

# THE R551N RECEIVER

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## FAQ FAULT FINDING THE REDIFON COMMUNICATIONS RECEIVER R551N

**Date: October 10th 1995 by: Jan Verduyn G5BBL**

### **Introduction:**

Recently a number of Redifon R551N receivers have appeared on the UK surplus market. These receivers were designed to a high specification and cover 10 KHz to 30 MHz with a resolution of 10 Hz, a sensitivity of 0.35 uV on the HF amateur bands and good selectivity due to 300Hz, 1 KHz and 3 KHz crystal filters.

Generally these receivers are in good working order, however a few owners have ended up with faulty receivers and this FAQ (Frequently Asked Questions) was written by me as a result of a Member's advertisement in RadCom asking for assistance to get his R551N working again. I understand there are other owners who are also looking for technical help in repairing their receiver.

It appears that the majority of the problems are in the 38-68 MHz LO Synthesizer system and this is the area where owners are experiencing fault finding problems. In most cases they are quite familiar fault finding the more conventional RF, IF and AF stages. The FAQ assumes that owners have access to R551N Documentation; however experienced engineers probably can locate the fault to module level using the Brief Block Diagram description below.

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I welcome any comments that would improve this FAQ.

### **BRIEF BLOCK DIAGRAM: RF/IF/AF SIGNALLING PROCESSING**

**A) Aerial Filters Module** Location: Top chassis at rear behind 1/10MHz synthesizer module

This unit contains the switched RF bandpass filters. The input is from the Antenna input socket via SK1 and filtered RF output is via routed SK/PL5 to RF/AGC Module (B).

**B) RF/AGC Module** Location: Lower chassis

This module mixes the RF input signal (PL5) from the AE filter unit with the 38-68 MHz VCO output (SK7) and produces an IF signal at 1.4 MHz (PL8) which goes via the Crystal filters to the IF/AF module. The RF/AGC Module also produces a 39.4 MHz Oscillator signal which is fed to the 38-68MHz VCO Module via PL11. The 1st IF is 38.0 MHz and the 2nd IF is 1.4 MHz is obtained by mixing with the 39.4 MHz 2nd LO.

**C) IF/AF Module** Location: Lower chassis

1.4 MHz IF signal from Crystal filters arrives at PL13. The BFO signal arrives at PL14 pin R or P from the BFO/Reference Osc Module. Audio output is via PL 14 pin A and B (Speaker) or PL14 pin H and F (600 Ohm)

### **BRIEF BLOCK DIAGRAM: SYTHESIZER (LOCAL OSCILLATOR)**

#### **A) VFO Subassembly Module** Location: top chassis

This unit generates 600KHz to 700KHz from a free running oscillator which is fed via SK30/PL30 to the 4.1-5 MHz VCO Module.

#### **B) 100 KHz Synthesizer Module = 4.1-5 MHz VCO Module** Location: top chassis

This Module converts the 600KHz to 700KHz signal from the VFO Module (A) via SK30 together with a 100 KHz reference signal obtained from 38-68 MHz VCO Module (C) via SK29/PL29. The output signal of this module is routed via PL27/SK27 to the 38-68 MHz VCO Module. Output frequency = (4.1 - 5 MHz VCO signal - VFO signal). (See examples below)

#### **C) 1/10MHz Synthesizer Module = 38-68 MHz VCO Module** Location: top chassis

This Module has three signal inputs and two output signals:

Input 1: 39.4 MHz oscillator signal from RF/AGC Module via SK42/PL42 and SK/PL11.

Input 2: 100 KHz reference signal from BFO/Reference Oscillator Module via SK/PL40 and SK/PL22

Input 3: RF output signal from 4.1-5 MHz VCO Module via SK/PL27

Output 1: 38-68MHz Synthesized 1st LO signal via SK/PL24 and PL/SK7 to RF/AGC Module.

Output 2: 100KHz reference signal from input 2: is fed out via PL/SK29 to 4.1-5 MHz VCO Module.

### **FAULT FINDING PREPARATIONS:**

#### **Warning: Usual AC Power Safety precautions should be observed !!!!!!!!!!!!!!!!!!!!!!!**

- 1) Check fuse holders at the back, all fuses should be present.
- 2) Check power supply strapping is correct for AC Power source.
- 3) It is essential that following 3 links are present: SK15 pin 1 to Ground (This is AE muting Relay), SK37 pin 5 and 6 strapped and SK37pin 5 and 8 strapped. These plugs are at rear of set.
- 4) Locate Reference Oscillator source switch next to SK37 at rear of set and check this switch is in down position marked INT REF OSCILLATOR.

