tx80m testing.

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Contents

Conventions: For orienting the board, the back will be considered North (N), the right East (E), and the rest as expected (S, W). Some abbreviations: PS, power supply.

1 Pre-build testing.

After the toroids are would, pictures are taken to check the number of windings (**Fig 1**). They are then moved from a bag marked "to check with computer" to one reserved for those that have been checked.

Figure 1: When a toroid is wound, take a picture, bring it up in Gimp, and overlay lines every 5 wires. The papers are placed in the bags with the toroids. I should mark the purple ones "ready" since they had already been checked.

2 SM-100: Voltage regulator submodule.

Nothing here yet.

3 SM-200: User input (switches) submodule.

The switches module tests have three parts. The first one is of the jumper pins, has the board powered, and measures voltage. The other two tests are done without power applied to the board and resistances are measured.

3.1 Header tests (i_sp, n_sp, and freq pins).

The headers are tested by first applying about 19 V to the barrel jack at the E side of the board ("Power input" in **Fig. 2**). Connect the PS to the barrel jack and connect the (-) lead of the voltmeter to the board ground ("probe pos for GND" in the figure). Turn the power switch on watching the amps at the PS. The green LED should come on; amps should be under 10 mA.

Testing i_sp header: Start with the jumper across pins marked "0". Place the voltmeter (+) probe on the S pin of the two pins marked "5". Then measure the voltage on that pin with the jumper placed at each position. The voltages should read as follows: pos-1 1 V, pos-2 2 V, ..., pos-5 5 V.

Repeat this procedure for the n_sp and freq headers. In each case, place the voltmeter (+) probe on the S pin of the two pins furthest to the right (the ones marked "5").
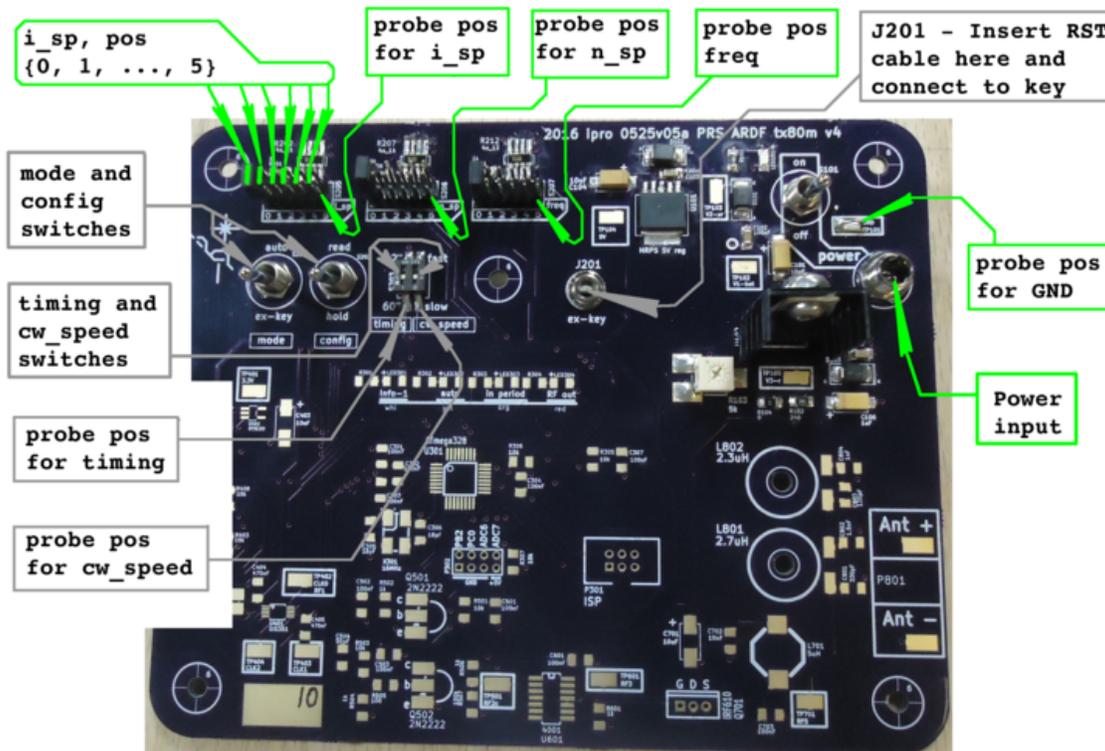

