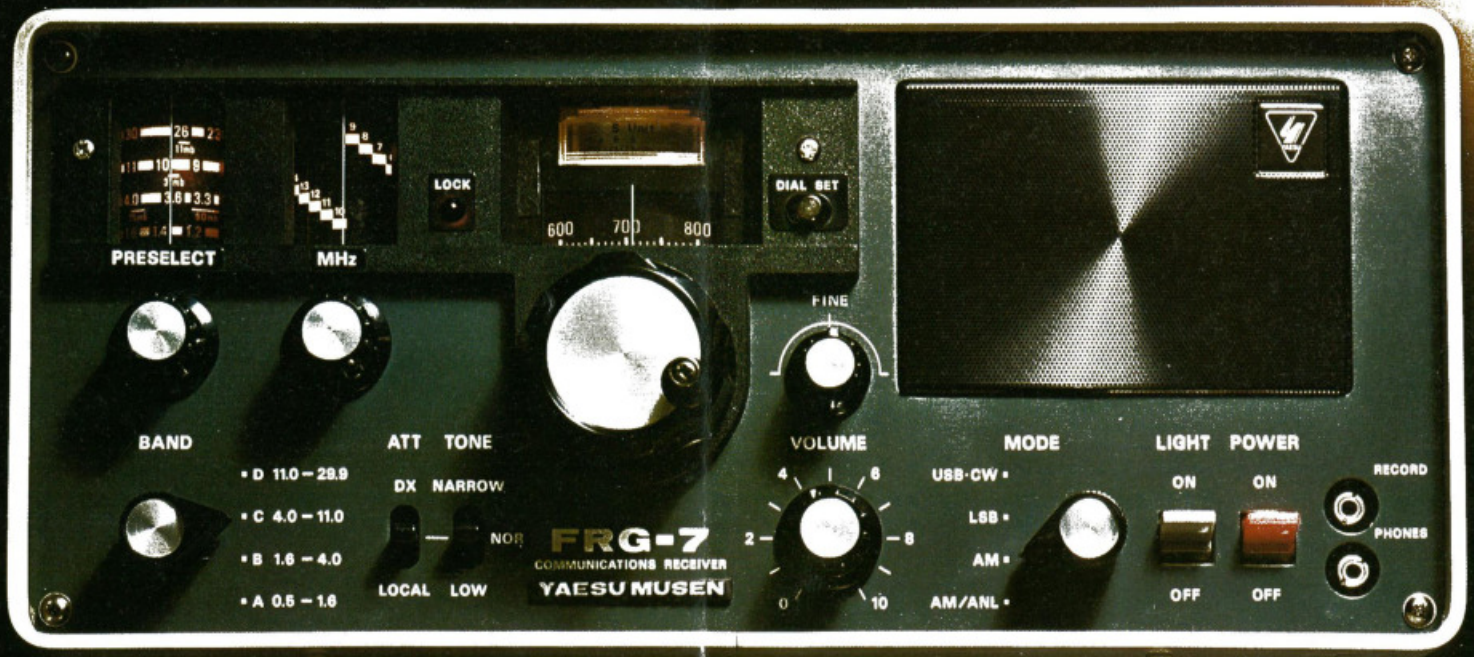
FRG-7 COMMUNICATIONS RECEIVER

YAESU



YAESU FRG-7 COMMUNICATIONS RECEIVER FOR WORLD

The model FRG-7 is a precision built high performance communication receiver designed to cover the band from 0.5 MHz–29.9 MHz. Its state of the art technology offers an unprecedented level of versatility.
The Wadley Loop System (drift cancellation circuit) coupled with a triple conversion super heterodyne system guarantees an extremely high sensitivity and excellent stability.
It provides complete satisfaction to amateurs as well as BCL's with superb performance and many features such as RF attenuator, selectable tone, and automatic noise suppression circuit.

FEATURES

▪ GENERAL COVERAGE

The model FRG-7 is a solid-state AC-DC communication receiver designed to cover the band from 0.5 MHz to 29.9 MHz with extremely high performance. It can be used as a stand-by receiver by Amateur Radio Operators.

▪ WIDE VERSATILITY

The receiver can be used for listening to various types of communications, commercial radio stations on medium wave, international short wave, amateur bands and citizen band.

▪ EXCEPTIONAL SENSITIVITY AND EXCELLENT STABILITY

The Wadley Loop System coupled with a triple conversion super heterodyne system guarantees an extremely high sensitivity and excellent stability. The dial indicator with 1 MHz VFO range will enable you to enjoy simplified tuning.

▪ 5 KHZ DIRECT DIAL READOUT

The extremely stable VFO equipped with precision dial mechanism permits 5 kHz direct dial readout, thus permitting presetting of dial for your desired station even when not on the air with assurance of "on the target" reception.

▪ ACCEPTS ALL TYPES OF MODES

It features receiving modes of SSB (USB LSB) for two way communications, C.W. for Morse Code communication and A.M. for general broadcasting stations.

