Description of Circuit for Dane Transmitter (433 MHz)

The transmitter is used to control a motorized shopping cart pushing device. This enables a person in a parking lot to return multiple shopping carts back to the store they came from. Four commands can be sent from the transmitter to the receiver that controls the pushing device. They are: slow speed, faster speed, honk horn, and stop. These are activated only while the respective push button is held down. If no button is held down the pushing device reverts to stop.

The transmitter is powered by a 9 volt DC battery (or 6 volt batteries). This is fed into a PNP transistor which acts as an on/off switch. When a push button is activated the transistor is turned on and furnishes power to the rest of the circuit. With no button pushed the only power draw is the leakage across the transistor and the PC board. The battery is presumed to be dead when it will no longer activate the pushing device. From the on/off switch the voltage is fed to a LED indicating device and a 5 volt DC regulator.

The 5 volt DC is then fed to the rest of the active circuits, which consist of a microprocessor, a 433 MHZ RF module, and a RF switch. The microprocessor is a PIC 12C508 which has its own internal RC oscillator. This oscillator runs at about 4 MHz. Inputs to the microprocessor are the four push button switches (slow, fast, horn, and stop). When these are held down, the respective commands are sent to the pushing device.

The command protocol consists of a pulse width OFK modulated signal. This has a start period of 750 microseconds to allow the receiver to enable. This is followed by a preamble of two zero's and a one. After this, 14 bits of information is sent consisting of address, data, and a check sum. The worst case (all information bits being ones) time the command is transmitted is 4.75 milliseconds. A bit time is 375 microseconds, with a zero being 250 microseconds off and 125 on and a one the opposite, with 125 microseconds off and 250 microseconds on. This command is repeated every 50 milliseconds, which gives it an on time of 9.5 milliseconds every 100 milliseconds (9.5%).

The microprocessor outputs two signals. The first enables the 433 MHz RF module, and the second sends the command to the RF switch. The RF module is used as a SAW oscillator which runs at 433.92 MHz. This is the fundamental frequency with no multiplication's of frequency used. When the microprocessor enables the oscillator, it runs constantly.

The oscillator is then fed to an RF switch. The RF switch consists of GaAs transistors which are turned on or off. When it is on, it shunts the oscillator signal to ground and when off allows the oscillator signal to drive the antenna.

The matching circuit filters the harmonics and matches the impedance of a short piece of wire which is raised up off the PC board and acts as the antenna.