Midland Titan 110 Watt Low Band 42-50 Mhz "C" Range Conversion to 6 Meters

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Note from Author

Let me begin by saying I don't have time to help you convert your radio unless you are willing to compensate me. I do welcome comments on your successes, observations, and suggestions and with your permission will add them to updated versions of this document.

The conversion software to convert a Midland Titan .dmp file to 6 meters is available in the MidlandLMR Yahoo Group files section. I encourage you to join this group, as it is presently the only place where the conversion software is distributed from. They have a lot of information in the message archives and a well stocked files section. I am not the author of the conversion software nor do I provide support for it. There are also people that are willing to help in the MidlandLMR Yahoo Group if you ask.

All of the radios I have converted were surplus from Ohio DOT and on 47 mhz. ODOT modified each radio for "ignition control" by lifting one leg of a small internal fuse from the 13.8 volt supply line on the RF board and connecting this wire to Pin 9 of the accessory connector. The ODOT surplus radios will not power up and stay on unless you connect 13.8 volts to that accessory connector pin or restore the connection of the fuse to the circuit board.

Each radio is unique in the way it tunes up, receiver sensitivity, and power output. Your results will vary. This is a general guide and you are welcome to experiment with the procedure and develop your own. Tuning the RX front end is a tedious process requiring patience, appropriate test equipment, and the expertise to use it. Just screwing in slugs or screws will be nothing more than a hack job that will improve the RX performance <u>BUT NOT OPTIMIZE IT!</u>

Radio Models That Can Be Converted

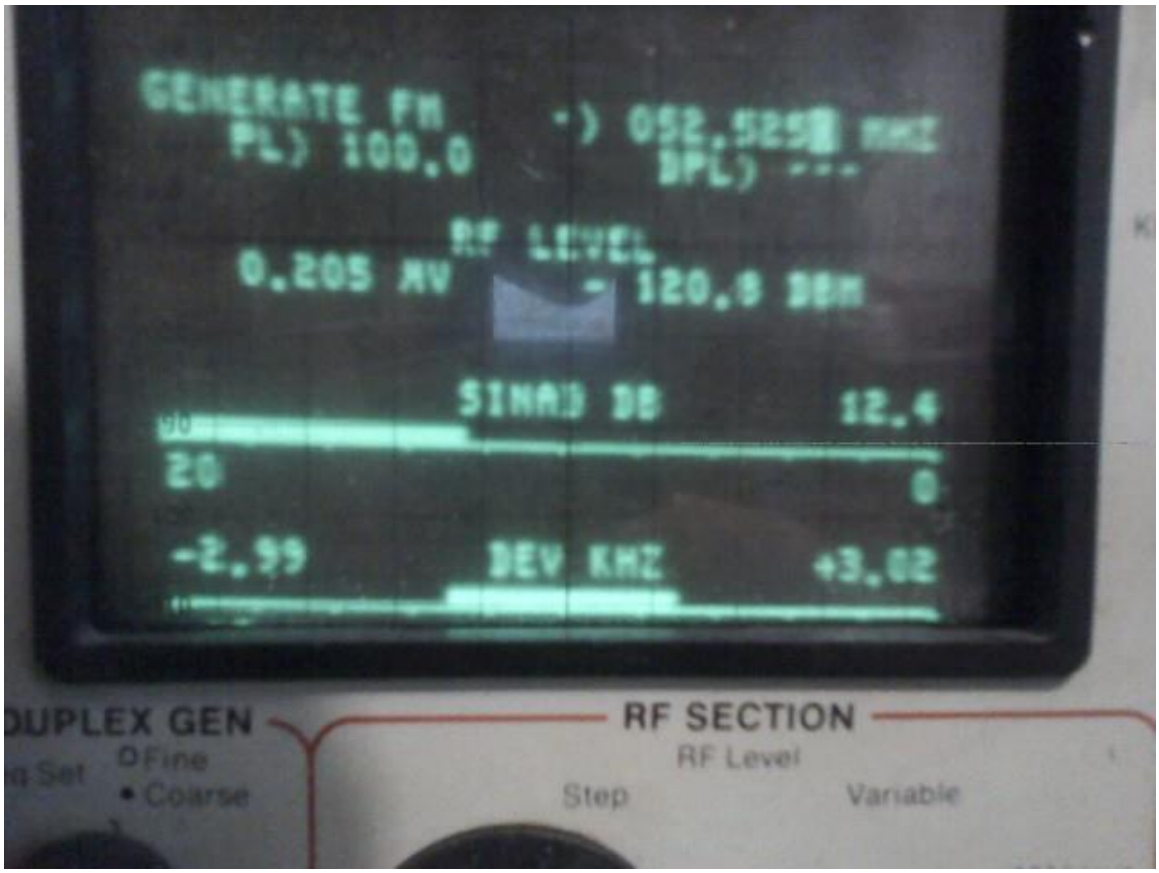
This document covers Midland and Securicor models 70-0551C, 70-054C, 70-0571C, 70-0574C, 70-0671C, and 70-0674C radios. All of these are 110 watt radios that utilize the same RF and PA boards. The model numbers designate if the radio is trunk or dash mount and if the standard or deluxe control panel is used. Note that all model numbers end in "C". "C" designates the radio frequency range of 42-50 mhz. The information in this document applies only to "C" models. Low power (40-60 watt) versions of this radio utilize the same RF board but the transmitter PA is on the RF board and not a separate board. The VCO tuning and RX front end tuning would remain the same. The TX modifications would be slightly different and since I have no radios to experiment with, this may be a future project.

