K2 Signal Traces

The purpose of this document is two fold. The first is educational, showing what is going on at various points in the K2 to help clarify the operation of the transceiver. With a picture being worth a thousand words this should be helpful to aid in tracing through the block diagram and theory of operation. Second, if needed, this information should be helpful in troubleshooting the K2. An oscilloscope is definitely not a required tool when building the K2, but if available, can be a real aid in troubleshooting. Using a scope and the following information should help in hunting down a problem.

If anyone has suggestions on improvements don't hesitate to drop me an email.

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The following waveforms were taken on my K2 (s/n 02395) with an Agilent (HP) 54624A 100 MHz oscilloscope. Note the volt and time division scales on the scope traces, and when included the measurement information.

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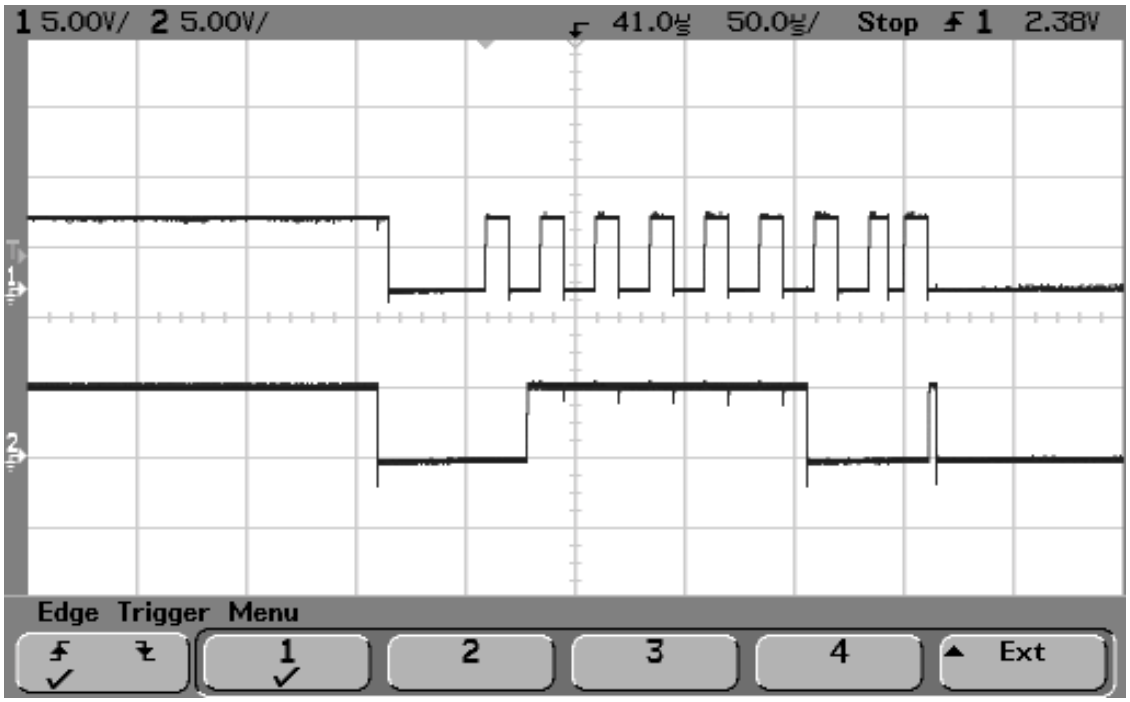

Figure 1 - ICLK & IDAT

Trace 1 – ICLK, I^2C clock pulses
Trace 2 – IDAT, I^2C LCD display driver data

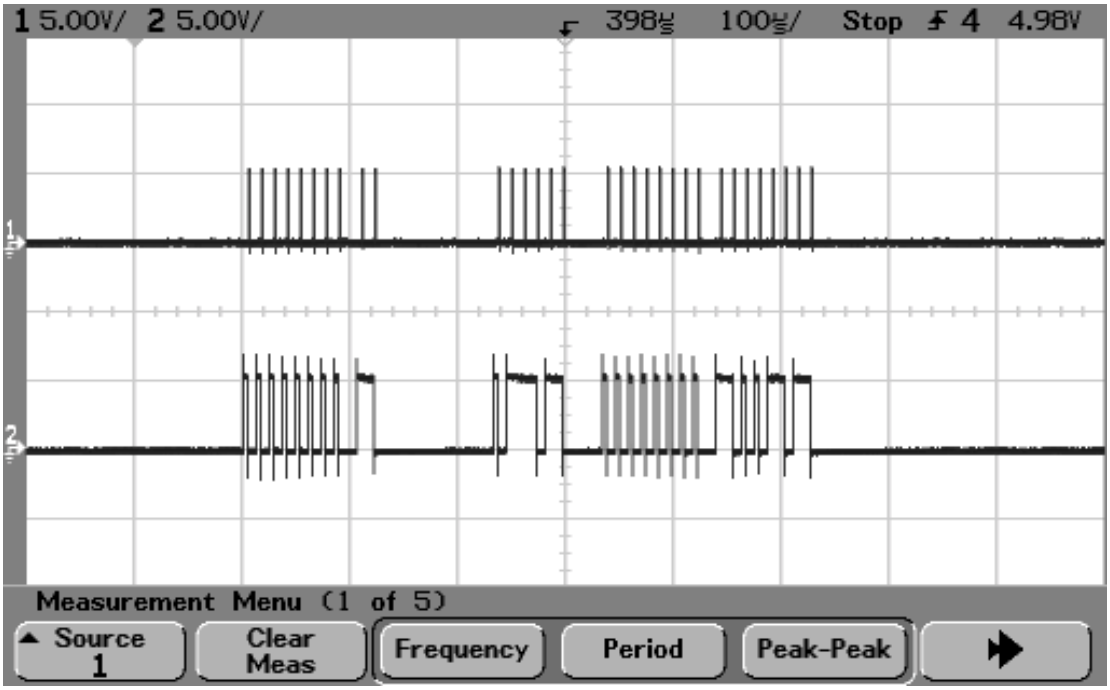

Figure 2 - SR CLK & SR DOUT

Trace 1 - SR CLK, shift register clock
Trace 2 - SR DOUT, shift register data out

