ON AN HF DATA COMMUNICATION BROADCAST SYSTEM

K. F. Chiang and J. Y. Lee
Research Institute of Electronics & Electrical Engineering
Department of Electrical Engineering
National Cheng-Kung University
No. 1 University Road, Tainan, Taiwan
Republic of China

T. N. C. Wang*
SRI International
Engineering Research Group
Menlo Park, California 94025

We have designed and implemented an HF data communication system for broadcast network applications. With the baseband message data managed and controlled by a computer, and followed by a quantized frequency modulation (QFM), the transmitting end of the system can be connected in parallel to multiple HF transmitters sending messages to receiver stations. Three key features were emphasized and built into the design: time and frequency diversities, and forward error correction, in order to ensure link-reliability for the system. HF carrier frequency selection for the link is conducted initially at the transmitting end by sending frequency acquisition commands (single tones) to align the receiver frequency within a tolerance of ±50 Hz. As a result of this frequency acquisition, reception process is automatic and no operator is required at the receiver end.

In the interest of the effects of channel coding in combination with QFM modulation, we have made an extensive study on the system by using Reed-Solomon Code and convolution code.

Extensive field experiments for the system were conducted during 1984. These field experiments were tested in the geographic region between latitudes of 21 to 25 degrees North and at longitudes between 119 and 124 degrees East. These field experiments provided a single hop link with frequencies at the low end of the HF band. Two QFM baud rates--50 and 75--together with different combinations of Reed-Solomon Code and convolutional code were used in the experiments.

Based on the results of our field experiments, we make the following conclusive remarks concerning our implemented HF data communication broadcast system:

1. Link reliability is reduced at nighttime. Link reliability factors above 90% can be achieved however, with increased transmitter power.

2. A 50 baud rate was always better than a 75 baud rate.
3. Combining convolutional code and Reed-Solomon Code did not increase link reliability or reduce error rate. In fact, a reduction of link reliability was determined. In addition, the experiments indicated that a combination of 50 baud rate and convolutional code was best during the day and the combination of 50 baud rate and Reed-Solomon Code was best at night.

In this paper we will introduce some details on the system design, configuration and implementation. We will describe details of our field experiments and the results. Procedures for HF channel frequency selection, effects on preamble time, synchronization, modem, etc., will be discussed.

*Dr. T. N. C. Wang was a visiting research supervisor at RIEEE, Cheng-Kung University.