2016 Dayton Hamvention Drake Forum

- **Drake Forum Committee**

- **Mark Gilger – WB0IQK**
- **Ron Baker – WB4HFN**
- **Evan Rolek – K9SQG**
- **Jeff Covelli – WA8SAJ**

Agenda

Drake Trivia

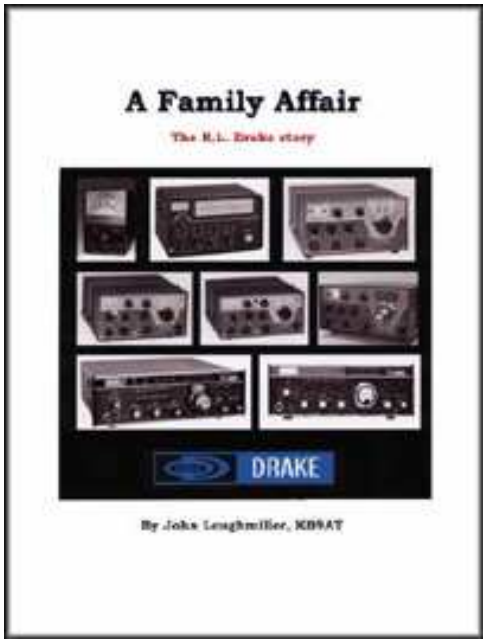
TR-7 Trouble Shooting.

TR-7 X-Lock VFO Stabilzer.

How I lost my Drakes, Almost.

Q&A

Drake Trivia



When did John, KB9AT first publish his book: “A Family Affair” ?

2001

Drake Trivia

- The R.L. Drake company was started in what year?

- 1943

- What does the R.L. in R.L. Drake stand for?

- Robert L. Drake

Drake Trivia

- Drake started out in what Ohio town?
- Miamisburg, Ohio
- Drake moved to it’s final location in what town?
- Franklin, Ohio

Drake Trivia

- The Drake 1A receiver was the company's first receiver meant specifically for radio amateurs. It was Introduced in what year?

- It was Introduced in 1957.

Drake Trivia

- What year was the Drake & Antique Tube Net started on 3.865mhz?

- It was started in 1994 by Danny Scrader, WA4SDE and Jeff Weinberg, W8CQ.

Drake Trivia

- The 40 meter Drake Technical Net was started in what year?

- John Loughmiller, KB9AT and Jeff Covelli, WA8SAJ started it in 1999.

Drake Trivia

The first Drake Dayton Forum was held in what year?

1998

- **Started by: W8NS (Ex: WZ8O), Don Spillman & WA4SDE, Danny Shrader**

- **Number of years: 18**

Drake Trivia

Why did Drake refuse to sell R4C front panels unless you turned in the old one first?

Their stated reason was so that people wouldn't take them to put on an R4B and sell it off as an R4C; that is virtually impossible since some of the controls are in different locations and the receiver would have to be heavily modified.

Drake Trivia

- Why did Drake willingly sell TR-7A insert strips, without any exchanges, that could easily be inserted into a TR-7 to make it seem like it was an A model when in fact it was an earlier model?

- <u>We don't know…</u>

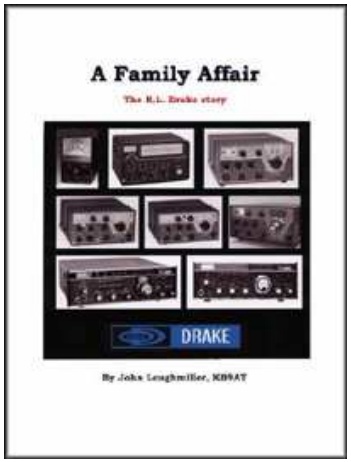
Resources

Drake Technical Net: Sunday, 7238 kc @ 4:00 PM Eastern

Drake & Antique Tube Gear Net: Tue. 3865 +/- kc @ 8 pm Eastern

Drake West Coast Net : Thur. 3895 +/- QRM @ 8pm Pacific Time

Drake Family Affair Book by John Loughmiller, KB9AT
Available @ Universal Radio



DRAKE

WB4 HFN

Drake Vintage Radio
Repair And Restoration

Email: wb4hfn@wb4hfn.com
Website: www.wb4hfn.com

Most Everything you ever wanted to know about the Drake TR7 Transceiver

A Little History

Common Easy To Fix Problems

Troubleshooting

Modifications

X-LOCK Stabilizer

Questions & Answers

Drake Trivia

What Does the Drake TR7 and the Heathkit SB104 Have in Common ?

Drake TR7 Transceiver

Heathkit SB104 Transceiver

Drake's First All Solid State Transceiver, The TR-7 in 1977

The development of the TR-7 transceiver was the first attempt of the Drake engineers, basically tube guys, switching to all solid state, went through a lot of pain-taking trials and errors. Drake convinced a young engineer, Mike Elliott, to come to work for Drake to help with the TR-7 design. At that time Mike worked for Heathkit and was the designer of the Heathkit SB-104, the first all solid state transceiver ever built.

Mike Elliott's engineering and design background was very instrumental it the design of the TR-7 radio. The most unusual design innovation of the TR-7 was the use of a very high IF frequency. Using 48.05 Mhz IF frequency eliminated most the birdies, whistles and squawks that popped up on the tuning dials commonly found in most radios of that era.

M.V.G. May 2014

Common “Easy to Fix” Problems

Check The Internal Fuse

Internal 5A Fuse
Mounted in the front corner right side. Shown with Display board in place.

The Drake TR-7 Transceiver does have one internal 5 amp fuse. The fuse is a standard 3AG fuse, 5 AMP rating. This is the first place you should check if the radio is totally dead and you know the connected power supply is delivering the proper voltage.

To locate the fuse first removing the top cover. The fuse holder is mounted on the right side panel in the front-right corner of the radio just beyond the edge of the Digital Display Board and directly in front of the Power Supply Board.

Before attempting to remove the fuse make sure all power is disconnected from the radio. The fuse is somewhat hard to access but with care and a small flat blade screwdriver the fuse will easily pop out from the holder. Replacing the fuse is a bit more tricky. First center the fuse over the holder clamps then push into place. Access to the fuse is easier if you work from the long side, going in behind the Digital Display Board.

Drake TR-7 and TR-7A Transceiver

Digital display and the receiver works fine on all bands 20 meters and below but is dead on 10 and 15 meters, and the digital display frequency readout slowly drifts upward continuously in the 32Mhz range with 10 or 15 meters selected.

On the TR-7 power supply board the 24VDC multivibrator circuit is not producing the correct voltage. Typically the voltage is in the 19 to 21 volt range because the transformer upper and lower haves are not touching together.

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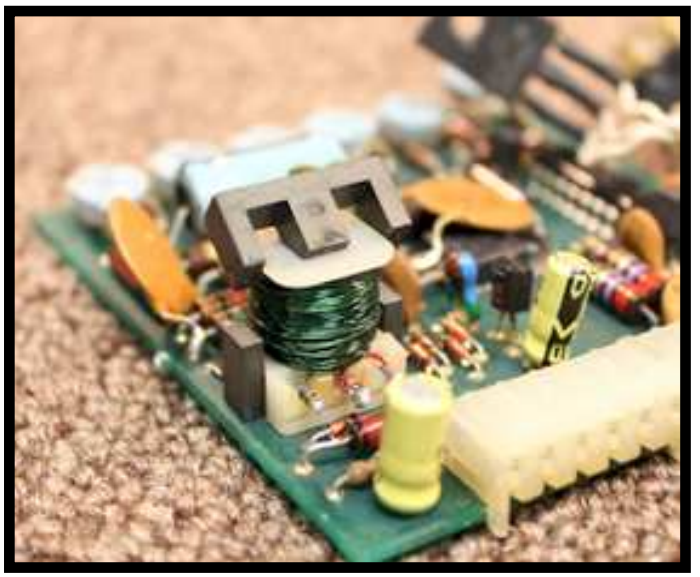
Drake TR-7 and TR-7A Transceiver



The top and bottom core halves are held in place with a twisted wire. When the core halves separate the output voltage goes down. The 24VDC supplies the primary power to the VCO oscillators. There are two VCO frequencies, the 16Mhz VCO variable range produces the injection signal for 160 through 20 meters. The second VCO frequency, 32Mhz, produces the injection signals for 15 and 10 meters. The second and higher VCO frequency needs a full 24VDC to produce the higher frequencies needed for 15 and 10 meters. When core halves come loose use a dot of Super Glue on each end of the core to hold in place.

