catalog, 1982** ,1983     **Subject Catalog** Library of Congress,     **Books in Series** ,1985 Vols for  
1980 issued in three parts Series Authors and Titles     **National Union Catalog, 1981** ,1982     American Book  
Publishing Record Cumulative, 1950-1977 R.R. Bowker Company. Department of Bibliography,1978     **American Book**  
**Publishing Record** ,2001     **Library of Congress Catalog** Library of Congress,1965 A cumulative list of works  
represented by Library of Congress printed cards     **The Radio Amateur's Handbook** ,1979     **Catalogs of the Scripps**  
**Institution of Oceanography Library: Subject Catalog, Shelf List, Shelf List of Documents and Reports Collection**  
Scripps Institution of Oceanography. Library,1973     University of California Union Catalog of Monographs Cataloged by  
the Nine Campuses from 1963 Through 1967: Subjects University of California (System). Institute of Library  
Research,University of California, Berkeley,1972     *Dimensions* ,1933     **Radio Service Bulletin** ,1925     Readers'  
Guide to Periodical Literature ,1925     *Radio World* ,1923     *Monthly Index of Russian Accessions* Library of Congress.  
Processing Department,1960-04

## Decoding **Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library**: Revealing the Captivating Potential of Verbal Expression

In a period characterized by interconnectedness and an insatiable thirst for knowledge, the captivating potential of verbal expression has emerged as a formidable force. Its power to evoke sentiments, stimulate introspection, and incite profound transformations is genuinely awe-inspiring. Within the pages of "**Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library**," a mesmerizing literary creation penned by a celebrated wordsmith, readers embark on an enlightening odyssey, unraveling the intricate significance of language and its enduring affect our lives. In this appraisal, we shall explore the book is central themes, evaluate its distinctive writing style, and gauge its pervasive influence on the hearts and minds of its readership.

<https://pinsupreme.com/About/book-search/fetch.php/Political%20Leadership%20And%20Nihilism.pdf>

### **Table of Contents Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library**

1. Understanding the eBook Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library
  - The Rise of Digital Reading Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library
  - Advantages of eBooks Over Traditional Books
2. Identifying Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library
  - User-Friendly Interface
4. Exploring eBook Recommendations from Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library

- Personalized Recommendations
  - Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library User Reviews and Ratings
  - Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library and Bestseller Lists
5. Accessing Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library Free and Paid eBooks
- Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library Public Domain eBooks
  - Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library eBook Subscription Services
  - Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library Budget-Friendly Options
6. Navigating Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library eBook Formats
- ePub, PDF, MOBI, and More
  - Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library Compatibility with Devices
  - Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library Enhanced eBook Features
7. Enhancing Your Reading Experience
- Adjustable Fonts and Text Sizes of Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library
  - Highlighting and Note-Taking Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library
  - Interactive Elements Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library
8. Staying Engaged with Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library
- Joining Online Reading Communities
  - Participating in Virtual Book Clubs
  - Following Authors and Publishers Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library
9. Balancing eBooks and Physical Books Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library
- Benefits of a Digital Library
  - Creating a Diverse Reading Collection Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library
10. Overcoming Reading Challenges
- Dealing with Digital Eye Strain
  - Minimizing Distractions
  - Managing Screen Time
11. Cultivating a Reading Routine Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library

- Setting Reading Goals Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library
- Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library
  - Fact-Checking eBook Content of Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library
  - Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
  - Utilizing eBooks for Skill Development
  - Exploring Educational eBooks
- 14. Embracing eBook Trends
  - Integration of Multimedia Elements
  - Interactive and Gamified eBooks

### **Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library Introduction**

Free PDF Books and Manuals for Download: Unlocking Knowledge at Your Fingertips In today's fast-paced digital age, obtaining valuable knowledge has become easier than ever. Thanks to the internet, a vast array of books and manuals are now available for free download in PDF format. Whether you are a student, professional, or simply an avid reader, this treasure trove of downloadable resources offers a wealth of information, conveniently accessible anytime, anywhere. The advent of online libraries and platforms dedicated to sharing knowledge has revolutionized the way we consume information. No longer confined to physical libraries or bookstores, readers can now access an extensive collection of digital books and manuals with just a few clicks. These resources, available in PDF, Microsoft Word, and PowerPoint formats, cater to a wide range of interests, including literature, technology, science, history, and much more. One notable platform where you can explore and download free Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library PDF books and manuals is the internet's largest free library. Hosted online, this catalog compiles a vast assortment of documents, making it a veritable goldmine of knowledge. With its easy-to-use website interface and customizable PDF generator, this platform offers a user-friendly experience, allowing individuals to effortlessly navigate and access the information they seek. The availability of free PDF books and manuals on this platform demonstrates its commitment to democratizing education and empowering individuals with the tools needed to succeed in their chosen fields. It allows anyone, regardless of their background or financial limitations, to expand their horizons and gain insights from experts in various disciplines. One of the most significant advantages of downloading PDF books and manuals lies in their portability. Unlike physical copies, digital books can be stored and carried on a single device, such as a tablet or smartphone, saving valuable space and weight. This

