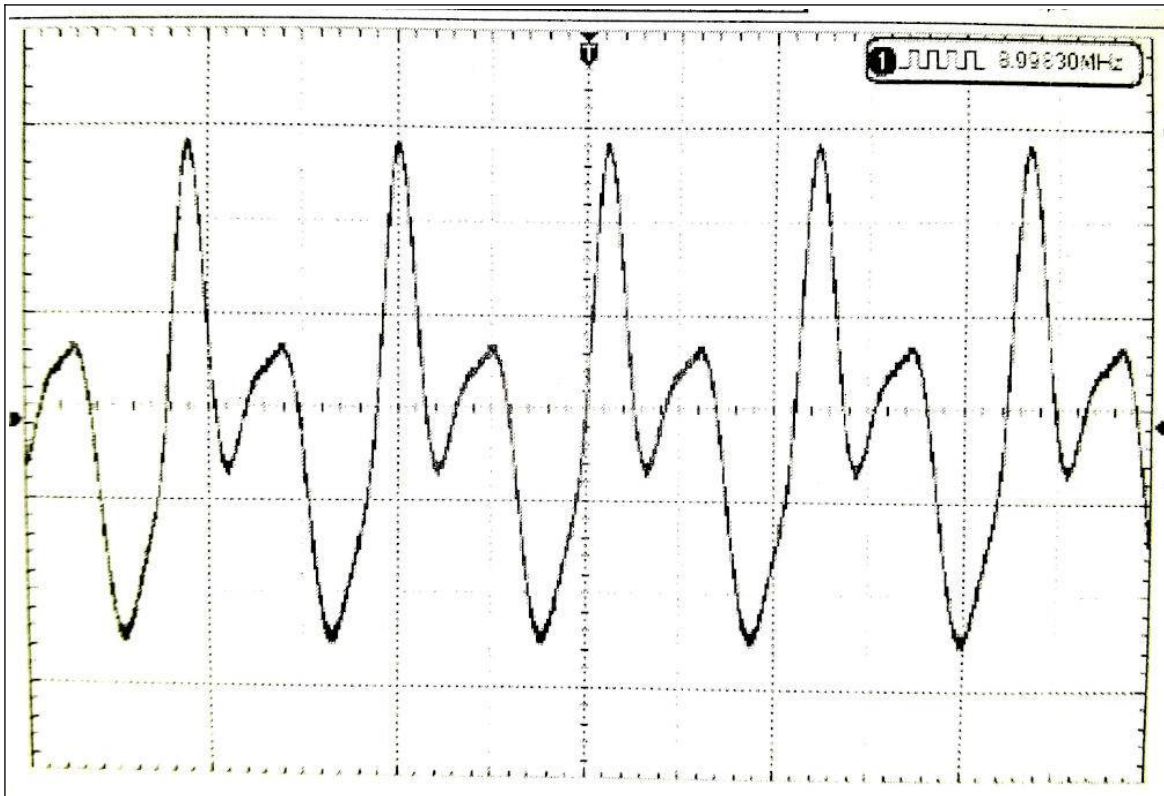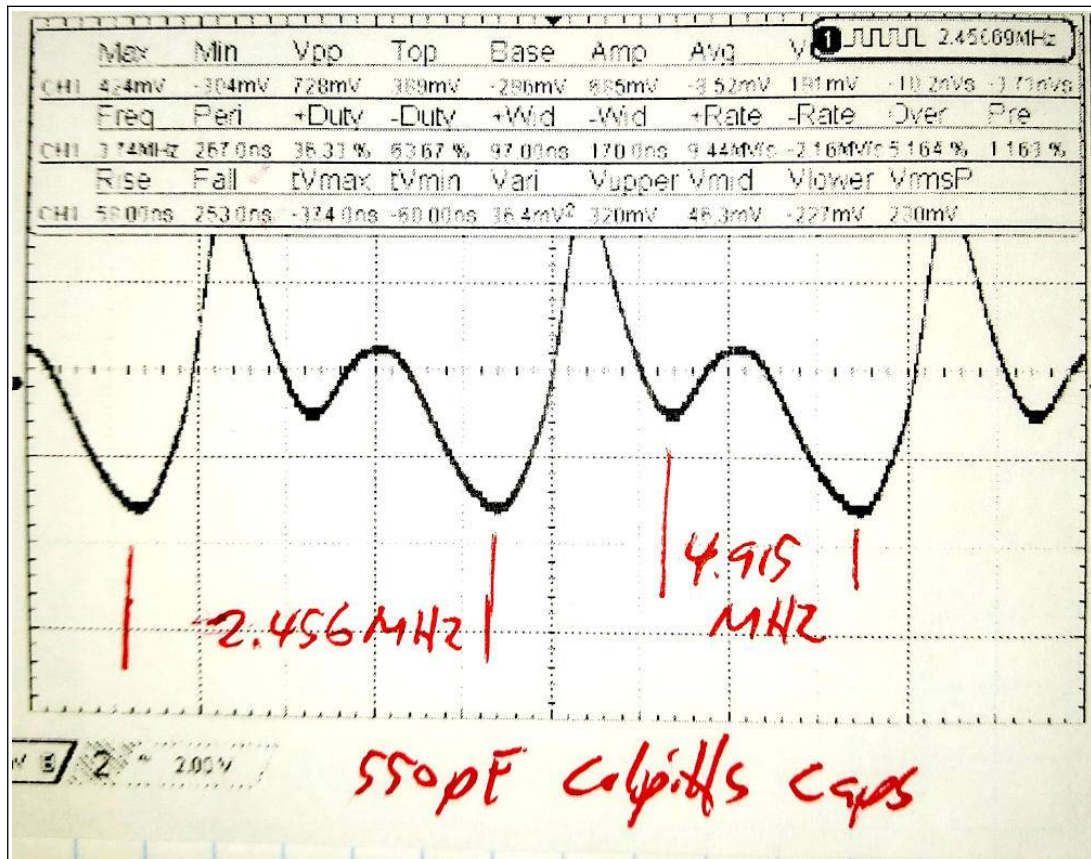# XTO-1 Application Notes

