Part 5 Application
Exhibit: Question 5

Original: 2012/09/10
Amendment: 2012/09/10

a. The complete program of research and experimentation proposed including description of equipment and theory of operation.

This is a program of research and experimentation of radio at the 2200m, 1750m, and 600m wavelengths. This program is expected to run for a 5 year period. Research into the propagation of radio at wavelengths, suitability of these bands for one- and two-way automatic (computer controlled) and aural communication, and the effects of the solar sunspot cycle, weather, season, time of day, radiated power and antenna height upon this communication. Modern narrowband signaling methods will be tested and optimized for suitability at LF/MF. This communication will be through a radio beacon operated using on/off keying (cw Morse code) for aural reception, slow Morse code for automatic reception (QRSS), low baud rate phase shift keying and MSK (minimum shift keying) for automatic reception as well as narrowband voice transmissions in the single-sideband suppressed carrier mode. Both one- and two-way communication (two-way with other Part-5 license holders and foreign amateur radio operators who are authorized to use the 2200, 1750, and 600 meter bands) will be attempted.

The transmitters and other equipment used for this experiment are and will be built by the applicant, also owner and operator, Eric Tichansky. The applicant has been a licensed Amateur Radio operator for 17 years, and has experience designing, constructing, maintaining and operating radio communications equipment. The transmitter's frequency will be determined by a quartz crystal local oscillator and operated at LF/MF through frequency mixing with a variable frequency oscillator source. The transmitters are linear designs capable of reproducing amplitude/phase modulation with low distortion. Operation will be either automatic (computer controlled) or hand keyed for CW (Morse code), computer generated low speed CW and frequency/phase shift keying, and narrow-band voice transmissions. The antenna will be an electrically short, top loaded monopole (ref: Antenna Drawing exhibit) with variable base loading depending on the specific frequency of operation.

b. The specific objectives sought to be accomplished.

Objectives to be accomplished are:

- Study and proof of effective communication in these bands using stated techniques.
- Optimization of modern narrowband signaling techniques for long distance and reliable low and medium frequency propagation.
- Study of propagation and suitability of these bands for one- and two-way communication particularly with regard to coherent techniques as applied to Minimum Shift Keying (MSK).
- Study of effects of solar cycle, weather, season, time of day, radiated power, and antenna height upon this communication.

c. How the program of experimentation has a reasonable promise of contribution to the development, extension, expansion or utilization of the radio art, or is along line not already investigated.

The Low Frequency (30-300 kHz) and lower end of the Medium Frequency range (300-3000 kHz) are characterized by stable ground wave paths with low to moderate path attenuation. This opens up the possibility of reliable communication on a scale of tens to a couple hundred kilometers independent of ionospheric propagation disturbances. Modern narrowband signaling techniques have not been studied in depth for application to the lower medium frequency range. This program will test both aural and automatic signaling techniques, and detail their effectiveness and how these techniques are influenced by sunspot cycle, weather, season, time of day, radiated power, and antenna height. Of particular interest is the study of the stability of ground wave paths with respect to amplitude and phase variations. Minimum shift keying (MSK), a form of modulation where the phase changes are undertaken at the zero crossing points. By adopting the MSK technique the sidebands and hence the bandwidth required is reduced. It also enables coherent techniques to be used to gain a 3 dB advantage. The results of this program will be made available to the public (for free) and to the FCC in hopes that the data may be used to further understand operation in this band and might perhaps be used by the FCC in any future consideration of uses for this band.