R-390A Repair Depot Sequence — Page 1

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Subject: [R-390] R390 Inspection_List

This paper is still not complete.

Nothing in this work is original to Roger Ruszkowski. 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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We want something that will sit there and run for month after month and need nothing but tubes and dial lamps. Nolan. 5/99.

R-390A Repair Depot Sequence — Page 2

DB	Watts	Volts	Ohms	Amps
00	00.0010	00.7746	600	00.0013
01	00.0013	00.8691	600	00.0014
02	00.0016	00.9752	600	00.0016
03	00.0020	01.0941	600	00.0018
04	00.0025	01.2277	600	00.0020
05	00.0032	01.3774	600	00.0023
06	00.0040	01.5455	600	00.0026
07	00.0050	01.7341	600	00.0029
08	00.0063	01.9457	600	00.0032
09	00.0079	02.1831	600	00.0036
10	00.0100	02.4495	600	00.0041
11	00.0126	02.7484	600	00.0046
12	00.0158	03.0837	600	00.0051
13	00.0200	03.4600	600	00.0058
14	00.0251	03.8822	600	00.0065
15	00.0316	04.3559	600	00.0073
16	00.0398	04.8874	600	00.0081
17	00.0501	05.4837	600	00.0091
18	00.0631	06.1528	600	00.0103
19	00.0794	06.9036	600	00.0115
20	00.1000	07.7460	600	00.0129
21	00.1259	08.6911	600	00.0145
22	00.1585	09.7516	600	00.0163
23	00.1995	10.9415	600	00.0182
24	00.2512	12.2765	600	00.0205
25	00.3162	13.7745	600	00.0230
26	00.3981	15.4552	600	00.0258
27	00.5012	17.3411	600	00.0289
28	00.6310	19.4570	600	00.0324
29	00.7943	21.8311	600	00.0364
30	01.0000	24.4949	600	00.0408
31	01.2589	27.4837	600	00.0458

R-390A Repair Depot Sequence — Page 3

A. Current State

B. Modifications Installed

C. Cosmetic Clean Up

D. Hard Core RF Module Cleaning

E. Cosmetic RF Module Cleaning

F. Rebuild Inspection / Visual Inspection

G. Reassemble The Receiver

H. Mechanical Alignment

I. Knobology Dynamic Testing Monthly Test

J Adjust the IF gain R519

K. Alternate Procedure To Set The IF Gain Control

L IF Module Alignment

M. To Stager Or Not To Stager

N. To Stager Tune IF

O. To Straight Tune IF

P. Adjust Z503 AGC

Q IF And Audio Module Tube Optimizing

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

S 2nd Crystal Oscillator Alignment

T 1st Crystal Oscillator Alignment

U VFO Band Spread Test

V VFO Band Spread Adjustment

W. RF Alignment

X RF Deck Tube Optimization

Y. Receiver Sensitivity Test

Z. Signal To Noise Test

@ Use the following to check set the first trimmer cap in the RF cans

R-390A Repair Depot Sequence — Page 4

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

R-390A Repair Depot Sequence — Page 5

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
___ 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
___ 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 .022 400 V
___ 25 R390A C605 0.01 300 WVDC 20% paper replaced with .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 all the same
___ 13 R390A All of the Variable six 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 fiber washers
___ 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)

R-390A Repair Depot Sequence — Page 7

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 (dish washer)
___ 09 Now bath the Gear parts in soap and water (dish washer)
___ 10 Dry the RF deck and gears (all day in the sun light)
___ 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 sun light)
___ 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

R-390A Repair Depot Sequence — Page 8

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 cover plate.
___ 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 micro switch
___ 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