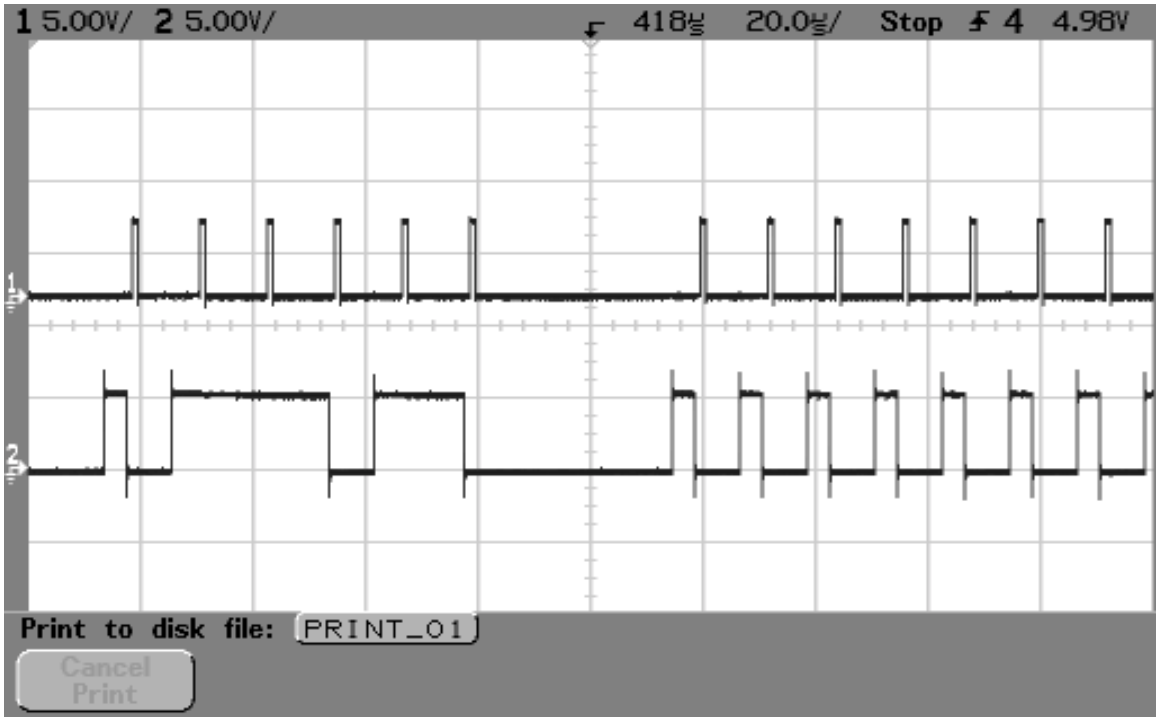

Figure 3 - SR CLK & SR DOUT Expanded

Trace 1 - SR CLK, shift register clock
Trace 2 - SR DOUT, shift register data out

