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Subject: [R-390] R390 Inspection \_List

You are looking for this stuff. Roger Ruskowski This paper is still not complete. Nothing in this work is original to Roger Ruskowski. I acknowledge that I copied and pasted every bit of it from others. Contributors include at least the following fellows. The contributions are not limited to the following fellows. Additional names may be added at any time. Acknowledgements appear in no special order. R-390@mailman.qth.net

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- A. Current State
  - 01 Top cover should not be installed if rack mounted
  - 02 Bottom cover should not be installed if rack mounted
  - 03 RF deck cover should be installed
  - 04 Factory holes in left side to allow adjustment of mechanical filters
  - 05 A Check the VFO position you may not want to loosen some screws
  - 05 B Collins / Motorola VFO
  - 05 C Cosmos VFO
  - 06 IF output connector on back panel is present
  - 07 IF output cable is present
  - 08 All the knobs are present
  - 09 Any obvious broken parts
  - 10 Any missing parts
  - 11 Any leaking parts
  - 12 Any wire harness damage

- B. Modifications Installed
  - 01 Diode load hole in the front panel (not desired)
  - 02 Adjustment hole in the top dust cover for the meter adjustment.
  - 03 Micro dial on BFO

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- \_\_\_ 04 Jumper from break-in on terminal board to ground
- \_\_\_ 05 A IF deck has no adjustments for mechanical filters
- \_\_\_ 05 B IF deck has trimmers only on top for mechanical filters
- \_\_\_ 05 C Chassis has no holes for under deck trimmer caps
- \_\_\_ 05 D Chassis has four added holes for under deck trimmer caps
- \_\_\_ 05 E Chassis has four manufactured holes for under deck trimmer caps
- \_\_\_ 06 A Ballast tube is original 3TF7
- \_\_\_ 06 B Ballast tube is 12 volt filament tube (12BY7 12.6 V.3 A)
- \_\_\_ 06 C Ballast tube is diode
- \_\_\_ 06 D Ballast tube is resistor
- \_\_\_ 06 E Ballast tube is removed with 12BA6 in BFO and VFO
- \_\_\_ 06 F Ballast tube is removed with 6.3 volt filaments for BFO and VFO
- \_\_\_ 07 A Solid state 26Z5's sockets unwired
- \_\_\_ 07 B Solid state 26Z5's sockets crimped over
- \_\_\_ 07 C Solid state 26Z5's diodes on top of sockets
- \_\_\_ 07 D Solid state 26Z5's no clue provided
- \_\_\_ 08 Spook cover on dial bezel
- \_\_\_ 09 Colored dial lights (red or blue)
- \_\_\_ 10 LED dial lamps
- \_\_\_ 11 EIA tube shields
- \_\_\_ 12 The selenium rectifier is replaced with bridge rectifier
- \_\_\_ 13 Replaced power filter caps
- \_\_\_ 14 Replaced AGC time constant caps
- \_\_\_ 15 Langford AGC diode modifications
- \_\_\_ 16 Other SSB modifications
- \_\_\_ 17 A Line filter is still original
- \_\_\_ 17 B Line filter is GFI friendly
- \_\_\_ 17 C Line filter is missing
- \_\_\_ 18 R390A has a quality capacitor for C553
- \_\_\_ 19 R390A black or brown beauties have been replaced in IF and RF decks
- \_\_\_ 20 A R390A power supply filter caps original style
- \_\_\_ 20 B R390A power supply filter caps re-stuffed cans
- \_\_\_ 20 C R390A power supply filter caps re-stuffed other package
- \_\_\_ 20 D R390A power supply filter caps under deck
- \_\_\_ 21 A R390 power supply filter caps original style
- \_\_\_ 21 B R390 power supply filter caps re-stuffed cans
- \_\_\_ 21 C R390 power supply filter caps re-stuffed other package
- \_\_\_ 21 D R390 power supply filter caps replaced other
- \_\_\_ 22 A R390 Audio 1UF B+ filter caps original style
- \_\_\_ 22 B R390 Audio 1UF B+ filter caps re-stuffed
- \_\_\_ 22 C R390 Audio 1UF B+ filter caps replaced under deck
- \_\_\_ 23 Paper caps removed from audio module.
- \_\_\_ 24 R390A C604 0.01 300 WVDC 20% paper replaced with 0.022 400 V
- \_\_\_ 25 R390A C605 0.01 300 WVDC 20% paper replaced with 0.022 400 V
- \_\_\_ 26 R390A C609 8uf 30 WVDC tantalum electrolytic replaced
- \_\_\_ 27 R390A 6626 MIL spec replacing the 0A2 commercial tube
- \_\_\_ 28 R390A R504 should have a value of 500 ohms.
- \_\_\_ 29 A Line meter is original type
- \_\_\_ 29 B Line meter is correct resistance but re-faced
- \_\_\_ 29 C Line meter is modified circuit and meter
- \_\_\_ 29 D Line meter does not have correct face
- \_\_\_ 30 A Carrier meter is original type
- \_\_\_ 30 B Carrier meter is correct resistance but re-faced
- \_\_\_ 30 C Carrier meter is modified circuit and meter
- \_\_\_ 30 D Carrier meter does not have correct face

C. Cosmetic Clean Up

- \_\_\_ 01 Remove all of the knobs and lightly lube the set screws
- \_\_\_ 02 Pull all of the modules out of receiver
- \_\_\_ 03 Drop the front panel
- \_\_\_ 04 Rip it's gizzard out and scatter and toss the parts around
- \_\_\_ 05 Try but manage to not loose any of the parts
- \_\_\_ 06 Do not have any extra parts left over when finished
- \_\_\_ 07 Pull all the tube shields
- \_\_\_ 08 Pull all the tubes
- \_\_\_ 09 Remove the RF slug racks and springs
- \_\_\_ 10 Wipe each of the RF cores out with a damp Q-tips
- \_\_\_ 11 Wipe the slugs off, and eye-ball them
- \_\_\_ 12 R390A All of the RF slugs are the same
- \_\_\_ 13 R390A All of the six Variable IF slugs are the same
- \_\_\_ 14 R390 RF slugs type a
- \_\_\_ 15 R390 RF slugs type b
- \_\_\_ 16 R390 First IF slugs
- \_\_\_ 17 R390 Second IF slugs
- \_\_\_ 18 Remove the RF coil can assemblies
- \_\_\_ 19 Straighten the IF and RF can assemblies as needed
- \_\_\_ 20 Verify that the index washers were installed in the two big knobs
- \_\_\_ 21 Give the chassis a bath with soap and water let dry
- \_\_\_ 22 Wash the front panel with soap and water let dry
- \_\_\_ 23 Wash the modules with soap and water let dry
- \_\_\_ 24 Do not take apart the 6 camshafts and the antenna trimmer can.
- \_\_\_ 25 Do not oil the antenna trimmer insulating fiberwashers
- \_\_\_ 26 Do not saturate / soak / submerge the slugs
- \_\_\_ 27 Clean the slug rack rollers by working penetrating oil into rollers
- \_\_\_ 28 Keep lubing and wiping them until only clean oil comes out
- \_\_\_ 29 Deoxit the tube sockets and coil sockets
- \_\_\_ 30 Deoxit the RF band switch
- \_\_\_ 31 Give rest of RF deck a bath (hard-core or cosmetic)

D. Hard Core RF Module Cleaning

- \_\_\_ 01 Disassemble the gear train
- \_\_\_ 02 When you take the split gears apart, tie them together
- \_\_\_ 03 Maintain the orientation that they were originally assembled with
- \_\_\_ 04 Except for the counter, toss all of the parts in a coffee can
- \_\_\_ 05 Add favorite degreaser and let brew
- \_\_\_ 06 Work penetrating oil into the bearings of the camshafts
- \_\_\_ 07 Keep lubing and wiping them until only clean oil comes out
- \_\_\_ 08 Now bath the RF deck in soap and water (dishwasher)
- \_\_\_ 09 Now bath the gear parts in soap and water (dishwasher)
- \_\_\_ 10 Dry the RF deck and gears (all day in the sunlight)
- \_\_\_ 11 Use 10W30 Mobil 1 synthetic oil for the RF deck
- \_\_\_ 12 Use Pennzoil wheel bearing grease on the detent
- \_\_\_ 13 Use compressed air to work oil into the bearings of the camshafts
- \_\_\_ 14 Lubricate each part of gear train prior to assembly
- \_\_\_ 15 Reassemble the gear train
- \_\_\_ 16 Use compressed air to work oil into the gears
- \_\_\_ 17 Wipe out excess oil
- \_\_\_ 18 Conduct mechanical alignment of the gear train
- \_\_\_ 19 Deoxit all the tube socket pins
- \_\_\_ 20 Deoxit all the connector sockets
- \_\_\_ 21 Deoxit all the plug pins