R-390A Repair Depot Sequence — Page 9

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 band switch
___ 13 "Time" the OSC deck band switch
___ 14 Install OSC deck subassembly
___ 16 Check the alignment and operation of the OSC deck switch
___ 17 In R390 check the Oldham coupler between OSC and RF decks
___ 18 In R390 check the OSC deck switch “timing”
___ 19 Install RF subassembly deck
___ 20 In R390 install the calibration sub assembly 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 switches
___ 33 Lightly lube the shafts of each front panel potentiometers
___ 34 Lightly lube the shafts IF gain potentiometer
___ 35 Lightly lube the shafts carrier meter adjust potentiometer
___ 36 IF deck lightly lube the shaft extensions 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 bottom side

R-390A Repair Depot Sequence — Page 10

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 25 —963 , -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 need 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 cam 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 .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

R-390A Repair Depot Sequence — Page 11

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 Band Width to 2KHz
___ 11 Set the BFO Pitch to 0
___ 12 Set the BFO OFF
___ 13 Set the Breakin 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 head phones
___ 21 Confirm Local Audio pot V603, V602A are good
___ 22 Switch the band pass filter from wide to sharp to wide
___ 23 Confirm band pass filter knob is not loose
___ 24 Listen for switch pop in the head phones
___ 25 Listen for narrow audio responce in the head phones
___ 26 Confirm Filter, switch, V601A are good
___ 27 Set the LIMITER to ON
___ 28 Listen for switch pop in the head phones
___ 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, 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 .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 .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 .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 cal tone
___ 49 Move the Mhz knob up one detent

R-390A Repair Depot Sequence — Page 12

___ 50 Verify detent seats, verify band switch 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)

R-390A Repair Depot Sequence — Page 13

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 Breakin 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 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 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 V DC 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 10 mw
___ 34 Phone Audio should be .78 Volts AC across 600 Ohms 1 mw
___ 35 Line Audio at .78 Volts across 600 should be Line Meter 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

R-390A Repair Depot Sequence — Page 14

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 an 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, R-523
___ 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 micro volt 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 Volts AC
___ 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

R-390A Repair Depot Sequence — Page 15

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 micro volt 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 Stager 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 Contiune 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

R-390A Repair Depot Sequence — Page 16

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 IF amp 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. 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, 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 Breakin 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 micro volt 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

R-390A Repair Depot Sequence — Page 17

___ 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 or 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 worse 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 (4^{th} 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 tube
___ 64 Place the worse tube in V602
___ 65 Place the second worse 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 2^{nd} best 5814 in V601 1^{st} AF AMP and Follower
___ 69 Place the 3^{rd} best 5814 in V602 Local AF AMP
___ 70 Place the 4^{th} best 5814 in V507 Limiter
___ 71 Place the 5^{th} best 5814 in V205 Calibration Oscillator
___ 72 Place the 6^{th} best 5814 in V206 100 KC Multivibrator
___ 73 Place the 7^{th} best 5814 in V509 AGC Rectifier
___ 74 Adjust signal generator for 455 KHz output frequency
___ 75 Adjust signal generator for 150 micro volt 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

R-390A Repair Depot Sequence — Page 18

___ 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-390A Repair Depot Sequence — Page 19

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 micro volt 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 micro volt 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 .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 switch steps 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 head phones.

___ 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 head phones 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 mid scale reading
___ 11 Use the head phones 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
___ 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

R-390A Repair Depot Sequence — Page 21

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 head phones 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

R-390A Repair Depot Sequence — Page 22

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 zero beat
___ 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 zero beat
___ 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 zero beat
___ 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 .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