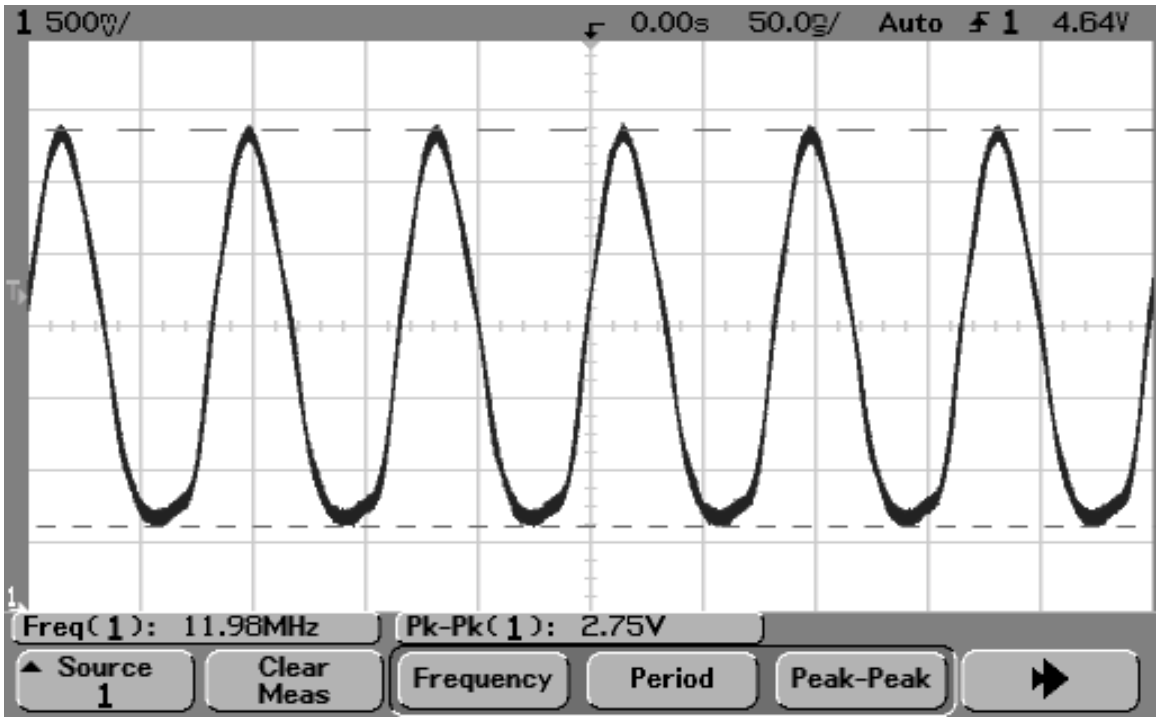

Figure 4 - TP1 RX VFO

VFO setting 7100.00 MHz

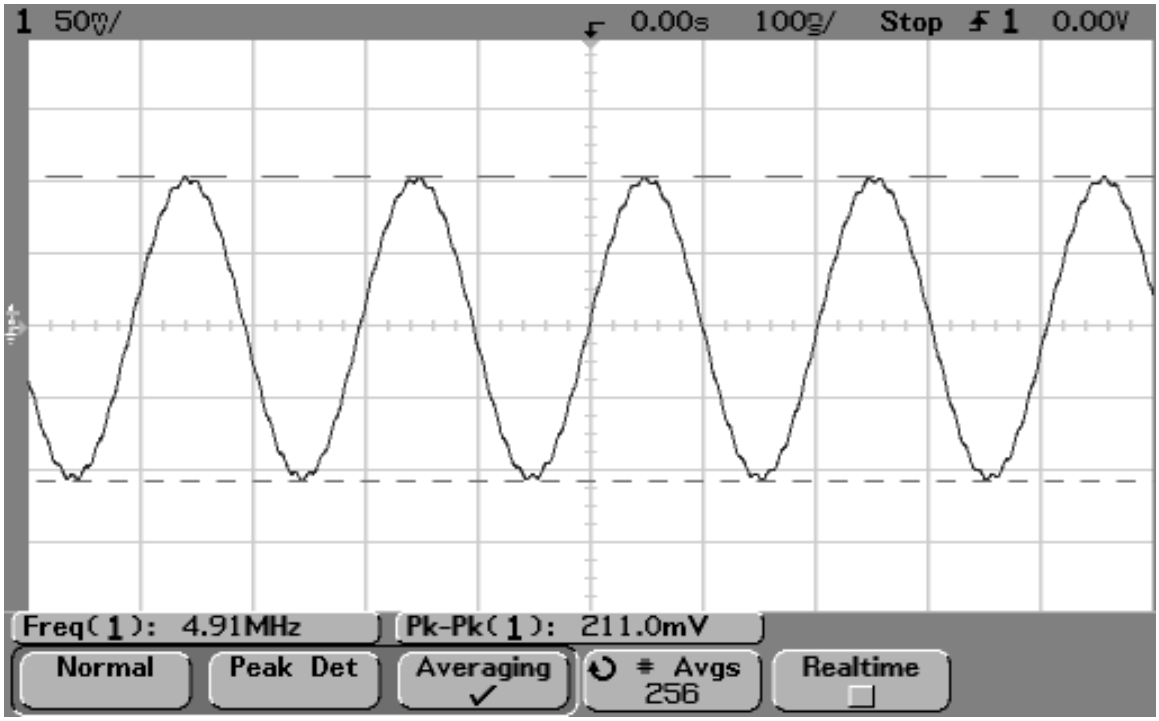

Figure 5 - TP2 BFO

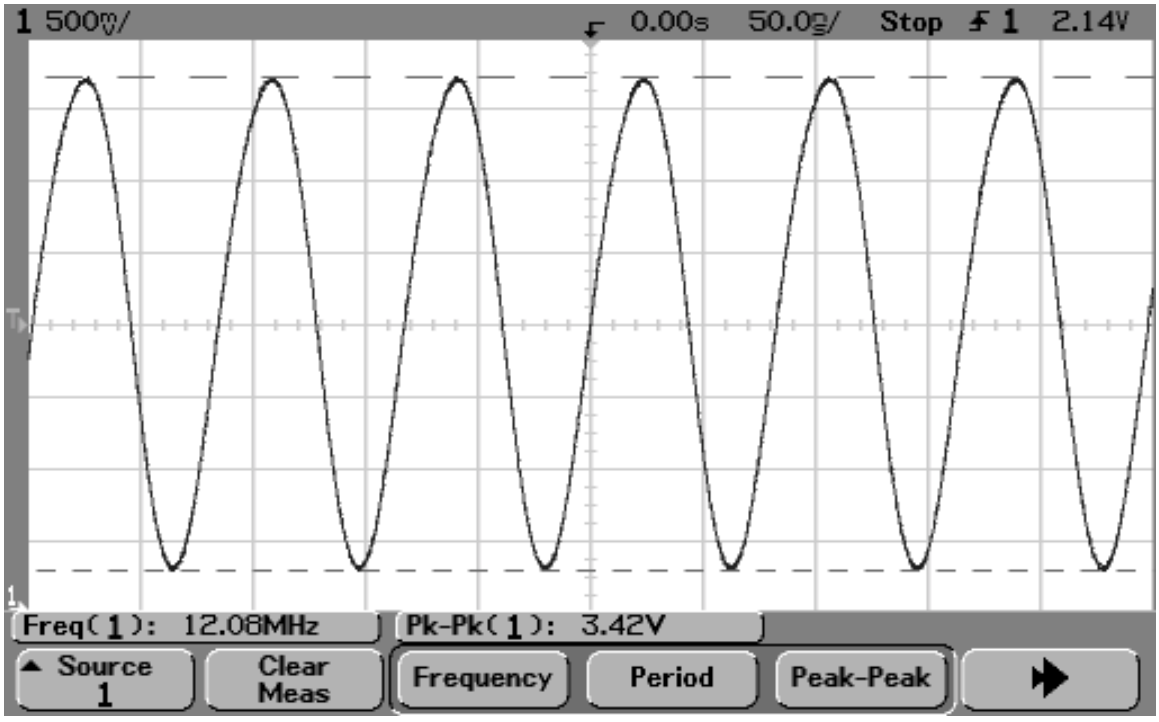

Figure 6 - TP3 PLL Reference Oscillator

VFO setting 7100.00 MHz

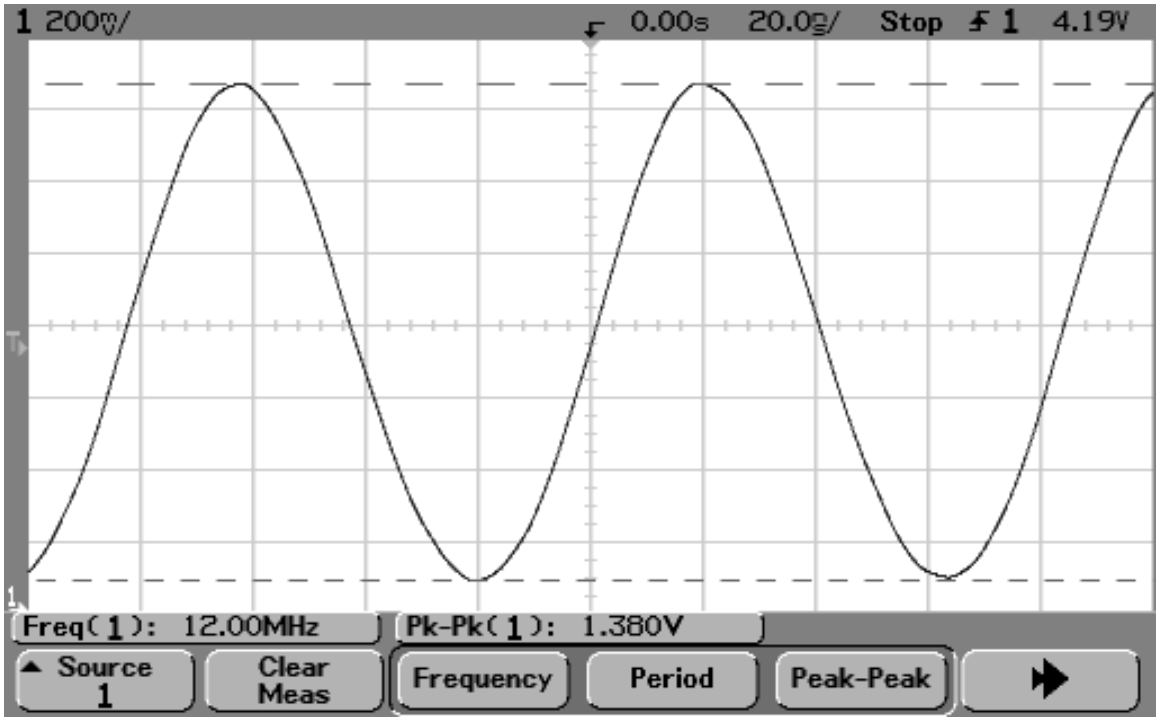

Figure 7 - TX VFO

This signal is input to U3, which buffers the RX VFO. VFO setting was 7100.00 MHz.

NOTE: the following waveforms were taken with the K2 locked on 7100.00 c.

