

MODEL HP106A LOCATOR HUB

IN HOME / OUT OF HOME TRANSMITTER DESCRIPTION

A.1 PPM IN HOME/OUT OF HOME INDICATOR OVERVIEW

Subscribers to Arbitron's ratings service are not just interested in *which* radio or television station a panelist listens to, but also *where* the station was heard: In their home, or somewhere out of home such as in their car, at work, etc?

To meet this need, the PPM system's HP106A Locator Hub (denoted the PL3150 Locator Hub and also known as the household collector) contains a low power 433 MHz RF transmitter that acts as a continuous "at-home" beacon. If a panelist is at home and within 100 feet of the Hub transmitter, an RF receiver in his personal meter (i.e., his PPM) will detect the transmission and log a positive "in Home" event. The PPM records successful detections in its listening log every few minutes. The In Home/Out of Home Indicator system is illustrated in Figure A-1 below.

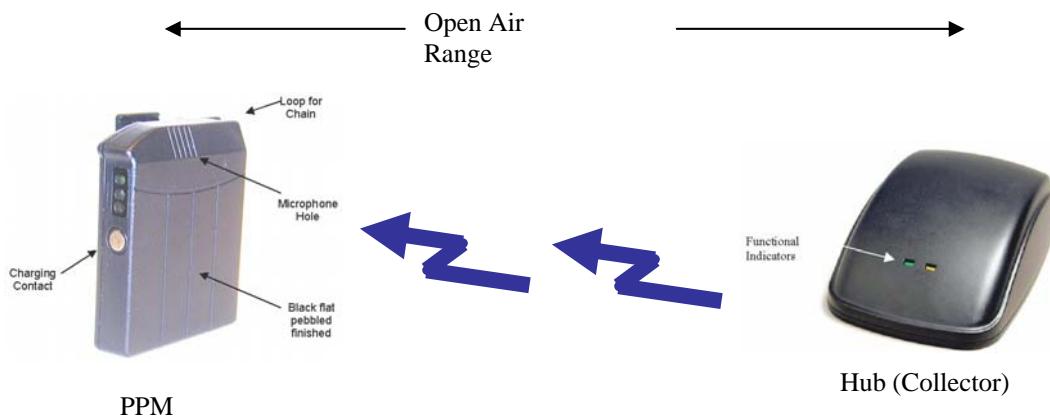


Figure A-1: In Home/Out of Home Indicator system

A.2 IN HOME/OUT OF HOME TRANSMITTER

The HP106A Locator Hub uses a Linx TXM-433-LC, a 433.92 MHz low-power RF transmitter, mated to a custom antenna to provide an "at home" signal to panelist

meters. The TXM-433-LC is driven by the Echelon Neuron microcontroller. As built, with the output power control resistor ($R_{35} = 1.1\text{K Ohms}$) and $V_{CC} = 5\text{V}$, the nominal power output = -2 dBm for FCC 15.231 compliance. Emissions testing at an independent lab determined that $R_{35}=1.1\text{K Ohms}$ (with a 14% duty cycle) permits the maximum transmitted power under FCC rules. See Figures A-2 through A-5.

