

Multispectral Solutions, Inc.
Answer
Call Sign WD2XSW
File Number 0038-EX-ML-2006
Reference number: 4428

On June 23, 2006 MSSSI was asked via email by Mr. John Kennedy of the FCC, "How is the request for 5000 units considered an experiment?"

Introduction

Multispectral Solutions, Inc. (MSSSI), in cooperation with BP (formerly British Petroleum), conducted a series of successful experiments with MSSSI's Sapphire DART RFID location awareness system during the period of August 2005 until January 2006. The trials were conducted under the current FCC Experimental License (0175-EX-PL-2005) at BP's Cherry Point Refinery in Blaine, Washington. The primary purpose of the experiments was to test the feasibility of MSSSI's Sapphire DART system to improve safety and to meet Occupational Safety and Health Act (OSHA) and Washington Industrial Safety and Health Act (WISHA) regulations. These regulations mandate "control over entrance to a facility by maintenance, contractor, laboratory, or other support personnel. These safe work practices shall apply to employees and contractor employees."¹

Specifically, BP requirements include:

- Location of staff that do not show up at assigned mustering points
- Improve rescue team response time and their safety
 - Limiting time in hazardous atmosphere, especially when using Self-Contained Breathing Apparatus
- Comply with OSHA/WISHA safety regulations
- Ensure personnel have proper certifications to enter hazardous areas
- Provide safety/maintenance information to personnel based upon location
- Track assets for more efficient operations

The experiments clearly demonstrated the value of MSSSI's system in improving the safety of operations within the refinery and are highlighted in the attached letter from Mr. Rick Porter (BP Cherry Point Business Unit Leader). The trials also demonstrated the need for using tags with a higher power output (e.g. +12.75 dB above Part 15.250 unlicensed limits for wideband transmissions). Higher power tags are necessary due to the need to locate personnel in an around the extremely high multipath environment of the refinery. The presence of metal tanks, pipes, grates, etc. makes localization extremely difficult without adequate tag transmitter power.

¹ OSHA CFR 1910.119(f)(4) and WISHA WAC 296-67-021 Operating procedures.



Figure 1. Challenging Refinery Environment

The other benefit of higher powered tags is the reduction in infrastructure complexity and cost. The trials showed that the infrastructure required to cover the refinery was reduced by a factor of 10-20 because the greater communications range of the tags significantly reduced the number of receivers. The Cherry Point Refinery (shown below) covers an area of approximately 4 million square feet making personnel localization very difficult and costly if excessive infrastructure is required. MSSSI has estimated that approximately 80 receivers will be required to cover the primary processing area of 1.5 million square feet. This discovery was made during the initial trial and is considered a major breakthrough in enabling a cost effective RFID solution.



Figure 2. Overhead view of BP's Cherry Point Refinery

Next Steps

At the conclusion of the trials, BP safety personnel stated to their management, “[b]ased on the test results, the Location Aware Safety System (based upon MSSSI’s UWB

technology) is the clear direction Cherry Point should pursue. This solution will place us in 100% compliance with PSM regulatory requirements while having minimal impact on the general refinery population. It also opens the door to unlimited possibilities in safety, security and asset management.”

Based upon the success of the experiments, MSSSI and BP would like to expand upon the experimental license to increase the number of RFID tags from 50 to 5000. 3500 tags will cover the maximum number of personnel that would have access to the refinery at any given time and 1500 will be used for the localization of assets such as motor vehicles and other ground equipment. In order to evaluate the system for BP safety and OSHA/WISHA compliance, all personnel will need to have badges. In addition, the operational area for locating tags will increase to cover a greater portion of the refinery.