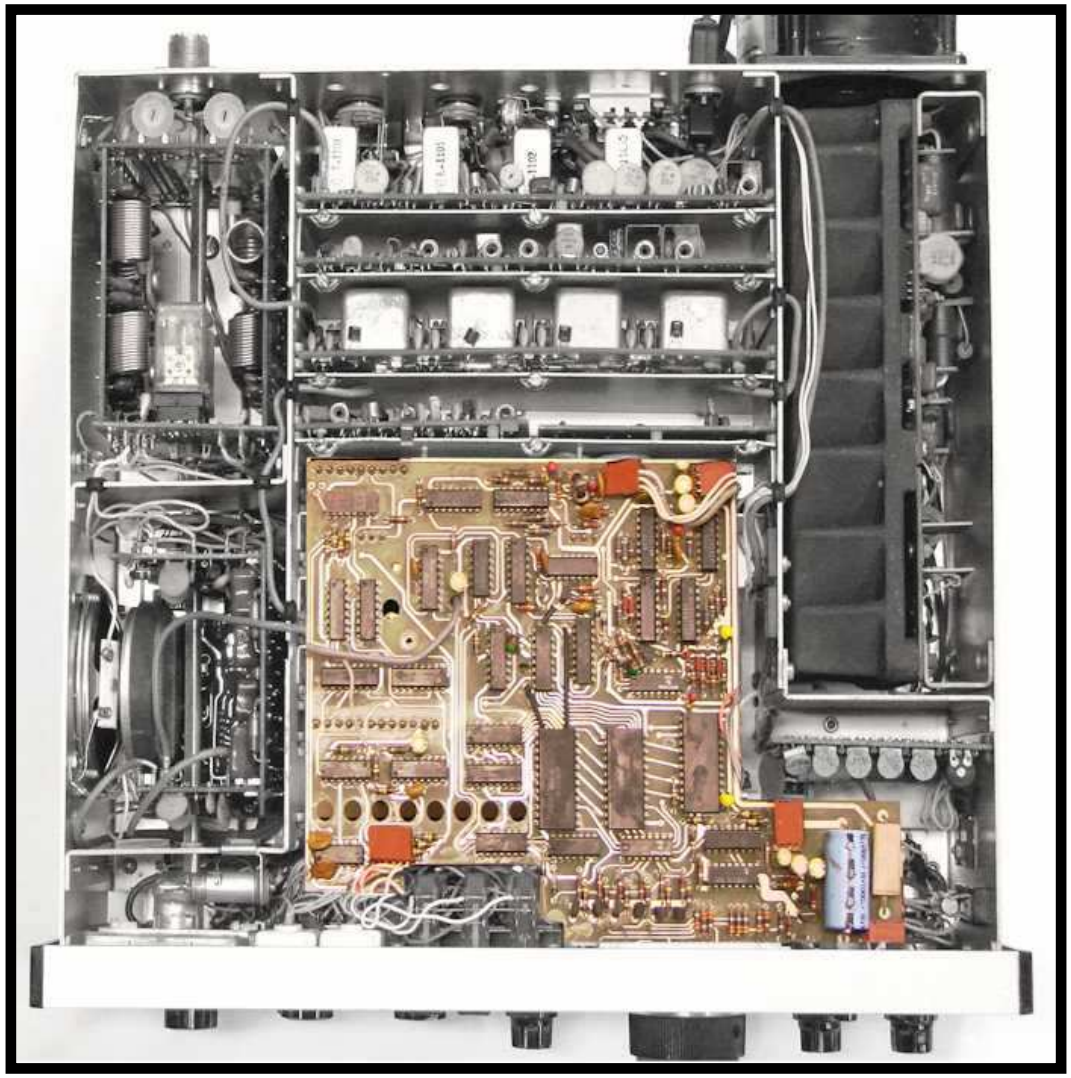
M.V.G. May 2013

Drake TR-7 and TR-7A Transceiver

Frequency digital display does not light, shows a series of periods across the display, drifts upward continuously or counts slowly upward in the 16Mhz on all bands 20 meters and below, or, counts around 32Mhz on 10 and 15 meters.

Receiver or transmitter is very intermittent, or doesn't receive or transmit but has audio background noise, or, maybe works only after being on for a half hour or longer.

All symptoms of loose circuit boards or bad board connections to the mother board. Try reseating the circuit board by pushing each board down firmly against the mother board.



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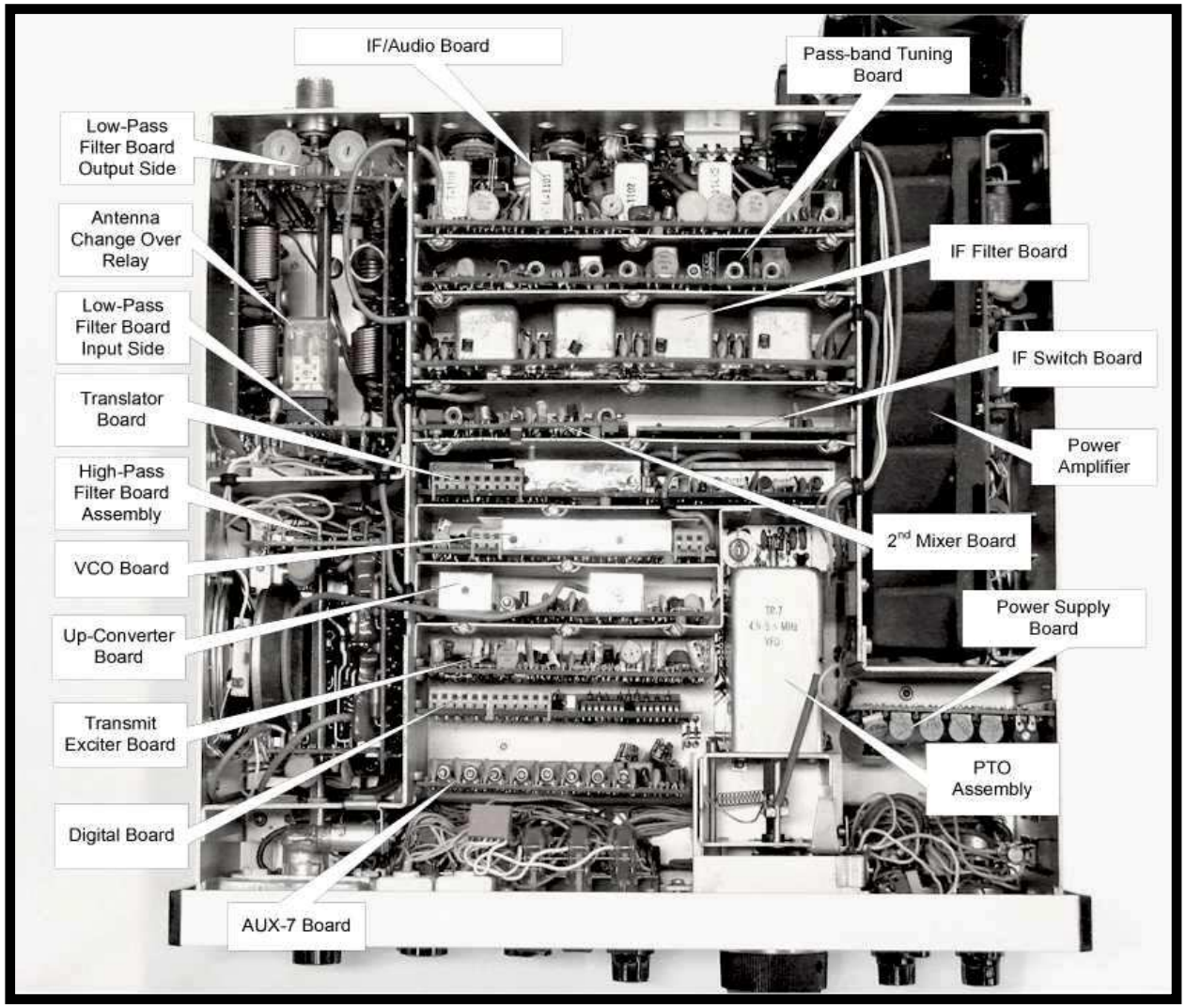
Drake TR-7 and TR-7A Transceiver

Frequency digital display does not light, shows a series of periods across the display, frequency drifts upward counts upward in the 16Mhz range on all bands 20M and below, or, counts around 32Mhz on 10 and 15 meters.

Receiver or transmitter is very intermittent, doesn't receive or transmit but has audio background noise, or, maybe works only after being on for a half hour or longer.

Try reseating the plug-in circuit boards in the radio.



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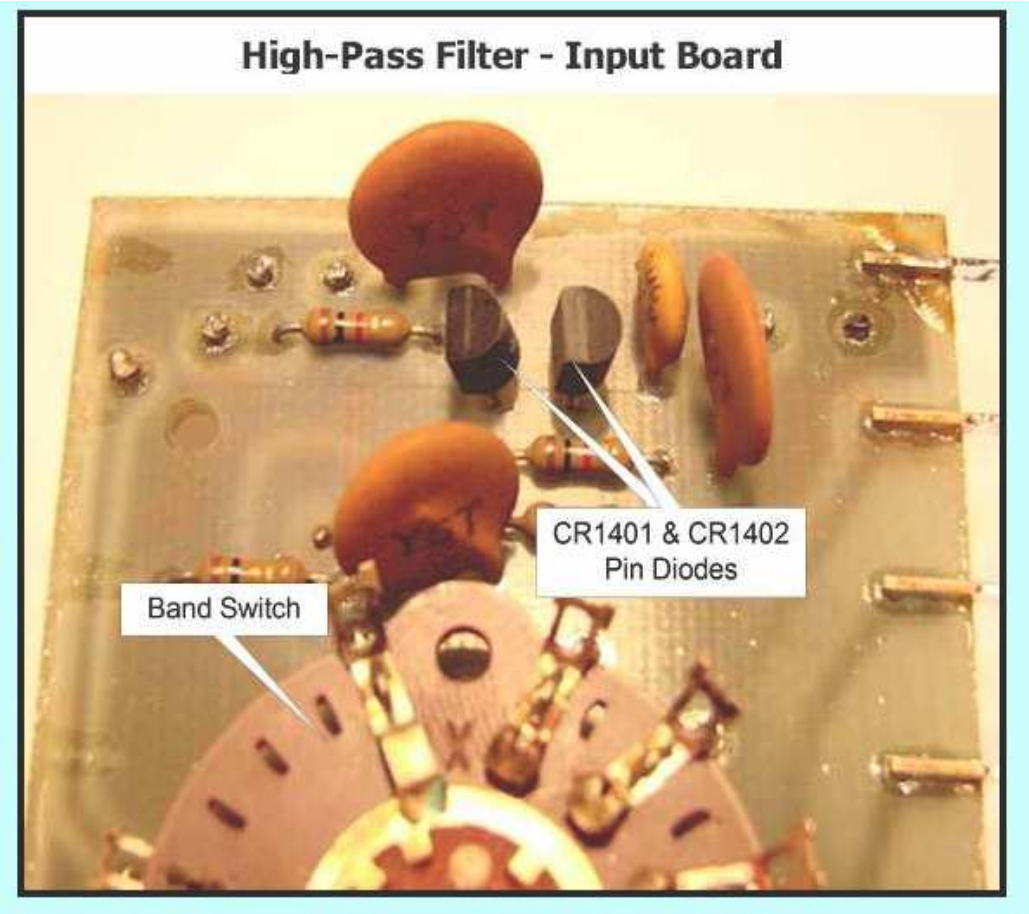
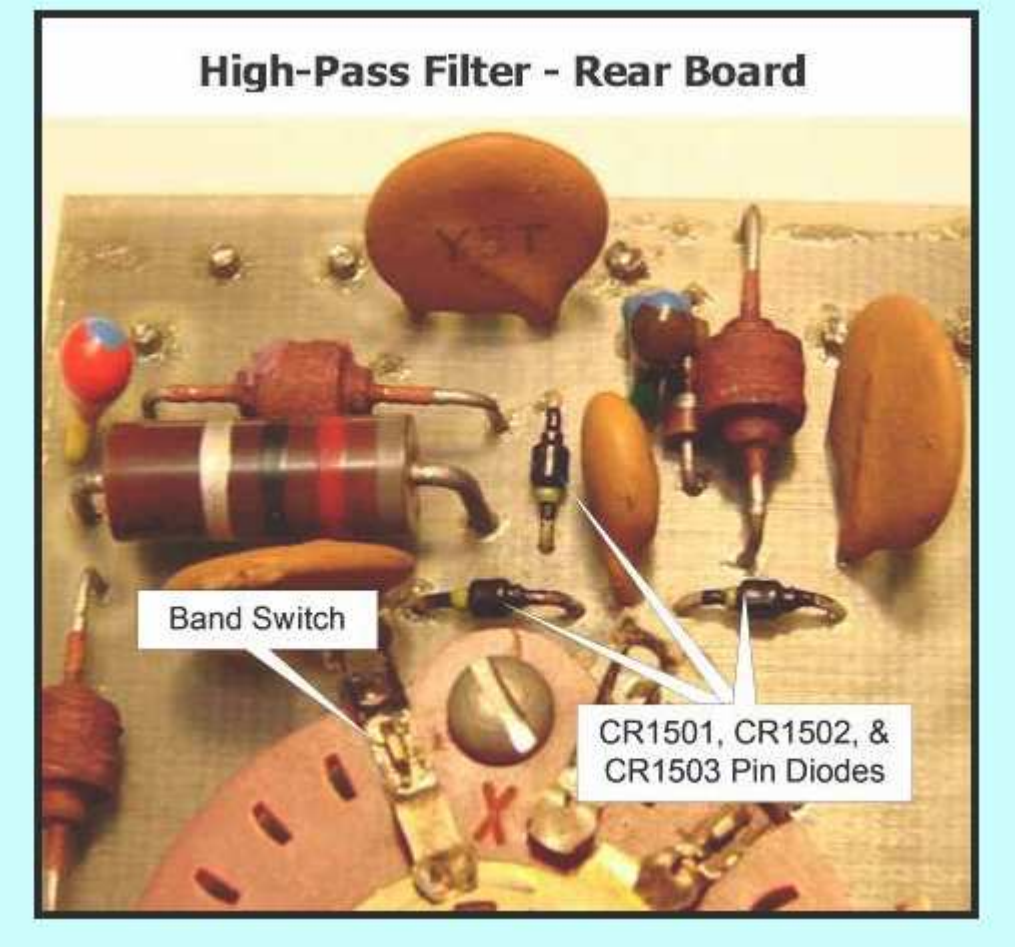
PIN Diodes On the High Pass Filter Input Board