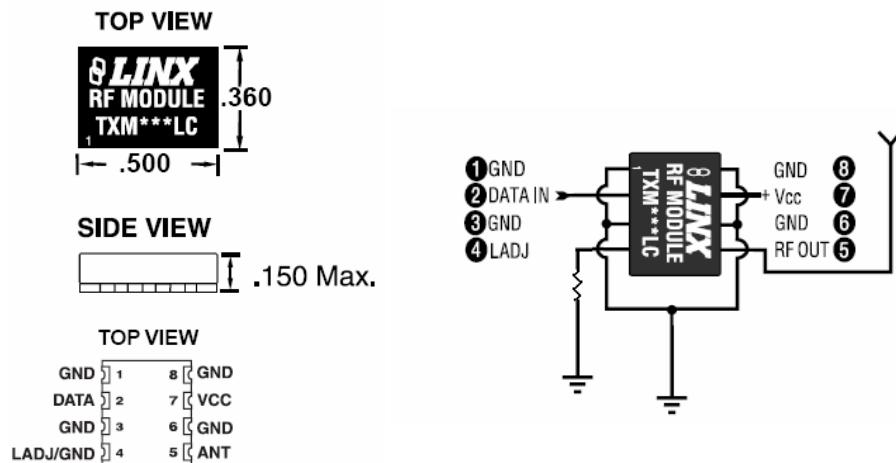


Figure A-2: Linx TXM-433-LC Transmitter

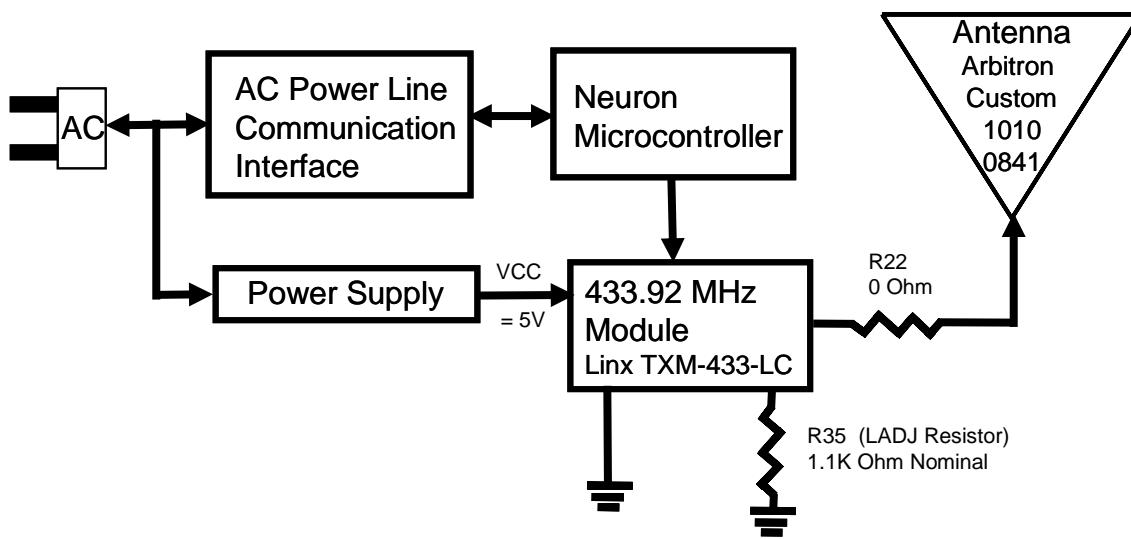
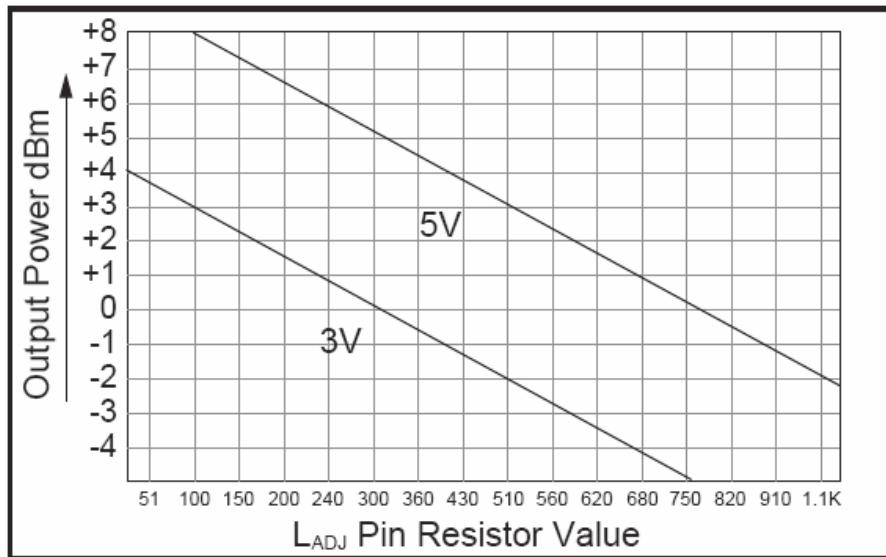
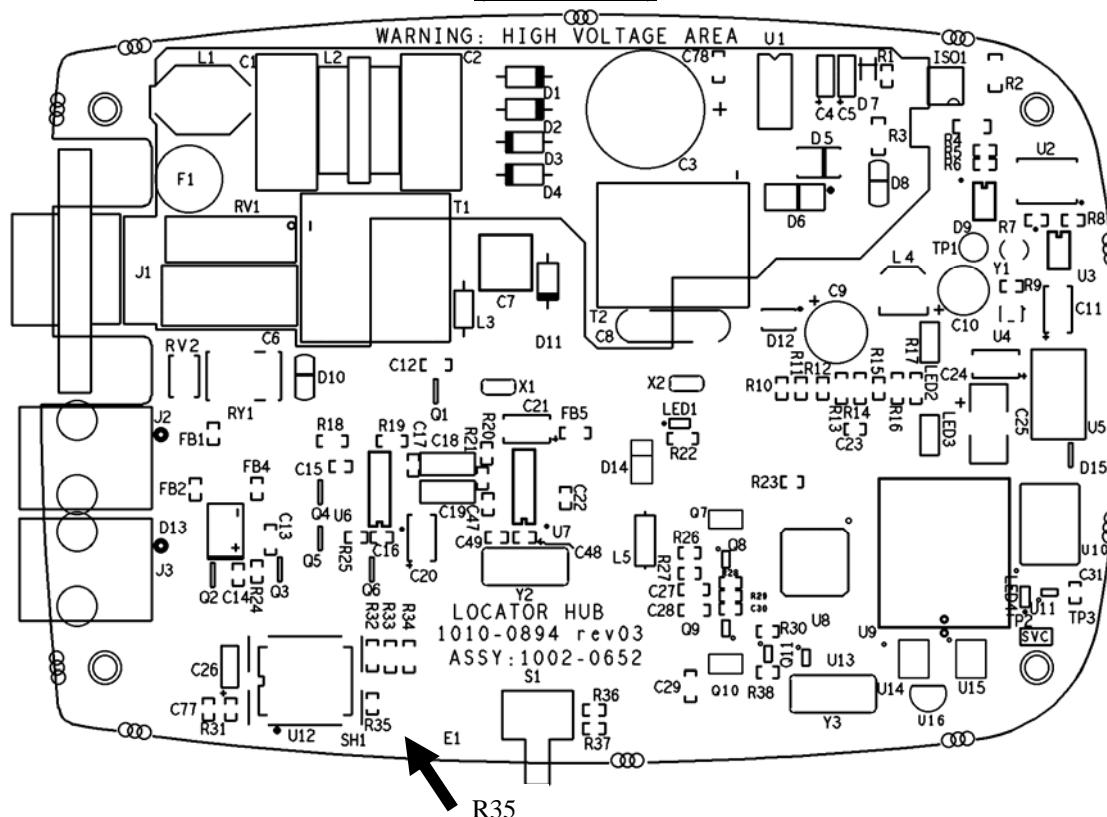