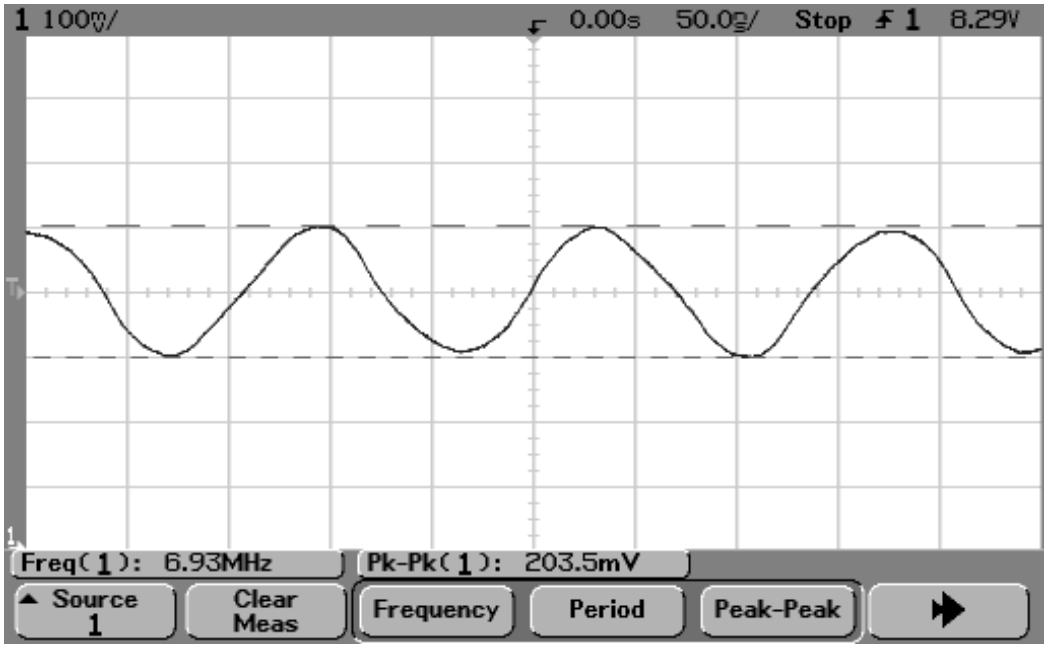

Figure 8 - Anode of Diode D7 (non-banded end)

TX output power of 12.1 watts, DC voltage 8.31 volts

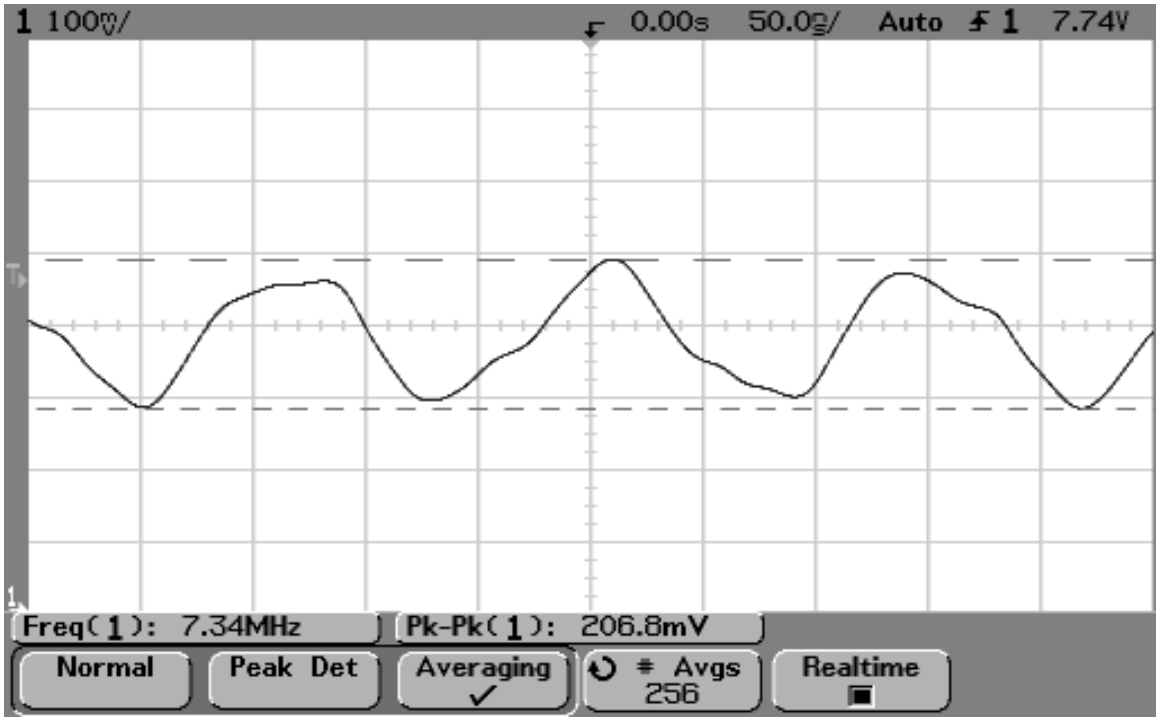

Figure 9 – Cathode of Diode D7 (banded end)