As stated on the FCC website, *“There are many instances in which experimental licenses are appropriate. Experimental licenses permit experimentation in scientific or technical operations directly related to the use of radio waves. The experimental radio service provides the opportunity to experiment with new techniques or new services prior to submitting proposals to the FCC to change its rules.”*

The initial experiments were focused on the localization of personnel within the severe multipath areas of the refinery. For the limited localization experiments within this small area, 50 tags were adequate. The next level of experimentation is focused on achieving accurate personnel counts in order to meet OSHA/WISHA regulations. Here, all contractors and employees will require RFID badges to enable counts throughout the various areas within the processing area of the refinery. This area within the refinery is estimated to encompass approximately 1.5 million square feet.

Areas for additional experimentation include:

- Sapphire system capability to accurately process and report a larger number of tags to meet OSHA/WISHA regulations
- Improve antenna designs to enhance coverage and location accuracy
- Middleware software capability to accurately process and report a larger number of tags to meet OSHA/WISHA regulations
- Investigate tag performance under real world conditions (e.g. reading tags mounted in various locations on moving personnel)
- Investigate receiver performance under real world conditions (e.g. exposure to various weather (rain, heat, humidity) and refinery conditions (vibration, shock, multipath)
- Examine compatibility with existing wireless services such as 802.11a/b/g
- Examine aggregate effects – 50 tags is too small of a sample for this purpose

MSSI does not believe that the aggregate effects of 5000 tags are an issue. In MSSI's Sapphire DART UWB-based Real Time Location System, the UWB tags transmit, on the average, approximately 100 UWB pulses (each roughly 2 ns in duration) each second. The pulses are transmitted in a single packet burst at a 1 Mpps intersymbol rate, resulting in a transmission duty cycle (i.e., ratio of RF "ON" time to "OFF" time) of

$$\text{Transmission duty cycle} = 2 \text{ ns} \times (100 \text{ pulses})/\text{sec} = 0.00002\%.^2$$

Thus, even with 5,000 tags, each continuously transmitting from the exact same location so as to obtain a worst case field strength, the measured effective transmission duty cycle is less than 0.1%. The tag transmissions have exceedingly small duty cycles for the purposes of maximizing battery life and minimizing channel occupancy to prevent packet collisions. These same attributes are precisely what makes this system non-interfering to other co-located systems.

The FCC website also states that the rules also provide for limited market studies to assist the licensee in evaluating the market potential for new equipment or services, and for demonstrating equipment prior to obtaining an equipment authorization. The successful results of MSSI initial experiment as evidenced by the strong endorsement by BP demonstrates a significant market opportunity for this U.S. born technology. Many other petrochemical companies seeking to improve the safety of their operations, within the U.S. and abroad, are eager to move forward with installations.

Finally, the FCC will benefit from the information provided by MSSI in aiding the FCC in identifying what new services and technologies are being developed and in what part of the spectrum. This experiment clearly meets the intent of Section 7 of the Communications Act of 1934 as shown in the following paragraph as written by the FCC in the UWB NPRM in 2000.

We believe that UWB technology holds promise for a vast array of new or improved devices that could have enormous benefits for public safety, consumers and businesses. Further, we anticipate the UWB technology could create new business opportunities for manufacturers, distributors and vendors that will enhance competition and the economy. UWB technology may also enable increased use of scarce spectrum resources by sharing frequencies with other services without causing interference. It is important that we find ways to encourage the development and deployment of technologies that may allow more efficient use of the spectrum. We note that Section 7 of the Communications Act of 1934, as amended, requires the Commission "to encourage the provision of new technologies and services to the public."³ Accordingly, we conclude that the

² The true transmission duty cycle is actually a fraction of this value since the pulses are transmitted with an ON-OFF keying technique, the absence of a transmission representing a logic "zero".

³ See 47 U.S.C. § 157(a) (1998).

Commission should develop reasonable regulations that will foster the development of UWB technology while continuing to protect radio services against interference.

The safe operation and security of our petrochemical facilities is in the nation's interest as it benefits public safety, consumers and businesses. MSSSI's UWB technology is also meeting the FCC's mandate to increase the use of scarce spectrum resources without causing interference. Thus, MSSSI respectfully requests that the FCC immediately approve the use of 5000 tags.