Figure 2: Header tests. The test is done under power. There are three headers (i_sp, n_sp, freq), each one with 8 pairs of pins. Each pair is labeled with a position number going left to right: 0, 1, 2, ... 5. Each pair has a N (North) and S (South) pin. For each header, the voltage is measured on the S pin of the two pins furthest to the right. The voltage measured should match the jumper position. I.e. at position 0, 0 V; at pos-1, 1 V; etc.

3.2 Timing and cw_speed switches.

The timing and cw_speed switches are not done under power. The resistance from ground to the S pin of each switch is measured with the switch on and off (see **Fig 3**). The resistance should be high when off and low when on.
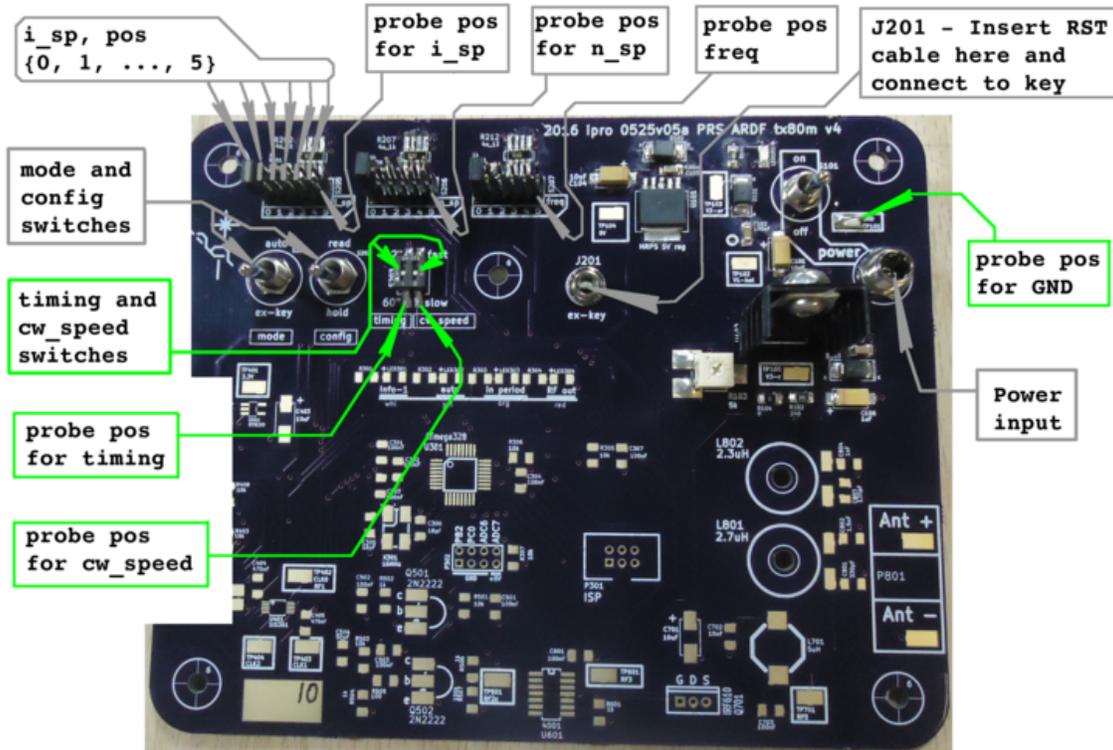
Figure 3: Test of timing and cw_speed switches. The ommeter (-) lead is attached to GND with an alligator clip. The ommeter (+) probe is touched to the S pin of each switch. The measurement should read high resistance when the switch is off and low when it is on. Pushing the switch Northward will put it in the "on" position.