TX output power of 12.1 watts, DC voltage 7.69 volts

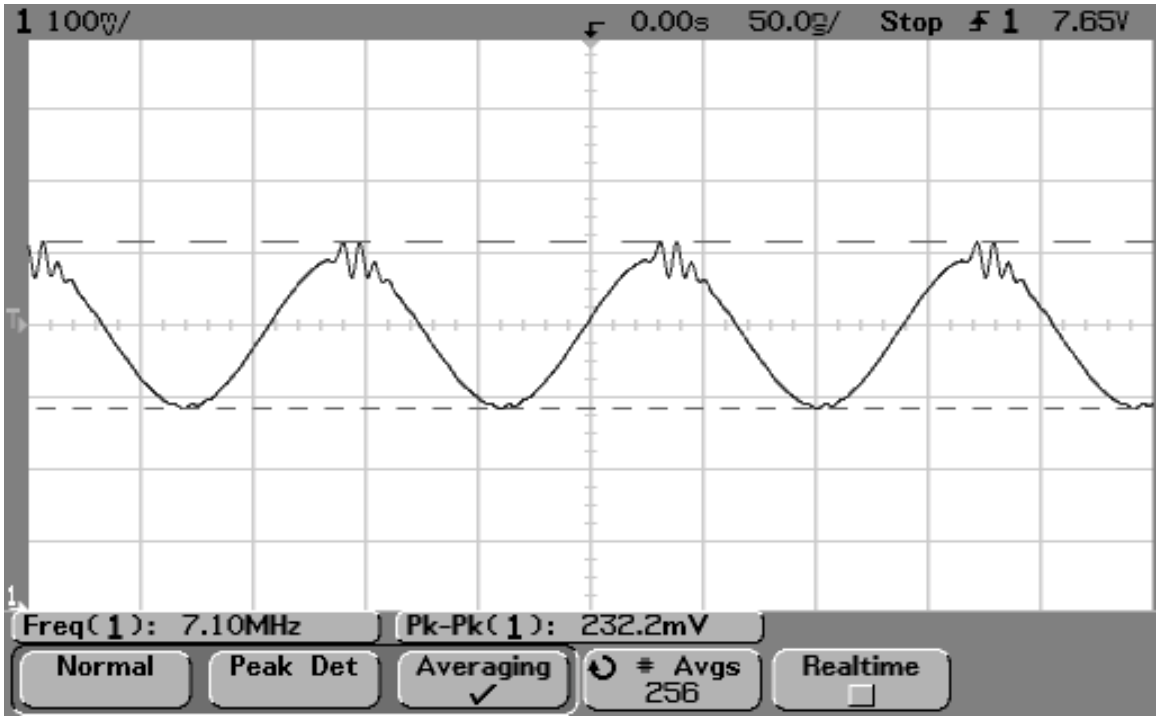

Figure 10 - Jumper W6

TX output power of 10.4 watts

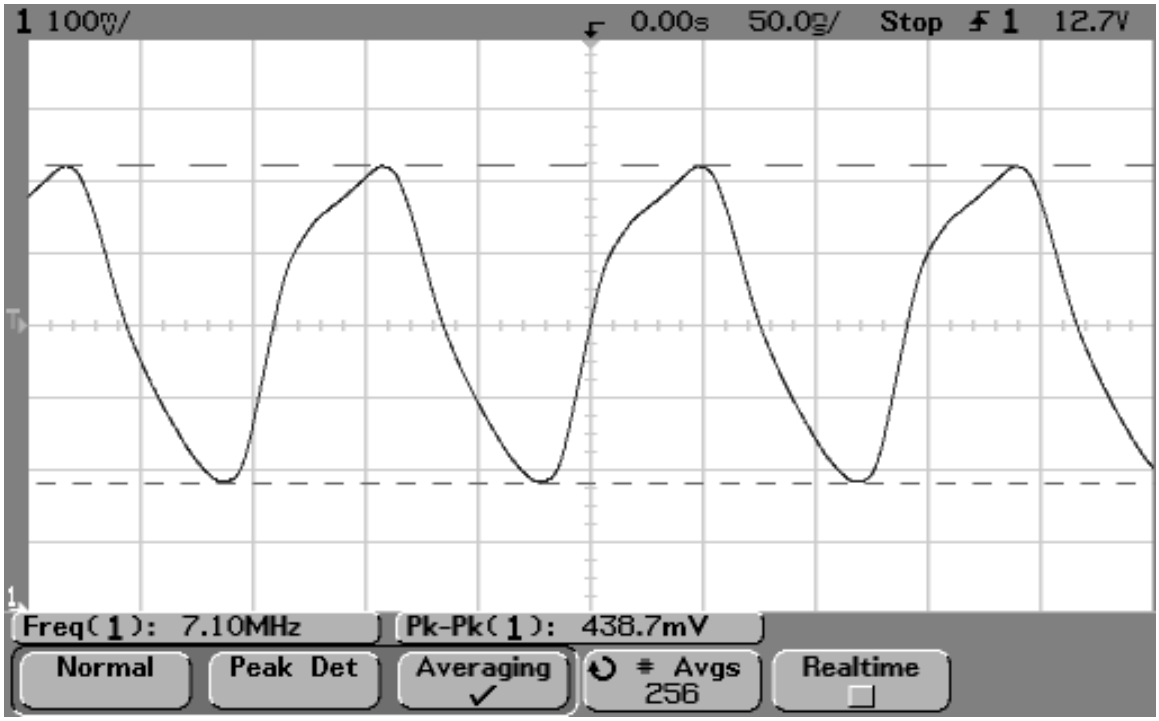

Figure 11 - Collector of Q5

Collector of Q5, TX output power of 5.2 watts, DC voltage 12.64 volts. At TX output power of 14.6 watts, DC voltage was 11.77 volts.