Test Equipment Requirements

This conversion requires quality, stable test equipment to get maximum sensitivity out of the receiver. I assume you have access to the proper test equipment such as a service monitor and familiar with how to use it. An analog SINAD meter may not see some of the peaks when tuning the front end coils as some are only a few tenths of a volt. I used a Motorola R2001 service monitor that utilized a SINAD meter on the scope. It reads out in tenths of volts. Attempts to use a SineAdder III were not as successful in gaining full sensitivity.

Sensitivity at 53.990 on a Randomly Selected Retuned Receiver – Results Will Vary

Before conversion the typical sensitivity on 47 mhz was about .175 uv for 12 db SINAD. After conversion sensitivity is better than .25uv for 12 db SINAD at 53.21 with slight degradation at 53.99. Sensitivity at 52.525 is usually slightly better than 53.210. Power output is anywhere from 100 to 110 watts and may be turned down in the test menu in the software.



Sensitivity at 52.525 On The Same Reciever – Results Will Vary

My regional 6 meter band plan is governed by SERA and all repeaters use a 1 mhz split (low in, high out). I have optimized my conversion for 52-53 mhz on transmit and 52.525 to 53.99 for receive. If your band plan is different you may need to change the frequencies to optimize the tuning procedure for your band plan.

Materials Required

You will need 8 non-ferrous slugs or screws. Aluminum or brass works equally well. 4-40 x ¼ inch brass screws are the easiest to find. Sometimes one or two may bottom out on the first tune sequence but as the front end was retuned on the second pass all that I had backed out from the bottom. A couple extra 3/8 inch screws might be good to have if you find one that remains all the way in. Because the 4-40 is smaller than the inside of the coil form it requires a shim of some kind to make the threads bite. 24 gauge wire insulation with the wire removed worked for me. After tuning the front end the screws should be locked down with a drop of super glue or loctite. I have found that some radios in my junk pile had aluminum slugs that could be salvaged and fit perfectly. These did not require gluing after tuning.