3.3 Mode and config switches, and ex-key jack.

These tests are not done under power. The (-) probe of the ohmmeter is placed on the ground test-point on the front (top) of the PCB (see **Fig. 4**). A small cable is plugged into the J201 (ex-key) jack and into a key at the other end. On the back (bottom) of the PCB, the (+) probe of the ohmmeter is placed on the S pin wire of the switch being tested (see **Fig. 5**). In each case, the resistance should be high with the switch off and low with it on. For the ex-key, closing the key should bring the resistance low.
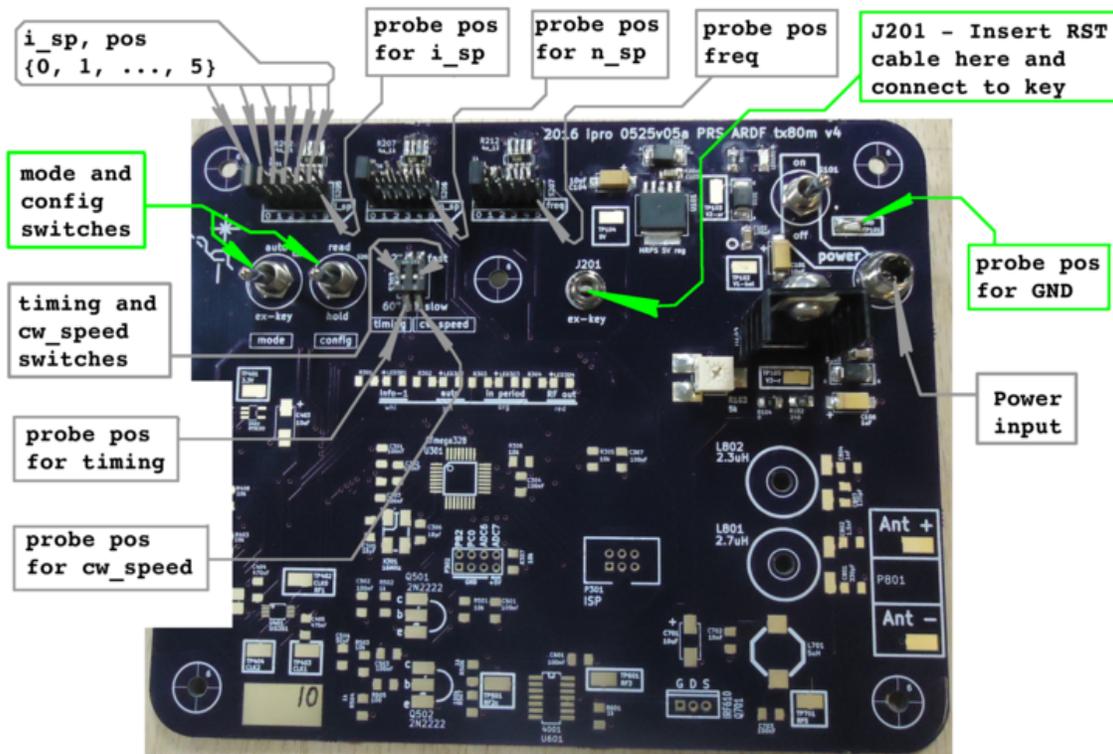
Figure 4: Mode and config switches, and ex-key jack – PCB Top. The (-) probe of the ohmmeter is placed on the ground test-point. Also, a cable with an TRS (Tip-Ring-Sleeve) connector is plugged into J201 (ex-key) and also into a key.
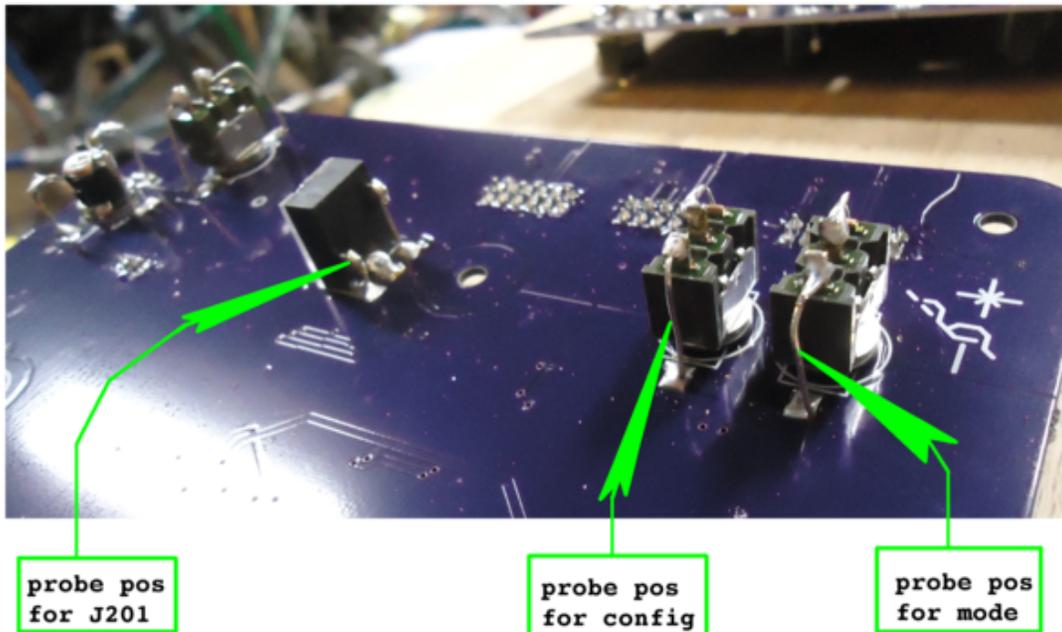