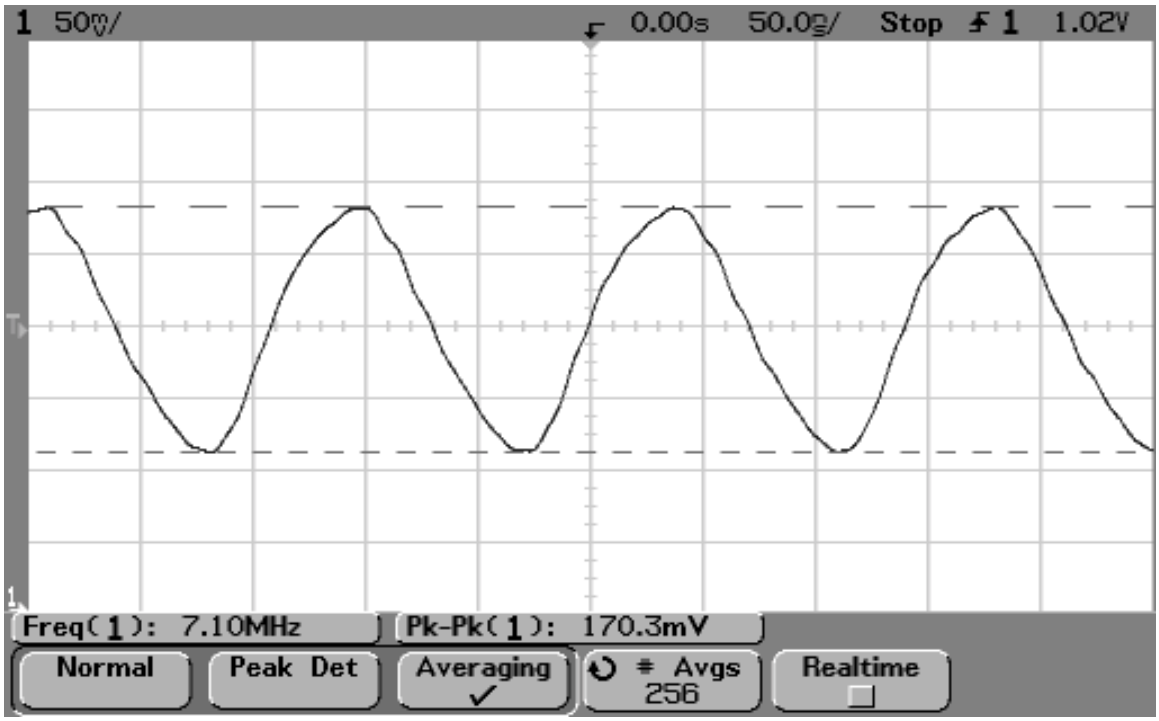

Figure 12 – Base of Q6

Base of Q6, TX output power of 5.2 watts, DC voltage 1.02 volts

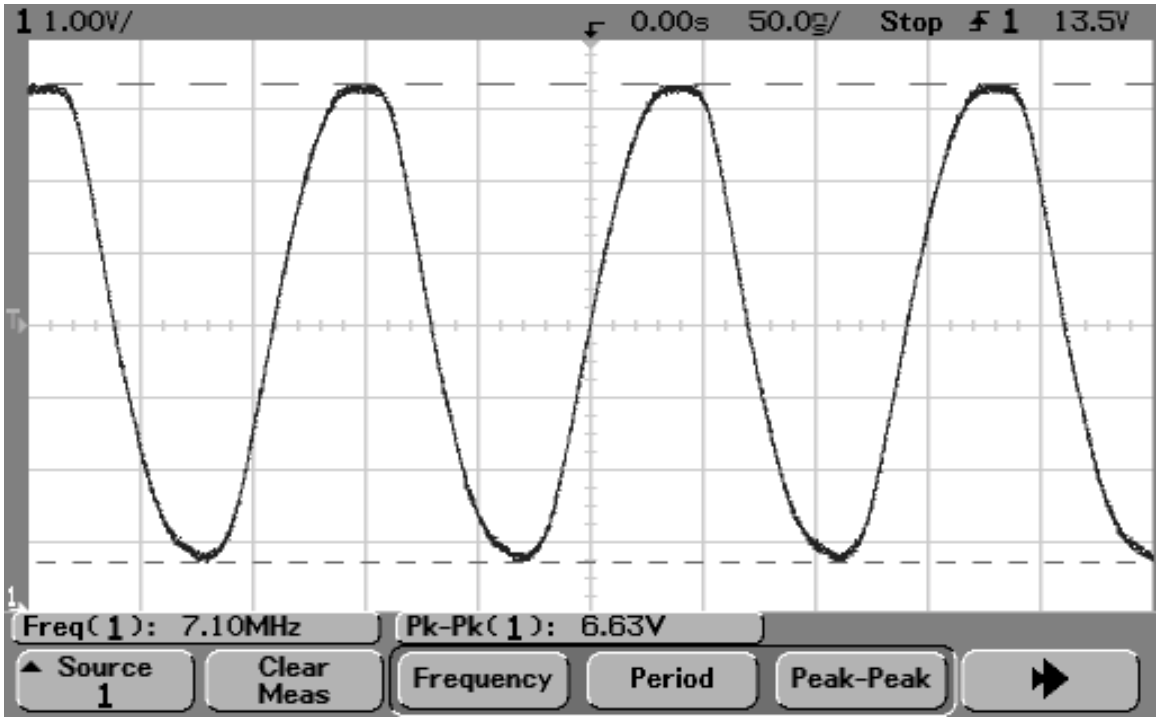

Figure 13 - Collector of Q6

Collector of Q6, TX output power of 5.6 watts, DC voltage of 13.6 volts

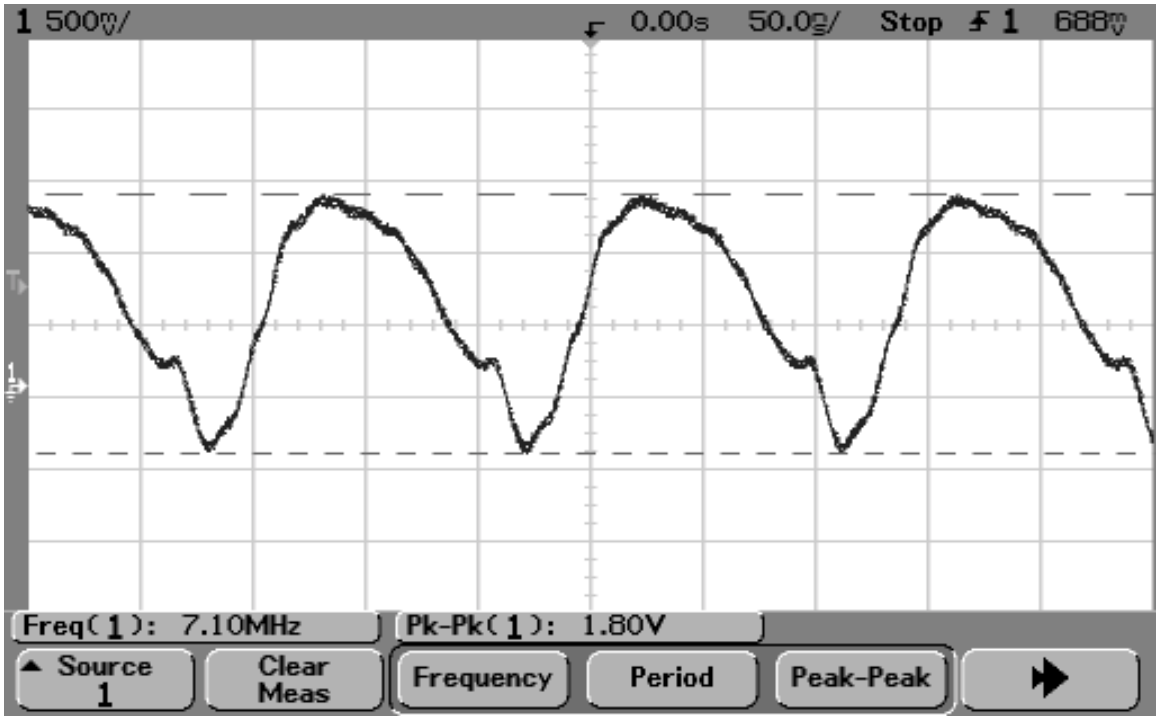

Figure 14 - Base of Q7/Q8

Base of Q7/Q8, TX output power of 5.3 watts, DC voltage 0.602 volts.