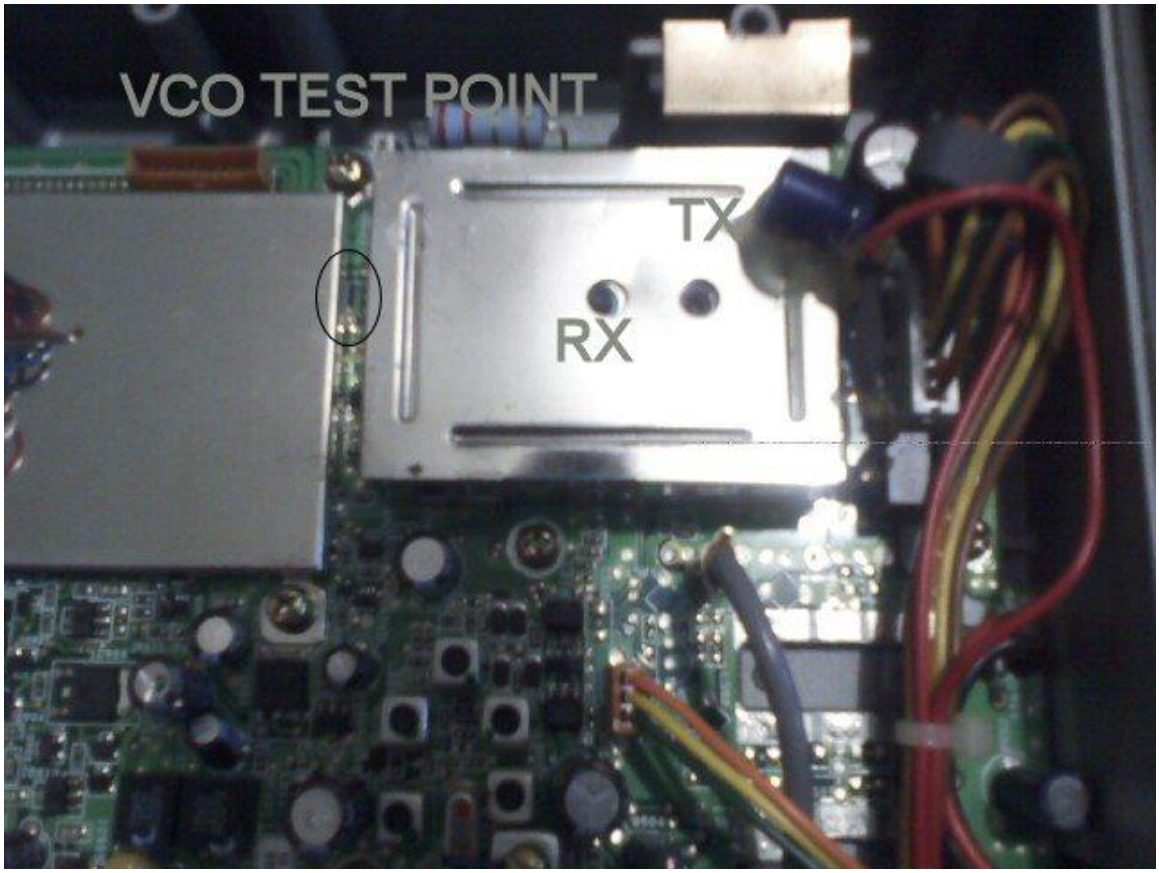
Starting The Conversion

Before beginning conversion verify the radio is functional on its original 42-50 mhz frequency. It is easier to address problems before conversion than afterwards. If the radio checks OK, then proceed.

Upload a test file with 6 meter frequencies into the radio. Each one should be programmed as wide band (+/- 5 khz), not narrow. I would suggest frequencies of 52, 52.525, 53.21, and 53.99 for RX and 52, 52.525, 53.210 and 52.990 for TX. The radio will usually flash E3 on several or all channels after powering up. This is normal and should be ignored for now as a VCO alignment in the next step will take care of this problem.