The PIN diodes, NPN3404, on this board are used to switch on and off the calibrator signal. When one or both of these diodes go bad most of the time they short. Symptoms of bad diodes include very low power output on 10 & 15 meters, to a lesser degree on 20M, 40M and below are not usually effected and will have normal power output. Other problems you may see, the calibrator signal is on all the time and poor sensitivity on 10 and 15 meters.

PIN Diodes On the High Pass Filter Input Board

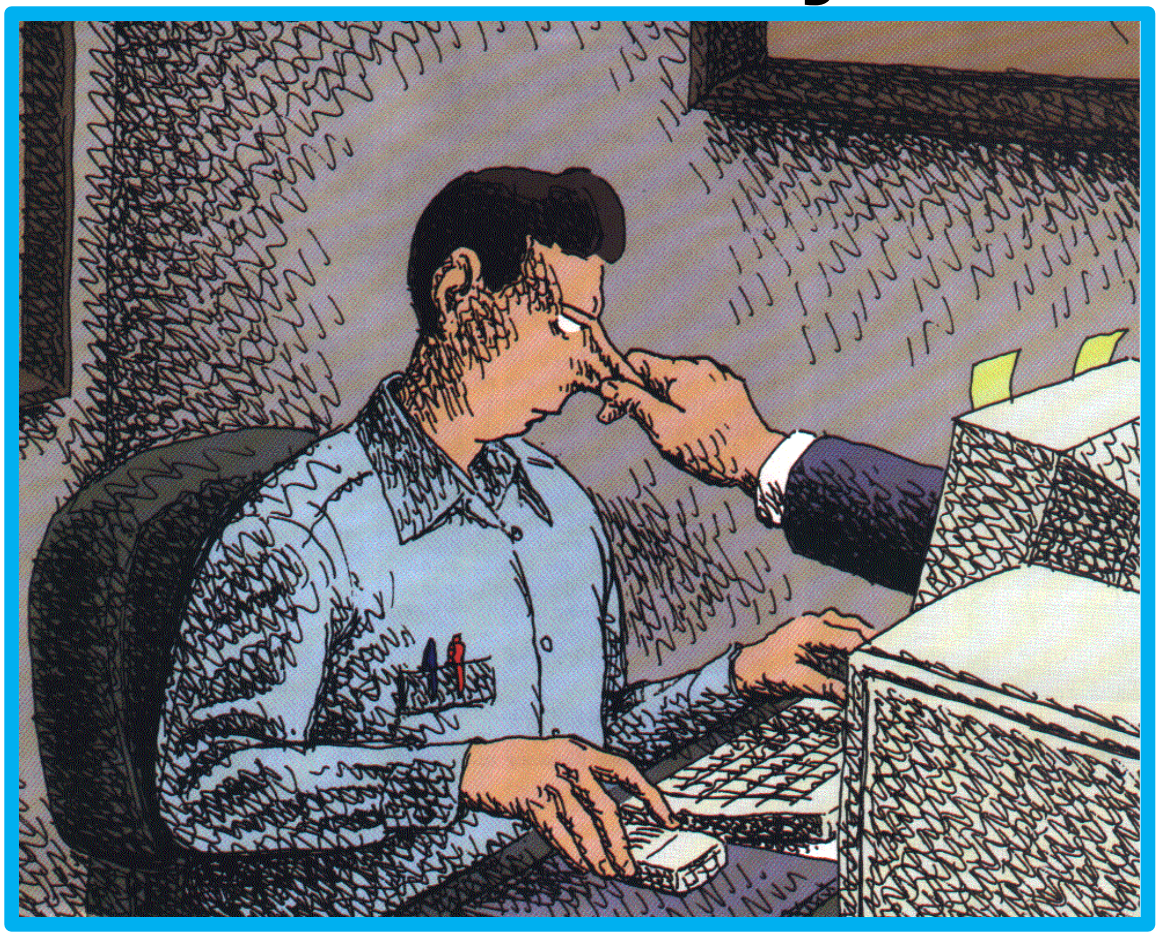


The PIN diodes, UM9401, located on the rear board of the High Pass Filter Board are high frequency switching diodes. These are used to switch the transmitter high power output and the receiver input signal through the High Pass Filter assembly. When these diodes go bad they usually start leaking or short out .

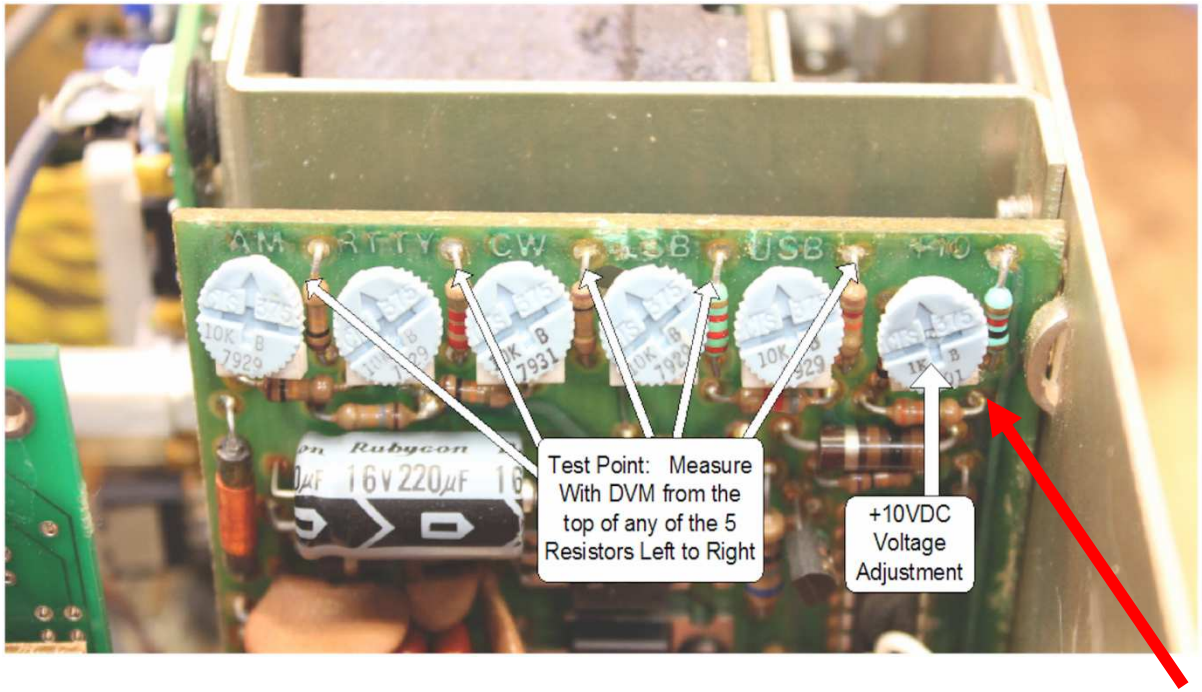
Symptoms of bad diodes here include low or no power output and/or very weak receive signals.

This usually effects all the bands.