E. Cosmetic RF Module Cleaning

- \_\_\_ 01 Hang gear train over edge of bench
- \_\_\_ 02 Rotate the deck any way needed to work out dirt
- \_\_\_ 03 Use liberal amounts of cleaner to wash gears
- \_\_\_ 04 Use compressed air to push cleaner into parts and dirt out
- \_\_\_ 05 Use penetrating oil on first pass
- \_\_\_ 06 Use alcohol on second pass
- \_\_\_ 07 Use degreaser on third pass
- \_\_\_ 08 Use simple soap on fourth pass
- \_\_\_ 09 Dry the RF deck and gears (all day in the sunlight)
- \_\_\_ 10 Use 10W30 Mobil 1 synthetic oil for the RF deck
- \_\_\_ 11 Use Pennzoil wheel bearing grease on the detent
- \_\_\_ 12 Use compressed air to work oil into the bearings of the camshafts
- \_\_\_ 13 Use compressed air to work oil into the gears
- \_\_\_ 14 Wipe out excess oil
- \_\_\_ 15 Conduct mechanical alignment of the gear train
- \_\_\_ 16 Deoxit all the tube socket pins
- \_\_\_ 17 Deoxit all the connector sockets
- \_\_\_ 18 Deoxit all the plug pins

F. Rebuild Inspection / Visual Inspection

- \_\_\_ 01 Spin all of the trimmers caps a couple of turns
- \_\_\_ 02 Tighten the screws holding the tube sockets to the chassis
- \_\_\_ 03 Check the value of all the resistors
- \_\_\_ 04 Check the value of all diodes
- \_\_\_ 05 Check the value of all capacitors
- \_\_\_ 06 Measure the resistance of all the front panel potentiometers
- \_\_\_ 07 Measure the resistance of the IF gain potentiometer
- \_\_\_ 08 Measure the resistance of the carrier meter zero potentiometer
- \_\_\_ 09 Remove all of the hoods of the chassis connectors to inspect
- \_\_\_ 10 Measure the resistance of EVERY damn wire in the chassis
- \_\_\_ 11 Inspect the power cord connections under the coverplate.
- \_\_\_ 12 Check the capacitors and resistors inside the IF transformer cans
- \_\_\_ 13 Test the dial lamps
- \_\_\_ 14 Check the selenium rectifier
- \_\_\_ 15 Check the antenna relay and inspected the contacts in the relay
- \_\_\_ 16 Check the main power microswitch
- \_\_\_ 17 Check capacitor C-553, which blocks B+ from the mechanical filters
- \_\_\_ 18 Check the 2UF AGC capacitor for leaking fluid
- \_\_\_ 19 Check C531 cause of audio and limiter function problems
- \_\_\_ 20 Check C547 cause of audio and limiter function problems
- \_\_\_ 21 Check C549 cause of audio and limiter function problems
- \_\_\_ 22 Check C603 capacitor mounted on the AF deck
- \_\_\_ 23 Check C606 capacitor mounted on the AF deck
- \_\_\_ 24 Check C609 8 ufd electrolytic capacitor mounted in the AF deck
- \_\_\_ 25 Check C-327, a 100 pf mica capacitor mounted in the RF deck
- \_\_\_ 26 Verify the values of the fuses
- \_\_\_ 27 Inspect the fuse holder operation
- \_\_\_ 28 Inspect the rear panel antenna and IF output connectors
- \_\_\_ 29 Inspect the terminal board screws and jumpers
- \_\_\_ 30 Check all the tubes with a tube tester for minimum values

G. Reassemble The Receiver

- \_\_\_ 01 Inspect the cams for burrs where the rollers ride on, hone if needed
- \_\_\_ 02 Inspect the gear clamps for cracks replace as needed
- \_\_\_ 03 Inspect the spline bolts in the gear clamps replace as needed
- \_\_\_ 04 Inspect the roller retainers on the slug racks these must roll freely
- \_\_\_ 05 Inspect slug racks for square true operation fix as needed
- \_\_\_ 06 Inspect slug racks for burrs and gouges on the end surfaces and fix
- \_\_\_ 07 Replace the RF deck transformer cans
- \_\_\_ 08 Replace the slug racks inspect for proper installation of racks
- \_\_\_ 09 Install the slug rack springs
- \_\_\_ 10 Install the calibration crystal oven
- \_\_\_ 11 Inspect the slug rack springs for poor tension, replace as needed
- \_\_\_ 12 "Time" the RF deck bandswitch
- \_\_\_ 13 "Time" the OSC deck bandswitch
- \_\_\_ 14 Install OSC deck subassembly
- \_\_\_ 16 Check the alignment and operation of the OSC deckswitch
- \_\_\_ 17 In R390 check the Oldham coupler between OSC and RFdecks
- \_\_\_ 18 In R390 check the OSC deck switch "timing"
- \_\_\_ 19 Install RF subassembly deck
- \_\_\_ 20 In R390 install the calibration subassembly deck
- \_\_\_ 21 Install VFO subassembly
- \_\_\_ 22 Check the VFO shaft alignment to the KHz shaft adjust as needed
- \_\_\_ 23 Check the VFO Oldham coupler spacing
- \_\_\_ 24 Install the VFO Oldham coupler spring
- \_\_\_ 25 Reinstall the front panel
- \_\_\_ 25 Conduct power supply module: visual inspection
- \_\_\_ 26 Verify power supply 115 volt switch setting
- \_\_\_ 27 Inspect the solder connections in power supply (diodes added)
- \_\_\_ 28 Install the power supply module
- \_\_\_ 29 Install the IF module
- \_\_\_ 20 Install the audio module
- \_\_\_ 31 Lightly lube the set-screws in the knobs, and install the knobs
- \_\_\_ 32 Lightly lube the shafts of each front panel switch
- \_\_\_ 33 Lightly lube the shafts of each front panel potentiometer
- \_\_\_ 34 Lightly lube the shafts IF gain potentiometer
- \_\_\_ 35 Lightly lube the shafts carrier meter, adjust potentiometer
- \_\_\_ 36 IF deck lightly lube the shaft extension bushings
- \_\_\_ 37 Reinstall the knobs
- \_\_\_ 38 Check the tightness on all of the screws and clamps
- \_\_\_ 39 Install the tubes
- \_\_\_ 40 Install selected tube shields
- \_\_\_ 41 All the knobs must operate freely
- \_\_\_ 42 Knobs must not be loose on shafts
- \_\_\_ 43 Verify all connectors are properly seated
- \_\_\_ 44 Ensure the wire harness is tucked in on the bottomside

#### H. Mechanical Alignment

- \_\_\_ 01 Set Oven switch to OFF
- \_\_\_ 02 Loosen the dial lock, check the knob and lock operation
- \_\_\_ 03 Check the zero adjust knob adjustment operation
- \_\_\_ 03 Set the zero adjust to center
- \_\_\_ 04 Check the over-run and under-run on the KHz knob (10 turn stop)
- \_\_\_ 05 Adjust the KHz counter as needed (greater than 257963 , -972 )
- \_\_\_ 06 Check the over run and under run on the MHz knob (10 turn stop)
- \_\_\_ 07 Adjust the MHz counter as needed
- \_\_\_ 08 Set the R390A to 7+000        Set the R390 to 2.000
- \_\_\_ 09 Check the cam alignment starting with the 8-16 MHz cam
- \_\_\_ 10 A If the 8-16 MHz cam needs adjusting, then loosen the following:
- \_\_\_ 10 B Release the clamp for 2-4, the slug rack should fall
- \_\_\_ 10 C Release the clamp for 4-8, the slug rack should fall
- \_\_\_ 10 D Release the clamp for 16-32, the slug rack should fall
- \_\_\_ 10 E The 8-16 slug rack should also fall
- \_\_\_ 11 Hold the 8-16 and 16-32 cams in place
- \_\_\_ 12 Tighten the 16-32 MHz cam clamp
- \_\_\_ 13 Hold the 4-8 cam in place
- \_\_\_ 14 Tighten the 4-8 MHz cam clamp
- \_\_\_ 15 Hold the 2-4 cam in place
- \_\_\_ 16 Tighten the 2-4 MHz cam clamp
- \_\_\_ 17 Adjust the 1-2 MHz cam if needed
- \_\_\_ 18 Adjust the 0.5-1 MHz cam if needed
- \_\_\_ 19 Adjust the 1st Variable IF cam if needed
- \_\_\_ 20 Adjust the 2nd Variable IF cam if needed
- \_\_\_ 21 Adjust the VFO if needed