▪ R.F. ATTENUATOR

The selectable three position RF attenuator is effective when tuning local or high powered stations. Tuning for a weak desired station adjacent to an strong unwanted signal, proper selection of DX or LOCAL position will help reduce the interference considerably.

▪ EXCELLENT SELECTIVITY

The ceramic filters guarantee sufficient bandwidth and high selectivity by rejecting unwanted signals and interferences.

▪ AUTOMATIC NOISE SUPPRESSION CIRCUIT

When impulse type noise is experienced the AM/ANL position will activate the automatic noise suppression circuit which effectively eliminates all pulse type noise, permitting you to enjoy noise free reception.

▪ THREE POSITION TONE SELECTOR

The audio spectrum in SSB communication is limited within the range of 300–2700 Hz. Broadening the bandwidth of the receiver will introduce more noise or interference unnecessarily. The tone selector will limit the audio spectrum and its selectable positions will increase readability of the signal being received.
It offers three position: LOW (high cut), NORMAL, and NARROW (high and low cut)

▪ DISTORTION AND FADE FREE RECEPTION

The active AGC (automatic gain control) circuit assures a distortion fade free reception.

▪ ACCEPTS THREE DIFFERENT TYPE OF POWER SOURCE

The receiver can be operated on A.C., D.C., or internal battery supply. When more than two power supplies are connected, it automatically selects the most economical source. The light switch will conserve energy when operated on batteries. The line cord retainer comes in handy in portable operation.

▪ PRESELECTOR

The preselector
antenna and R.
ceiver front-end.
is calibrated with
ing the correct s
bands. It should
reception.



▪ MAIN TUNING

The main tuning dial determines the receiving frequency. The stable VFO combined with precision dial mechanism permits 5 kHz direct dial readout. Presetting the dial on the desired frequency allows you to stand-by for anticipated stations to come in.

WIDE LISTENING AT ITS BEST 0.5 MHZ—29.9 MHZ

control tunes the
circuits of the re-
The scale of this dial
he frequencies show-
tting for the various
e fine-tuned for best

■ ELLIPTICAL SPEAKER
The elliptical speaker (125 x 77 mm) mounted on the front panel produces the clearest and sharpest tonal range.

■ RECORDING OUTPUT
Provides constant output level regardless of the volume control setting, either with speaker or headphone.



■ TONE SELECTOR
Proper selection of the switch position will reduce noise level and increase readability.

■ R.F. ATTENUATOR
It is effective in reception of local or high powered stations.

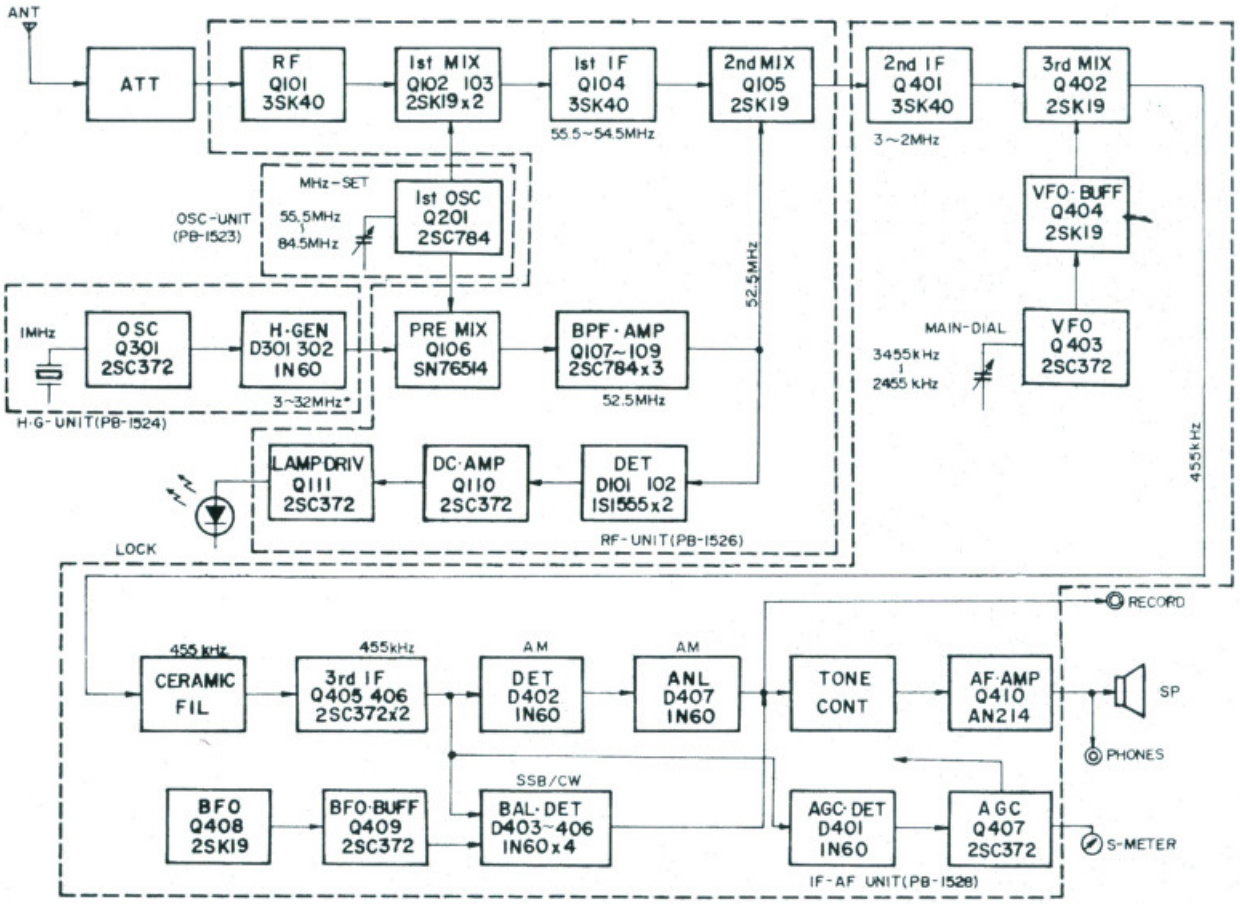
■ FINE TUNING
The FINE TUNING control is used for precise tuning of the received signal. The main tuning dial is calibrated to the frequency with the fine control at centre.