Figure 5: Mode and config switches, and ex-key jack – PCB Bottom. The (+) probe of the ohmmeter is placed on the S pin wire of the switch being tested (see **Fig. 5**). The S-most pin and wire for the ex-key jack are connected to the TRS tip. Closing the key at the other end of the cable should connect T (tip) to S (sleeve).

4   SM-300. Controller.

Partially finished controller SM shows how I mark layout as I solder components (**Fig. 6**).
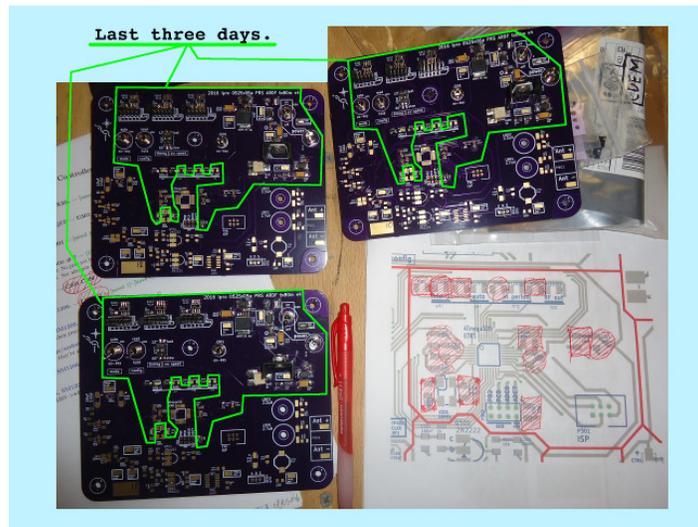

Figure 6: Partially completed controller SM. The green outline shows the area of the board already soldered. The paper shows the layout of the controller SM with my "stripping out" of components that I have already soldered on.

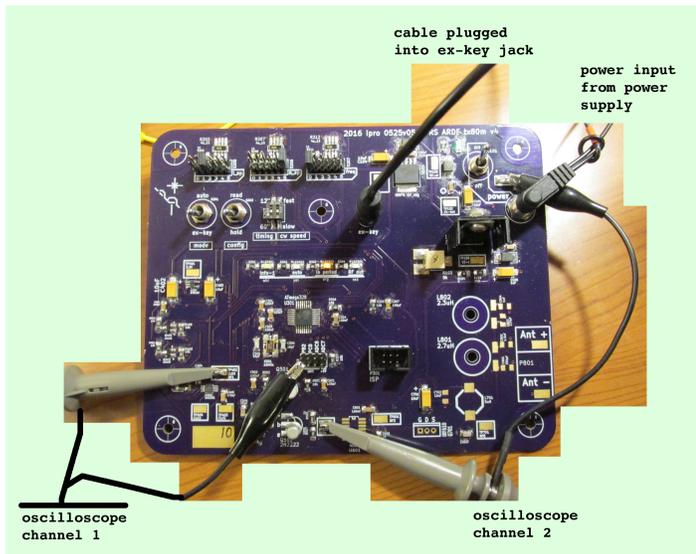# 5 SM-400. Oscillator.