R-390A Repair Depot Sequence — Page 23

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 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 (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 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 Use 550 for L213, L224-1,, L224-2 Slugs 1st Octave
___ 23 Use 950 for C201-B, C230-1, C230-2 Caps 1st Octave
___ 24 Use 1,100 for L215-1, L215-2, L215-3 Slugs 2nd Octave
___ 25 Use 1,100 for C291-1, C291-2, C291-3 Caps 2nd Variable IF
___ 26 Use 1,250 for L232-1, L232-2, L232-3 Slugs 1st Variable IF
___ 27 Use 1,900 for L233-1, L233-2, L233-3 Slugs 2nd Variable IF
___ 28 Use 1,900 for C205-B, C233-1, C233-2 Caps 2nd Octave
___ 29 Use 2,250 for L217, L226-1, L226-3 Slugs 3rd Octave
___ 30 Use 3,800 for C209B, C236-1, C26-2 Caps 3rd Octave
___ 31 Use 4,400 for L219, L227-1, L227-2 Slugs 4th Octave
___ 32 Use 7,250 for C283-1, C283-2, C283-3 Caps 1st Variable IF
___ 33 Use 7,600 for C213B, C239-1, C239-2 Caps 4th Octave
___ 34 Use 8,800 for L221, L227-1, L227-2 Slugs 5th Octave
___ 35 Use 15,200 for C217B, C242-1, C242-2 Caps 5th Octave
___ 36 Use 17,600 for L223, L229-1, L229-2 Slugs 6th Octave
___ 37 Use 30,400 for C221B, C241-1, C241-2 Caps 6th Octave

___ 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 micro volts
___ 45 Record the frequency and the output of the generator in micro volts
___ 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 Band Width 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 band width 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 band width 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 band width 7.5 or more
___ 63 Set BANDWIDTH KC switch S501 to 16 KHz position
___ 64 Repeat steps 50 through 55 for the 16 KHz band width 12 or more
___ 65 No bandwidth test is required for 0.1 KC setting.

R-390A Repair Depot Sequence — Page 25

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 (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 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 Audio meter
___ 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 2nd 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 some day 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, Your 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 futher 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.

R-390A Repair Depot Sequence — Page 27

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 band width 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 micro volts to provide 30 DB of signal above the noise floor. In the RF deck or end to end test we expect 3 micro volts 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 (Clock Wise)
___ 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 micro volts
___ 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 micro volts
___ 25 Work alone 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 1 hour
___ 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 (Clock Wise)
___ 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 —20 DB
___ 28 This is the relative receiver noise floor level at this frequency
___ 29 It signal generator RF level should be less than 3 micro volts
___ 30 The official specifications of the receiver call for 3 micro volts
___ 31 Record the frequency and the output of the generator in micro volts

R-390A Repair Depot Sequence — Page 29

@ Use the following to check set the first trimmer cap in the RF cans

___ 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 Use two 68 ohm resistors between the generator and the receiver
___ 04 Insert one resistor lead into each of the balanced antenna inputs
___ 05 Place the resistors in parallel
___ 06 Place a DC meter on the diode load (- 7 volts DC)
___ 07 Turn the receiver on and allow it to warm up for 1 hour
___ 08 Turn the signal generator on and allow it to warm up for 1 hour
___ 09 Set the R390 or R390A Function switch to "MGC
___ 10 Set the R390 or R390A Bandwidth to 2kc
___ 11 Set the R390 or R390A RF gain full CW (Clock Wise)
___ 12 Set the R390 or R390A AF line gain full CW
___ 13 Set the Line Meter range switch to + 10
___ 14 Set the R390 or R390A AF local gain full CW
___ 15 Set the R390 or R390A BFO off
___ 16 Set the Audio response to wide
___ 17 Set the Limiter to off
___ 18 Set the receiver and generator to the same frequency of choice
___ 19 Set the initial generator output to 100uv (or more)
___ 20 Set the initial generator modulation level to 400 Hz or 1KHz at 30%
___ 21 Rock the generator for a peak in to the band pass
___ 22 Reduce the generator output for a diode load value of —5 volts
___ 23 Use 750, 1,500, 3,000, 6,000 12,000, 24,000 Mhz
___ 24 Use 750 for C201-A, Cap 1st Octave
___ 25 Use 1,500 for C205-A, Cap 2nd Octave
___ 26 Use 3,000 for C209-A, Cap 3rd Octave
___ 27 Use 6,000 for C213-A, Cap 4th Octave
___ 28 Use 12,000 for C217-A, Cap 5th Octave
___ 29 Use 24,000 for C221-A, Cap 6th Octave
___ 30 Ignore the TM and adjust each cap for maximum output