Figure A-3: In Home / Out of Home System Block Diagram



Power Output vs. LADJ Pad Resistor Value

Figure A-4: Linx TXM-433-LC Transmitter Power Output Versus R35 Value
(Use 5V line.)



A.3 FCC TRANSMITTER REGULATIONS

As an intentional radiator, the In Home/Out of Home transmitter needs to be compliant with FCC regulations outlined under section 15.231, which contains five subsections:

(a), (b), (c), (d), and (e).

Subsection (a) allows for three types of intentional transmitters: manually operated, or automatically triggered but restricted to transmitting less than 2 seconds per hour. Subsection (b) specifies the power limits for subsection (a) devices, while subsections (c) and (d) specify bandwidth and band-limit requirements.

Subsection (e) provides a special exception to subsection (a) with allowable transmission levels of less than *half* those provided under subsection (b). In addition, subsection (e) devices must not transmit for greater than one second and the silent period between transmissions must be at least 30 times the duration of the transmission but in no case less than 10 seconds. Lastly, subsection (e) devices must meet the bandwidth and band-limit requirements of subsection (b), which includes a power-measuring requirement covered under section 15.35. Specifically, the measured field strength must be determined from the average absolute voltage during a 0.1 second interval when the transmitted pulse code is at its maximum.

For reference, the Subsection (e) 433.92 MHz power limit is 4,399 μ V/m (72.9 dB μ V/m).

1. Transmitter Power

The Linx TXM433 module transmits at a nominal -2dBm power level.

2. Transmitter 100 ms burst duty cycle

The transmitter emits 2 ms power pulses every 16 ms. Within a worst-case 100 ms window there are 7 power pulses, resulting in $2 \times 7 / 100 = 14\%$ duty cycle.