#### I. Knobology Dynamic Testing Monthly Test

- \_\_\_ 01 Set the Function Switch to MGC
- \_\_\_ 02 Eye-ball the receiver in the dark for blue tube glow
- \_\_\_ 03 Eye-ball the dial lights
- \_\_\_ 04 Get the head-phones adjusted over the ears
- \_\_\_ 05 Set the line meter to 0
- \_\_\_ 06 Set the line gain to 10
- \_\_\_ 07 Set the ANT trim to 0
- \_\_\_ 08 Set the AGC to MED
- \_\_\_ 09 Set the LIMITER to OFF
- \_\_\_ 10 Set the Bandwidth to 2KHz
- \_\_\_ 11 Set the BFO Pitch to 0
- \_\_\_ 12 Set the BFO OFF
- \_\_\_ 13 Set the Break-in OFF
- \_\_\_ 14 Set the Audio Response to wide
- \_\_\_ 15 Set the Zero Adjust to center and confirm knob is not loose
- \_\_\_ 16 Release the Dial Lock and confirm knob is not loose
- \_\_\_ 17 Set the Local Audio to max and confirm knob is not loose
- \_\_\_ 18 Set the RF to max and confirm knob is not loose
- \_\_\_ 19 Run the Local Audio from end to end and confirm knob is not loose
- \_\_\_ 20 Listen for pot pop in the headphones
- \_\_\_ 21 Confirm Local Audio pot, V603, and V602A are good
- \_\_\_ 22 Switch the bandpass filter from wide to sharp to wide
- \_\_\_ 23 Confirm bandpass filter knob is not loose
- \_\_\_ 24 Listen for switch pop in the headphones
- \_\_\_ 25 Listen for narrow audio response in the headphones
- \_\_\_ 26 Confirm Filter, switch, and V601A are good
- \_\_\_ 27 Set the LIMITER to ON
- \_\_\_ 28 Listen for switch pop in the headphones

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- \_\_\_ 29 Run the LIMITER pot from end-to-end
- \_\_\_ 30 Listen for a change in audio spectrum
- \_\_\_ 31 Set the LIMITER to OFF and confirm knob is not loose
- \_\_\_ 32 Confirm Limiter switch, and V507 are good
- \_\_\_ 33 Set the Function to CAL
- \_\_\_ 34 Listen for the Antenna Relay to click between MGC and CAL
- \_\_\_ 35 Set the BFO ON and confirm knob is not loose
- \_\_\_ 36 Set the Khz to 500Khz
- \_\_\_ 37 Vary the BFO pitch and confirm knob is not loose
- \_\_\_ 38 Confirm the BFO pitch goes through zero and the knob stops work
- \_\_\_ 39 Set the Band Width to 0.1Khz, 1Khz, 2KHz, 4Khz, 8Khz,16Khz
- \_\_\_ 40 Listen for a change in audio spectrum and confirm knob is not loose
- \_\_\_ 41 Set the Band Width to 0.1Khz
- \_\_\_ 42 Set the BFO Pitch to zero, confirm knob adjustment for zero is good
- \_\_\_ 43 Vary the Khz Knob to get a zero BFO through the 0.1KHz
- \_\_\_ 44 Confirm V505, V701, V506B, V504, V503, V502, V501 are good
- \_\_\_ 45 Set the Band Width to 4Khz
- \_\_\_ 46 Set the MHz to 00
- \_\_\_ 47 Verify Mhz stop at 00
- \_\_\_ 48 Set the Khz to 500Khz and listen for a calibration tone
- \_\_\_ 49 Move the Mhz knob up one detent
- \_\_\_ 50 Verify detent seats, verify bandswitch changes as needed
- \_\_\_ 51 Verify 2nd Crystal Oscillator crystal is within 1KHz on each Mhz
- \_\_\_ 52 Move the Mhz knob up one detent
- \_\_\_ 53 Verify Mhz stop at 31
- \_\_\_ 54 Dial Khz to 000
- \_\_\_ 55 Check counter under-run
- \_\_\_ 56 Dial Khz to 000 and null cal tone to zero with BFO
- \_\_\_ 57 Dial Khz to each 100 KHz and note VFO spread
- \_\_\_ 58 Dial Khz to 900 and note that total VFO spread is less than 300 Hz
- \_\_\_ 59 Check counter over-run
- \_\_\_ 60 Ground break-in and set break in ON
- \_\_\_ 61 Confirm audio mutes
- \_\_\_ 62 Set break in OFF
- \_\_\_ 63 Confirm antenna relay operation in STANDBY and CAL
- \_\_\_ 64 Set the Function to AGC
- \_\_\_ 65 Set the AGC to SLOW, MED, FAST
- \_\_\_ 66 Observe that the carrier meter moves upscale and drops back to zero
- \_\_\_ 67 Set the Function to CAL
- \_\_\_ 68 Set the BFO ON
- \_\_\_ 69 Dial KHz to a cal tone and adjust BFO for a tone
- \_\_\_ 70 Set the line gain to max
- \_\_\_ 71 Set the line meter switch to 0
- \_\_\_ 72 Set the line gain for a meter indication of 0
- \_\_\_ 73 Set the line meter switch to +10
- \_\_\_ 74 Observe the line meter reads -10
- \_\_\_ 75 CARRIER LEVEL meter deflection of at least 40 dB on Cal tone
- \_\_\_ 76 Set the Function to AGC
- \_\_\_ 77 Tune KILOCYCLE CHANGE control across any band
- \_\_\_ 78 Tune KILOCYCLE CHANGE control through several signals
- \_\_\_ 79 Output volume should be nearly constant
- \_\_\_ 80 Tune KILOCYCLE CHANGE control to one signal
- \_\_\_ 81 CARRIER LEVEL meter indicates strength of received signals
- \_\_\_ 82 Rotate ANT TRIM control to peak CARRIER LEVEL meter
- \_\_\_ 83 Set FUNCTION switch to MGC
- \_\_\_ 84 Tune the receiver away from any signal
- \_\_\_ 85 CARRIER LEVEL should not indicate (read zero)

J Adjust the IF gain R519

- \_\_\_ 01 Set the Line Meter OFF
- \_\_\_ 02 Set the Line gain to 0
- \_\_\_ 03 Set the ANT Trim to 0
- \_\_\_ 04 Set the AGC to MED
- \_\_\_ 05 Set the LIMITER to OFF
- \_\_\_ 06 Set the Band Width to 2KHz
- \_\_\_ 07 Set the BFO Pitch to 0
- \_\_\_ 08 Set the Audio Response to WIDE
- \_\_\_ 09 Set the Break-in OFF
- \_\_\_ 10 Set the Function to MGC
- \_\_\_ 11 Set the BFO to OFF
- \_\_\_ 12 Release the Zero Adjust
- \_\_\_ 13 Release the Dial Lock
- \_\_\_ 14 Set the Local Audio to max
- \_\_\_ 15 Set the RF to max
- \_\_\_ 16 Remove P114 from J514
- \_\_\_ 17 Remove P213 from J513
- \_\_\_ 18 Remove P218 from J518
- \_\_\_ 19 Remove J116 adapter from the back panel if necessary
- \_\_\_ 20 Couple P114 to J513
- \_\_\_ 21 Couple P116 to J116
- \_\_\_ 22 Couple J116 to the signal generator RF output
- \_\_\_ 22 Adjust signal generator for 455 KHz output frequency
- \_\_\_ 24 Adjust signal generator for 150 micro volt RF output
- \_\_\_ 25 Adjust signal generator for 30% audio tonemodulation (400 Hz)
- \_\_\_ 26 Meter diode load output for -7 VDC
- \_\_\_ 27 Place a 600 ohm load across the local audio output
- \_\_\_ 28 Place a 600 ohm load across the line audio output
- \_\_\_ 29 Meter local audio output for 450 milliwatts, 27 db, or 17.3 Volts AC
- \_\_\_ 30 Adjust the IF gain R519 for -7 VDC on the diode load
- \_\_\_ 31 Observe the local audio output level is greater than 400 milliwatts
- \_\_\_ 32 Local Audio should be 17.3 Volts AC across 600 ohms 450 mw
- \_\_\_ 33 Line Audio should be 2.45 Volts AC across 600 ohms 10mw
- \_\_\_ 34 Phone Audio should be 0.78 Volts AC across 600 ohms 1mw
- \_\_\_ 35 Line Audio at 0.78 Volts across 600 should be LineMeter Zero VU
- \_\_\_ 36 Set the Line Meter to +10
- \_\_\_ 37 Set the signal generator modulation on
- \_\_\_ 38 The Line Meter should read above 0 VU (10 mw)
- \_\_\_ 39 Set the Line Gain off max until the Line Meter reads 0 VU (10 mw)
- \_\_\_ 40 Set the signal generator modulation off
- \_\_\_ 41 Set the Meter Switch to -10
- \_\_\_ 42 Observe 30 db change (20 db on switch plus 10 db on meter scale)
- \_\_\_ 43 The Line Meter should read less than -10 VU (SN + N > 30 DB)
- \_\_\_ 44 Set the Line Meter to OFF
- \_\_\_ 45 Set the Line Gain to 0