5) Switch on AC Power.

### **A) TEST EQUIPMENT REQUIRED:**

This FAQ assumes you have access to:

1) General Coverage Receiver plus long wire Antenna with minimum length of 5 meters or more.

2) DC Voltmeter (Multimeter) with range of 0-1 or 0-3 Volt DC and a minimum sensitivity of 10.000 Ohms per Volt plus RF Probe. (conventional circuit using 2 x 0A95 germanium diodes, and 2 10nF capacitors)

3) Optionally Oscilloscope covering 0-10 MHz with sensitivity of .1V/cm.

4) Optionally Frequency Meter covering up to 100 MHz (i.e. Thandar PFA200A) or equivalent.

### **B) CHECKING SIGNAL PROCESSING FUNCTIONS**

A) Switch AC Power and Loudspeaker switches on front panel to ON.

Place Service band switch to A3 DSB position. Adjust RF GAIN and AF gain to full clockwise position.

If no receiver noise is heard check: whether + 20V is present on PSU print pin 17 and +5 V present on pin 21 of Power supply print. If not: trace back and repair fault on Power Supply Circuit.

B) If receiver IF noise heard, connect an external antenna (5-15 meter long wire) to pin 1 or pin 3 on the 1.4 MHz 8 KHz filter print at bottom chassis. Local AM medium wave station should be plainly heard. Also the BFO can be tested by placing the Bandwidth Service switch to position A1 8 KHz and adjusting the BFO control and checking whether a changing beat note can be heard. Fault-find the IF/AF Module until these results are obtained. The circuitry is conventional and faulting should be pretty straightforward.

### **C) Check VCO Failure or VCO Lock problem**

Connect a good external Antenna (5-15 meter long wire) to the Antenna connector on rear of set, place set to tune 1.0 MHz and adjust Main Tuning to 50.0 KHz (Set tuned to 1.050 MHz).

If you can receive Broadcasting stations but tuning does not change when adjusting the Main Tuning, the fault is because the 38-68MHz VCO is oscillating, but this oscillator is unlocked, and therefore does not change when main Tuning is changed. Proceed to F. below.

### **D) Check Antenna Filter Module**

Locate cable PL5 coming from RF/AGC module and disconnect from SK5. Connect external Antenna to PL5. If still no reception then proceed to E), If reception okay then check the following items:

Muting connections to Antenna filter Module

Any band switches broken or damaged (switch segments broken off) in this Module.

Is Antenna filter Module failing on one or more bands? Filters are switched in following ranges:

100-150 KHz 150-200 KHz 200-300 KHz 300-500 KHz 500-700 KHz 700-1000 KHz 1-1.6 MHz 1.6-2.0 MHz 2.0-3.0 MHz 3-5 MHz 5-7 MHz 7-10 MHz 10-15 MHz 15-20 MHz 20-30MHz.

### **E) 38-68 MHz VCO not oscillating**

This can be checked by connecting a RF diode probe/3V DC meter to SK24. Normally the meter should indicate about 3V. If there is no indication then check following:

1) Remove cover from 38-68 MHz VCO module and check whether plus 20V is present on the feedthrough connector on the right hand side of this Module which has a 100 uF capacitor connected.

2) Visually check the VCO band switches (nearest to front panel) for any damage, like broken switch body or metal switch segments broken off (these still may be found inside this Module). If this is the case then it is possible to repair these switches but this is a job that requires major surgery to get access to the VCO PCB.

See under F) how to remove the 38-68 MHz VCO module.

I used 5 second glue (Cyanoacrylate) to fix the broken parts quickly and accurately and build up the joints with Araldite Epoxy Heady duty two component glue for additional strength.

### **F) 38-68 MHz VCO not locked (COMPLETE SYNTHESIZER CHECK)**

All the relevant Synthesizer circuitry will be checked in this step.

#### **F1) Check VFO Module**

Remove PL30 and connect to General Coverage Receiver antenna input via attenuator or loosely coupled With the Main Tuning set at 50.0 check whether you can hear a S9 plus signal on or around 650 KHz.

