Theory of Operation: Infinity Start System Transmitter

General:

The Colorado Time Systems (CTS) Infinity Start System is a unit which provides a start signal, in the form of an audio tone and a strobe flash, for racing swimmers and a signal to a timing computer to indicate when a swim race has begun. The unit also acts as a PA system to allow the start judge to prepare the swimmers for the start of a race. The Infinity Start System by CTS can use either a wired or wireless microphone. The microphone also contains the button used to trigger the start of a race.

Wireless Transmitter:

The wireless microphone uses a Linx HP-TXM transmitter module operating in the 902-928 MHz band. The HP-TXM is a high-performance, eight channel, FM transmitter capable of transmitting analog or digital data. Digital information is modulated at the transmitter using FSK (frequency shift keying), the binary form of frequency modulation.

To transmit analog information the module reverts to FM modulation.

An antenna is connected at pin 2. The HP series transmitters are designed to operate with a 50-ohm load. In the Infinity Start System transmitter, the antenna is located inside of the unit housing as an integral part of the circuit board.

An accurate 12.00MHz VCXO (voltage-controlled crystal oscillator) serves as the frequency reference for the transmitter. The modulation input pin is connected to the VCXO through a 25kHz two-pole Low-pass filter. The low-pass filter is used to shape the incoming data and limit the transmission bandwidth to 25kHz.

The reference frequency is directly modulated. This method affords two benefits. First, it eliminates the need for a frequency conversion in the transmitter, reducing size, cost, and current consumption. Second, it allows the modulation to occur within the loop bandwidth of the frequency synthesizer allowing a wide modulation bandwidth of 50Hz to 25kHz.

The modulated 12.00MHz reference frequency is applied to the Phase-Locked-Loop (PLL). The PLL, combined with a 902-928MHz VCO, forms a stable frequency synthesizer that can be programmed to oscillate at a number of preset frequencies.

An on-board micro-controller reads the channel-selection lines and programs the PLL to the desired channel frequency. The micro-controller also monitors the status if the PLL and indicates when the transmitter is stable and ready to transmit data by asserting the CTS line high.

A buffer amplifier is used to isolate the VCO from the antenna and to increase the output power of the transmitter. The output of the buffer amplifier is connected to a LPF which is used to suppress harmonic emissions. Since the harmonic LPF is designed for a 50-ohm load, all specifications are provided as such.