Quick Internal Adjustments



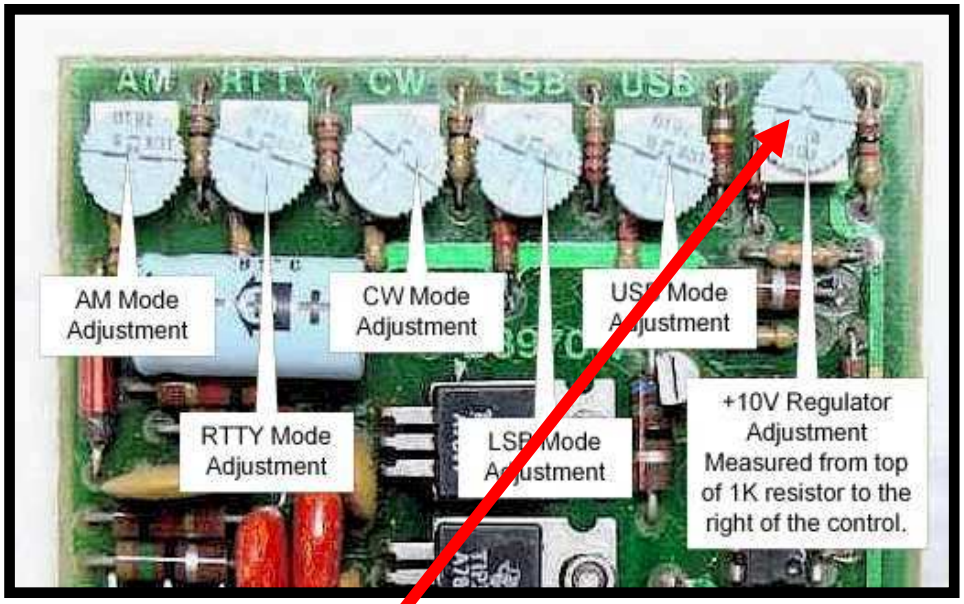
Setting The +10VDC Power Supply



Before making any adjustment in the radio, verify the +10VDC supply voltage is set to the exact voltage, All the crystal oscillators and some tuning adjustment depend on this voltage to be absolutely correct. The +10VDC voltage adjustment is on the far right side. For the test point, use the top any of the other five resistors across the top of the power supply board.

Get It On The Right Frequency

The receiver sounds off frequency, or, you need to tune high or low of the operating frequency to get a clear on-frequency signal when using CW, LSB and/or USB mode.



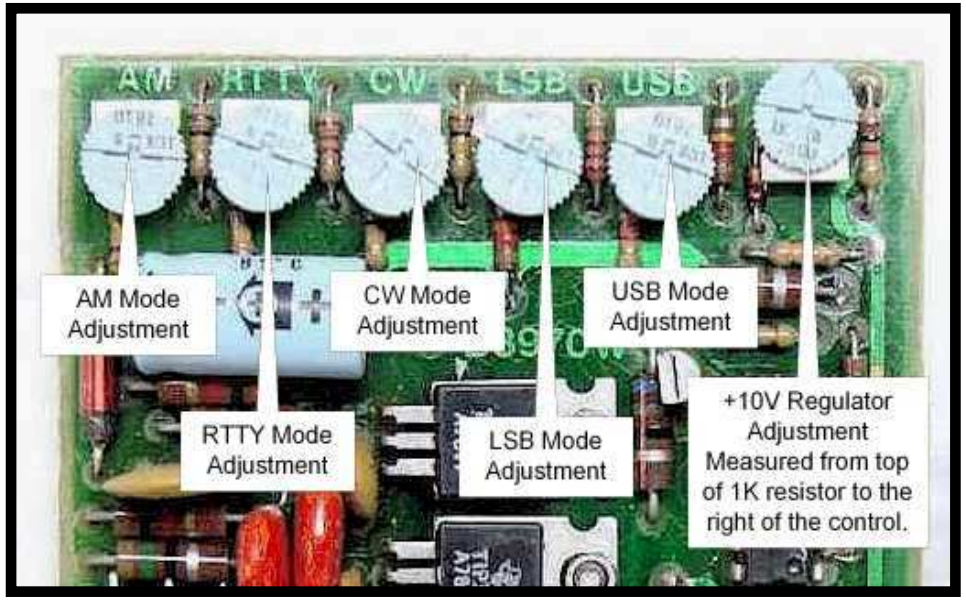
More than likely the +10VDC regulated voltage is off, or the individual fixed mode adjustments on the power supply board are not adjusted properly.

First, and most important, verify the +10VDC test point is exactly right on using a digital volt meter.

M.V.G. May 2013

Setting The Mode Frequencies

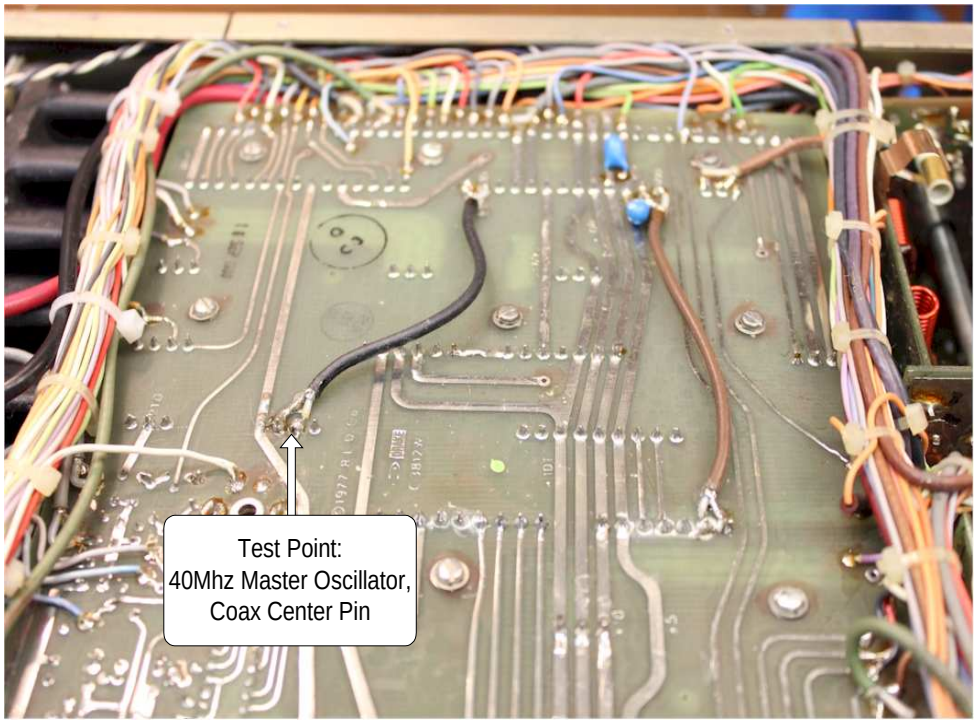
To set the individual frequencies of the fixed mode adjustments first put the transceiver on 20 meters and select the frequency range “Down” to tune 13.5-14.0Mhz. In the steps below you will set the receiver to the exact frequency and mode, and then zero beat the frequency using the mode frequency adjustment on the power supply board.

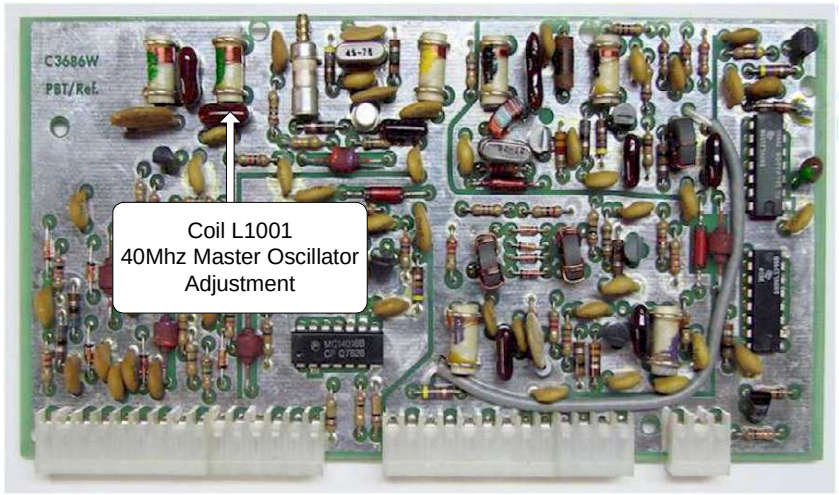


1) Select “AM” mode, tune to 13.695.00 Mhz and tune for maximum signal.
2) Select “RTTY” mode, tune to 13.697.50 Mhz and zero beat signal
3) Select “CW” mode, tune to 13.694.20 Mhz and zero beat the “CW” control.
4) Select “USB” mode, tune to 13.696.40 Mhz and zero beat the “USB” control.
5) Select “LSB” mode, tune to 13.693.60 Mhz and zero beat the “LSB” control.

M.V.G. May 2013

Setting The Master 40MHz Oscillator





On the bottom of the mother board, the center pin of the coax cable is the test point. Using a high impedance probe and frequency counter, adjust L1001 on the PBT/REF board and adjust to exactly 40.000Mhz

Calibrating The Watt Meter

Power Meter Calibration

To calibrate the internal Watt Meter you will need an external Watt Meter with known accuracy like a Bird Model 43 Watt Meter with a 100 watt or higher element for the 3-30Mhz range. Connect your known accurate watt meter to the antenna connector and a 50 ohm dummy load to the other side of the watt meter. Set the transceiver to the 14Mhz band and select the CW mode. Next key the transmitter and using the front panel Carrier Level control adjust the power output to exactly 100 watts as indicated on the external watt meter. While the transmitter is still keyed adjust R2001 on the Low-Pass Filter Board until the internal transceiver watt meter indicates 100 watts. Make sure the front panel watt meter switch is set to the "Forward" position before making the adjustment. Do not keep the transmitter keyed for more that a few seconds at a time to prevent over heating the power amplifier. Next remove the antenna connection to the external watt meter. Quickly key the transmitter and turn down the power level using the Carrier Level control until the green ALC lamp goes out. At that point take note where the internal watt meter in indicating with the "Forward" position. Next select the "Reflected" position and set R-2002 on the Low-Pass Filter Board to the same internal watt meter indication as noted in the "Forward" position.