#### K. Alternate Procedure To Set The IF Gain Control

Once the receiver has been fully mechanically and electrically aligned, the final procedure to perform before "buttoning it up" is to set the IF gain control. The manual specification to set the IF Gain control for a level of -7 volts on the diode load for 150uv @455kc into J-513 is far too hot. Many otherwise very sensitive R390A's are thought not be hearing weak signals, because these signals are covered by excess noise generated in the IF module. The most common single item responsible for holding a R390A back is not lack of sensitivity. Rather it is internally generated IF deck noise.

- \_\_\_ 01 Allow the receiver to warm up for at least 1 hour then:
- \_\_\_ 02 Terminate the antenna input (just ground the balanced inputs)
- \_\_\_ 03 Set receiver for 15.2 MHz (Selected point of mechanical alignment)
- \_\_\_ 04 Set the "FUNCTION" switch to MGC
- \_\_\_ 05 Select the 4kc filter with the "BANDWIDTH"
- \_\_\_ 06 Set "RF GAIN" control to 10 or maximum
- \_\_\_ 07 Peak the "ANTENNA TRIM" for maximum noise
- \_\_\_ 08 Use the "LINE LEVEL" meter for peaking noise
- \_\_\_ 09 Set "Line Meter" switch to -10db scale
- \_\_\_ 10 Set "Line Gain" control to full CW or "10."
- \_\_\_ 11 Adjust IF gain control, R-519 to between -4 to -7 VU on Line Meter
- \_\_\_ 12 Set the "FUNCTION" switch to AGC
- \_\_\_ 13 Re-zero the carrier meter control, R523
- \_\_\_ 14 Set controls above for normal operation
- \_\_\_ 15 Remove antenna short, and reinstall antenna
- \_\_\_ 16 Power up the oven, and verify function of the thermostat
- \_\_\_ 17 Turn the oven off
- \_\_\_ 18 Leave receiver on for at least 14 days to reform caps

#### L IF Module Alignment

- \_\_\_ 01 Continue with the prior setup
- \_\_\_ 02 Adjust signal generator for 455 KHz output frequency
- \_\_\_ 03 Adjust signal generator for 150 microvolt RF output
- \_\_\_ 04 Adjust signal generator for 30% audio tone modulation (400 Hz)
- \_\_\_ 05 Meter diode load output for -7 volts DC
- \_\_\_ 06 Place a 600 ohm load across the local audio output
- \_\_\_ 07 Meter local audio output for 450 milliwatts, 27 db, or 17.3 VAC
- \_\_\_ 08 Set the Band Width to 2 KHz
- \_\_\_ 09 Adjust C571 (top trimmer) for max diode load output
- \_\_\_ 10 Adjust C513 (bottom trimmer) for max diode load output
- \_\_\_ 11 Set the Band Width to 4 KHz
- \_\_\_ 12 Adjust C570 (top trimmer) for max diode load output
- \_\_\_ 13 Adjust C514 (bottom trimmer) for max diode load output
- \_\_\_ 14 Set the Band Width to 8 KHz
- \_\_\_ 15 Adjust C568 (top trimmer) for max diode load output
- \_\_\_ 16 Adjust C515 (bottom trimmer) for max diode load output
- \_\_\_ 17 Set the Band Width to 16 KHz
- \_\_\_ 18 Adjust C569 (top trimmer) for max diode load output
- \_\_\_ 19 Adjust C516 (bottom trimmer) for max diode load output

M. To Stagger Or Not To Stagger

- 01 Continue with the prior setup
- 02 Set the Band Width to 16 KHz
- 03 Set the Function to MGC
- 04 Adjust signal generator for 455 KHz output frequency
- 05 Adjust signal generator for 150 microvolts RF output
- 06 Adjust signal generator for 30% audio tone modulation (400 Hz)
- 07 Meter diode load output for -7 volts DC
- 08 Note the position of the top slug in T501
- 09 Adjust the top slug of T501 for maximum output
- 10 Return the top slug in T501 to its original position
- 11 Adjust signal generator for 467 KHz output frequency
- 12 Adjust the top slug of T501 for maximum output
- 13 Note the position of the top slug in T501
- 14 If the slug was tuned closer to 467 than 455 the module is staggered
- 15 If the module is to be stagger-tuned then use the stagger tune steps

N. To stagger tune IF

- 01 Adjust signal generator for 467 KHz output frequency
- 02 Adjust the top slug of T501 for maximum output
- 03 Adjust the bottom slug of T502 for maximum output
- 04 Adjust signal generator for 443 KHz output frequency
- 05 Adjust the bottom slug of T501 for maximum output
- 06 Adjust the top slug of T502 for maximum output
- 07 Adjust signal generator for 455 KHz output frequency
- 08 Adjust the bottom slug of T503 for maximum output
- 09 Adjust the top slug of T503 for maximum output

O. To straight tune IF

- 01 Adjust signal generator for 455 KHz output frequency
- 02 Adjust the top slug of T501 for maximum output
- 03 Adjust the bottom slug of T501 for maximum output
- 04 Adjust the top slug of T502 for maximum output
- 05 Adjust the bottom slug of T502 for maximum output
- 06 Adjust the bottom slug of T503 for maximum output
- 07 Adjust the top slug of T503 for maximum output

P. Adjust Z503 AGC

- 01 Continue from part J above
- 02 Set the function switch to AGC
- 03 Meter the AGC voltage for -1 to -2 volts on the AGC jumper
- 04 Adjust the signal generator for an AGC voltage in the meter range
- 05 Adjust Z503 for maximum AGC voltage on the AGC jumper
- 06 Set the function switch to MGC

Q IF And Audio Module Tube Optimizing

Optimizing the vacuum tube lineup in the signal path is another technique to maximize performance. Start with the tubes in the IF strip. These are the 5749W's IF amps, V-501, V-502 and V-503. The 6AK6 4th IFamp V-504 and the detector, V-506, a 5814A. Continue with the audio module tubes. Then do the RF module tubes last. The tubes can be optimized before any alignment is conducted. But the usual procedure is to do a signal alignment, conduct the tube optimization, and then do another complete signal alignment. Normal procedure is to conduct the signal alignment and tube optimization together in module by module stages IF and audio modules, then RF and oscillator modules. Watch the noise level of each tube with the modulation off. The meter should lie quietly. If the meter needle is bouncing, then consider this as additional noise from the tube. It may take several passes in a poor receiver to grade other noisy tubes out of the receiver and reach acceptable levels of performance. Use the best tubes on hand and place them in the optimum performance order. New tubes may not be better than existing tubes.

## R390A repair depot sequence page 11

When new tubes are received, grade them against all like tubes on hand. Keep track of the spares and their values. If the signal-to-noise ratios are good some meter bounce is expected. If you reach the point where you believe you have good tubes through the receiver and the meter just will not lie quietly, then you have to start looking for leaky caps, poor resistors, bad solder joints, dirty tube sockets, dirty connector pins, or loose or corroded tie lugs.