Nothing here yet.

Figure 7: SM-500 (pre-driver) test setup. I have the ch2 ground on the TP next to the power switch and the ch1 ground on one of the ground pins of controller's unused pins header. In the future, we'll put a temporary loop on the ANT-(-) pad to use as a ground when testing stuff on the south side of the board.

6   SM-500. Pre-driver.

The tx80m-v4 SM-500 was completed and tested on 2016-11-20. Transmitter n10 used 2N2222, thile n11 and n12 used MMBT2222. All the "multi" components for the RF power chain (except filter SM) were already soldered on.

The pre-driver SM has two independent circuits to test. The c1 circuit outputs a constant high or low voltage and is directly controlled by the controller SM. The c2 circuit outputs RF whenever the oscillator SM is on. We test c2 first. There is no TP for c1 output but the collector pad on Q501 serves that purpose.

The following procedure was first written up looking at notes from the tests done on 2016-11-20.

- Set PS to 16 V.

- Plug cable into ex-key jack.

- Hook up oscilloscope ch1 to TP402 (Si5351 CLK0, RF1). Set it as the trigger.

- Hook up ch2 to TP501 (RF2c).

- Set both channels to DC, 5 V/div. Set time to 200 ns/div. See **Fig 7**.

- Turn on power switch. The PS I_{out} should read about 0.04 A.

- **Testing c2...**

- Expect RF on both channels at 3.5 MHz. Approximately, V_{pp}: ch1 3.28 V, ch2 7.5 V. See **Fig 8**.

- Turn the mode to "auto" and wait for the transmitter to be out of period. RF should disappear from both channels. See **Fig 9**.

- **Testing c1...**

- Turn mode back to "ex-key".

- Put multimeter probe on Q501 collector. It should read about 8 V.

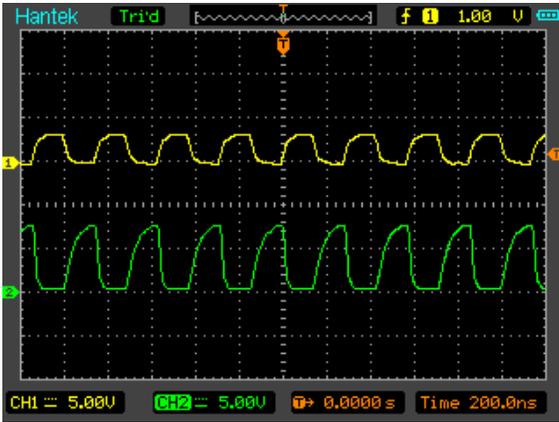- Short the ex-key cable tip to sleeve. The Q501 collector should now read 0 V.

Figure 8: SM-500 (pre-driver). Output at TP402 (Si5351 CLK0, RF1) and TP501 (RF2c) with the mode switch set to "ex-key". The pre-driver output is out of phase with the oscillator and about twice the voltage. Yellow trace (ch1) TP402, green (ch2) trace TP501.
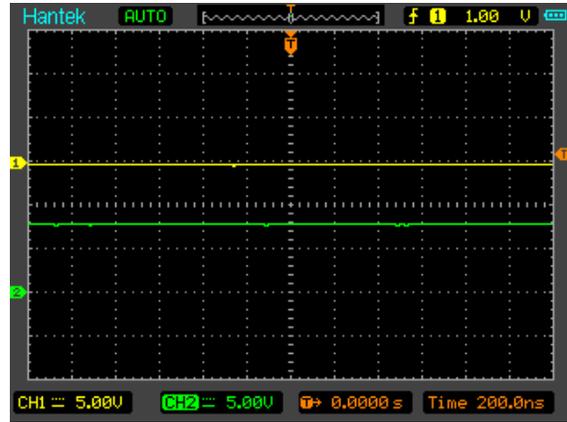

Figure 9: SM-500 (pre-driver). Output at TP402 (Si5351 CLK0, RF1) and TP501 (RF2c) with the mode switch set to "auto" and the transmitter "out of period". Yellow trace TP402, green trace TP501.