Setting The RIT Centering

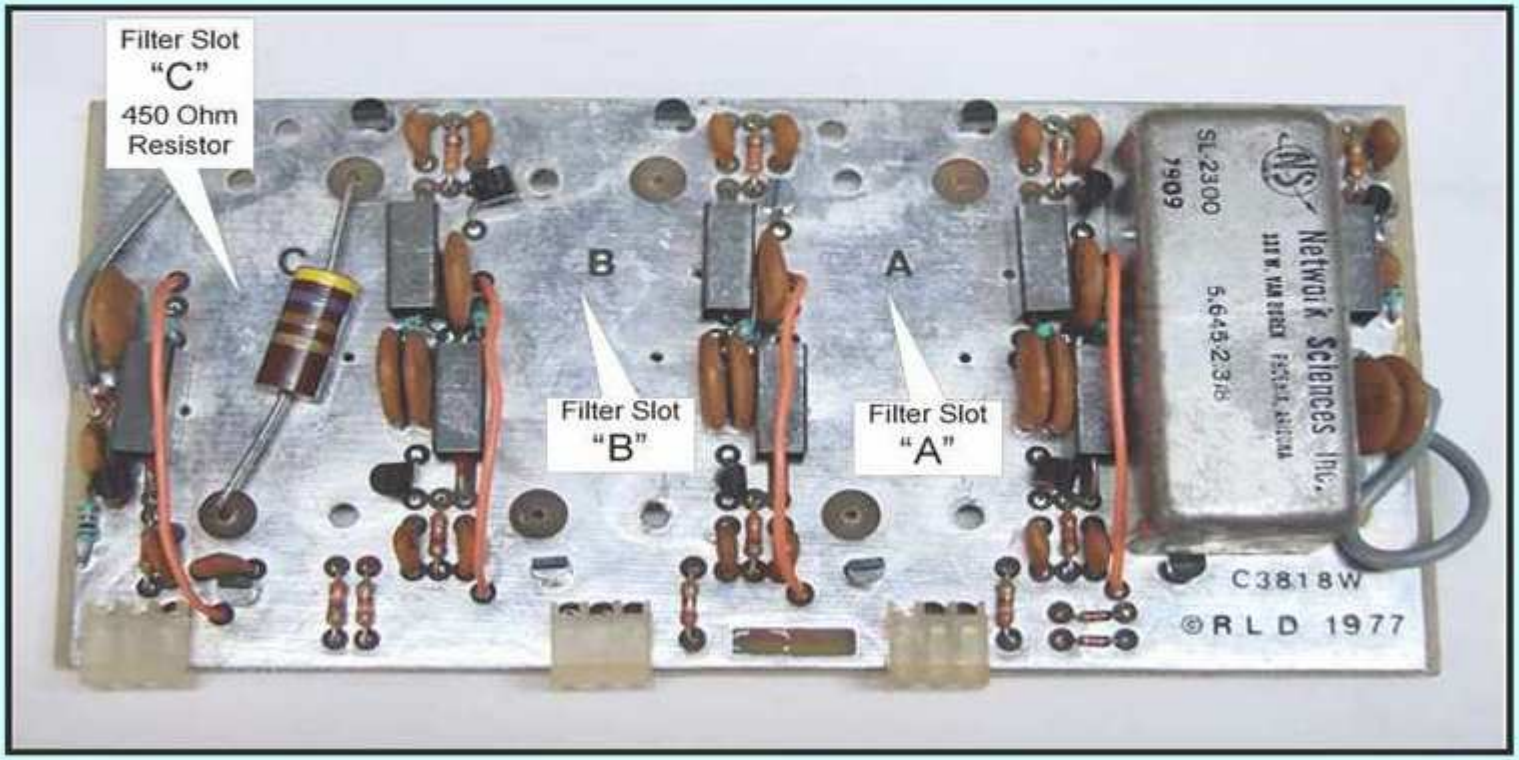
RIT Centering Adjustment

To calibrate the front panel RIT control, first turn "ON" the RIT function and set the RIT knob pointer to the center, or straight-up position. Then zero-beat the receiver to the internal calibrator signal and the nearest 25khz increments. Once you set the zero-beat, then turn "OFF" the RIT function and adjust control R-24 on the Parent Board to zero-beat with the internal calibrator signal. R-24 is located on the Parent Board just behind the PTO as shown in the picture with the Display Board removed. There is also an access hole on the Parent Board from the bottom side to access R-24 with the Display Board mounted in position.

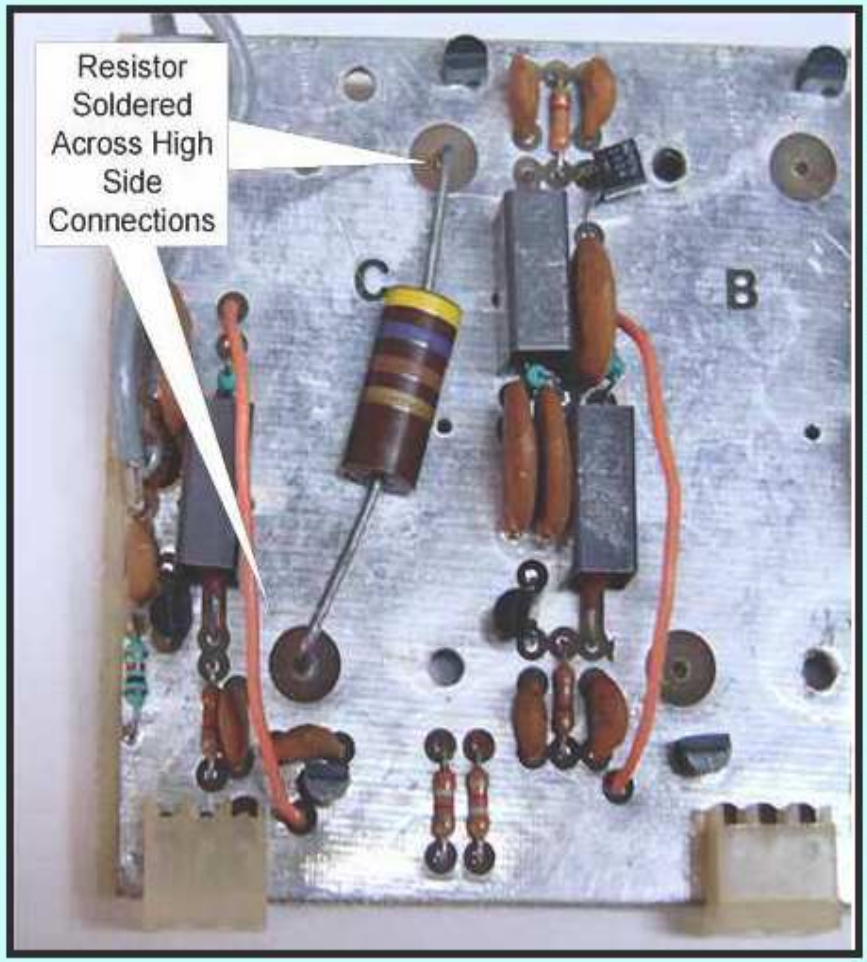
Quick and Easy Modifications

“Poor Mans” AM Filter

The TR-7 Filter Board comes standard with only the 2.3Khz filter installed. The board has three additional slot to add additional filters. The slots are labeled "A", "B", and "C" which are selected with the front panel Bandwidth Switches. The accessory filter options include a 250Hz and 500Hz CW filter, 1000Hz and 1800Hz RTTY filter and a 4Khz and 6Khz AM filter. The AM filters are hard to find and expensive when you do find them. One option called the "Poor Man's AM Filter" is simply adding a 470 ohm resistor across the filter high side connections of any open slot. With this modification and the filter slot selected, allows the receiver to pass a wide band signal for AM reception. The downside to this modification, the bandwidth is somewhat wider than the 6Khz AM filter and has significantly less ability to reject adjacent frequency interference. One the positive side it provides wide band high quality AM reception, and provide excellent audio when using the 500Khz to 1.5Mhz AM broadcast bands.

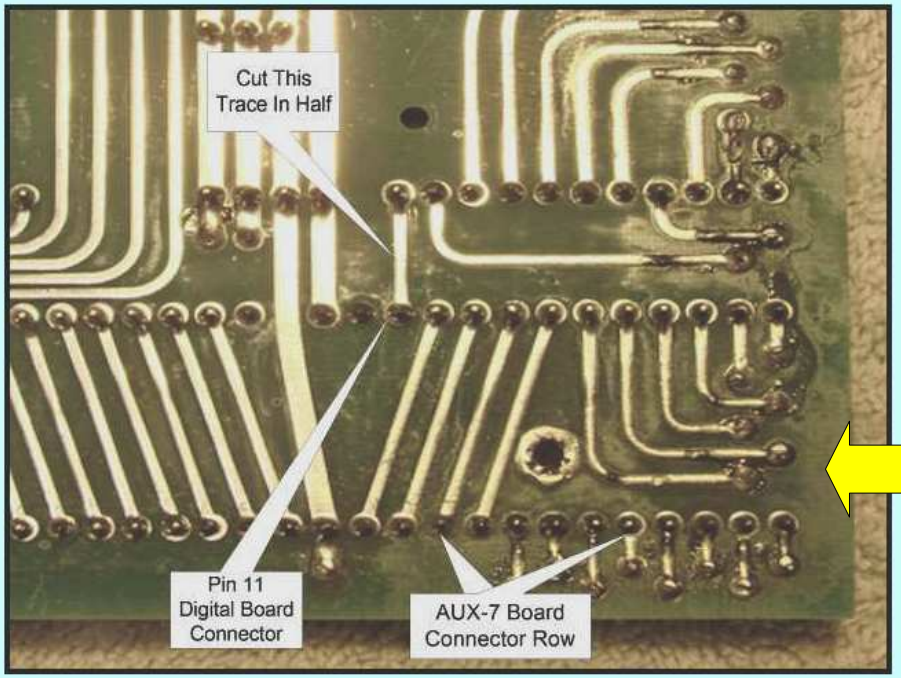


“Poor Mans” AM Filter



The picture on the left is a close-up of the wide band AM mode modification. Shown here is a 450 ohm resistor, but a lower value such as a 150 ohm resistor will also work fine. In some cases the lower value will allow a little more signal to pass but may be more prone to overloading the receiver with a strong signal. The larger value will pass less signal and is less susceptible to receiver overloading. The higher value would be better choice for radios which exhibits high signal gain or considered a 'Hot" receiver. In this picture a 2 watt, 450 ohm resistor installed in slot "C". Any wattage resistor will work since the power rating is not a factor, and can be installed in any open slot. The 2 watt resistor is typically used because the lead size is approximately the same size as the filter pins which makes a nice fit.

