SRI Meteorburst Antenna Exhibit 23 July 2019
For file no. 1337-EX-ST-2019

Background

The proposed experiment will use links operating between two fixed sites. We will construct two transceiver stations, which we will operate over the duration of our campaign.

The two fixed locations are a site on land belonging to Stanford University in Palo Alto, California, that is managed by SRI and the Hat Creek Radio Observatory near Burney, California (managed by SRI)~~.~~

Antenna Type

To accommodate the desired tuning range for our experiment, we have selected a log periodic antenna, model no. 30-70LP7 from M^2 Antenna Systems, with a nominal boresight gain of 6.0 dBi and a front-to-back ratio of 15 dB. When mounted for horizontal polarization, this antenna has an azimuth beamwidth of 70° and an elevation beamwidth of 138°.

Antenna Pointing Information

Palo Alto Antenna

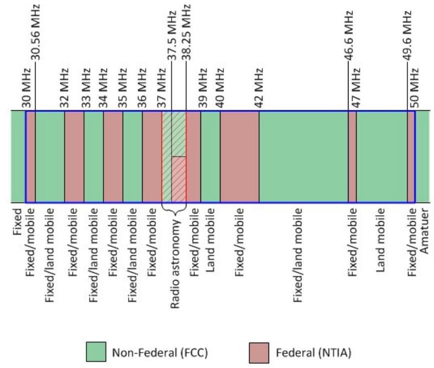
To establish the link to the Hat Creek Radio Observatory, the beam will be pointed at 9° azimuth and 24° elevation.

Hat Creek Observatory Antenna

To establish the link to the Palo Alto site, the beam will be pointed at 189° azimuth and 24° elevation.

Frequency Use

The planned experiment will include testing on different center frequencies to assess how the sensitivity of performance to frequency tuning. In addition, we will perform site surveys at each location before starting operations to determine local use of spectrum so that we may avoid interfering with other band users.



36.25 and 41.71 MHz	Petroleum radio service for spill containment and cleanup.
37.5 – 38.25 MHz	Radio astronomy spectral line observation band. No new fixed or mobile allocations.
40.66 – 40.70 MHz	Shared allocation/ISM band. Must accept ISM interference. Use subject to 47 CFR 90.248.
30.85 – 34.0 MHz 37.0 – 38.0 MHz 39.0 – 40.0 MHz 42.0 – 47.41 MHz	Low-power police transmitters (secondary licenses).

We have selected a set of subbands for potential operation after consulting the Code of Federal Regulations, Title 47, §90.248. We are avoiding the use of spectrum managed by the National Telecommunications and Information Administration. Also, we are not requesting the use of the radio astronomy bands between 37.0 MHz and 38.25 MHz.

We have planned our tests for flexibility, so we would be happy to adjust our plans to address any concerns, if needed.

Emission Information

During our tests, the transceiver at one end of the link (the primary site) will be responsible for establishing the link and performing the time synchronization operation. The secondary transceiver at the other site will send acknowledgement packets containing information allowing the primary transceiver to measure the round-trip propagation delay and to calculate and send a suitable correction. This operation may be viewed as packet data transmission using a custom protocol on a half-duplex channel.

The primary will probe for the presence of a usable meteor trail by emitting 100 µs pulses at a 10 Hz rate (i.e., at a duty cycle of 10^{-3}.) When a usable meteor trail is present with a suitable geometry (expected once every few minutes) the secondary will send an acknowledgement packet of a smaller duration at a fixed turnaround delay. The primary will then send another 100 µs packet containing the appropriate correction factor.

Pulses transmitted by both transceivers will include both a digital data portion, in which data and a spreading sequence will be phase-modulated onto the carrier, and a portion with a set of unmodulated analog subcarriers (i.e., a frequency comb). The digital portion will be modulated with a bandwidth of less than 1 MHz. The analog portion will include two tones at a time with a frequency spacing of up to 10 MHz (to be chosen from a table of discrete values). Frequency spacings will be selected in coordination with the frequency tuning of the main carrier to ensure that the tones fall within the allowed spectral subbands (see preceding section).

Based on the above description, the system emission designator will be 1M00Q9BAT, signifying a 1 MHz modulation bandwidth (during the modulated portion), phase-modulated pulses containing digital information (no subcarrier) followed by unmodulated tone pairs (which may be viewed as subcarriers). The digital information will vary in content (that is, ACKs will be shorter), and the channel will be shared using time-division multiplexing. (In addition, the two transceivers need not transmit on the same frequency.)