Letter requesting Special Temporary Authority

Re: FRN 0006-5324-02
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Name and address:

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Need for expedient action:

We are requesting a Special Temporary Authority to use low-power FM voice transmission on 418.0 and 433.9 MHz to support development and demonstration of apparatus for survivor location in Urban Search and Rescue (USAR) operations. In order to determine potential and identify fruitful directions for development, it is necessary to demonstrate prototype systems to USAR and Emergency Management personnel. While we hope to use the STA for six months, we are asking for the STA to commence on March 8, 2002. The reason for this urgency is that there is a meeting at the Pennsylvania State Fire Academy in Lewistown, PA on March 15, 2002 to evaluate technology concepts for enhancing Urban Search and Rescue operations. This meeting presents a unique opportunity since it will be attended by Pennsylvania USAR personnel, fire department personnel, state police personnel, and personnel from the Pennsylvania Emergency Management Agency (PEMA). If the STA cannot be granted until March 15, we can still perform the demonstration but without an advance check of the equipment. A request for an STA was not submitted earlier because this meeting was just recently organized.

Description of operation to be conducted:

Under the STA, if granted, intermittent, low-power transmissions would be made within the specifications detailed below. The operation is intended to establish the practicality and potential of small, inexpensive, expendable wireless modules for detection and location of survivors by Urban Search and Rescue teams. The STA would cover test transmissions to evaluate performance of the modules and would cover demonstrations to USAR personnel. These demonstrations are intended to incorporate the experience of field USAR personnel in developing the packages, acoustic processing, and deployment tactics to make survivor rescue more effective.

Purpose of operation:

The purpose of this request for an STA is to obtain permission to develop, test, and demonstrate a wireless audio link for rapid detection and location of survivors in a building or structure collapse caused by earthquake, severe weather, or terrorist attack. In conventional Urban Search and Rescue operations, time is critical in locating survivors. However, the search and rescue personnel must not be exposed to unnecessary risk. Typically, rescue workers use a bullhorn to “alert” trapped survivors and listen for response. In the initial stages of search, the rescuers do not enter the collapsed structure unless the structural integrity is obvious. Experience in USAR operations has shown that trapped survivors can often hear the rescue workers long before the rescue workers can hear the survivors’ responses. This is because the survivors are usually in a quieter environment than the rescuers and the bullhorn transmits a much louder sound than a survivor’s voice.

An effective solution to this problem is to place a microphone into the wreckage. This moves the microphone into a quieter location that is also closer to the survivor. If the wreckage is stable and the rescuers can stay close to the site, then the microphone can be part of a hardwire system. However, in the early stages of search-and-rescue, the stability of the wreckage is unknown and the USAR personnel must be able to move freely. A very small, deployable unit consisting of a transmitter module, an audio amplifier/filter, and a microphone would permit rapid search of unstable structures without forcing personnel to remain by the terminal end of a hardwire system. If the structure is safe enough to approach briefly, the microphone can be lowered into a cavity and the transmitter/antenna unit placed at the surface. A number of these units could be placed, then monitored by a single USAR worker with a receiver and directional antenna. If the structure is not safe enough to approach, the weighted microphone with trailing transmitter/antenna can be thrown into openings in the wreckage.

The units must be small enough and rugged enough to be dropped, thrown, or projected. Also, the units must be inexpensive enough to be expendable; if no survivors are detected

with a particular device, the unit can be abandoned if it is not safe to recover or if it has
been damaged after deployment. These issues of size, cost, and durability are the
principal motivating factors in the selection of 418 and 433.9 MHz transmitter modules.
These modules are readily available in very small packages well suited to miniature,
expendable devices. If necessary, the total transmission time can be limited so that
unrecovered devices “time-out” in a predictable manner.

The scope of this proposal includes: technical demonstrations of equipment or techniques; and development of radio technique, equipment, operational and engineering
data related to a proposed radio service. The proposed service would be primarily an
emergency service in which the transmissions would only be made during an on-going
search-and-rescue operation at the site of a building or structure collapse. The exception
would be for training of search and rescue personnel.

