

Current Status of Amateur Spread Spectrum Radio in Japan

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Abstract

We have practiced field tests using our PRUG96 system with SS transceivers, where we performed the 30km distance QSO. The output power of the transceiver is only about 30mW and the front gain of the antenna is 2.1 dBi. We also confirmed that our system enables us to use the internet applications ('web browsing', 'videoconference' and so on) with practical speed.

Key words: PRUG96, Spread Spectrum, SS, PS, IPSM

Introduction

In 1997, some Japanese amateur radio stations were licensed Spread Spectrum (SS) by the MPT, which wasn't allowed before. We, the PRUG96 members applied for SS licenses unifying our method to the same one and practiced field tests three times, while most of other stations were not able to communicate each other, since each of them used different SS methods. In this paper, the author would like to explain these results of our experiments, and mention the state of alpha/beta tests just in progress right now.

The first experiment between Kitakyushu and Shimonoseki (Nov. 2, 1997)

On November 2, 1997 --- just after Mack, JJ1 CEI and the author, 7KINCP received SS licenses --- we attended Partech'97 in Kitakyushu-City, and demonstrated SS QSO for the first time.

Figure 1 shows the system we used in the first experiment. The PS (Protocol Server)[1] converts an IP packet into a radio packet, and the IPSM (IP Shield Machine)[2] hands it to the 2.4GHz SS data transceiver (Table 1). The antennas we used were 27 elements Yagi-beam, front gain of 21dBi.

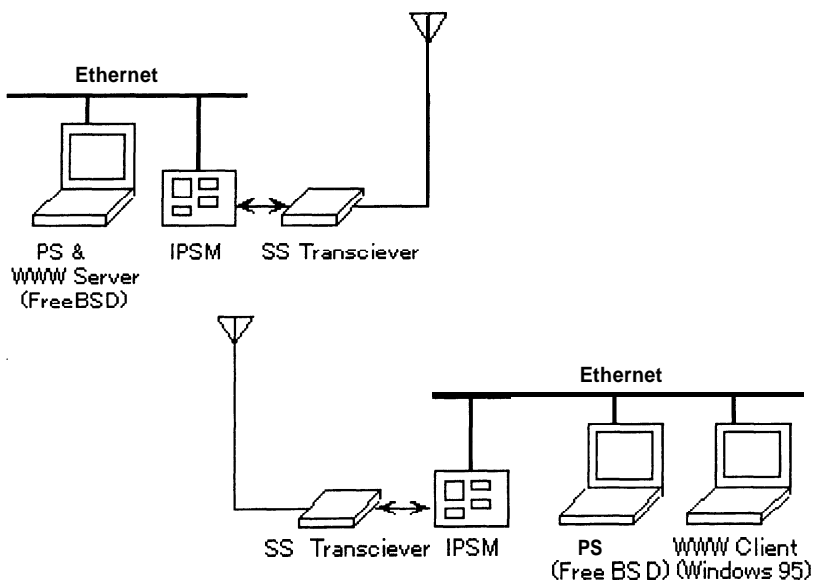


Figure 1. System configuration



Figure 2.
The first letter of Japanese old alphabet.

Table 1. The features of an SS transceiver.

| | |
|----------------------|-------------------------|
| Center Frequency | 2446MHz |
| Output Power | 30mW |
| Spreading Method | Direct Sequence |
| Spread Length & Code | 11 bits Baker, 63bits m |
| Chipping Rate | 4.4444Mchips/sec |
| Occupied Band Width | 8MHz |
| Modulation | DQPSK |
| Data Transfer Rate | 808kbps |

The first ever SS QSO in Japan was performed by JJ1 CEI/4 and 7K1NCP/6, between Kyushu-Island and Honshu-Island, across the Kanmon Strait, where the distance between two stations was about 2km. Not only had we accomplished 2way SS QSO for the first time, but also this QSO has a special

meaning because we used TCP/IP protocol over amateur SS packet radio.

We have measured the ping statistics, round trip time and throughput, using 'ping command' and 'web browser'. The results were 99%, 110ms and 80kbps, respectively. Figure 2 shows one of the pictures used in the experiment. The reason why we used this picture is that we wanted to share the Dr. Takayanagi's success in 1926 --- the first experiment of TV transmittance in Japan.

