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Space Debris Detection Telecomm Systems – UHF Radios

Introduction

All wireless communication systems, including cell phones and two-way radios, operate on what is known as the operating frequency which is the frequency at which the communications are being made with the total bandwidth occupied by the carrier signal with modulation. Based on the operating frequencies the Federal Communication Commission (FCC) has four categories of bandwidths: low-band Very High Frequency (VHF:49-10 MHz), high-band VHF (169-219MHz), low-band Ultra High Frequency (UHF:450-06 MHz), and high-band UHF (900-952 MHz) [1]. The UHF packet radios that use UHF bandwidths, are a good choice for transmission over long distances as UHF signals are very effective at penetrating physical barriers like walls, buildings, and rugged landscape. Anything that obstructs a radio wave, will weaken a radio signal and UHF radios lessens that effect.

Commercial Application

UHF packet radios are generally used for non-commercial exchange of messages, wireless experimentation and emergency communication. The UHF spectrum is used by mobile phones, television broadcasters, GPS satellites and devices, satellite radio, cordless phones, wireless networking, ham radio operators, Bluetooth devices and some RFID [2]. The UHF bandwidth is operated exclusively by amateur-radio operators (HAMs). There is no administration that regulates the usage of the bandwidth and the equipment and it is free for all amateur operators. The FCC allows this free operation as long as the equipment itself obeys certain operating limitations [3]. In times of disaster, when regular communications channels fail, hams can swing into action assisting emergency communications efforts and working with public service agencies [4].

Technology in UHF Packet Radios

Packet radios can be used from very remote locations and can support multiple conversations on the same frequency at the same time in a time shared process. However, interference still occurs when two stations emit signals at the same time. This is called a collision and it occurs when time sharing fails.

Conversations occur during the times when the other conversations are not using the channel. Packet radio uses a protocol called AX.25 to accomplish this shared channel.

UHF Packet radio has three important features: transparency, error correction, and automatic control. The operation of a packet station is transparent to the end user; connect to the other station, type in your message, and it is sent automatically. The terminal Node Controller (TNC) automatically divides the message into packets, keys the transmitter, and then sends the packets. While receiving packets, the TNC automatically decodes, checks for errors, and displays the received messages. Packet radio provides error free communications because of built-in error detection schemes. If a packet is received, it is checked for errors and will be displayed only if it is correct [5]. Another advantage of UHF transmission is the physically short wave that is produced by the high frequency. That means the antenna on the radio can be short [6].

Equipment for UHF radio

TNC (terminal Node Controller)

A TNC contains a modem, a computer processor (CPU), and the associated circuitry required to convert communications between your computer (RS-232) and the packet radio protocol in use. Most amateurs currently use 1200 bps (bits per second) for local VHF and UHF packet, and 300 bps for longer distance, lower bandwidth HF communication.

Computer or Terminal

This is the user interface. A computer running a terminal emulator program, a packet-specific program, or just a dumb terminal can be used.

A radio

For 1200/2400 bps UHF/VHF packet, commonly available narrow band FM voice radios are used. For HF packet, 300 BPS data is used over single side band (SSB) modulation. For high speed packet (starting at 9600 bps), special radios or modified FM radios must be used [4].

[1] The differences between UFH and VHF Radio Frequencies [Online]. Available: http://www.highlandwireless.com

[2] UHF (Ultra High Frequency) [Outline]. Available: http://www.tech-faq.com/uhf.html

[3] Daniel M. Dobkin, *The RF in RFID: UHF RFID in Practice*, Newnes; 2nd Edition, December 13, 2012, Pg 72

[4] What is Ham Radio? [Online]. Available: http://www.arrl.org

[5] Packet Radio: Introduction to Packet Radio [Outline]. Available: https://www.tapr.org/pr_intro.html

[6] Should I choose UHF or VHF Two-Way radios and intercoms[Online]. Available: https://www.intercomsonline.com