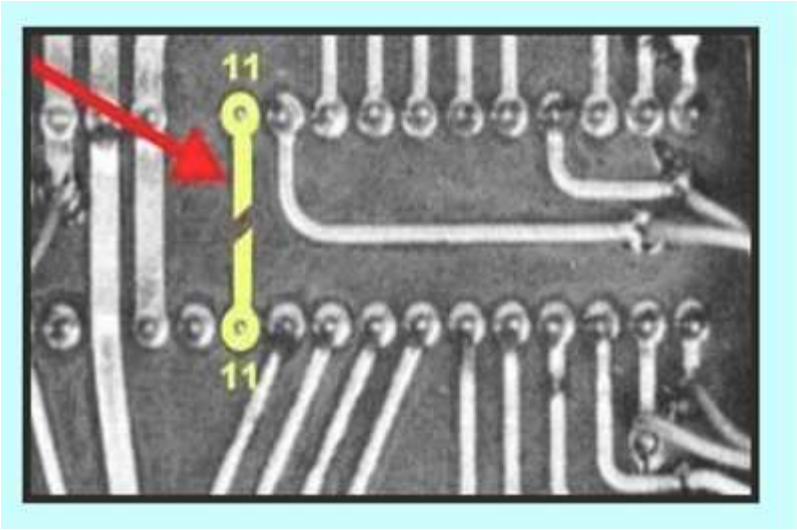
“All Band Transmit”



Circuit Board Area Is Located In The Front, Right Side Corner Of The Mother Board

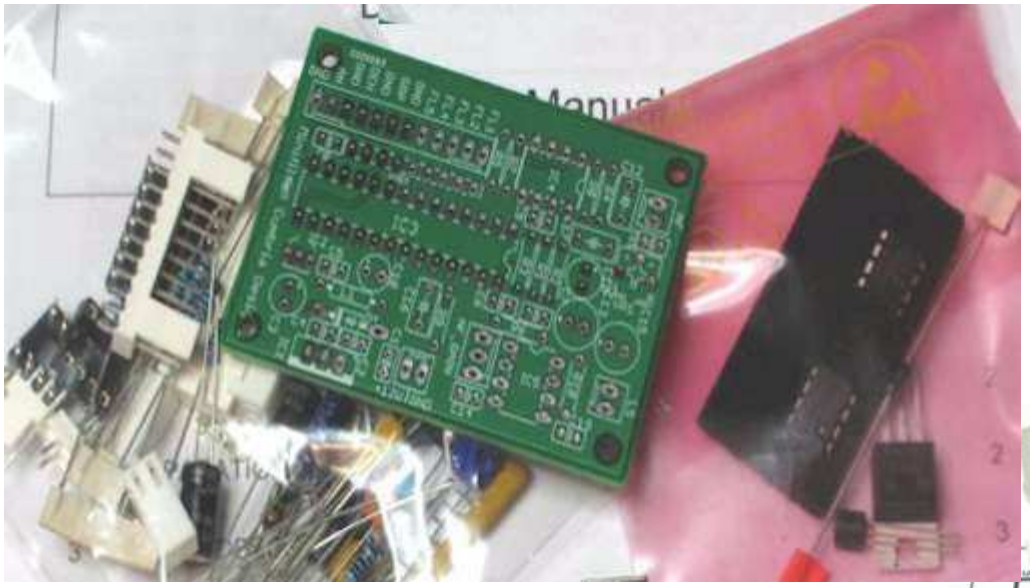
The TR-7 transceiver was originally designed to transmit on all bands between 1.8Mhz to 30Mhz. However the transmitter was disabled from transmitting outside the established Amateur Radio bands with an inhibit circuit on the Digital Board. To work around the inhibit circuit Drake produced the AUX-7 Board accessory. This board would allow out of band transmitting with a programmable IC module setup for the proper band. Out of band 500Khz segments was then accessible by selecting the programmed module using the front panel "AUX Program" switch. The band programmable module plugged into one of eight IC sockets along the bottom of the board. Shortly after the transceiver was on the market the ham community discovered a simple work-around modification to disable the inhibit circuit allowing all-band transmission capability without the need for the AUX-7 Board or the programmable modules.

“All Band Transmit” Modification



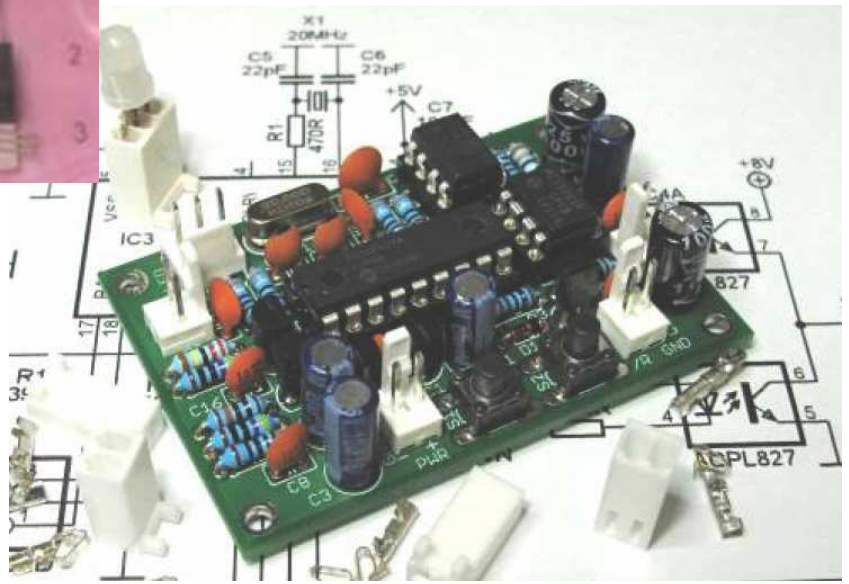
- The modification is as simple as cutting one circuit trace on the Parent Board. The trace you cut runs between pin 11 of the Digital Board connector and pin 11 of the Transmit Exciter Board. From the bottom of the transceiver locate the copper trace as shown in the picture. The location is along the front edge, right corner, looking at the radio bottom side up. Using a razor blade cut the trace halfway between the board connectors as shown in the picture. Once this trace is cut the TR-7 transceiver is capable of transmitting on any frequency tuned on the display or VFO setting. This modification will now allow you to operate on all the new WARC bands. Just remember, "KEEP IT LEGAL", operate only in the approved Amateur Radio bands. The TR-7 in not FCC type-accepted to operate outside the Amateur Radio bands.

Cumbria Designs X-Lock Installation

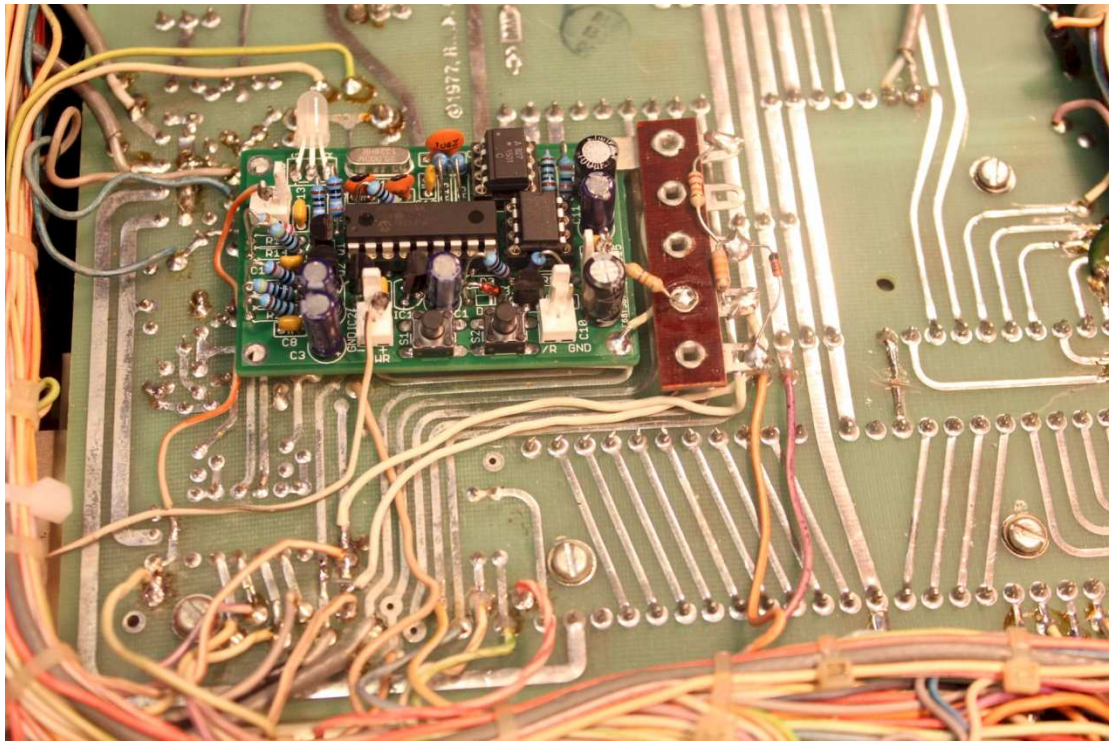


YES

It’s a kit that you assemble, with small intricate soldering contacts.



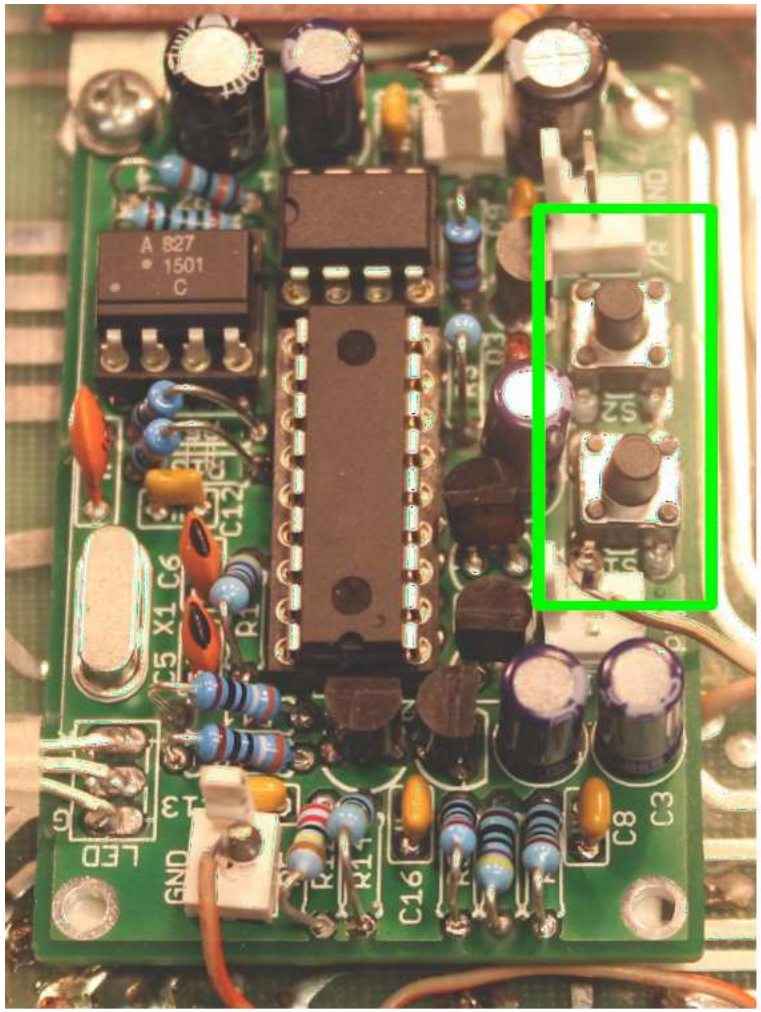
Cumbria Designs “X-Lock” Installation



The X-Lock Board from Cumbria Designs is an add-on board that controls the natural PTO drift that is associated with the analog design effected by heat and voltage changes. The X-Lock board samples the PTO frequency several times a second, when a frequency change as small and 50Hz is detected the X-Lock applies a small voltage change to the RIT input of the PTO to pull the frequency back to the original frequency.

