

TAPR Status Report on Spread Spectrum Activity in the Amateur Radio Service

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Abstract

This paper reviews the current status of Spread Spectrum (SS) in the Amateur Radio Service and also covers TAPR's activity on Spread Spectrum issues over the last two years.

Introduction

Back in 1989, Al Brocius N3FCT [1] discussed the use of commercially available Part 15 SS devices that were becoming available in the market, for use in the amateur radio service (ARS) for packet radio operations. He identified several commercial systems that were then available and made the following recommendation:

“To responsibly address this technology, we feel amateur operators should experiment with the commercial systems now available in establishing long distance communication paths using high-gain antenna systems coupled with the maximum legal power of one watt, determining interference levels seen by weak signal receivers attributable to spread spectrum transmissions, and carefully introducing this technology to computer bulletin board operators who could financially support development of an unlicensed computer Internet.”

To the author's knowledge, some effort has been made by the amateur radio community to pursue this recommendation. For instance, there have been reports by various hams of their experiences with such devices on various USENET newsgroups over the last several years; however, there has been little written about such experiences in ARS publications such as QEX, PSR or DCC proceedings. So while there are now millions of SS devices out in the world today in the hands of the average consumer, SS remains an unrealized technology in the world of amateur radio.

This paper will discuss some of the current activity that TAPR has undertaken over the previous year.

Amateur Radio SS Activities

Little has changed in the amateur radio service as far as high-speed Spread Spectrum (SS) packet radio is concerned in the period since 1989. Most of the commercial SS equipment available today on the market cannot be operated under the current Part 97 rules. One event of note however, was the publishing by the ARRL of the "Spread Spectrum Sourcebook" [2]. This was an excellent attempt by the League to acquaint the average ham with the technology of spread spectrum. Another excellent reference on packet radio technology and the use of SS appears in [3].

About the time of Apple's Data-PCS petition, Robert Buaas K6KGS submitted a request for an STA (Special Temporary Authorization) to amend Part 97 to allow relaxed usage of SS technology in the ARS. Buaas' request was granted by the FCC in 1992 and he was awarded an STA that had been renewed several times and remains in effect as of today. There is a recent QEX article which covers the STA and SS technology [4]. An earlier QEX article which describes the STA appears in [5].

Since the original STA was granted, Buaas and the other hams who are authorized to experiment under the STA have performed many experiments using SS technology both with existing Part 15 SS devices and homebrew hardware that was developed for the purpose of the experiments. This work formed the basis for the ARRL Board of Director's to pass a motion in January, 1994 to have their counsel submit to the FCC a petition for rule making to modify the SS rules in Part 97. Nothing was filed with the Commission in 1994, however the League's Board reaffirmed its decision in 1995 at their January meeting. In December of 1995, the ARRL filed for a rule making for the Amendment of Part 97 of the Commission's Rules Governing the Amateur Radio Service to Facilitate Spread Spectrum Communications [6]. The FCC assigned it as RM-8737 and comments and reply comments followed. Many of these are available on the TAPR SS web pages <<http://www.tapr.org/ss>>.

On April 10th, 1996, TAPR requested a waiver of the rules and regulations governing Amateur Radio spread spectrum communications in order to conduct an experimental program to test spread spectrum emissions over amateur radio facilities on different bands. Details on the request and subsequent STA see <http://www.tapr.org/ss/tapr_sta.html>.

In September 1996, TAPR released a position statement on Spread Spectrum Technology Development which in part states, "TAPR believes that the technical facts support our conviction that conventional and spread spectrum systems can coexist without detriment to conventional systems on all frequencies from MF to EHF. To this end, TAPR will begin to research spread spectrum systems that will develop technology for future deployment." (<<http://www.tapr.org/ss/>>) The full text is presented below.

On November 6, 1996 the FCC granted the TAPR STA request to conduct an experimental program to test Code Division Multiple Access spread spectrum emissions. By the end of January 1997, 61 TAPR members were participating in the TAPR STA on SS. At the end of 1996, TAPR was working with a manufacture of SS equipment that would

work under the STA. There was high hopes for this group purchase, but by the end of January '97, after 5 months of work, it became obvious that the Part 15 commercial manufacture had second thoughts and TAPR pulled the plug on the deal after the company continued to request agreements that could not be agreed to by TAPR.

On March 3rd, 1997, the FCC issued Docket 97-12 regarding a Notice of Proposed Rule Making with regards to RM-8737. The text is available at <http://www.fcc.gov/Bureaus/Wireless/Notices/1997/fcc97010.txt>. The comments and reply comments that followed showed general agreement in some areas and disagreement in others. Much more work will be required in the future to get closure on this issue so that the ARS has rules that can best reflect what is required in the future for experimentation and technology adoption with the amateur radio service.

The next step will be for the FCC to issue a final rule making, but with all the recent staffing changes in the works at the FCC and the lack of consensus in the amateur radio community regarding the notice of proposed rule making, it might be some time before we see a final Report & Order.

On April 28, 1997, TAPR's initial six-month period of the TAPR STA ended. In accordance with the original terms of the STA, the TAPR program is on-going. Consequently, the applicants requested renewal of the TAPR STA, for an additional six months period. On May 6th, 1997, the STA extension was granted. In addition to submitting the request for renewal, the TAPR SS STA participants submitted an 80 page report on activity. This report can be found at: http://www.tapr.org/ss/tapr_sta.html.