- \_\_\_ 01 Set the Line Meter OFF
- \_\_\_ 02 Set the Line gain to 0
- \_\_\_ 03 Set the ANT Trim to 0
- \_\_\_ 04 Set the AGC to MED
- \_\_\_ 05 Set the LIMITER to OFF
- \_\_\_ 06 Set the Band Width to 2KHz
- \_\_\_ 07 Set the BFO Pitch to 0
- \_\_\_ 08 Set the Audio Response to WIDE
- \_\_\_ 09 Set the Break-in OFF
- \_\_\_ 10 Set the Function Switch to MGC
- \_\_\_ 11 Set the BFO to OFF
- \_\_\_ 12 Release the Zero Adjust
- \_\_\_ 13 Release the Dial Lock
- \_\_\_ 14 Set the Local Audio to max
- \_\_\_ 15 Set the RF to max
- \_\_\_ 16 Remove P114 from J514
- \_\_\_ 17 Remove P213 from J513
- \_\_\_ 18 Remove P218 from J518
- \_\_\_ 19 Remove J116 adapter from the back panel if necessary
- \_\_\_ 20 Couple P114 to J513
- \_\_\_ 21 Couple P116 to J116
- \_\_\_ 22 Couple J116 to the signal generator RF output
- \_\_\_ 22 Adjust signal generator for 455 KHz output frequency
- \_\_\_ 24 Adjust signal generator for 150 microvolts RF output
- \_\_\_ 25 Adjust signal generator for 30% audio tone modulation (400 Hz)
- \_\_\_ 26 Meter diode load output for -7 volts DC
- \_\_\_ 27 Place a 600 ohm load across the local audio output
- \_\_\_ 28 Meter local audio output for 450 milliwatts, 27 db, or 17.3 Volts AC
- \_\_\_ 29 In pass one gather all the spare 5749's
- \_\_\_ 30 Pull the BFO and VFO 5759 tubes (V505, V701)
- \_\_\_ 31 Pull the AGC IF AMP (V508)
- \_\_\_ 32 Remember the goal is best signal-to-noise ratio for each tube
- \_\_\_ 33 Set the signal generator modulation on and record the audio output
- \_\_\_ 34 Set the signal generator modulation off and record the audio output
- \_\_\_ 35 The difference in these two values is the merit of the tube in V501
- \_\_\_ 36 Place each spare 5759 into V501 to find a merit value for the tube
- \_\_\_ 37 Grade the spare 5749's from worse to best
- \_\_\_ 38 Place the worse tube in V503
- \_\_\_ 39 Place the second poorest tube in V502
- \_\_\_ 40 Start over and re-grade the 5749's in V501 (32, 33,34)
- \_\_\_ 41 Select the very best signal-to-noise 5749 for the V701 (VFO)
- \_\_\_ 42 Place the second best 5749 in V501
- \_\_\_ 43 Place the third best 5749 in V502
- \_\_\_ 44 Place the fourth best 5749 in V503
- \_\_\_ 45 Place the fifth best 5749 in V505 (BFO)
- \_\_\_ 46 Place the sixth best 5749 in V508 (AGC IF amp)
- \_\_\_ 47 In pass two gather all the spare 6AK6's
- \_\_\_ 48 Remove V604 Line Audio
- \_\_\_ 49 Set the signal generator modulation on and record the audio output
- \_\_\_ 50 Set the signal generator modulation off and record the audio output
- \_\_\_ 51 The difference in these two values is the merit of the tube in V504
- \_\_\_ 52 Place each spare 6AK6 into V504 to find a merit value for the tube

- \_\_\_ 53 Place the worst tube in V603 Local Audio
- \_\_\_ 54 Start over and re-grade the 6AK6's in V504 (49, 50,51)
- \_\_\_ 55 Place the best 6AK6 in V504 (4th IF stage)
- \_\_\_ 56 Place the second best 6AK6 in V603 Local Audio
- \_\_\_ 57 Place the third best 6AK6 in V604 Line Audio
- \_\_\_ 58 In pass three gather all the spare 5814's
- \_\_\_ 59 Remove V507, V509, V205, V206
- \_\_\_ 60 Set the signal generator modulation on and record the audio output
- \_\_\_ 61 Set the signal generator modulation off and record the audio output
- \_\_\_ 62 The difference in these two values is the merit of the tube in V601
- \_\_\_ 63 Place each spare 5814 into V601 to find a merit value for the tubes
- \_\_\_ 64 Place the worst tube in V602
- \_\_\_ 65 Place the second worst tube in V506
- \_\_\_ 66 Start over and re-grade the 5814's in V601 (60, 61,62)
- \_\_\_ 67 Place the best 5814 in V506 Detector
  
- \_\_\_ 68 Place the 2nd best 5814 in V601 1<sup>st</sup> AF amp and follower
- \_\_\_ 69 Place the 3rd best 5814 in V602 local AF amp
- \_\_\_ 70 Place the 4th best 5814 in V507 Limiter
- \_\_\_ 71 Place the 5th best 5814 in V205 Calibration Oscillator
- \_\_\_ 72 Place the 6th best 5814 in V206 100 KC multivibrator
- \_\_\_ 73 Place the 7th best 5814 in V509 AGC rectifier
- \_\_\_ 74 Adjust signal generator for 455 KHz output frequency
- \_\_\_ 75 Adjust signal generator for 150 microvolts RF output
- \_\_\_ 76 Adjust signal generator for 30% audio tone modulation (400 Hz)
- \_\_\_ 77 Meter diode load output for -7 volts DC
- \_\_\_ 78 Set the Band Width to 2 KHz
- \_\_\_ 79 Adjust the IF gain R519 for -7 V DC on the diode load
- \_\_\_ 80 Meter local audio output for 450 milliwatts, 27 db, or 17.3 Volts AC
- \_\_\_ 81 Set the signal generator modulation on and record the audio output
- \_\_\_ 82 Set the signal generator modulation off and record the audio output
- \_\_\_ 83 Meter local audio output for 1 milliwatt, 0 db, or .775 Volts AC
- \_\_\_ 84 If the difference must be greater than 27 db. (30 likely)
- \_\_\_ 85 Remove all test equipment
- \_\_\_ 86 Return the receiver connections to their original configurations

R. Adjust T208, C520, L503, and Zero BFO

- \_\_\_ 01 Set the Line Meter OFF
- \_\_\_ 02 Set the Line gain to 0
- \_\_\_ 03 Set the ANT Trim to 0
- \_\_\_ 04 Set the AGC to MED
- \_\_\_ 05 Set the LIMITER to OFF
- \_\_\_ 06 Set the Band Width to 2KHz
- \_\_\_ 07 Set the BFO Pitch to 0
- \_\_\_ 08 Set the Audio Response to wide
- \_\_\_ 09 Set the Breakin OFF
- \_\_\_ 10 Set the Function to MGC
- \_\_\_ 11 Set the BFO OFF
- \_\_\_ 12 Release the Zero Adjust
- \_\_\_ 13 Release the Dial Lock
- \_\_\_ 14 Set the Local Audio to max
- \_\_\_ 15 Set the RF to max
- \_\_\_ 16 Adjust signal generator for 455 KHz output frequency
- \_\_\_ 17 Adjust signal generator for 75 microvolts RF output
- \_\_\_ 18 Adjust signal generator for 30% audio tone modulation (400 Hz)
- \_\_\_ 19 Meter diode load output for -7 volts DC
- \_\_\_ 20 Place a 600 ohm load across the local audio output
- \_\_\_ 21 Meter local audio output for 450 milliwatts, 27 db, or 17.3 Volts AC
- \_\_\_ 22 Connect the signal generator to E211 through a capacitor.