With RF probe Voltmeter measure 0.25 V. If Frequency meter is available check whether output is 600 KHz with Dial set at 00.0 and 700 KHz with Dial set at 99.9. Reconnect SK30. If these tests fail then troubleshoot this Module before proceeding.

#### **F2) Check 100 KHz and 39.4 MHz Reference Oscillators**

Remove PL40 and connect to General Coverage Receiver, Frequency meter or RF Probe Voltmeter to detect presence of 100 KHz. The RF voltmeter should indicate at least 1 Volt RF. Reconnect PL40.

Remove PL29 and connect General Coverage Receiver, Frequency meter or RF Probe Voltmeter presence of 100 KHz. The RF voltmeter should indicate at least 1 Volt RF. Reconnect PL29.

Remove PL11 and with RF Voltmeter or Frequency meter check presence of 39.4 MHz 2nd Oscillator. The RF Probe Voltmeter should indicate about 2.5 V RF. If this value is not obtained troubleshoot this Oscillator which is located in the RF/AGC unit!!

### **F3) Check 4.1 - 5.0 MHz VCO Module**

Remove PL27 and connect to General Coverage Receiver antenna input via attenuator or loosely coupled

Set Main Dial to 50.0 and place 100 KHz Frequency selector switch in position 0 (i.e. 01.0 MHz)

Check on General Coverage Receiver that VCO output can be heard on 4350 KHz.

Change 100 KHz Frequency selector switch to position 1 (ie. 01.1 MHz) and check whether VCO output can be heard on 4250 KHz. Repeat until in position 9 (ie. 01.9 MHz) VCO output at 3450 KHz is measured. These values should be checked if a Frequency meter is available.

With RF Probe Voltmeter measure 0.1V. Troubleshoot this module until these results are obtained before proceeding.

### **F4) Check input to Programmable divider on 38-68 MHz VCO Module**

Locate TP37 on Filter Amp PCB at the rear of the 38-68 MHz VCO Module and connect to frequency meter of General Coverage receiver (via Attenuator).

Set Main dial to 00.0 and set Frequency switches to 03.0 MHz and you should measure a signal of 6000 KHz on TP37. An RF probe Voltmeter should indicate 0.5V to 1V RF.

If no results check with RF Probe Voltmeter on TP32 (2nd PCB RH side) and measure 2.5V RF with RF Probe Voltmeter. If absent, repair VCO PCB first before proceeding.

### **F5) Check Digital circuitry on 38-68 MHz VCO Module**

Connect Frequency Meter, General Coverage Receiver, or Scope to TP36 located at Top right hand corner of Digital Divider board and check whether the values measured are exactly one tenth of those measured in the previous step. (i.e. set R551NL to 3000 KHz and measure 600 KHz on TP36)

If not then fault-find the: 10 digital circuitry. Please note there are two variation of Digital board in use. The older version uses three IC's type MC1013P whilst the later version uses one N8290A as divide by 10 circuitry.

One of the R551N's which I repaired had a faulty N8290A. This Signetics chip is now obsolete and can be substituted by a 74LS196 which is a pin for pin replacement.

Check TP45 and TP 46 on Digital Divider board for presence of +5 V DC.

Connect a Frequency Meter, General Coverage Receiver or Scope to TP18 on the 100 KHz Phase Comparator PCB and measure 100 KHz Square Wave.

Check 100 KHz Reference signal is present on Pin 3 of the same print. RF Probe Voltmeter should indicate at least 2.5V RF. Fault find this Module until this result is obtained before proceeding

#### **F6) Check Phase Lock Loop output**

Locate TP20 (near Link 20) and measure with DC Voltmeter between +5V and +9V DC.

This voltage should vary slightly when Main Tuning is changed and should jump in this range when 100 KHz and 1 MHz tuning is changed.

#### **F7) Synthesizer Frequency relationship**

##### **Tuning, VCO Freq, TP 37 Output, TP36:10 Output**

50 KHz 38050 KHz 3000 KHz 300 KHz

150 KHz 38150 KHz 3000 KHz 300 KHz

1050 KHz 39050 KHz 4600 KHz 400 KHz

1150 KHz 39150 KHz 4500 KHz 400 KHz

3.050 KHz 41050 KHz 6000 KHz 600 KHz

10050 KHz 48050 KHz 13000 KHz 1300 KHz

20050 KHz 58050 KHz 23000 KHz 2300 KHz

29050 KHz 67050 KHz 32000 KHz 3200 KHz

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73's and Good Luck

**Jan**