Uplink Preamble Discussion

Initial draft KB5MU, KA9Q, W5NYV

The Phase 4 FDMA uplink channel is currently assumed to be 10MHz wide, consisting of one hundred 100kHz channels.

There are certain things we need from our uplink signal. We need a constant envelope signal. We need reliable signal acquisition at the satellite. We want to reduce adjacent channel interference. We do not want to spend more power than necessary.

We believe that reliable signal acquisition at the satellite can be enabled with a preamble on uplink transmissions. The purpose of the preamble is for the satellite to identify a Phase 4 signal from the earth, obtain symbol timing, obtain frame timing, and then set the modulation, coding, and data rate for the transmission that follows.

Since a user terminal can hear itself on the downlink, it will not have to resynchronize as long as its own signal is being received. If it loses its own signal, then the preamble is resent. For cases where there are uplink-only stations, such as emergency operations, automated operations, or equipment failure, another mechanism must be required that forces resynchronization.

Below are the major components of the preamble in time order.

carrier detect

- must be at least 15dB SNR at satellite
- exact power level depends on what false alarm probability is tolerable
- 100mS of carrier is estimated to be on the order of 33dB SNR

symbol timing

- a fixed sequence of bits is sent to obtain symbol timing
- symbol timing is obtained by a symbol tracking loop

frame timing

- a fixed PN sequence is sent to obtain frame boundary
- frame timing is obtained by a frame timing loop
- CCSDS recommends a 32-bit sequence of 0xA1CFFC1D

A fixed-sized header is then sent at the lowest modulation rate. This header describes the packet. The contents of the header are as follows.

header version number

- having a header version provides a safety valve

next header field

- provides details on how to demodulate what follows

The next header field contains the following information. The modulation, coding, and data rate combinations may be encoded in order to make them as compact as possible.

modulation

- defines the symbol set used for this transmission

coding

- defines what each symbol means

data rate

- defines the data rate used by this transmission