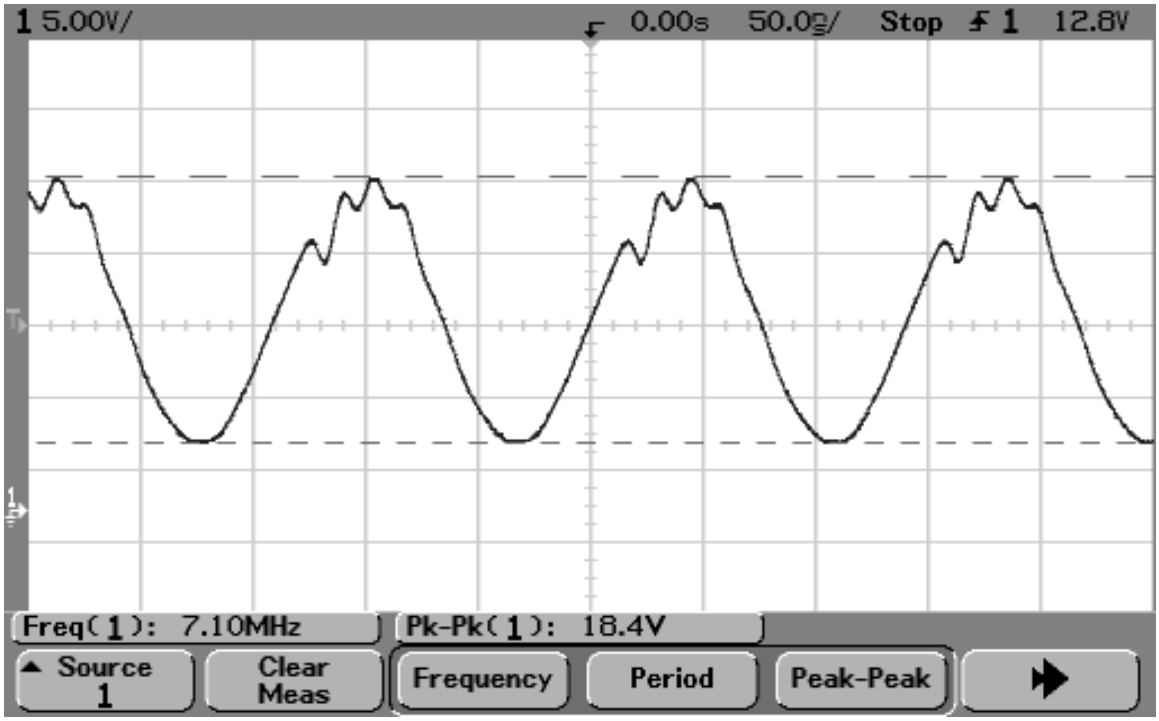

Figure 15 - Collector of Q7/Q8 at 5.3 watts

Collector of Q7/Q8, TX output power of 5.3 watts, DC voltage 13.58 volts

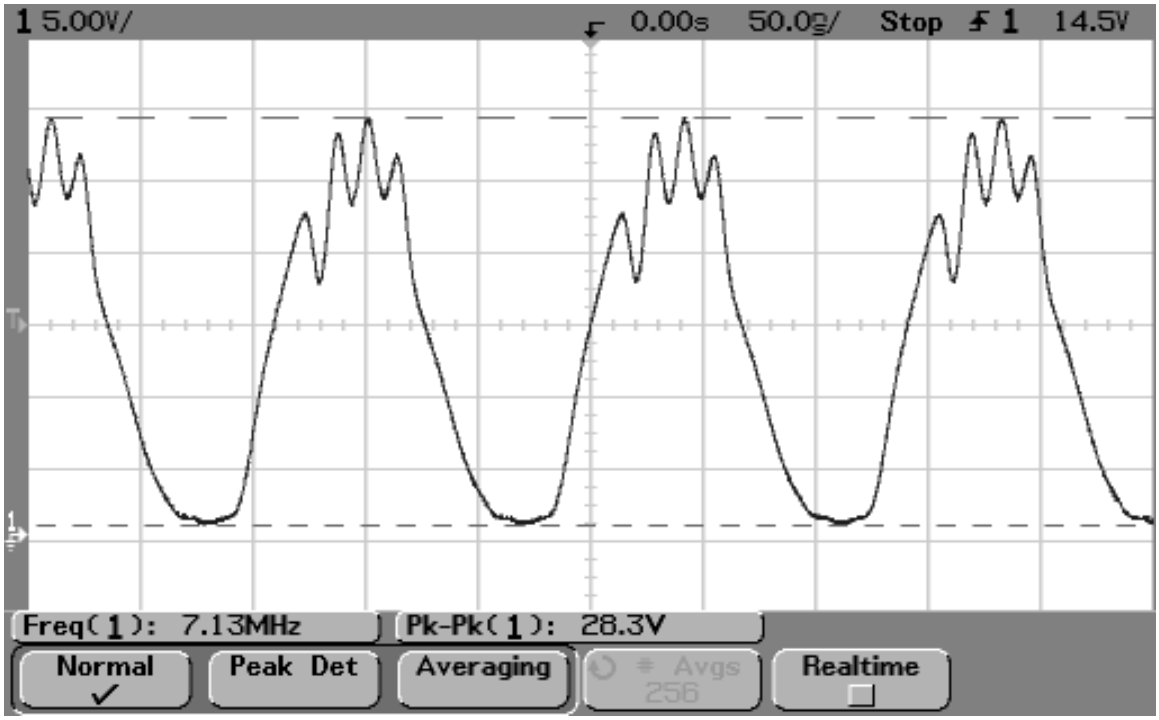

Figure 16 - Collector of Q7/Q8 at 14.2 watts

Collector of Q7/Q8, TX output power of 14.2 watts, DC voltage 13.14 volts

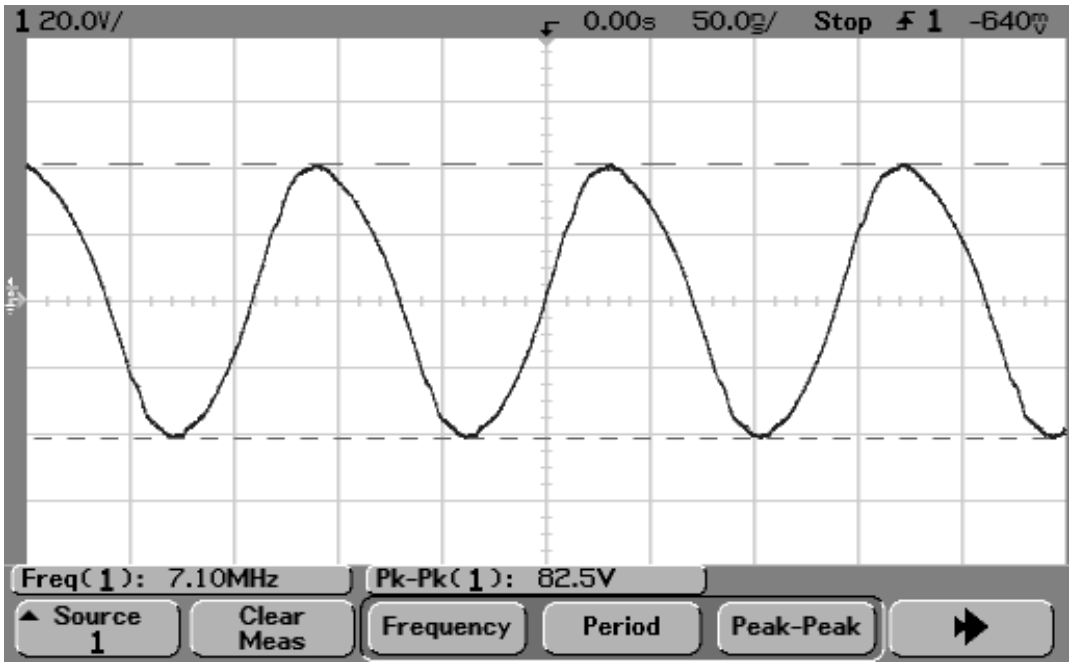

Figure 17 - Jumper W1

Jumper W1, TX output power of 14.2 watts

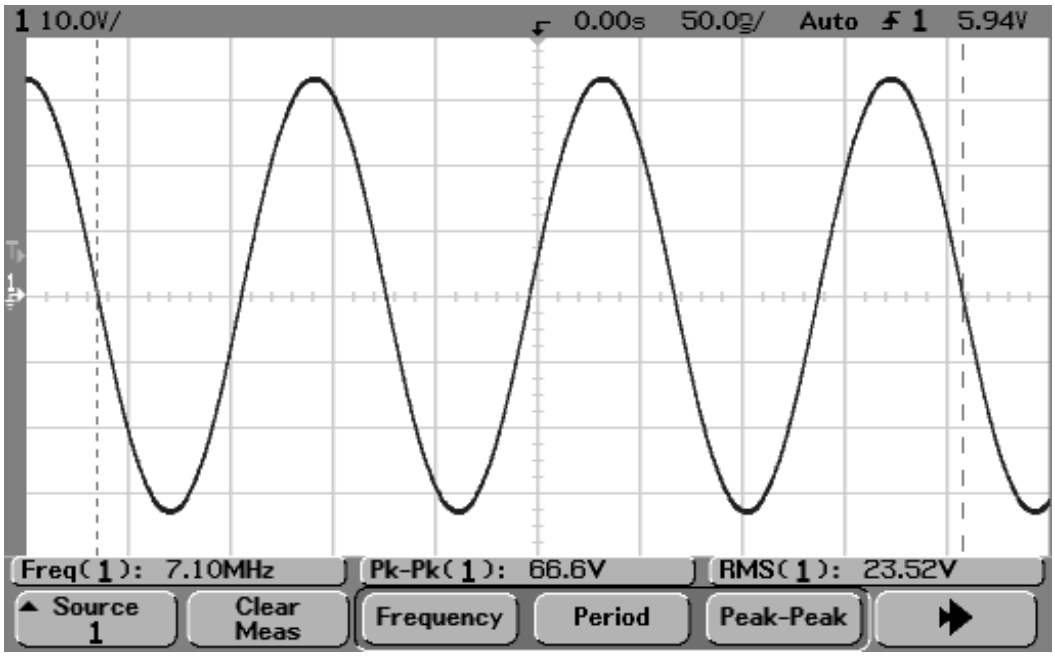

Figure 18 - Antenna Jack at 10.2 watts

This trace shows the signal on the BNC antenna connector. VFO setting 7100.00 MHz. K2 displayed showed 10.2 watts output power. Computed power is 10.8 watts.