- \_\_\_ 23 Adjust signal generator for diode load output of -7 volts DC
- \_\_\_ 24 Adjust T208 for peak (this adjustment is broad)
- \_\_\_ 25 Adjust signal generator for diode load output of -7 volts DC
- \_\_\_ 26 The signal level should be less than 75 microvolts RF output (50)
- \_\_\_ 27 The signal with 30% modulation should output 450 milliwatts audio
- \_\_\_ 28 Set the signal generator modulation on and record the audio output
- \_\_\_ 29 Meter local audio output for 450 milliwatts 27 db, or more
- \_\_\_ 30 Set the signal generator modulation off and record the audio output
- \_\_\_ 31 Meter local audio output for 1 milliwatt, 0 db, or less
- \_\_\_ 32 Set the Band Width to 0.1 KHz
- \_\_\_ 33 Rock the signal generator for maximum diode load output
- \_\_\_ 34 Adjust signal generator for diode load output of -7 volts DC
- \_\_\_ 35 Record the signal generator output level
- \_\_\_ 36 The following steps should produce six marks around C520
- \_\_\_ 37 Switch the generator output up 60 db (two switchsteps on URM 25)
- \_\_\_ 38 Increase the generator frequency until output drops to -7 volts DC
- \_\_\_ 39 Adjust C520 for a dip in the diode load voltage
- \_\_\_ 40 Mark the can and label this H (5 o'clock)
- \_\_\_ 41 Adjust C520 for the other side dip in the diode load voltage
- \_\_\_ 42 Mark the can and label this H (7 o'clock)
- \_\_\_ 43 Decrease the generator frequency until output drops to -7 volts DC
- \_\_\_ 44 Adjust C520 for a dip in the diode load voltage
- \_\_\_ 45 Mark the can and label this L (4 o'clock)
- \_\_\_ 46 Adjust C520 for the other side dip in the diode load voltage
- \_\_\_ 47 Mark the can and label this L (8 o'clock)
- \_\_\_ 48 Divide each pair of dips and mark the can C
- \_\_\_ 49 Set C520 to the C mark (either 4:30 or 7:30)
- \_\_\_ 50 Rock the signal generator (to 455) for maximum diode load output
- \_\_\_ 51 Adjust signal generator for diode load output of -7 volts DC
- \_\_\_ 52 Set the Band Width to 1 KHz
- \_\_\_ 53 Adjust L503 for peak output
- \_\_\_ 54 Set the BFO switch ON
- \_\_\_ 55 Loosen the clamp on the BFO shaft extension
- \_\_\_ 56 Zero the BFO knob
- \_\_\_ 57 Zero the BFO against the signal
- \_\_\_ 55 Tighen the clamp on the BFO shaft extension
- \_\_\_ 56 Set the BFO switch OFF
- \_\_\_ 57 Disconnect the generator

#### S 2nd Crystal Oscillator Alignment

When adjusting the 2nd Crystal Oscillator you can hear the noise peak better than you can measure it with the meter. Peak the caps up with both the meter and headphones.

- \_\_\_ 01 Meter the local audio output across a 600 Ohm load
- \_\_\_ 02 Meter the diode load for -7 volts DC
- \_\_\_ 03 Use a good set of headphones to monitor the audio output
- \_\_\_ 04 Set the function switch to CAL
- \_\_\_ 05 Set the BFO OFF
- \_\_\_ 06 Set the KHz to 500
- \_\_\_ 07 Set the KHz to 31
- \_\_\_ 08 Set the Bandwidth to 2 KHz
- \_\_\_ 09 Rock the KHz to produce maximum indication on the diode load
- \_\_\_ 10 Set the Local Output meter range to provide a midscale reading
- \_\_\_ 11 Use the headphones to hear the noise peak as you make adjustments
- \_\_\_ 12 Screw the slug of T401 out until only one peak can be obtained while turning trimmer capacitor 31 through its entire range.
- \_\_\_ 13 Set trimmer capacitor slightly away from peak
- \_\_\_ 14 Adjust the slug in T401 for peak output

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- \_\_\_ 15 Readjust capacitor 31 and ensure it has two peaks.
- \_\_\_ 16 Adjust capacitor 31 to peak (watch the meters for best indication)
- \_\_\_ 17 Move the MHz down one detent (you can hear the noise peak)
- \_\_\_ 18 Adjust the corresponding capacitor to peak
- \_\_\_ 19 Stop at 8MHz

### T 1st Crystal Oscillator Alignment

- \_\_\_ 01 Meter the local audio output across a 600 Ohm load
- \_\_\_ 02 Meter the diode load for -7 volts DC
- \_\_\_ 03 Use a good set of headphones to monitor the audio output
- \_\_\_ 04 Set the function switch to CAL
- \_\_\_ 05 Set the BFO OFF
- \_\_\_ 06 Set the KHz to 500
- \_\_\_ 07 Set the MHz to 7
- \_\_\_ 08 Set the Bandwidth to 2 KHz
- \_\_\_ 09 Rock the KHz to produce maximum indication on the diode load
- \_\_\_ 10 Adjust the slug in T207 for peak output

### U VFO Band Spread Test

- \_\_\_ 01 Set the Line Meter OFF
- \_\_\_ 02 Set the Line gain to 0
- \_\_\_ 03 Set the ANT Trim to 0
- \_\_\_ 04 Set the AGC to MED
- \_\_\_ 05 Set the LIMITER to OFF
- \_\_\_ 06 Set the Band Width to 2KHz
- \_\_\_ 07 Set the BFO Pitch to 0
- \_\_\_ 08 Set the Audio Response to wide
- \_\_\_ 09 Set the Breakin to OFF
- \_\_\_ 10 Set the Function to CAL
- \_\_\_ 11 Set the BFO to ON
- \_\_\_ 12 Set the Zero Adjust to center
- \_\_\_ 13 Release the Dial Lock
- \_\_\_ 14 Set the Local Audio to max
- \_\_\_ 15 Set the RF to max
- \_\_\_ 16 Set the KHz knob to -000
- \_\_\_ 17 Adjust the BFO Pitch to zero beat
- \_\_\_ 18 Set the KHz knob to +000
- \_\_\_ 19 Rock the KHz knob to zero beat
- \_\_\_ 20 The VFO band spread should be less than 300 Hertz

### V VFO Band Spread Adjustment

- \_\_\_ 01 If needed continue from the preceding section
- \_\_\_ 02 Set the FUNCTION switch to CAL
- \_\_\_ 03 Set the MHz to 9 MHz
- \_\_\_ 04 Set the Zero Adjust to center
- \_\_\_ 05 Set the KHz knob to 000
- \_\_\_ 06 Remove the Oldham coupler spring
- \_\_\_ 07 Remove the VFO from the receive
- \_\_\_ 08 Remove the end point adjustment cap screw
- \_\_\_ 09 Attach the output cable and harness cable
- \_\_\_ 10 Adjust the VFO shaft for a zero beat
- \_\_\_ 11 Mark the coupler and VFO face (9,000 3,455)
- \_\_\_ 12 Set the KHz knob for 9, +000 (9, +000 2,455)
- \_\_\_ 13 Dial 10 turns on the VFO shaft and align the marks
- \_\_\_ 14 If the span is not exact make a small adjustment to the end point
- \_\_\_ 15 Do not over adjust the end point to a complete zerobeat
- \_\_\_ 16 Observe the pitch is closer to zero beat
- \_\_\_ 17 Back off the 10 turns on the VFO shaft (only work one way)

- \_\_\_ 18 Set the KHz knob to 000
- \_\_\_ 19 Adjust the VFO shaft for a zero beat
- \_\_\_ 20 Mark the coupler and VFO face (9,000 3,455)
- \_\_\_ 21 Set the KHz knob for 9, +000 (9,+000 2,455)
- \_\_\_ 22 Dial 10 turns on the VFO shaft and align the marks
- \_\_\_ 23 If the span is not exact make a small adjustment to the end point
- \_\_\_ 24 Do not over adjust the end point to a complete zerobeat
- \_\_\_ 25 Observe the pitch is closer to zero beat
- \_\_\_ 26 Repeat steps 17, 18, 19, 20, 21,22, 23, 24 and 25 until span is exact
- \_\_\_ 27 Make a small adjustment to the end point (CW longer CCW shorter)
- \_\_\_ 28 Do not over adjust the end point to a complete zerobeat
- \_\_\_ 29 Replace the end point cover screw
- \_\_\_ 30 Return the VFO shaft to its original location
- \_\_\_ 31 Reinstall the VFO into the receiver
- \_\_\_ 32 Carefully verify the 10 turn operation of the VFO
- \_\_\_ 33 Adjust the mechanical position of module for best shaft alignment
- \_\_\_ 34 Adjust the Oldham coupler for a free spacing of shafts
- \_\_\_ 35 Replace the Oldham coupler spring
- \_\_\_ 36 Attach an antenna to the balanced input
- \_\_\_ 37 Tune WWV at 20MHz, 15Mhz, 10MHz or 5Mhz
- \_\_\_ 38 Set the BFO to OFF
- \_\_\_ 39 Set the bandwidth to 0.1Khz
- \_\_\_ 40 Set the KHz to 000
- \_\_\_ 41 Loosen the front KHz shaft clamp on the Oldham coupler
- \_\_\_ 42 Rock the VFO to peak WWV through the crystal filter
- \_\_\_ 43 Tighten the front KHz shaft clamp on the Oldham coupler
- \_\_\_ 44 Set the BFO to ON
- \_\_\_ 45 Set the BFO Pitch to 0
- \_\_\_ 46 Loosen the extension shaft clamp on the BFO
- \_\_\_ 47 Adjust the BFO shaft to zero the BFO Pitch
- \_\_\_ 48 Tighten the extension shaft clamp on the BFO
- \_\_\_ 49 Set the FUNCTION Switch to CAL
- \_\_\_ 50 Adjust the CAL Adjust Trim to zero the Calibration Oscillator

