Publications: Spread Spectrum Update

Books
Wireless Digital Communications: Design and Theory
TAPR Spread Spectrum Update
TAPR Packet Radio: What? Why? How?
TAPR PSR All Issues
CDs / DVDs
TAPR/ARRL DCC Proceeding CDs
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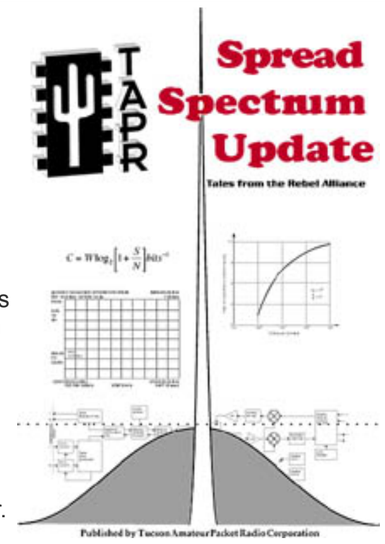
AX.25 Protocol
TAPR 9600
Proceedings
Digital Communications Conference
TAPR 1995 Annual Meeting
TAPR 1994 Annual Meeting
Out of Print
NOSIntro
TAPR BBS Sysop Guide

Editors: Greg Jones, WD5IVD and Steve Bible, N7HPR
214 pages. ISBN: 0-9644707-5-6



Ordering Information

Sorry, TAPR Spread Spectrum Update is no longer available

Foreward

This book provides an extremely broad treatment of the subject of spread spectrum systems as applied to amateur radio. While little technical and social literature exists on this subject, the publication provides a convenient compilation of a fair amount of the significant work. It should appeal to a wide-ranging audience with an interest in the subject.

There is, apparently, much misunderstanding of the application of spread-spectrum techniques to amateur radio. A classic introduction to the subject written by Costas (in 1959, no less) provides a view of the efficiency of spectrum utilization. His material is timeless and still relevant today, as the recent upsurge in CDMA-based personal communications systems (PCS) amply demonstrates.

The difficulty in applying such techniques to amateur usage perhaps has to do more with the lack of surplus SS (spread spectrum) equipment than with any other factor. Today most of the VHF and UHF amateur bands consist of warehoused spectrum FM repeaters are assigned exclusively to channels based on the first-application for the spectrum. However, it can be readily shown that, on average, the spectrum is significantly under-utilized. This is because the repeaters are mostly not emitting a carrier at any given instant in time. Therefore a statistical technique can be applied to understand the usage of the spectrum. In the case of on-off emitters, far better utilization of the spectrum can be made with spread-spectrum techniques.

One way to visualize this is to look at the telephone system. It has long been known that most people make local calls far more often than they make long-distance calls. Thus, a local telephone switch does not need to have nearly as many long-distance trunks (which are expensive) as it has telephones connected to it. In fact, as the number of users of the switch increases, the probability that a large number of those users all simultaneously wanting to access a long-distance converges asymptotically to the average value with the deviation decreasing rapidly. Essentially the same things happens with a large number of amateurs attempting to access a limited amount of spectrum the probability that they all want to transmit as the same time converges to the average value. This means that one can engineer the spectrum utilization to the average value, not the peak value. A glance at traffic engineering tables will illustrate the profound efficiency of this type of engineering. Thus, the conclusion that assigning and administering FM repeaters based on SS techniques could essentially totally eliminate the current stoppage on these allocation.

Trunked systems and SS systems are both approaches to such dynamic utilization. Trunked systems allocate shared narrowband spectrum in a dynamic fashion, whereas SS systems can be viewed as allocating wideband orthogonal codes in a dynamic fashion. SS systems however might not require significant coordination, while trunked systems certainly do. Additionally, SS systems can be resistant to narrowband interference, alleviating some coordination issues. SS systems have also been looked at to provide higher data rates. In such cases, a narrowband emitter is still fairly wide, and would pose perhaps significant coordination issues. Spreading the energy out over a wide number of frequencies should lessen the impact, and might allow easier fitting in of higher data rates to existing amateur bands. Finally, SS systems may prove to be more resistant to multipath problems, however, the engineering of good-performing radio systems with significant multipath is usually a very difficult problem, and SS is not the complete solution.

In the future, there will be additional pressure on the spectrum that amateur radio operators occupy. Amateurs have the secondary allocation on many VHF And UHF bands. Fortunately, the primary allocation is in many cases to those whose needs are highly compatible with narrowband (amateur) emitters. Unfortunately, this may not always remain the case. Thus, SS techniques could prove to be one method whereby amateurs could prove to be compatible with primary users who are susceptible to narrowband interference.

This book should prove to be a valuable source of reference material on these issues, as well as some practical and social ones.

Tom McDermott, N5EG

Dallas, Texas July 12, 1998

Chapter 1 - Introductory/Informative

- Spread Spectrum - It's not just for breakfast anymore!
- A Short History of Spread Spectrum
- Spread Spectrum and the Amateur Radio Service - Recent Developments
- The Trip So Far in High Speed Digital Communication via Spread Sprectrum
- Wireless In Ulaan Bataar - Learning From A True-Life Mongolian Network Adventure
- License -Free Spread Spectrum Packet Radio
- The Markey/Antheil Spread Spectrum Patent

Chapter 2 - TAPR

- TAPR's Statement on Spread Spectrum Technology Development
- TAPR Status Report on Spread Spectrum Activity in the Amateur Radio Service
- Paradigms Shifts in Amateur Radio and the future of TAPR
- Is the Internet good or bad and Spread Spectrum - happenings?
- Banquet Speech by Lyle Johnson, WA7GXD at the 1996 ARRL & TAPR DCC
- Smart Radio Technology and Spread Spectrum

Chapter 3 - Technical/Theory

- Poisson, Shannon, and the Radio Amateur
- A Primer on Reliability as Applied to Amateur Radio Packet Networks
- An Amateur 900 MHz Spread-Spectrum Radio Design
- Voice Link Over Spread Spectrum Radio - Part 1
- Voice Link Over Spread Spectrum Radio - Part 2
- Detection and Estimation of Covert DS/SS Signals using Higher Order Statistical Processing
- VHF/UHF/Microwave Radio Propagation: A Primer for Digital Experimenters

Chapter 4 - Regulatory

- S 97.311 SS emission types
- FCC Proposed Amateur Radio Service Spread Spectrum Rule Making (RM-8737)
- Current Information on Amateur Spread Spectrum Rule Changes
- TAPR Comments to NPRM on Amateur Radio Service Spread Spectrum Rule Making
- TAPR Reply Comments to NPRM on Amateur Radio Service Spread Spectrum Rule Making

Appendix A

- Wireless LAN/MAN Modem Product
  - 5.8GHz Wireless LAN/MAN Modem Products
  - 2.4GHz Wireless LAN/MAN Modem Products
  - 915MHz Wireless LAN/MAN Modem Products
  - WLAN Vendor Information

- TAPR Information
- Index
- Supplied Software