[Note: 15.35(b) ...When average radiated emission measurements are specified in the regulations there is also a limit on the radio frequency emissions corresponding to 20 dB above the maximum permitted average limit for the frequency being investigated

So, since $20 \times \log(0.1) = -20$ dB, this means that a duty cycle less than 10% is not useful for lowering the FCC power level compliance further.]

3. Total Transmission Time

The total transmission time is 978 ms. Note this is less than the one second section 15.231(e) maximum.

4. Transmitter Silent Period

The transmitter will be silent for 30.022 seconds between transmissions.

Section 15.231 (e) requires a minimum silent period of $30 \times 0.978 = 29.340$ seconds or 10.00 seconds, which ever is greater.

5. Transmitter Transmission Period

The transmitter 0.978 second 'on' period followed by the 30.022 second 'off' period equates to a 31.000 second period repeating transmission pattern. The resulting transmitted pattern is illustrated in Figures A-6 and A-7 below.

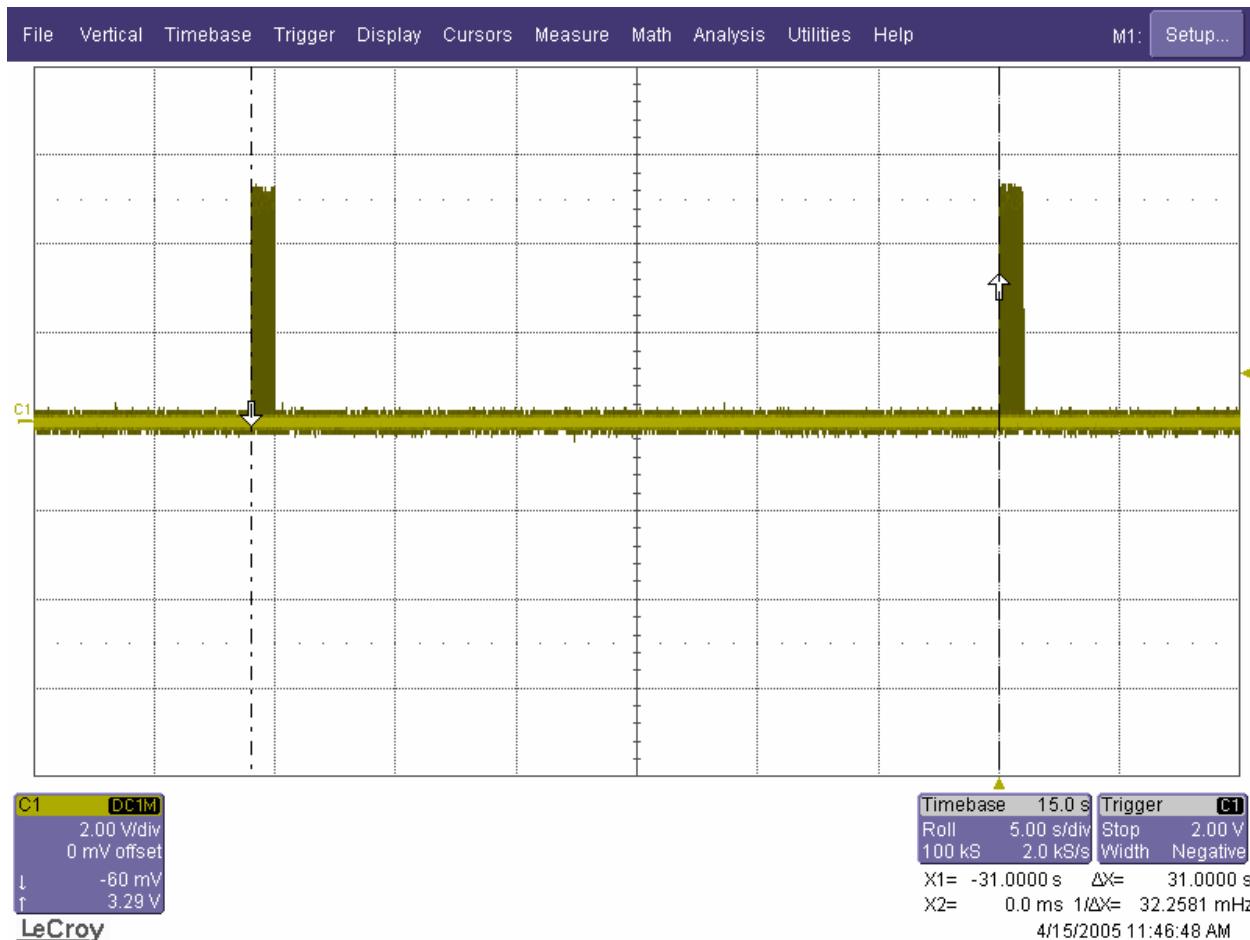


Figure A-6: In Home/Out of Home Transmitter Quiescent Period

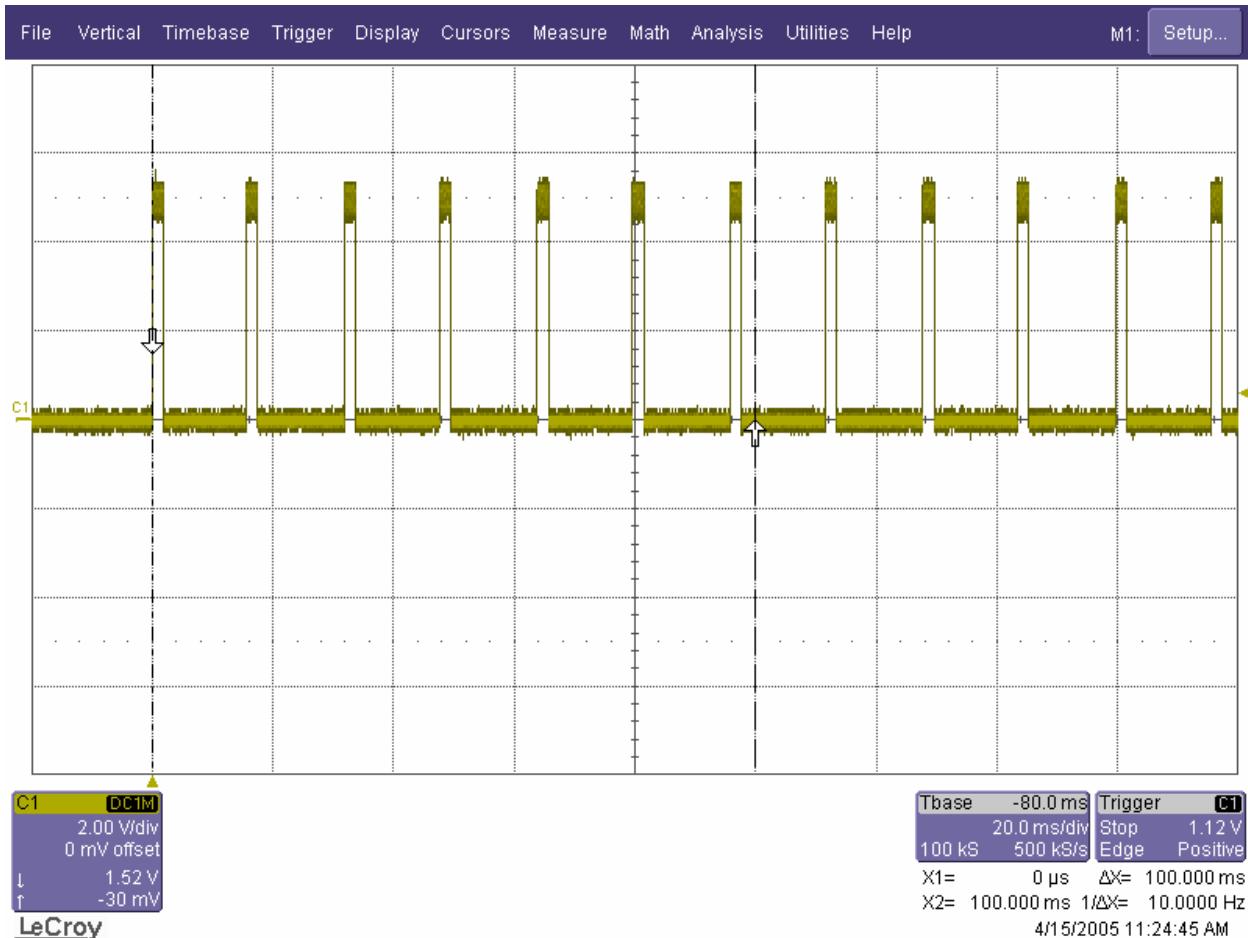


Figure A-7: Transmitter Duty Cycle