Step 1 - Realign VCO- Voltmeter required

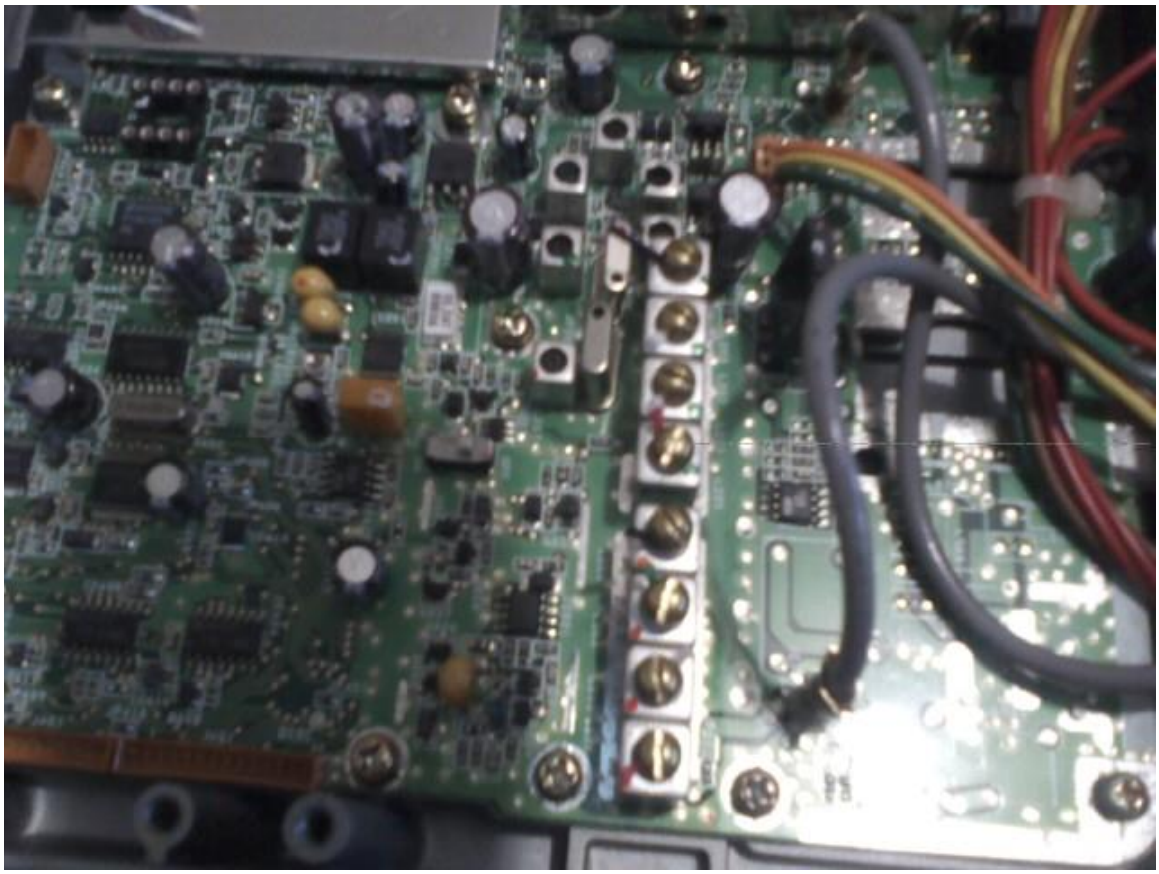
Remove Cover – Refer to the picture below.



VCO Test Point and RX and TX VCO Coil Location

Instead of tuning the VCO for the low end as called for in most alignments, we are tuning it for the high end. Select 53.990 on the radio. The VCO test point has a circle drawn around it in the above picture. Put voltmeter – anywhere to chassis ground. Place voltmeter + on the test point between the VCO shield and CPU shield on the pad inside the outlined square closest to the side of the radio and adjust the RX VCO coil. This voltage will read about 7 volts before tuning the coil. Back the coil out until the voltage reads about 6 v dc. You will screw the slug counter clockwise (out, not in). The radio should beep at some point and the E3 error stop flashing. Select 53.210 on the radio and key the transmitter. Adjust the TX coil on the VCO shield until the volt meter reads 6 v dc. You will screw the slug counter clockwise (out, not in). The E3 error should go away and the radio start making power. Unkey the transmitter. If the slugs require more than a few turns for the voltage to drop to 6 volts, something is wrong with the radio or frequencies programmed.