Times and dates of proposed operation:

Intermittent testing for six months commencing on March 8, 2002. Periodic technology
demonstrations, the first scheduled for March 15, 2002. Testing and demonstration will
consist of periods of FM voice (or simulated voice) transmission. These will typically be
intermittent transmissions of a few seconds to a few minutes over periods of up to two
hours per day. Occasionally, the transmissions will be continuous for periods not to
exceed 30 minutes. In all cases, identification per §5.115 will be done.

Class of station:

Most of the work will constitute a mobile service. For both testing and demonstration,
neither the transmitters nor the receivers will be in fixed locations. The operations will
normally be confined to an area of less than 100 meters by 100 meters for any specific
operation but the operation itself may take place at various locations given below.

Location of proposed operation:

Primary testing will take place at various locations at the University Park campus of the
Pennsylvania State University in State College, PA. Most of the evaluations are expected
to be performed in and around the Applied Sciences Building (40.7935? N, 77.8699? W).

Less frequently, tests may be performed in other areas in Centre County, PA. The first demonstration is intended to take place at the Pennsylvania State Fire Academy facility in Lewistown, PA (40.5797? N, 77.5381? W). It is anticipated that a series of tests will be performed in conjunction with Urban Search and Rescue personnel at the Pennsylvania State Fire Academy.

Equipment to be used:

Linx Technologies TXM-418-RM and TXM-433-RM transmitter modules. Normally, no more than two units would be operating simultaneously (one on each frequency) but there may be demonstrations with up to four units of a single frequency transmitting simultaneously (in conjunction with a directional receiving antenna). The TXM-418/433 modules are 30 x 9.5 x 5 mm (1.18 x 0.37 x 0.19 inches) and are sufficiently small for incorporation in the deployable packages. In addition, Linx Technologies TXM-900-HP-II transmitter modules may be used (902 – 928 MHz band); however, these modules are too large for integration into the package size required by the search and rescue teams. If the TXM-900 modules are used for concept demonstrations, then up to two additional transmitters may be operated. No modifications will be made to the transmitter modules.

Frequencies to be used:

The frequencies of primary operation are 418.0 MHz and 433.9 MHz with a maximum tolerance (manufacturer’s specification for TXM-418/433) of plus/minus 95 kHz. Compliance with this tolerance will be determined by measurement in our laboratory.
Some demonstrations may also be done using the TXM-900 modules, which are selectable to 903.37, 906.37, 907.87, 909.37, 912.37, 915.37, 919.87, and 921.37 MHz with a maximum tolerance at any frequency of plus/minus 50 kHz.

Maximum effective radiated power:

The effective radiated power (ERP) will not exceed 4 dBm (2.5 milliwatts). Compliance with this manufacturer’s specification will be determined by measurement in our laboratory. The antenna will be located within inches of the transmitter so transmission line loss is considered to be zero. The antenna will be no better than a quarter-wave vertical with ground plane and will frequently be a quarter-wave wire without ground plane. The ERP quoted above assumes the full gain of an ideal quarter-wave vertical with ground plane (0 dBd).

Emission type:

The emission type is F3E. In particular, the transmission consists of FM modulation by a single channel of audio (voice – survivor or simulated survivor). We will limit the audio bandwidth to 3 to 5 kHz as the higher frequencies are of little value for survivor location. At 5 kHz audio input and 25 kHz nominal carrier deviation, the total signal bandwidth is 60 kHz. The manufacturer indicates that the maximum carrier deviation can be as high as 50 kHz for some units but each unit will be tested in our laboratory and the input level restricted if necessary to maintain a maximum deviation of 25 kHz.

Description of antenna structure:

The antenna will consist of either a quarter-wave wire or a quarter-wave vertical with ground plane. The antenna will be connected directly to the transmitter module with a minimum of cable. The antenna will never be more than 2 meters above existing structures and will normally be at the level of the structure.