Recent batches of crystals from various manufacturers have shown a tendency in the XTO-1 to be sensitive to the Vcc voltage used to supply the device. With **550pF** "Colpitts" capacitors (C1 and C2) and Vcc at 12V, for instance, a 11.052MHz HC49u (the tall package) will oscillate and produce an output of 1.03Vpp. It will stop oscillating, though, at 4.7Vcc. A 9MHz HC49us (the short package) requires 5.5Vcc but above 8.5Vcc it will break into a complex oscillation:

At 8.5Vcc the XTO-1 output is 528mVpp.

4.915MHz crystals, manufactured either by ECS or CTS, can't tolerate higher than 3.9Vcc without become unstable and exhibit a multi-frequency output of both 4.915MHz and half that (2.456MHz):
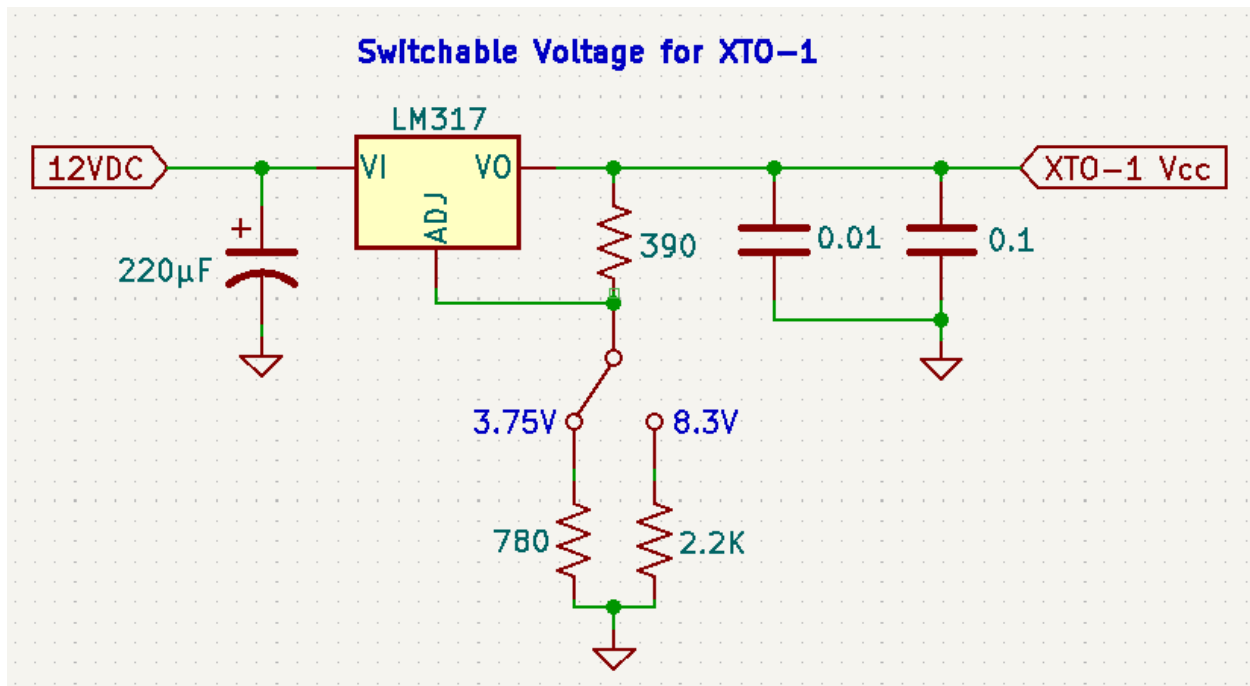
I changed the Colpitts capacitors to **440pF** and there was no change in the results for 4.915MHz crystals except the tolerated Vcc was below 3.9V. The 9MHz and 11.052MHz crystals worked fine. The 11.052MHz crystals could take up to 10.2Vcc before becoming unstable.

After changing the Colpitts caps to **660pF**, the 4.915 crystals were stable and at their fundamental frequency up to 3.9Vcc. Below 3.5V, though, they were unstable. At 3.9Vcc, the XTO-1 outputted 360mVpp. With the 660pF caps, the 9MHz crystals required 7.1Vcc for stability. They became unstable at 13.1Vcc. The 11.059MHz crystals remained stable to at least 16Vcc (not tested above that) but were unstable below 5.5Vcc. At 12Vcc, the XTO-1 produced 616mVpp with 9MHz crystals and 784mVpp with 11.052MHz ones.

The Bottom Line (so far)

1. Use **660pF** for the Colpitts capacitors.

2. Two Vcc settings are needed: 3.8V (for safety margin) and 7.5V.

3. Numbers 1 and 2 have been tested with 4.915MHz, 9MHz, and 11.059MHz crystals. OFMV (other frequencies may vary).

4. The switchable shunt capacitance (used to calculate motional parameters) seems to have no effect on either Vcc or Colpitts-capacitor conditions.

5. Either a bench power supply set to the appropriate voltage, or a dedicated switched regulator (see below) can be used for Vcc.

Switchable Voltage for XTO-1

12VDC — LM317 — XTO-1 Vcc

VI VO ADJ

220μF +

390 0.01 0.1

3.75V 8.3V

780 2.2K

6. XTO-1 output should be adequate for any frequency counter, including the inexpensive Sanjian 6- or 8-digit modules.