Hints and Kinks - Low-Pass Filter Cures Touch-Lamp Interference

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LOW-PASS FILTER CURES TOUCH-LAMP INTERFERENCE

◊ Not only can touch-controlled lamps cause strong interference, they can also suffer interference. I've read several articles on curing the problem of touch lamps being turned on and off by RF fields, but none of them were fully successful in solving this problem in my lamp. This hint describes my solution to the second problem (interference to the lamp)—a solution that also greatly minimizes the effects of the first problem (interference *from* the lamp).

A touch-controlled lamp's control circuit (Figure 2) consists of an oscillator connected to the lamp's base and shade frame, a circuit that detects a shift in oscillator frequency when the lampshade (the oscillator's antenna) is touched, and a switch circuit to turn on and off the lamp's bulb(s). My interference solution (Figure 3) consists of a pi-network low-pass filter installed between the lamp oscillator and its antenna (the lamp shade). This peaks the oscillator signal and sharply reduces its harmonics while making the lamp insensitive to interference from ham-band signals. An attenuator resistor in series with the lamp lead decouples the oscillator even more from incoming ham-band signals.

My lamp's oscillator operates at 244 kHz. (You can easily determine your lamp's oscillator frequency if you have a general-coverage receiver that tunes down to 100 kHz or so. Plug the banana-plug end of a test-probe lead into the radio's antenna jack and drape the other end of the test lead over the lampshade. Tune the transceiver farther and farther below 500 kHz until you find the lowest-frequency signal emitted by the lamp. This is the lamp oscillator's operating frequency—its *fundamental*.)

If your lamp operates at or somewhat below 244 kHz, the values shown in Figure 3 should work. If your lamp operates above 244 kHz, you may need to adjust the values shown in Figure 3 for your lamp's oscillator frequency. You can do this in one of two ways.

First, you can try *scaling* Figure 3's values to match your oscillator's frequency. To do this, divide my oscillator's frequency (244 kHz) by your oscillator's frequency to determine the scaling factor. If your lamp operates at 300 kHz, you'd solve the equation

$$\text{scaling factor} = \frac{244\,\text{kHz}}{300\,\text{kHz}}$$

—to which the answer is 0.813. Then, multiply Figure 3's capacitor and inductor values by this number, and install standard-value parts that most closely match the values you get. Multiplying Figure 3's values by 0.813 returns 66.7 pF for the capacitors, and 1.8 mH for L1. The standard value of 68 pF is closest to 66.7 pF, but 1-kV 68-pF capacitors may be hard to find. Two general-purpose 120-pF, 1-kV disc capacitors, connected in series (to make a 60-pF, 2-kV capacitance) should be close enough.

The alternative method requires an oscilloscope or the receiver you used in determining the oscillator's frequency. Attach the scope to the lampshade frame (with the receiver, use the test-lead method already described) and use it as an output indicator as you adjust the values of the capacitors and L1 for maximum output at the oscillator fundamental.

A different ratio of L to C could work for the filter; the values shown in Figures 3 and 4 are based on what I had available.

The oscillator output lead is the one that comes from the circuit box or connector and attaches directly to the inside bottom of the metal lamp base. As to parts, the 2.2-mH chokes I used were J. W. Miller 9250-225s (Allied Electronics cat. no. 871-3270), and the 1-kV 82-pF capacitors were Alectron SE-1026s (Allied Electronics cat. no. 285-1026).[1]

The most rewarding part of this project is that my wife is pleased with it!—*Leo G. Birgenheier, AC4DA, Lynn Haven, Florida*

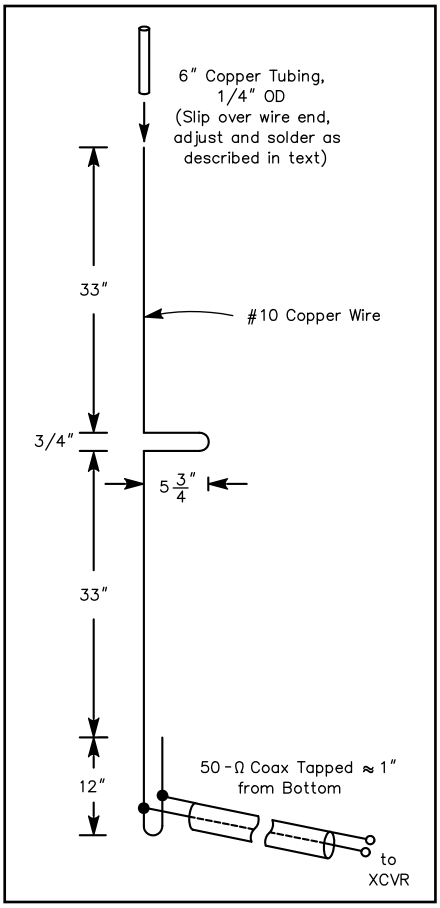

Figure 1—WA4UZM's quick 223-MHz antenna gets you going on 1¹/₄ meters in a hurry. (The text explains how to adjust it for minimum SWR.) To support the antenna, lash it to a piece of PVC pipe with nylon cable ties.

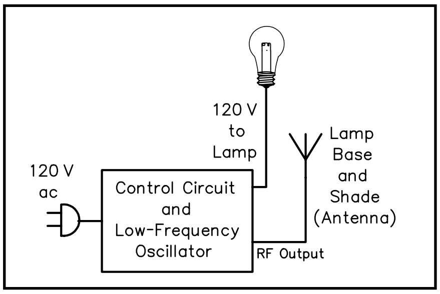

Figure 2—A touch-controlled lamp turns on when you touch the antenna (a special plate, or the lamp base and shade frame) connected to a low-frequency oscillator. If there's no filtering between the oscillator and its antenna, the lamp may respond to strong signals at ham-band frequencies—in addition to emitting oscillator harmonics across a wide chunk of the spectrum.

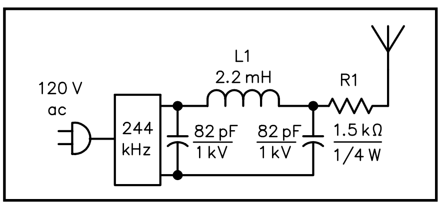

Figure 3—Leo, AC4DA, solved both of these problems in his touch-controlled lamp by putting a low-pass filter between its oscillator and antenna. (See the text for how to adjust the filter's values for your particular lamp.) The capacitors should be rated at 1 kV dc because the negative side of the circuit, which is connected to the negative lead of the oscillator's power-supply filter capacitor, may be connected to one side of the lamp's ac power-line cord. [For added safety, use capacitors rated for 125-V ac, across-the-line service.—*Ed.*] Although attenuator resistor R1 is shown here as 1.5 kΩ, Leo recommends starting with 4.7 kΩ and reducing its value until the lamp switches consistently. Safety note: Make changes in your lamp's wiring only with the lamp *unplugged from the ac line!*