

## Bibliography for RFI Mitigation

Compiled by: Whitham D. Reeve

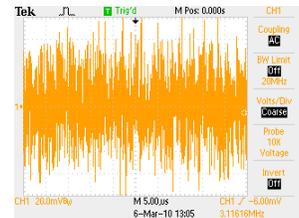


Every amateur radio astronomer experiences radio frequency interference (RFI) at one time or another. In many cases, the RFI is self-inflicted – something in the amateur radio astronomer's own installation is causing the interference – but many times it comes from outside sources. There are three basic steps to RFI mitigation: Recognizing the type of interference, locating its source and mitigating or eliminating it.

The books and articles listed here help the amateur radio astronomer with all three. It turns out there is very little specifically written by or for amateur radio astronomers, but there are many sources of information written by others that can be very useful. In particular, amateur radio operators have been plagued by RFI almost since the beginning of radio and they have written books and articles that can be applied directly to our RFI problems. Also, since most national administrations regulate radio and television broadcast transmitters and are charged with making sure the associated receivers operate in an interference-free environment, they have published consumer guidelines for locating and eliminating RFI at the receiving end.

The most common type of amateur radio astronomy is passive reception of celestial radio emissions. Our radio telescopes contain radio receivers, which many times are the same as those used by amateur radio operators or used to listen to broadcast stations. It follows that we can apply the same techniques used by amateur radio operators and recommended by national administrations.

This article does not provide specific recommendations for locating and eliminating RFI but, instead, provides a short list of books, articles and web links that readers can use as resources. I have broken the list into technician level and engineering level and have provided a very brief description of each entry. This list is by no means exhaustive. I have read every entry in the list and feel these are written well enough to be useful (in contrast to large amount of useless information available). Some are free downloads from the internet and some others are modestly priced paperback books. Most of the engineering level books are hard-bound and in the US\$100 range, although used copies will be much cheaper. An easy way to locate a particular book is to use Amazon.com or Abebooks.com. I would appreciate suggestions from readers for worthwhile additions to the list.



### Technician level (non-mathematical):

- T1. Brown, J., ***A Ham's Guide to RFI, Ferrites, Baluns, and Audio Interfacing***, [www.audiosystemsgroup.com/RFI-Ham.pdf](http://www.audiosystemsgroup.com/RFI-Ham.pdf), 2010. This is a tutorial based on the author's extensive engineering experience, work as vice-chair of the AES (Audio Engineering Society) Standards Committee working group on EMC (electromagnetic compatibility), and extensive research on RFI in the professional audio industry. This guide contains many charts and graphs and helpful construction hints and details.
- T2. Gruber, M., Editor, ***The ARRL RFI Book – Practical Cures for Radio Frequency Interference***, 2<sup>nd</sup> Ed., American Radio Relay League, 2007, 317 pp (ISBN: 0-87259-989-2). This edited ARRL book reflects the work by several radio amateurs to solve their multitude of RFI problems. There is considerable information on limiting the interference caused by amateur radio transmitters but the chapters on finding and eliminating receiver interference can be directly applied by amateur radio astronomers. Has 20 chapters, varying in length from 7 to 34 pages.

