Light-O-Rama, Inc. LOR-RF-V4 Wireless Interconnect
Theory of Operation 03/14/2006

The LOR-RF-V4 was designed to be a replacement for the cable between Light-O-Rama (LOR) lighting controllers. Using the LOR-RF-V4 requires no changes in any other LOR product. The customer simply removes the RS485 cable between two LOR devices and plugs an LOR-RF-V4 into each device. All LOR controllers supply a filtered 9VDC on two of the wires of the interconnect cable. This voltage powers the LOR-RF-V4.

The LOR-RF-V4 is based on the Wi.M900X wireless transceiver module from Radiotronix, Inc. The Wi.M900X is based on the XE1203 chip from Xemics, Inc. The Wi.M900X contains all of the RF components (coils, capacitors, RF switch and SAW filter) except for the antenna. LOR supplies a 900 MHz dipole antenna. The XE1203 provides a bit clock and bit output during receive and has a data in bit for transmit (no clock, you change the bit.) The Wi.M900X also has a small non-volatile ROM on it. The ROM contains a crystal frequency calibration offset from the factory. We apply this when setting the transceiver channel.

The LOR-RF-V4 uses a MicroChip 18F4620 PIC with an external 10 MHz crystal. The PIC drives both the Wi.M900X and the level shifters for the RS485 communications line. A PIC timer interrupt is used to transmit data a bit at a time to the XE1203 and the XE1203 bit clock is used to sample data a bit at a time on receive. A UART in the PIC is used to drive the RS485 level shifters.

The XE1203 is configured to use a 235 KHz frequency deviation with 2-FSK modulation. The data transmitted by the PIC are whitened. Whitening is accomplished by converting every 4-bit nibble to be transmitted into a 6-bit code. These 6-bit codes are selected from the set of 20 possible 6-bit codes that have equal numbers of ones and zeros. The receiving LOR-RF-V4 reverses this process to convert 6-bit codes to 4-bit nibbles.

LOR networks transmit data asynchronously at 19,200 and 57,600 bps. Because of whitening and the restricted speed set of the Xemics XE1203 chip, these speeds correspond to RF bit rates of 38,085 and 76,170 bps. At 76,170 bps, RF transmit on time is typically less than 7% with a maximum of 46%. The lower speed (19,200) is used for hardware configuration where RF transmit on time is insignificant.

LOR messages consist of a null, some data and another null. The LOR-RF-V4 continuously monitors the RS485 line looking for these messages. If it sees one, it transmits it out the RF link. The LOR-RF-V4 also continuously monitors the RF link. If it sees a valid message (CRC checks out, no invalid 6-bit codes, etc) it transmits this message out the RS485 link. This works because LOR networks are polled, half-duplex. One network device directs all the rest.

Even though the LOR-RF-V4 expects a filtered 9 VDC power supply, it contains its own, over-engineered power supplies. A 5 VDC one for the PIC and a 3.3 VDC one for the Wi.M900X.

[The end.]