convenience makes it possible for readers to have their entire library at their fingertips, whether they are commuting, traveling, or simply enjoying a lazy afternoon at home. Additionally, digital files are easily searchable, enabling readers to locate specific information within seconds. With a few keystrokes, users can search for keywords, topics, or phrases, making research and finding relevant information a breeze. This efficiency saves time and effort, streamlining the learning process and allowing individuals to focus on extracting the information they need. Furthermore, the availability of free PDF books and manuals fosters a culture of continuous learning. By removing financial barriers, more people can access educational resources and pursue lifelong learning, contributing to personal growth and professional development. This democratization of knowledge promotes intellectual curiosity and empowers individuals to become lifelong learners, promoting progress and innovation in various fields. It is worth noting that while accessing free Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library PDF books and manuals is convenient and cost-effective, it is vital to respect copyright laws and intellectual property rights. Platforms offering free downloads often operate within legal boundaries, ensuring that the materials they provide are either in the public domain or authorized for distribution. By adhering to copyright laws, users can enjoy the benefits of free access to knowledge while supporting the authors and publishers who make these resources available. In conclusion, the availability of Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library free PDF books and manuals for download has revolutionized the way we access and consume knowledge. With just a few clicks, individuals can explore a vast collection of resources across different disciplines, all free of charge. This accessibility empowers individuals to become lifelong learners, contributing to personal growth, professional development, and the advancement of society as a whole. So why not unlock a world of knowledge today? Start exploring the vast sea of free PDF books and manuals waiting to be discovered right at your fingertips.

### **FAQs About Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library Books**

How do I know which eBook platform is the best for me? Finding the best eBook platform depends on your reading preferences and device compatibility. Research different platforms, read user reviews, and explore their features before making a choice. Are free eBooks of good quality? Yes, many reputable platforms offer high-quality free eBooks, including classics and public domain works. However, make sure to verify the source to ensure the eBook credibility. Can I read eBooks without an eReader? Absolutely! Most eBook platforms offer web-based readers or mobile apps that allow you to read eBooks on your computer, tablet, or smartphone. How do I avoid digital eye strain while reading eBooks? To prevent digital eye strain, take regular breaks, adjust the font size and background color, and ensure proper lighting while reading eBooks. What the advantage of interactive eBooks? Interactive eBooks incorporate multimedia elements, quizzes, and activities,

enhancing the reader engagement and providing a more immersive learning experience. Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library is one of the best book in our library for free trial. We provide copy of Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library in digital format, so the resources that you find are reliable. There are also many Ebooks of related with Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library. Where to download Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library online for free? Are you looking for Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library PDF? This is definitely going to save you time and cash in something you should think about.

**Find Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library :**

**political leadership and nihilism**

**political economy of contemporary africa**

**point of pines arizona a history of the university of arizona archaeological field school**

**polish to english and english to polish technical dictionary**

*political economy of fiscal limits*

*poisons in your food*

**points the most practical program ever to improve your selfimage**

political partnerships neighborhood residents and their council members

political islam religion and politics in the arab world

policing the occupation and the introduction of female officers - an anthropologists study

political participation in latin america. volume i citizen and state

political philosophy time

polar bears sierra club boxed holiday cards

police quest casebook

polar life stickers

**Radio Frequency Interference Publication No 34 Of The Radio Amateurs Library :**

Installation Instructions & Owner's Operation Manual for ... Fire alarm systems use a variety of components to meet the requirements of each installation. The fire alarm panel, automatic and manual detection ... FSC Series Technical Reference Manual Edwards, A Division of UTC Fire & Security. Americas Corporation, Inc. 8985 ... This chapter provides instructions