Typically the PTO will drift a few hundred hertz from power up to operating temperature. With the X-Lock installed most all the PTO drift is eliminated.

Cumbria Designs “X-Lock” Installation



The X-Lock Board has two programming switched used to set the frequency sampling rate and the timing delay rate which is how long X-Lock waits to start sampling the frequency after the VFO tuning knob is moved. Programming instruction come with the kit.

Complete X-Lock installation for the TR7 can be found in the Drake section of the www.wb4hfn.com website home page, Article entitled “TR7 Improvements X-Lock Stabilizer”

The TR7 Project In 2015

This is my never-ending TR7 project that I am constantly thinking of ways to improve the performance.

The TR7 Upgrade List In 2015

So far the list of changes include:

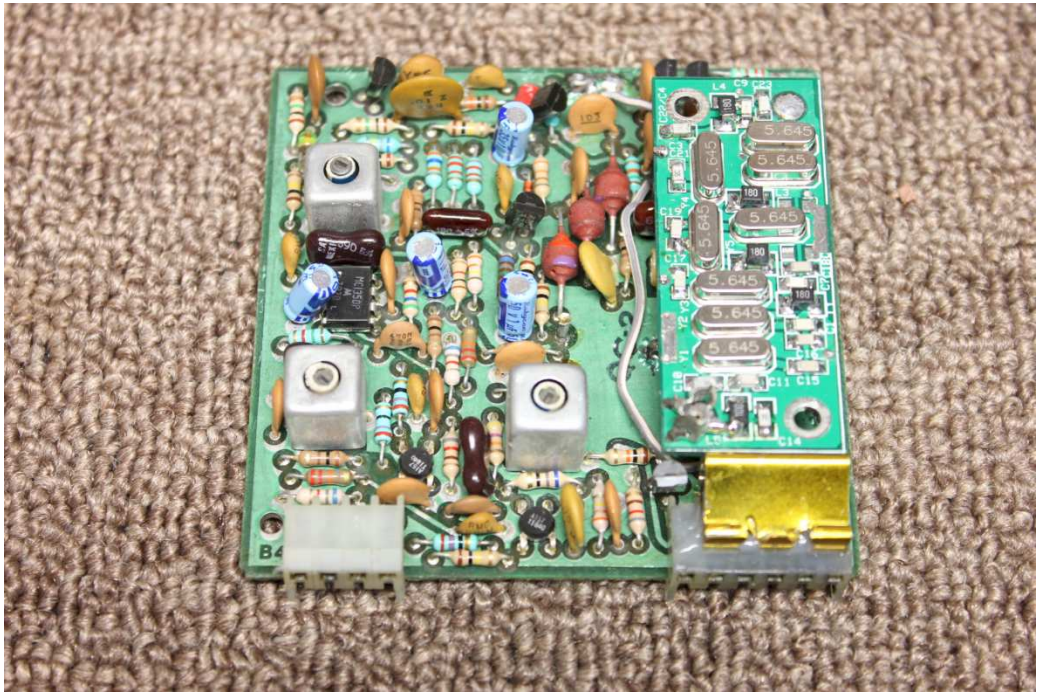
- Built-in AC Power Supply
- 15 watt output Power Amplifier
- Large Blue LED display
- Digital Display board cut away modification
- Relocation of the Mode Switch frequency adjustments
- Removal of the entire analog frequency display section.
- New LED background lighting.
- Transmit predriver section of the PA amplifier relocated to the plugin slot of the old power supply board.
- New low noise balanced mixer stage in the receiver front end.
- Replaced the mixer diodes with new low noise tunnel diodes.

The TR7 Future Upgrades in 2016

So What Are The future Upgrades:

- Adding the Digital DDS PTO and eliminating the analog PTO.
- The AUX programming switch will become the IF bandwidth selector with up to 8 digitally programmable IF filters.
- The “A-B-C” IF filter selector will become the “A & B” digital VFO selector with the “C” position for operating split frequency.
- Anything I have not yet thought about adding to the radio.

The TR7 Project Now

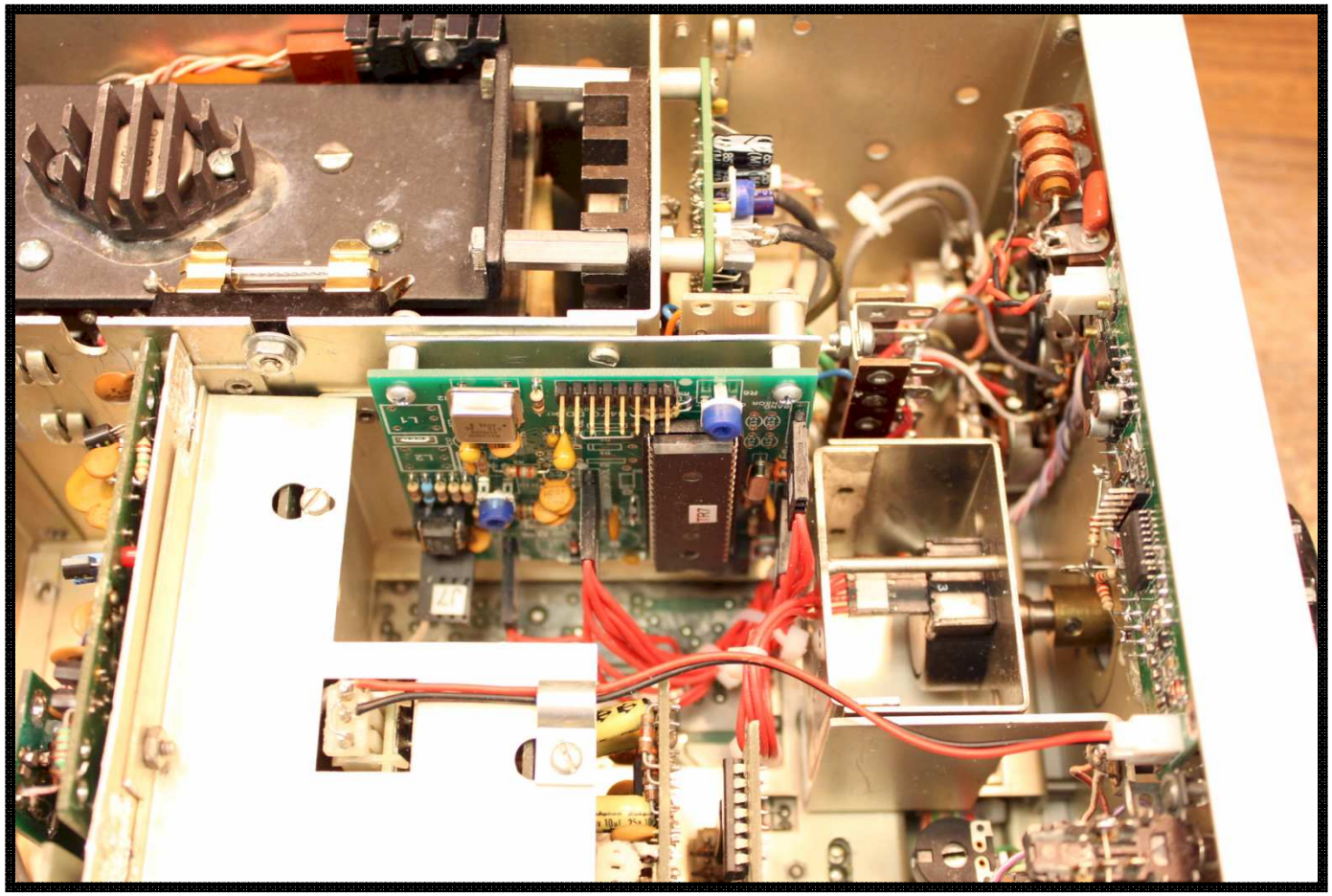


New Board Modification

The NB-7 Noise Blanker board now includes a 2.8Khz IF Filter.

This IF filter come as the same size as standard IF filters, but removing the housing leaves a nice flat PC board.

The TR7 Project Now



The Digital VFO in the center with the encoder mounted in a analog VFO metal housing, and the Signal Processor mounted where the original power supply was.

The TR7 Project Now

DRAKE

QUESTIONS

???

WB4 HFN

Drake Vintage Radio
Repair And Restoration

Email: wb4hfn@wb4hfn.com
Website: www.wb4hfn.com

How I lost my Drakes, almost

Evan, K9SQG

Our Common Goals

* Enjoy ham radio
* Enjoy Drake equipment
* Don't deprive others from enjoying our hobby

Ham Radio Annoyances

* Hear that RF on my voice as I speak?
* The "manufacturer" said I’m version 1.0.
* But how can I avoid distorted audio on the air?

Background

* For over 10 years, everything worked fine.

* Then the gremlins came and went, at will.

* 80 M and 40 M horizontal loops showed no change in SWR.

* Antenna tuners, linears, transmitters, all behaved the same.

* So what's causing the audio distortion and hum on 40 meters?!

DRAKE

Could different equipment help?

* Not the Drake C-line
* Not the Drake TR-7A
* Not the Kenwood TS-830S
* Not the Kenwood TS-590S
* Not the Johnson Valiant

Could a different microphone help?

* Not the Astatic D-104
* Not the Astatic 10DA
* Not the Shure 444D
* Not the Drake hand microphone
* Not the Heil headset
* Not the Kenwood hand microphone

Could a different linear help?

