PO Box 100
Hildebran, NC 28637
800-797-9355 Sales
(828) 397-4415 FAX
http://www.elkproducts.com
Email: sales@elkproducts.com

Date: July 27, 2016
Reference: M1XRFTWM Receiver (Transceiver)
Timco Engineering, Inc.
849 N.W. State Road 45
P.O. Box 370
Newberry, FL 32669

M1XRFTWM Receiver (Transceiver) Compliance Test

Note: In this document the M1XRFTWM Transceiver is identified as the "receiver". The sensors are identified as a "transmitter".

Overview:
The ELK Products, Inc. wireless security system consists of multiple transmitters identified with a unique transmitter identification code and a receiver which connects to a security control system. When a transmitter is triggered to transmit its data packet, the receiver (M1XRFTWM Receiver (transceiver)) detects the 5 millisecond preamble from the receiver frequency scan of the 25 channels in the 902 to 928 Mhz frequency range. The receiver locks onto the received frequency channel that contains the preamble. It then receives the 11 milliseconds of additional data and acknowledges the transmitter with a 11 ms response on the receiver's next frequency hop channel. The receiver then continues to scan all frequencies for other transmitter data. After receiving the acknowledgement data packet, the transmitter will go to its normal sleep mode. Any retry transmissions from a transmitter will be delayed at least 250 milliseconds or more and repeated up to 8 to 12 times, selecting another unused channel frequency of the 25 channel frequencies.

Data Packet:
Preamble-1010s, 16 bit data packet identifier, data, CRC.

Random Frequency Hopping (FHSS) Sequence
Describe how the hopping sequence is generated.

Each transmitter includes a randomly generated frequency hopping table that scatters the frequencies to be transmitted across the 902 to 928 Mhz frequency band with 1 Mhz channel separation. Each transmission from a transmitter selects an unused frequency channel from the frequency hopping table so that all channel frequencies are used equally. When all 25 frequencies have been used by the transmitter, the frequency hopping table is reinitialized. Each transmission from a transmitter is active for 11 milliseconds.

Equal Hopping Frequency Use
Describe how each individual EUT meets the requirement that each of its hopping channels is used equally on average.

As described in the **Random Frequency Hopping Sequence**, the transmitter selects one of the 25 unused channel frequencies that have not been used. When all 25 channel frequencies on the transmitter have been used, the frequency hopping table is reinitialized. This insures that all channel frequencies are equally used.

System Receiver Input Bandwidth
Describe how the associated receiver(s) complies with the requirement that it's input bandwidth (either RF or IF) matches the bandwidth of the transmitted signal.

Each device is a transceiver as built into the Silicon Labs Si1000 IC. Upon power up, the RF section of the Si1000 IC is loaded with identical configuration data on the receiver and transmitter which is used to configure the frequency hopping range, frequency between hops, and bandwidth. The frequency and bandwidth is software controlled and clocked by a 30 Mhz. precision crystal oscillator.

{0x75, 0x25, 0x80, 100, 56, 25, 193, 0x01, 0x82, 4, 0x52}

This table was generated by Silicon Labs to satisfy the 25 channel bandwidth.

System Receiver Hopping Capability
Describe how the associated receiver(s) has the ability to shift frequencies in synchronization with the transmitted signals.

The transmitter and receiver are synchronized through identical initialization tables controlling the frequency hopping range, frequency between hops, and bandwidth.

The receiver portion of the M1XRFTWM Receiver constantly scans the 25 channels as described in the **Overview and the System Receiver Input Bandwidth**. When preamble data is detected on a channel, the receiver frequency scan listens on that channel for a few milliseconds waiting for a data packet identifier word. If the packet identifier word is not received within the time limit, the receiver will continue scanning the 25 channel frequencies. If the data packet identifier is received, the remainder of the data packet is received and checked against the CRC value for proper received data. An 11 millisecond acknowledgement data packet is sent from the receiver to the transmitter. The receiver's acknowledgment data packet is sent on the receiver's next channel hop frequency which is independent from the transmitter's frequency. The receiver will then continue scanning the 25 channel frequencies, listening for transmitter preambles. The transmitter will go to its sleep mode until it is triggered to transmit again.

Sincerely,

David Steele
Chief Engineer
ELK Products, Inc.