

**File #: 0682-EX-PL-2013 Exhibit 1: Narrative Statement Exhibit: Question #7 Response Conventional Experimental License Application Form 442**

L-3 Communication-Communications Systems East

**Question:** If all the answers to Items 4, 5, 6 are "NO", include as an exhibit a narrative statement describing in detail the following items:

- a. The complete program of research and experimentation proposed including description of equipment and theory of operation.
- b. The specific objectives sought to be accomplished.
- 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.

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**Response:**

a. **Experiment:** Developmental testing of an L-3 product which performs HF single platform geo-location against non-cooperative active HF communications emitters. The product, which uses fractional wavelength antennas and short baselines, is mounted on a tower to simulate an airborne platform. A single HF test emitter is located on the ground. The location and power level of this emitter is varied during the testing and the impact on the geo-location accuracy of the product under development recorded. The test emitter can transmit AM voice telephony ( 8 KHz bandwidth) or FSK at 16 Kbps at selected frequencies in the 3-30 MHz band. The planned transmit power levels measured at the antenna input are adjustable from 1mW to a maximum of 5 Watts by changing the exciter drive level to the linear power amplifier(PA). An in-line RF power meter and VSWR meter are used to setup and continuously monitor the PA output power and condition of the antenna match. During setup a dummy load is used to establish the correct exciter drive level into the PA for the test power level before connecting to the antenna where final fine power adjustments are made.

The test emitter can be configured for single frequency or frequency hopping operation. In the frequency hopping mode the test emitter sequentially transmits 25 ms pulses of AM voice or FSK modulated carrier at frequencies selected over a 200 kHz operating band in the 3-30 MHz range. Up to 10 hopping frequencies over the 200 KHz operating band are planned and loaded into the exciter memory. A spectrum analyzer is used to perform a spectrum survey before any frequencies are selected for use. Only clear frequencies containing no current detectable activity, which are outside bands currently allocated for other services such as the amateur radio service, are candidates for use during a test run. The selected operating frequencies are constantly monitored between test runs to insure continued operation on a non-interfering basis with any other users. A test run is planned to be several minutes of continuous transmission from the test emitter, with 10-30 minutes between runs. A typical test day is 4-6 hours long.

The test emitter is implemented with an HP-8645A signal generator for the exciter which can be programmed in frequency hopping or fixed frequency modes and contains an internal AM and FSK modulator with an external microphone input. The PA is an Amplifier Research 10 Watt class A linear amplifier model number 10W10008 , 500 kHz-1 GHZ operating range. The exciter drive level is variable up to a maximum of 0 dBm which permits test emitter output power levels from 1 mW to 5 Watts. The test emitter antenna is a ground mounted broadband vertical (Comet CHA-250B) with < 0dBi of gain from 3-30 MHz.

b. **Objective:** The objective of these experiments is to determine the single platform geo-location accuracy of the L-3 product as a function of input SNR in the presence of real world HF environmental noise and propagation conditions. The product's detection algorithms and parameter measurement algorithms will be adjusted for best real world performance.

c. **Contribution to Radio State of Art:** The product provides a capability to perform HF single platform geo-location with fractional wavelength antennas and short baseline. Operation at HF is achieved with a very small aperture footprint . This HF aperture size permits single platform HF geo-location from commercial and military airborne platforms which is currently impossible with currently available HF DF technologies.