Step 2 - Receiver Realignment - Calibrated signal generator, SINAD meter required



Brass Screws In Coils After Tuning.

DO NOT GROUND EITHER SIDE OF THE SPEAKER LEADS by connecting the SINAD meter ground to one. Connect SINAD ground to chassis or power supply ground. The audio PA chip can be damaged if either speaker lead is grounded. At the very least

an internal fuse in the radio will blow. Then connect the SINAD meter Audio In to one of the speaker leads.

Set the radio to 53.210 and signal generator to 53.210. Inject .25 to .5 uv of signal frequency modulated with 3 khz of 1000 hz tone (no CTCSS TONE) in the antenna connector of the radio. Adjust the squelch setting to less than 10. While watching the SINAD meter, insert a slug into L207 and tune for maximum quieting. Try to maintain a signal level around 8-12 db SINAD throughout this procedure. Tune slowly as the peaks can be very sharp. When the slug is peaked, insert another slug into L206 and repeat the procedure. These first two coils have the most effect on the receiver sensitivity. Continue on to L205, peak. Beyond this point the increase in sensitivity is usually a small amount for each coil tuned.

Insert a slug or screw with a shim into L208. Peak, then begin at L204 and repeat the procedure with L203, 202, and 201 in that order. Start with L208 and readjust working back toward L201. Go very slowly, the peaks can be hard to see. You may want to repeat the sequence several times as the some of the slug positions in adjacent coils affects the tuning. The peaks are very slight on some and you may not see more than a few tenths of a volt in change. Take your time and turn the screws very slowly.

When finished check for 12 db SINAD on 52, 52.525 and 53.990 to see how successful you have been.

You should have less than .25 uv for 12 db SINAD after following the above procedure on 53.210. You may get some improvement by adjusting the slugs in the IF coils, starting with L801, L802, L803, and L804 to see if they are peaked properly. Reset the squelch to threshold when you are finished with receiver alignment.

If you used screws, don't forget to lock them down with a drop of Loctite or super glue.

Replace cover.

Receiver Conversion is completed.

Step 3 – Transmitter Adjustment –

Transmitter Coil Adjustment Locations – Amount of Adjustment Varies Between Radios

Set the radio to 52.525. Remove the cover from the PA deck. Locate L301 and L302. Spread each turn in the coil so they no longer touch. Key the radio to see how much improvement has been made in power output. If not around 100 watts, keep spreading L301 and L302 with something non-metallic to peak the power output. Sometimes one or both get really stretched out, sometimes it doesn't take much spreading to achieve max power. After getting max power, split the output filter coil in the center as shown in the picture. Slight separation in the center is usually all it takes to max output. In the band pass filter, the coil on the left is easily accessible and sometimes separating it slightly in the center improves power output. The rest of the coils are under the shield and much harder to get to. I usually leave these alone. If spreading a coil reduces the power, you can adjust the turn back. The unlabeled coils have no affect on output power so leave them alone. Check on 52 and 53.210 mhz when the power is maxed out. You should have about the same amount of power.

Transmitter Power After Coil Adjustment – Results Vary

Replace cover.

PA Conversion Completed.

Step 4 – Final Checks

View TX audio deviation and CTCSS deviation, adjust if needed in the test menu of the software. Set desired power output in the test menu of the software in both HIGH and LOW power. The aluminum chassis of the 110 watt radio weighs 5 lbs 10 oz when stripped so there is quite a bit of "heat sink" available but turning the radio down to 60-75 watts may be more sensible if you are long winded and let the PA have less heat to dissipate.

Radio Conversion Is Completed.