for installing the fire alarm system. It ... EDWARDS-5754B-USER-MANUAL.pdf 5754B Fire Alarm Control Panel is a 24VDC, supervised, four-zone panel. The panel is UL List- ed and meets all performance and operational requirements of UL ... Control Panels | Edwards Fire Safety EDWARDS CONTROL PANELS ... Featuring a new network architecture, EST4 makes fire alarm, mass notification, and building integration easy to implement, quick to ... Edwards 1526 Users Manual Operation of any initiating device (manual fire alarm station, automatic heat detector, auto- matic smoke detector, etc.) sounds all the fire alarm signals to ... EST Fire Alarm Control Panel Operating Instructions May 2, 2013 — Make sure all smoke detectors are free from smoke and all manual pull stations are reset. 2. Press Reset. Note: Panel programming may delay ... EST3 Installation and Service Manual Sep 10, 2007 — EST3 System Operation Manual (P/N 270382): Provides detailed ... security and fire alarm systems. The KPDISP has an LCD display and a ... IRC-3 This manual contains proprietary information intended for distribution to authorized persons or companies for the sole purpose of conducting business with ... Submittal Guides | Edwards Fire Safety Our extensive range of fire alarm products gives you the freedom to tailor each system to the particular needs of the building - and the budget of the building ... Edwards 2400 series panel manual Download Edwards 2400 series panel manual PDF. Fire Alarm Resources has free fire alarm PDF manuals, documents, installation instructions, and technical ... Principles of Sedimentology and Stratigraphy - Amazon It emphasizes the ways in which the study of sedimentary rocks is used to interpret depositional environments, changes in ancient sea level, and other ... Principles of Sedimentology and Stratigraphy Principles of Sedimentology and Stratigraphy, 5th edition. Published by Pearson (January 15, 2011) © 2012. Sam Boggs University of Oregon. Hardcover. \$218.66. Principles of Sedimentology and Stratigraphy (4th Edition) A concise treatment of the fundamental principles of sedimentology and stratigraphy, featuring the important physical, chemical, biological and ... Principles of Sedimentology and Stratigraphy - Hardcover It emphasizes the ways in which the study of sedimentary rocks is used to interpret depositional environments, changes in ancient sea level, and other ... Principles of Sedimentology and Stratigraphy Principles of sedimentology and stratigraphy I Sam Boggs, Jr.-4th ed. p.cm. Includes bibliographical references and index. ISBN 0-13-154728-3. Principles of Sedimentology and Stratigraphy - Sam Boggs A concise treatment of the fundamental principles of sedimentology and stratigraphy, featuring the important physical, chemical, biological and ... Principles of Sedimentology and Stratigraphy - Sam Boggs This concise treatment of the fundamental principles of sedimentology and stratigraphy highlights the important physical, chemical, biological, ... Principles of Sedimentology and Stratigraphy Second ... [Item #76327] Principles of Sedimentology and Stratigraphy Second Edition. Sam Boggs Jr. Jr., Sam Boggs. Principles of Sedimentology and Stratigraphy Second ... Principles of Sedimentology and Stratigraphy - Sam Boggs Principles of Sedimentology and Stratigraphy is a thoroughly modern ... Sam Boggs. Edition, 2, illustrated. Publisher, Prentice Hall, 1995. Original from ... CML - Grade 2 (2022-2023) Celebrating 35 years of motivating students to become better problem-solvers in multiple disciplines through national level participation and recognition.

Grades 2-3 Continental Mathematics League. The Best of. Gi. Grades 2-3 tansk. 2001-2005. Page 2. www. M Questions. 1). How many triangles are there in the figure at the ... CML - Grade 2 (2023-2024) Celebrating 35 years of motivating students to become better problem-solvers in multiple disciplines through national level participation and recognition. CML - Grade 2 (2019-2020) Celebrating 35 years of motivating students to become better problem-solvers in multiple disciplines through national level participation and recognition. CML Grade 2 Sample Lafayette Mills School · Home · Resources · For Students · Continental Math League (CML) ... For Students / Continental Math League (CML) What is Continental Math League (CML)? It is a national problem solving competition that requires your child to complete timed, written tests. Continental Mathematics League The Continental Mathematics League (CML) hosts contests for students in grades 2 through 12. Resources. CML homepage · Mathematics competition resources. Continental Math League: How To Prepare And Score Well May 11, 2022 — On the Continental Math League website, there are sample tests designed for different grade levels and divisions. ... CML questions grades 2-3:. Cml Math Questions Grades 2 3 Pdf Use the pdfFiller mobile app to complete your continental math league practice problems pdf form on an Android device. The application makes it possible to ...