* Not the Drake L4B
* Not the second Drake L4B
* Not the Drake L7
* Not the second Drake L7

Could a different antenna tuner help?

- Not the Drake MN-2000
- Not the Drake MN-2700
- Not the second Drake MN-2700
- Not the Johnson Kilowatt Matchbox
- Not the second Johnson Kilowatt Matchbox
- Not the Nye Viking MBVA
- Not a Palstar BT-1500A balanced tuner

Could it be the power line?

* Tripp-Lite Line Conditioner didn't help

* Medical grade isolation transformer didn’t help.

* Ferrite beads on ALL cables didn’t help

Could it be the antenna system?

* Replacing the 40 M loop had no effect.

* Replacing the 80 M loop had no effect.

* Replacing all the feedlines had no effect.

* Replacing feedline quick-disconnects had no effect.

* Adding more ground rods, radials, ground screen, etc. had no effect.

An aha moment!

* Replaced all coax jumpers, one by one
* Replacing one coax jumper, 12 inches long, solved the problem!
* No leakage, no opens, no shorts, but with RF it caused distortion!
* And that jumper was only 50 years old?!
* Problem solved!

Or was the problem really solved?!

* I was a happy camper....
* Then the gremlins returned !
* There was nothing else I could change.
* I decided to get out of the hobby, and sell off my equipment.
* Drake enthusiasts encouraged me to stay with the hobby, and Drakes!

Drake Equipment Sell-Off

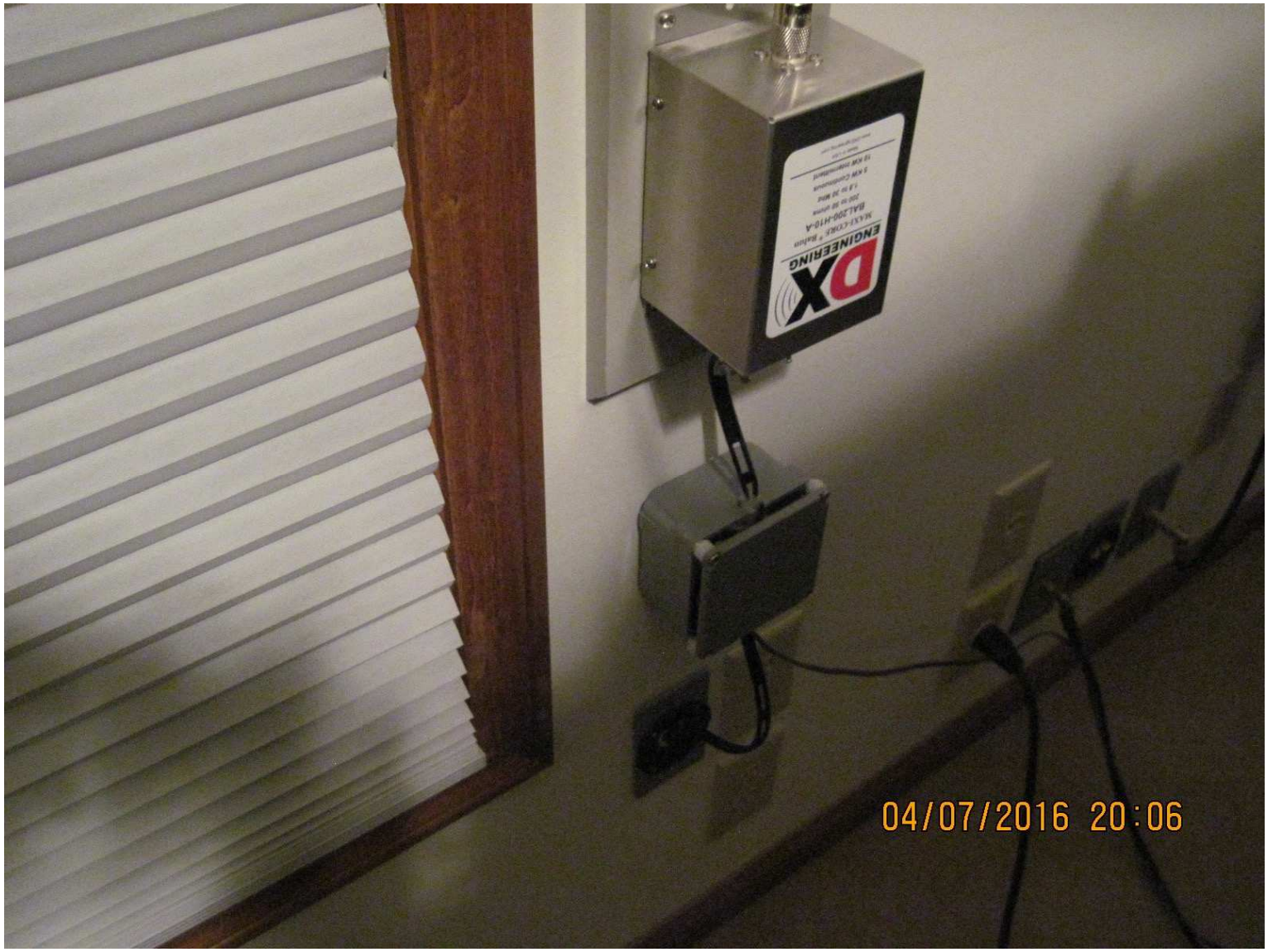
- Two TR-7As
- Two RV-75s
- Some L4Bs, L7s
- C-line
- Two R-7As
- Astatic microphones
- Etc. etc. etc.

Final Curious Experiments

- Remember: this was mainly a 40 meter problem.
- 1:1 balun for 40 M loop, at house entry, then coax, helped somewhat.
- Feedline choke in shack for 40 M loop helped somewhat.
- Disconnecting 80 M loop from tuner helped significantly. Why?
- DPDT relay in 80 M window line helped significantly. Why?
- Switching from L4B to L7 helped significantly. Why?

DRAKE

External Balun in Shack



Conclusions

* Only 1 report of distortion this year, due to mic gain being too high.

* Have no explanation why that distortion started, came and went, at will.

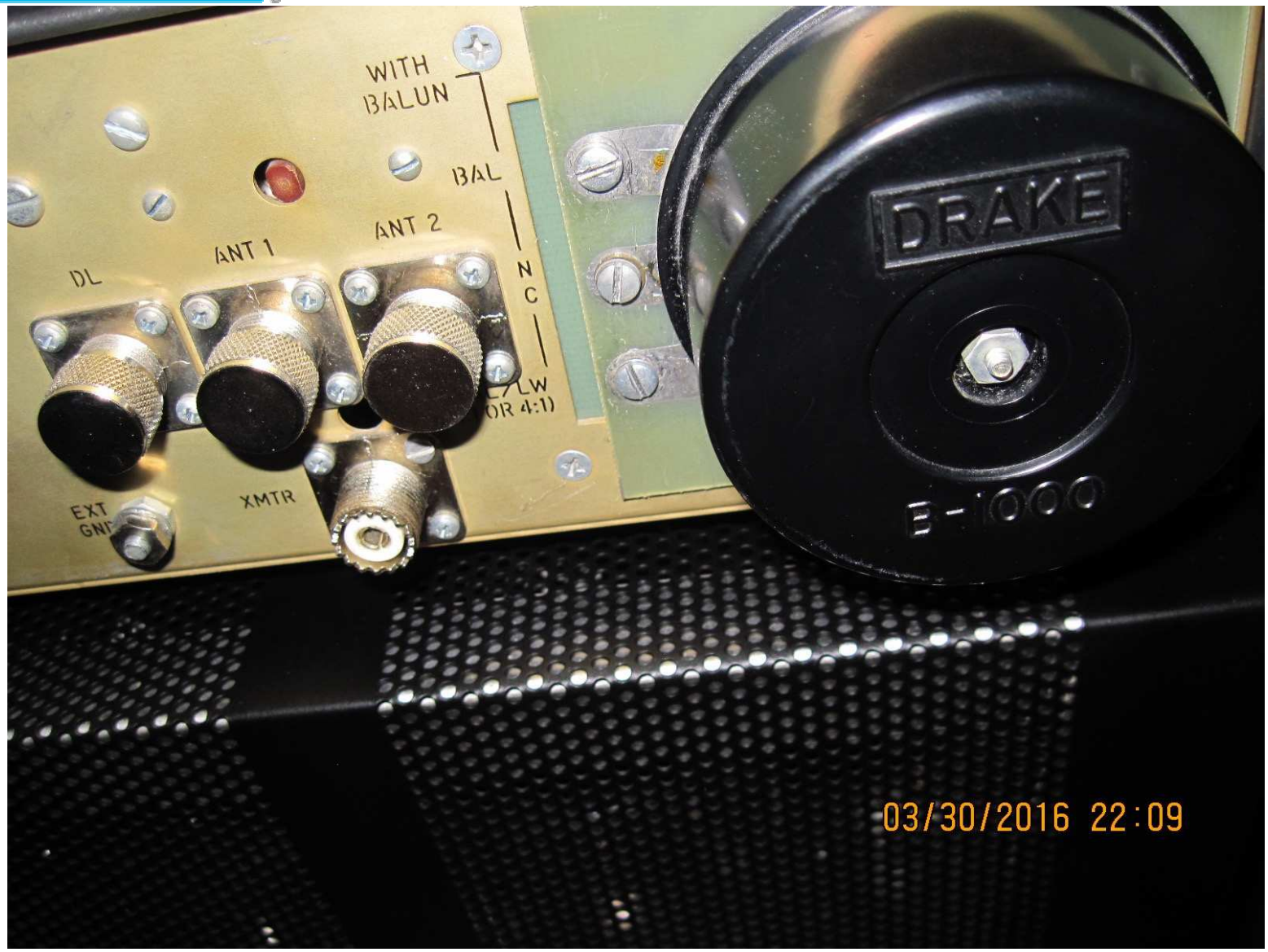
* Antenna pickup and conducting feedline were culprits. Why suddenly?

* Perforated cabinet on L4B was a culprit due to RF leakage.

* Field strength meter in the shack was a useful diagnostic instrument.

* NOT selling off my remaining Drake equipment!

The Culprits



Questions & Answers

Ron, WB4HFN
Mark, WB0IQK
Jeff, WA8SAJ
Evan, K9SQG

The Path Ahead…