Sidebands be gone, or let there be (no) light

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Back in 1983, I was working at ESL (Electromagnetic Systems Labs) in Sunnyvale, CA, on exotic, high-performance radios. I had done all the calculations and developed a circuit for one of these radios. The prototypes had come in, and I was pleased with much of the design. There was one problem, though: spurious sidebands on the synthesizer output. I feared that I had created some type of sensitive node in the synthesizer and that power-line ac hum was polluting the RF signal.

Fortunately, ESL had a "screen room"—a gaussian chamber enclosed in small-gauge-copper-mesh screening. The size of the mesh prevents any external signals from penetrating into the space. I took the synthesizer prototype and the spectrum analyzer into the chamber. The 120-cycle sidebands were still in the synthesizer output. I thought the problem was the receiver's power supply, so I tried running the synthesizer from a battery. You can't get much more dc than that.

After trying that tack, the sidebands were still there! I was going crazy. However, while repositioning a piece of lab equipment above the bench, I noticed out of the corner of my eye that the sideband level was changing. I waved my arms above the receiver. The sidebands disappeared as my arms passed over the chassis. I wondered whether I had created a theremin. (A theremin is a musical instrument consisting of an array of circuitry, including two antennas around which the user moves his hands; it requires no physical contact to produce music.)

Instead, though, I realized that several glass-encapsulated, variable-capacitance diodes were in the VCO (voltage-controlled oscillator). As a result, it was picking up the 120 Hz in the varying intensity of the fluorescent lights above the bench. I placed a black-velvet cloth that I found in the lab over the prototype: no sidebands. Then I tried turning off the lights: still no sidebands.

What really annoyed me is that I knew clear-glass-encapsulated variable-capacitance diodes would cause sidebands. Even with that knowledge, however, I never suspected that they had in fact caused the sidebands because they were painted black—mostly. What I did not notice is that the ends of the diode bodies, right where the leads went in, were unpainted. Eureka! These clear, unpainted ends were allowing the light in. (Despite this cautionary tale, be aware that, with modern electronic-fluorescent ballasts, you might see effects at other frequencies besides 120 Hz.)

To this day, a mystery still remains unsolved: Where did the black-velvet cloth come from? Such items are not common in an electronics laboratory. EDN

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