Using the V_{pk-pk} formula $(V_{pk-pk}/2)*0.707)^2 / R_{load}$

$((66.6/2)*0.707)^2/51.3 = 10.8$ watts

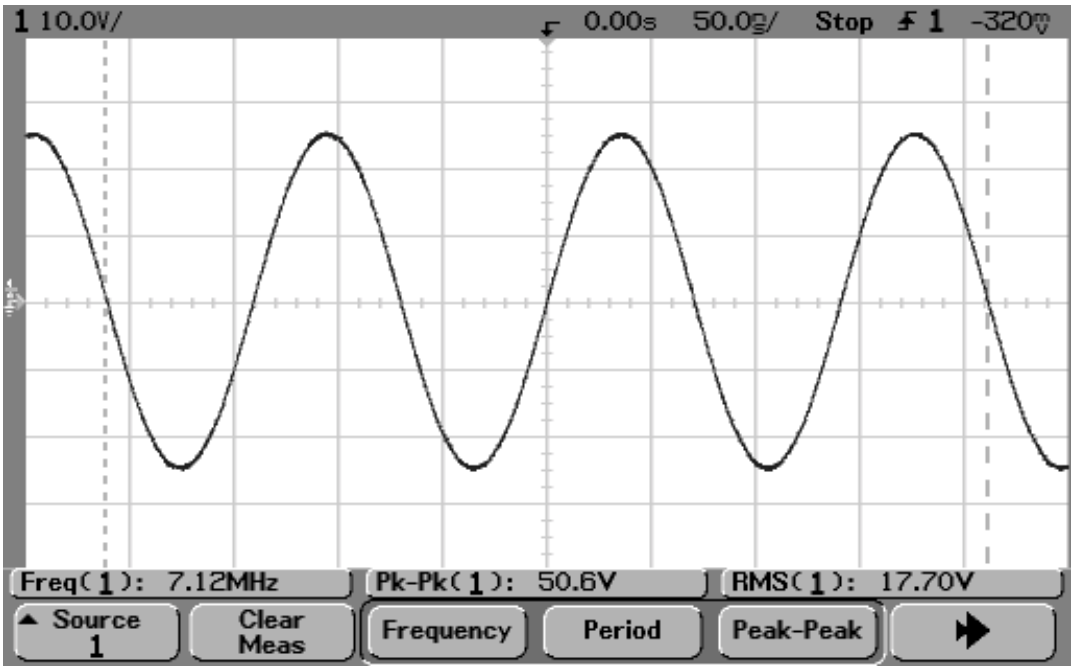

Figure 19 - Antenna Jack at 5.4 watts

This trace shows the signal on the BNC antenna connector. VFO setting 7100.00 MHz. K2 displayed showed 5.4 watts output power. Computed power is 6.1 watts. Computed power is $(V_{RMS})^2$ divided by R_{load}.

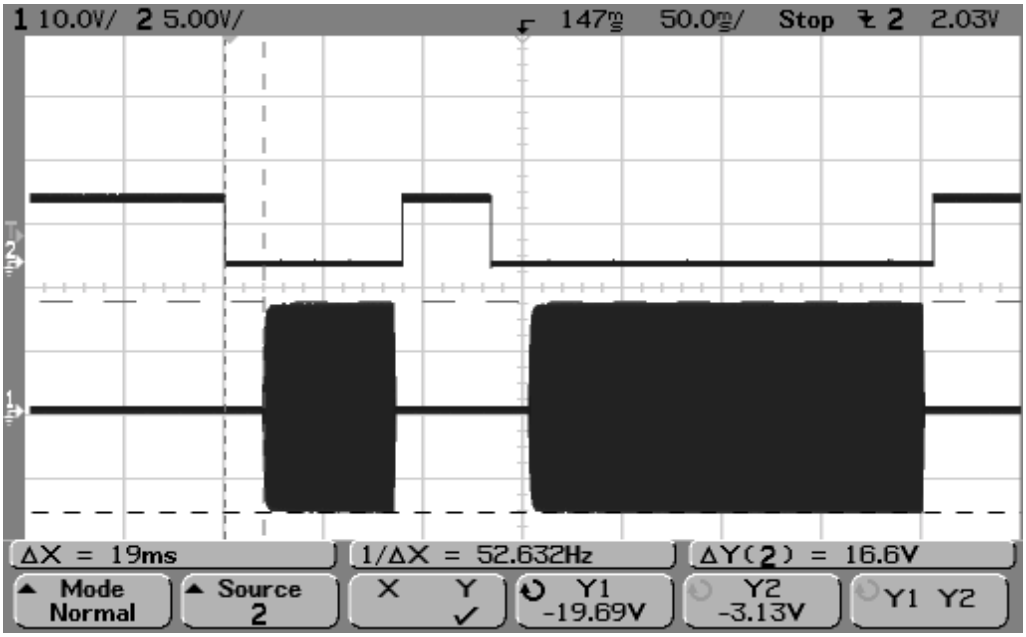

Figure 20 - Keyer input vs. Antenna Jack

/DASH input (pin 28) to the U6 MCU (top) vs. Antenna output at the BNC connector. DeltaX shows the delay from key input to the TX output