#### W. RF Alignment

- \_\_\_ 01 Install a 600 ohm resistor on the line level output.
- \_\_\_ 02 Place a meter and 600 ohm load on the Local Audio output TS 585
- \_\_\_ 03 Connect the generator to the receiver's balanced antenna input
- \_\_\_ 04 Place a DC meter on the diode load
- \_\_\_ 05 Turn the receiver on and allow it to warm up for 1hour
- \_\_\_ 06 Turn the signal generator on and allow it to warm up for 1 hour
- \_\_\_ 07 Set the R390 or R390A Function switch to "MGC
- \_\_\_ 08 Set the R390 or R390A Bandwidth to 2kc
- \_\_\_ 09 Set the R390 or R390A RF gain full CW (clock-wise)
- \_\_\_ 10 Set the R390 or R390A AF line gain full CW
- \_\_\_ 11 Set the Line Meter range switch to + 10
- \_\_\_ 12 Set the R390 or R390A AF local gain full CW
- \_\_\_ 13 Set the R390 or R390A BFO off
- \_\_\_ 14 Set the Audio response to wide
- \_\_\_ 15 Set the Limiter to off
- \_\_\_ 16 Set the receiver and generator to the same frequency of choice
- \_\_\_ 17 Rock the generator for a peak into the band pass
- \_\_\_ 18 Set the initial generator output to 10uv
- \_\_\_ 19 Set the generator modulation level to at 30% 400 Hz or 1 KHz
- \_\_\_ 20 Use the Ant Trim to peak the receiver
- \_\_\_ 21 Reduce the signal generator RF output for -7 volts DC

- \_\_\_ 22 Use 550 for L213, L224-1, L224-2 Slugs 1stOctave
  - \_\_\_ 23 Use 950 for C201-B, C230-1, C230-2 Caps 1stOctave
  - \_\_\_ 24 Use 1,100 for L215-1, L215-2, L215-3 Slugs 2ndOctave
  - \_\_\_ 25 Use 1,100 for C291-1, C291-2, C291-3 Caps 2ndVariable IF
  - \_\_\_ 26 Use 1,250 for L232-1, L232-2, L232-3 Slugs 1stVariable IF
  - \_\_\_ 27 Use 1,900 for L233-1, L233-2, L233-3 Slugs 2ndVariable IF
  - \_\_\_ 28 Use 1,900 for C205-B, C233-1, C233-2 Caps 2ndOctave
  - \_\_\_ 29 Use 2,250 for L217, L226-1, L226-3 Slugs 3rdOctave
  - \_\_\_ 30 Use 3,800 for C209B, C236-1, C26-2 Caps 3rdOctave
  - \_\_\_ 31 Use 4,400 for L219, L227-1, L227-2 Slugs 4thOctave
  - \_\_\_ 32 Use 7,250 for C283-1, C283-2, C283-3 Caps 1stVariable IF
  - \_\_\_ 33 Use 7,600 for C213B, C239-1, C239-2 Caps 4thOctave
  - \_\_\_ 34 Use 8,800 for L221, L227-1, L227-2 Slugs 5thOctave
  - \_\_\_ 35 Use 15,200 for C217B, C242-1, C242-2 Caps 5thOctave
  - \_\_\_ 36 Use 17,600 for L223, L229-1, L229-2 Slugs 6thOctave
  - \_\_\_ 37 Use 30,400 for C221B, C241-1, C241-2 Caps 6thOctave
  
  - \_\_\_ 38 Observe 27 DB (17 Volts AC) on the Local Audio
  - \_\_\_ 39 This should also be 450 milliwatts on the Local Audio
  - \_\_\_ 40 Observe + 10 on the Line Meter (0 VU + 10 switch)
  - \_\_\_ 41 Set the signal generator to CW
  - \_\_\_ 42 The meter on the Local Level should drop 20 DB
  - \_\_\_ 43 The Line Meter should drop 20 DB
  - \_\_\_ 44 The signal generator RF level should be less than 3 microvolts
  - \_\_\_ 45 Record the frequency and the output of the generator in microvolts
  - \_\_\_ 46 This value is the 20 DB S/N + N receiver level at this frequency
  - \_\_\_ 47 This is the relative receiver noise floor level at this frequency
  
  - \_\_\_ 48 Use the following check the mechanical filters at one frequency
  - \_\_\_ 49 Set BANDWIDTH KC switch S501 to position 1.
  - \_\_\_ 50 Adjust the signal generator output for -5 volts on the diode load
  - \_\_\_ 51 Tune the KILOCYCLE CHANGE to one side of the center  
frequency until the multi-meter reads 2.5 volts.
  - \_\_\_ 52 Note the frequency indicated on the receiver frequency counter.
  - \_\_\_ 53 Tune the receiver KILOCYCLE CHANGE control to the other side  
of the center frequency until the meter reads 2.5 volts.
  - \_\_\_ 54 Note the frequency indicated on the receiver frequency counter
  - \_\_\_ 55 Subtract the lower from the higher of the two values
  - \_\_\_ 56 This is the receiver bandwidth for 1 KiloHertz bandwidth 0.8 to 1.3
  - \_\_\_ 57 Set BANDWIDTH KC switch S501 to 2 KHz position
  - \_\_\_ 58 Repeat steps 50 through 55 for the 2 KHz bandwidth 1.9 to 2.3
  - \_\_\_ 59 Set BANDWIDTH KC switch S501 to 4 KHz position
  - \_\_\_ 60 Repeat steps 50 through 55 for the 4 KHz bandwidth 3.6 to 4.4
  - \_\_\_ 61 Set BANDWIDTH KC switch S501 to 8 KHz position
  - \_\_\_ 62 Repeat steps 50 through 55 for the 8 KHz bandwidth 7.5 or more
  - \_\_\_ 63 Set BANDWIDTH KC switch S501 to 16 KHz position
  - \_\_\_ 64 Repeat steps 50 through 55 for the 16 KHz bandwidth 12 or more
  - \_\_\_ 65 No bandwidth test is required for 0.1 KC setting.
-

### X RF Deck Tube Optimization

In the RF deck we want to check the 6DC6 1st RF, 6C4's mixers, and 5654's crystal oscillators. Use a frequency above 8 MHz to take the third conversion out of the process.