TAPR's Statement on Spread Spectrum Technology Development

TAPR was founded in 1982 as a membership supported non-profit amateur radio research and development organization with specific interests in the areas of packet and digital communications. In the tradition of TAPR, the Board of Directors at their Fall 1995 meeting voted that the organization would begin to actively pursue the research and development of amateur radio spread spectrum digital communications. At the Spring 1996 board of directors meeting, the following statement of purpose was passed:

“TAPR believes that the technical facts support our conviction that conventional and spread spectrum systems can coexist without detriment to conventional systems on all frequencies from MF to EHF. To this end, TAPR will begin to research spread spectrum systems that will develop technology for future deployment.”

As stated above, the TAPR board feels strongly about TAPR's focus on spread spectrum technology and especially how it relates to the potential coexistence on frequencies that will have increased number of users occupying them. The amateur radio bands, like other spectrum will become more heavily utilized in the future. It is in the interest of amateur radio to develop systems that are interference-resistant while not interfering with other primary or secondary users on those frequencies.

TAPR understands the concerns many have with the new technology, and believes that efforts in both education and research is necessary in order to allay the fears about interference and to demonstrate the benefits of the technology.

TAPR believes that today's communications technology is moving toward all digital transmitters and receivers. These advances in technology, combined with the swift evolution of cell based transmission and switching protocols, are opening up a new set of possibilities for unique new services utilizing intelligent networks. These will contain smart transmitters, receivers, and switches. Today's Internet is perhaps the best example of a self-regulating structure that embodies these new technological approaches to communications in the networking domain. However, to date, many of these innovations have not moved into the wireless networking arena. TAPR will work on moving these innovations into the amateur radio community.

TAPR feels that the VHF/UHF/SHF radio networks of the future will involve a mixture of links and switches of different ownership, which terminate at the end-user via relatively short-distance links. What will then be required is a built-in, distributed, self-governing set of protocols to cause the network's behavior to make more efficient use of a limited, common shared resource, the radio spectrum. Creating such a self-regulating structure for the optimal sharing of spectrum will require much effort.

One of the major problems which stands in the way of these new approaches today is the current FCC regulatory environment and the manner in which spectrum is managed and allocated under its rules.

Historically, the current regulatory approach to radio has been based upon the technology that was in use at the time that the Communications Act of 1934 was framed, basically what we would call today, 'dumb' transmitters speaking to 'dumb' receivers. The technology of that time required reserved bandwidths to be set aside for each licensed service so that spectrum would be available when needed. Given this regulatory approach, many new applications cannot be accommodated since there is no available unallocated spectrum to 'park' new services. However, given the new set of tools available to the entrepreneur with the advent of digital technology, what once were 'dumb' transmitters and receivers can now be smart devices which are capable of exercising greater judgment in the effective use and sharing of spectrum. The more flexible the tools that we incorporate in these devices, the greater the number of uses that can be accommodated in a fixed, shared spectrum.

Therefore, TAPR will focus its spread spectrum effort in the following areas:

TAPR will work to promote rules and technologies to make the most efficient use of the spectrum through power control, forward error correction, and other means to minimize interference among spread spectrum users and existing communications systems.

TAPR will work on issues and efforts with other national organizations to change the regulatory environment and rules in order to promote the experimentation, development, and later deployment of spread spectrum technology.

TAPR will work to develop information on the topic to help educate members and the amateur community as a whole about spread spectrum technology, and to disseminate this information via printed publications, the World Wide Web, presentations at conferences and meetings, and other means.

TAPR will work to foster experimentation, development, and design of spread spectrum systems, and to facilitate the exchange of information between the researchers and other interested parties.

TAPR will work to develop a national intra-network to foster the deployment of future high-speed spread spectrum systems into regional and local communities, including the development of suitable protocols and guidelines for deployment of these systems.

TAPR will work with commercial companies who manufacture spread spectrum devices which operate in spectrum shared by the amateur radio service (ARS), in order to make them more aware of the nature of ARS operations on those bands with the goal to work towards the deployment of devices which will minimize interference between all spectrum sharing partners.

TAPR will work with commercial companies who manufacture spread spectrum devices in order to identify equipments that can be either used or modified for use for Part 97 operation.

Adopted by the TAPR Board on September 20th, 1996
at Seatac, Washington Board Meeting.

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The Future / Conclusion

TAPR plans to continue its leading role in developing standards and technology for spread spectrum communications for the amateur radio community through discussion groups, cooperative efforts and experimental programs such as now being permitted by the TAPR SS STA. In particular, due to the rapid development of communications hardware and software, TAPR believes that the use of hybrid spread spectrum emissions, as well as spreading codes not envisioned by Section 97.311(d) of the Rules can be employed without causing harmful interference to other amateur radio operations. Much of the debate over this issue has been voiced in the FCC SS rule making process and anyone interested should read through the comments and reply comments which are available on the TAPR website.

With the continued lack of available commercial equipment at a price that amateur radio operators can afford, the TAPR Board of Directors voted to fund the initial stages of a 900Mhz 200Kbps+ FHSS (Frequency Hopper) design. This is one of two designs that TAPR is undertaking in 1997. An initial design review of the radio should be published in the 1997 ARRL/TAPR DCC proceedings. The second design, which we believe will target either 2.4GHz or 1.2GHz and operate at speeds up to 1.544Mbps (T1), is on hold awaiting grant money to support the development project.

Like any volunteer effort, TAPR members and others interested in the technology will have to eventually become involved for the successful completion of many of these future projects. TAPR is always looking for members who want to be active in our Regulatory Affairs Committee or who want to participate in the TAPR SS STA. If you want to get involved it starts with asking and then doing.

References

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- [6] ARRL. "RM-8737" Available at: http://www.tapr.org/ss/arrl_filing_95.html [1996].