The second experiment in Kofu (Dec. 14, 1997)

In the first experiment, we could confirm that our system, employing TCP/IP over amateur SS packet radio, worked well with practical speed. However, the distance between two stations was only 2km, which could be achieved even with ISM band transceivers, very low EIRP (Equivalent Isotropic Radiated Power). Therefore, we decided to practice one more experiment, aiming to make a long distance QSO. Furthermore, multimedia such as voice communication was also the purpose of the experiment.

On December 14, 1997, the second experiment was done in Kofu-Valley, where we performed the 15km distance 2way QSO. The system we used in this experiment was almost the same as what we used in the first experiment. The slight difference was that we added some client PCs to each site (station).

In this experiment, we divided ourselves into two groups. One set up the base station on the top of a hill and another moved around Kofu-Valley and operated from three different points: 5, 15 and 30km from the base station. At the 5 and 15km point, the ping statistics was 100% and we tried not only web browsing but also voice communication using 'cool talk'. We could hear the voice from the other station clearly on both sides, as if they were connected to the same Ethernet.

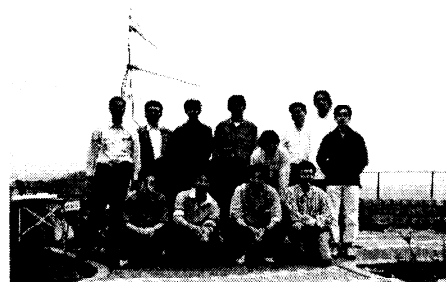
However, at 30km point, the condition was very bad and unstable. The ping statistic shows nearly 20% at its peak and the BER (Bit Error Rate) was almost 1E-2. We changed the position slightly, but it didn't make the situation better.

The third experiment in Kofu (May. 9-10, 1998)

During wintertime, there had been much improvement in our system, though we didn't practice any field experiment. Mack tune-upped SS transceivers to make its sensitivity better. Satoshi, 7M3LCG rewrote IPSM's firmware to improve its stability. Shin, JN1JDZ implemented routing protocol into the PS. In addition, some of our members (neither Mack nor the author) obtained the SS licenses.

On May 9 and 10, 1998, we practiced the third experiment in Kofu-Valley (picture 1). In this experiment, we put the 30km distance QSO as the main purpose. The Radio-Network operation (something like a round QSO), the videoconference using CU-SeeMe and mobile communication were the purposes too.

In this experiment, we could achieve all of our purposes: We performed the 30km 2way QSO and videoconference connected three points simultaneously. Furthermore, we confirmed the following two matters: The routing table changed dynamically as we move the direction of the antenna or as the new site appeared/disappeared; We could communicate between running cars as far as they were in sight each other.



Picture 1.

Alpha/Beta tests

Since April 1998, the alpha test using our PRUG96 system has been proceeding around Meguro-Ward, Tokyo, under the support by JA1 YAD/JL 1ZCF, Tokyo Institute of Technology Amateur Radio Club [3]. The purposes of the alpha test are to estimate its stability, to find out its weak point and so on.

We will soon start the beta tests in many regions in Japan, such as Aichi, Fukushima, Kanagawa, Tokyo, Miyagi and Nagano. You can expect to know some outcomes of these tests in the next Partech/DCC.

References

- [1] S. Kanno, not published
- [2] S. Funada, IP-Shield Machine (IPSM): An Ethernet Interface for High Speed Packet Radio, this conference
- [3] S. Watanabe, S. Funada, Alpha-test report of PRUG96 High speed radio link, this conference

MPT: Ministry of Posts and Telecommunications Japan

PRUG96 project: the group consists of people interested in high-speed packet links and networks

Partech: Packet Radio Technical Conference; annual meeting of amateur packet radio in Japan

Kitakyushu: a city in Fukuoka Prefecture, Kyushu-Island, Japan

Shimonoseki: a city in Yamaguchi Prefecture, Honshu-Island, Japan

Kofu: a city in Yamanashi Prefecture, central part of Japan