- \_\_\_ 01 Install a 600 ohm resistor on the line level output.
- \_\_\_ 02 Place a meter and 600 ohm load on the Local Audio output TS 585
- \_\_\_ 03 Connect the generator to the receiver's balanced antenna input
- \_\_\_ 04 Place a DC meter on the diode load
- \_\_\_ 05 Turn the receiver on and allow it to warm up for 1 hour
- \_\_\_ 06 Turn the signal generator on and allow it to warm up for 1 hour
- \_\_\_ 07 Set the R390 or R390A Function switch to "MGC
- \_\_\_ 08 Set the R390 or R390A Bandwidth to 2kc
- \_\_\_ 09 Set the R390 or R390A RF gain full CW (clockwise)
- \_\_\_ 10 Set the R390 or R390A AF line gain full CW
- \_\_\_ 11 Set the Line Meter range switch to + 10
- \_\_\_ 12 Set the R390 or R390A AF local gain full CW
- \_\_\_ 13 Set the R390 or R390A BFO off
- \_\_\_ 14 Set the Audio response to wide
- \_\_\_ 15 Set the Limiter to off
- \_\_\_ 16 Set the receiver and generator to the same frequency of choice
- \_\_\_ 17 Rock the generator for a peak in to the band pass
- \_\_\_ 18 Set the initial generator output to 10uv
- \_\_\_ 19 Set the generator modulation level to at 30% 400 Hz or 1 KHz
- \_\_\_ 20 Use the Ant Trim to peak the receiver
- \_\_\_ 21 Reduce the signal generator RF output for -7 volts DC
- \_\_\_ 22 Observe the power level on the Local Audio meter.
- \_\_\_ 23 Set the generator to CW
- \_\_\_ 24 Observe the power level on the Local Audio meter
- \_\_\_ 25 You expect a 20 DB drop in output on the Local Audiometer
- \_\_\_ 26 Swap all your 6DC6 tubes into the 1st RF.
- \_\_\_ 27 Measure the relative difference of each tube (step 20-25)
- \_\_\_ 28 Select the 6DC6 with the largest difference of signal to noise
- \_\_\_ 29 This tube may not be the one with the largest gain
- \_\_\_ 30 Swap all your 6C4 tubes into V203 2nd Mixer
- \_\_\_ 31 Measure the relative difference of each tube (step 20-25)
- \_\_\_ 32 Select the 6C4 with the largest difference of signal to noise
- \_\_\_ 33 Place the best 6C4 in the 1st Mixer
- \_\_\_ 34 Place the best 6C4 in the 2nd Mixer
- \_\_\_ 35 Place the best 6C4 in the 3rd Mixer
- \_\_\_ 36 Swap all your 5654 6AK5 tubes into V401 2<sup>nd</sup> Crystal Oscillator
- \_\_\_ 37 Measure the relative difference of each tube (step 20-25)
- \_\_\_ 38 Place the best 5654 in the 1st Crystal Oscillator
- \_\_\_ 39 Place the best 5654 in the 2nd Crystal Oscillator
- \_\_\_ 40 Grade all the spare tubes for future use

Older used tubes will often have a better signal to noise span than new tubes. So someday you have to put the new tubes into the receiver and start aging them so they can get quiet. A new 6CD6 is what it is. You are stuck with it as the best you have. You can put new 5654's 2nd Crystal Oscillator and 6C4's into the 3rd mixer. It gets them further down the amplifier chain and thus their higher noise level is masked by other stages. You may know a tube is not as good as another tube, but when used in the later stages you may not be able to measure the difference of the tubes when swapping them into the later stages.

## Y. Receiver Sensitivity Test

There may be an occasion when its appropriate to measure and record receiver sensitivity in real terms using an accepted standard. For radio receivers, real term sensitivity is expressed as the value of a modulated RF voltage applied to the antenna input necessary to provide a 10db S/N + N figure. This means, what input voltage is required to raise audio output 10 db over the receiver noise floor. Some prefer to do the test with a bandwidth of 2 Khz. Others prefer to do the test at 4 or 8 Khz. If you are comparing the R390 to another receiver you would like to use the same band width. At 2 Khz you expect the receiver to have a 20db S/N + N figure. This test is preferred as a minimum signal test. How small of a signal on the antenna can still be copied? An alternative test is for a fixed signal level, how far is it above the noise floor. We see this in the IF deck where we expect 150 microvolts to provide 30 DB of signal above the noise floor. In the RF deck or end to end test we expect 3 microvolts to provide 20 DB of signal above the noise floor. Measuring the receiver sensitivity in the R390A is an easy, straight forward procedure. The receiver Line Level meter can even be used to help with the measurement.

Here is the procedure for sensitivity:

- \_\_\_ 01 Turn the receiver and allow it to warm up for 1 hour
- \_\_\_ 02 Turn the signal generator and allow it to warm up for 1 hour
- \_\_\_ 03 Set the receiver and generator to the same frequency of choice
- \_\_\_ 04 Adjust the Kilocycle Change to peak the generator in the band pass
- \_\_\_ 05 Set the initial generator output to 1uv
- \_\_\_ 06 Set the initial generator modulation level to 400 Hz or 1kc at 30%
- \_\_\_ 07 Set the R390 or R390A Function switch to "MGC
- \_\_\_ 08 Set the R390 or R390A Bandwidth to 4kc
- \_\_\_ 09 Set the R390 or R390A RF gain full CW (clockwise)
- \_\_\_ 10 Set the R390 or R390A AF line gain full CW
- \_\_\_ 11 Set the R390 or R390A AF local gain full CW
- \_\_\_ 12 Set the R390 or R390A BFO off
- \_\_\_ 13 Disconnect the signal generator from the receiver
- \_\_\_ 14 Set the Line Meter range switch to -10
- \_\_\_ 15 Adjust the Line Gain for a -10db indication on the Line Level meter
- \_\_\_ 16 Use the Ant Trim to peak the receiver noise alone
- \_\_\_ 16 Readjust the Line Gain for a -10db on the Line Level meter
- \_\_\_ 17 This is the relative receiver noise floor level
- \_\_\_ 18 Connect the generator to the receiver's balanced antenna input
- \_\_\_ 19 Reduce the RF output level of the generator.
- \_\_\_ 20 For a R390 Line Level meter value of 0
- \_\_\_ 21 Record the frequency and the output of the generator in microvolts
- \_\_\_ 22 This value is the 10db S/N + N receiver sensitivity at this frequency
- \_\_\_ 23 It should be less than .5uv
- \_\_\_ 24 The official specifications of the receiver call for 3 microvolts
- \_\_\_ 25 Work along the range of the VFO and conduct this test at each MHz
- \_\_\_ 26 .900, 1,900, 2,800, 3,700, 4,600, 5,500, 6,400, 7,300
- \_\_\_ 27 8,200, 9,100, 10,000
- \_\_\_ 28 To get a value for each Mhz crystal and the range of the VFO.
- \_\_\_ 29 Check the SN + N at the alignment points
- \_\_\_ 30 550, 950, 1,100, 1,250, 1,900, 2,200, 3,800, 4,400,
- \_\_\_ 31 7,250, 7,600, 8,800, 15,200, 17,600 30,400

Z. Receiver Signal to Noise Test

- \_\_\_ 01 Install a 600 ohm resistor on the line level output.
- \_\_\_ 02 Turn the receiver on and allow it to warm up for 1hour
- \_\_\_ 03 Turn the signal generator on and allow it to warm up for 1 hour
- \_\_\_ 04 Set the R390 or R390A Function switch to "MGC
- \_\_\_ 05 Set the R390 or R390A Bandwidth to 2kc
- \_\_\_ 06 Set the R390 or R390A RF gain full CW (clockwise)
- \_\_\_ 07 Set the R390 or R390A AF line gain full CW
- \_\_\_ 08 Set the R390 or R390A AF local gain full CW
- \_\_\_ 09 Set the R390 or R390A BFO off
- \_\_\_ 10 Connect the generator to the receiver's balanced antenna input
- \_\_\_ 11 Place a meter and 600 ohm load on the Local Audio output.
- \_\_\_ 12 Set the receiver and generator to the same frequency of choice
- \_\_\_ 13 Use the RF deck alignment point frequencies
- \_\_\_ 14 Conduct the test while performing RF deck alignments
- \_\_\_ 15 Use 550, 950, 1,100, 1,200, 1,900, 2,250, 3,800, 4,400,
- \_\_\_ 16 Use 7,250, 7,600, 8,800, 15,200, 17,600 30,400
- \_\_\_ 17 Rock the generator for a peak in to the band pass
- \_\_\_ 18 Set the initial generator output to 10uv
- \_\_\_ 19 Set the generator modulation level to at 30% 400 Hz or 1 KHz
- \_\_\_ 20 Use the Ant Trim to peak the receiver
- \_\_\_ 21 Set the Line Meter range switch to + 10
- \_\_\_ 22 Reduce the RF output level of the generator to 0 VU
- \_\_\_ 23 This should also be 450 milliwatts on the Local Audio
- \_\_\_ 24 This value is the 20 DB S/N + N receiver level at this frequency
- \_\_\_ 25 Set the signal generator to CW
- \_\_\_ 26 The Meter on the Local Level should drop 20 DB
- \_\_\_ 27 The Line Meter should drop to under 20 DB
- \_\_\_ 28 This is the relative receiver noise floor level at this frequency
- \_\_\_ 29 The signal generator RF level should be less than 3 microvolts
- \_\_\_ 30 The official specifications of the receiver calls for 3 microvolts
- \_\_\_ 31 Record the frequency and the output of the generator in microvolts

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END