- T3. Loftness, M., ***AC Power Interference Handbook – Insights into the Causes, Effects, Locating, and Correcting of Power-Line and Other Electrical Interference***, 3<sup>rd</sup> Ed., American Radio Relay League, 2007, 298 pp (ISBN: 978-0-963760-3-7). The author solved powerline interference problems for electric utilities throughout his career and is quite knowledgeable. He used custom-made and specialized equipment in his work but his methods are well-described and useful to anybody, and he provides many drawings and photographs.
- T4. Morrison, R., ***Noise and Other Interfering Signals***, John Wiley & Sons, 1992, 144 pp (ISBN: 0-471-54288-1). This is a small book but it provides a good definition of just what noise is, how it is produced by various types of electronic equipment, and how it is transmitted to cause interference. It contains very little math and is easy to read.
- T5. Nelson, W., ***Interference Handbook***, Radio Amateur Callbook (Watson-Guption Publications), 1993, 250 pp (ISBN: 0-8230-8709-3). Several versions of this book have been published over the years, and it has been updated from time to time (but not recently). Later versions appear to be edited by William Orr. This book starts out by discussing RFI in general terms and then describing specific but common sources. Has a lot of practical information in a non-technical format.
- T6. Committee on Radio Astronomy Frequencies (CRAF), ***Handbook for Radio Astronomy***, 3<sup>rd</sup> Ed., 2005, <http://www.craf.eu/CRAFhandbook3.pdf>. The scope of this book is much broader than just RFI and, as such, is good to have as a reference for radio astronomy work.
- T7. Federal Communications Commission staff, ***Interference Handbook***, 1993 Edition. Several versions of this handbook were published over the years and printed copies are no longer available. However, a PDF version can be found here: [http://www.fcc.gov/Bureaus/Mass\\_Media/Databases/documents\\_collection/1993InterferenceHandbook.pdf](http://www.fcc.gov/Bureaus/Mass_Media/Databases/documents_collection/1993InterferenceHandbook.pdf). Another version can be found here: <http://www.kyes.com/antenna/interference/tvibook.html>
- T8. Industry Canada, Spectrum Management and Telecommunications, ***Cutting Through... Radio Interference Series***, 1997, [http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/h\\_sf06086.html](http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/h_sf06086.html). Basic step-by-step guide targeted at consumers.
- T9. New Zealand Ministry of Economic Development – Radio Spectrum Management, ***Radio Frequency Interference (RFI) Investigation and Resolution Guide***, 2008, [www.rsm.govt.nz](http://www.rsm.govt.nz) (ISBN: 978-0-478-31073-3 [print], 978-0-478-31075-7 [online]). Basic step-by-step guide targeted at consumers.
- T10. ***VLF Noise Reduction Yahoo group***, VLF\_Noise\_Red, [http://tech.groups.yahoo.com/group/VLF\\_Noise\\_Red/](http://tech.groups.yahoo.com/group/VLF_Noise_Red/). The description of this Yahoo group says: “Man-made noise is encroaching on the VLF radio spectrum making it difficult to record radio astronomy data at these frequencies, particularly the SuperSID project of Stanford University and the Society of Amateur Radio Astronomers (SARA). This group endeavors to develop and share a repository of noise signatures, categorize them and try to find methods of reducing the noise or its impact on the VLF portion of the radio spectrum. The noise reduction methods may involve software, hardware, better methodology, etc. This group is intended for SuperSID or SID project monitor stations, however it is open to anyone with an interest in this area.” Note: There is at least one other Yahoo group dedicated to RFI mitigation: <http://groups.yahoo.com/group/radiointerference/>
- T11. Adler, R., Munsch, G., Parker, A., Vincent, W., ***The Mitigation of Radio Noise and Interference from On-Site Sources at Radio Receiving Sites***, NPS-EC-10-001, Naval Post Graduate School, 2009: [www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA510185](http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA510185)

Engineering level:

- E1. Kodali, V., ***Engineering Electromagnetic Compatibility – Principles, Measurements and Technologies***, IEEE Press, 1996, 309 pp (ISBN: 0-7803-1117-5). This book was published when I was on the editorial board of the IEEE (Institute of Electrical and Electronics Engineers) Press. It includes a little math but has much practical information to offer.
- E2. Ott, H., ***Electromagnetic Compatibility Engineering***, John Wiley & Sons, 2009, 843 pp (ISBN: 978-0-470-18930-6). The author states this book started out as a 3<sup>rd</sup> edition to his earlier book ***Noise Reduction Techniques in Electronic Systems*** (listed below), but ended up being much more. Like his earlier book, this book is slightly technical but still very practical and usable.
- E3. Ott, H., ***Noise Reduction Techniques in Electronic Systems***, 2<sup>nd</sup> Ed., John Wiley & Sons, 1998, 426 pp (ISBN: 0-471-85068-3). The author's work is well-known to probably everyone who works on electromagnetic compatibility. This book is a little more technical than the books written by radio amateurs but still easily understood and practical. In 2009 this book received an almost complete rewrite and new title, ***Electromagnetic Compatibility Engineering*** (above).
- E4. Violette, J., White, D., and Violette, M., ***Electromagnetic Compatibility Handbook***, Van Nostrand Reinhold Company, 1987, 707 pp (ISBN: 0-442-28903-0). This is a practical handbook that is full of charts and tables and avoids dense mathematical derivations.
- E5. Taylor, R., Editor, ***Radio Frequency Interference Handbook***, NASA SP-3067, NASA Goddard Space Flight Center, 1971: <http://hdl.handle.net/2060/19720003504>