SPECIFICATIONS

- **Type of Mode:**
A.M. SSB (USB, LSB) C.W.
- **Frequency range**
0.5 MHz–29.9 MHz
- **Sensitivity**
SSB/CW better than 0.7μV for 10 db S/N at 30% modulation
- **Selectivity**
3 kHz–6 db
7 kHz–50 db
- **Frequency stability**
Within 500 Hz during any 30 minute period after warm-up.
- **Input Impedance**
0.5 MHz–1.6 MHz High impedance
1.6 MHz–29.9 MHz 50–75 Ohm unbalanced
- **Output Impedance**
4 Ohms
- **Audio Output**
More than 2 watts
- **Power requirement**
A.C. 100/110/117/200/220/234 V 50/60 Hz
D.C. 13.5 V Negative ground
Battery: Type UM-1 x 8
- **Dimensions**
340(W) x 153 (H) x 285(D) mm
- **Weight**
7 kg without batteries
- **Semiconductors**

I.C.	AN214	1
	SN76514N	1
FET	3SK40M	3
	2SK19GR	6
TR	2SC372Y	8
	2SC784R	4
	2SD313	1
Ge diode	1N60AM	9
SI diode	1S1555	2
	V06B	3
Zener	WZ110	1
	BZ091	1

BLOCK DIAGRAM



YAESU MUSEN CO., LTD.
C.P.O. BOX 1500, TOKYO, JAPAN

YAESU ELECTRONIC CORPORATION
P.O. BOX 498,
PARAMOUNT, CALIFORNIA 90723

Printed in Japan

VFO runs 3445 – 2455 reverse to dial.
mix with 455 & low pass @ 3000 gives 3000 – 2000
mix with 4000 & low pass @ 2000 " 1000 – 2000 → 160m ✓

PLS7

CONVERTING THE FRG-7 RECEIVER TO TRANSCEIVE EXCITER

IAN KEYSER, G3ROO

WHEN the author opened his FRG-7 to change the filter for one suitable for SSB working, he realised that there was plenty of room to convert the unit for transceive operation. After investigation of the board layout and circuit diagram the idea became even more exciting.

Description

The microphone signal is amplified by an SL630 and fed to the balanced modulator, SL640 (Figs. 1 and 2). The double sideband signal is fed to the filter by a small co-ax cable. SSB output from the filter is fed back to the exciter board into a 455 kHz IF amplifier; the gain of this amplifier is adjustable by RV1, which adjusts the negative feedback. The amplified SSB signal is fed to the mixer, SL640, and mixed with the 2.5-3.5 MHz VFO to produce a sideband signal tunable between 2 and 3 MHz by the main dial; this signal is fed *via* a 1K resistor into T401, where it is tuned and amplified. The output is taken from the drain of Q401 *via* a small reed relay mounted alongside on the chassis.

This signal, about 100 mV. p/p, is fed by miniature co-ax to the HF exciter board, Figs. 3 and 4, where it is mixed in an SL641 with the signal from TP109. The output at 54 MHz is amplified and filtered in the Mosfet stage, then fed to an SL640 and mixed with the VHF VFO. The output is a signal which, among others, is tunable between 1.6 and 30 MHz; this signal passes through a 3:1 wideband transformer and relay to the input of S2a. The RF stage is used on transmit to filter and amplify this signal, the output

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C104 = 0.0001 µF cer.
C105 = 0.002 µF
C107, C110, C111, C113, C116 = 0.01 µF cer.
IFT1 = 455 kHz (from old transistor radio mixer)
R101, R102, R105 = 220 ohm
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R104 = 10K
RV101 = 2K2
IC1 = SL630
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IC3 = SL610
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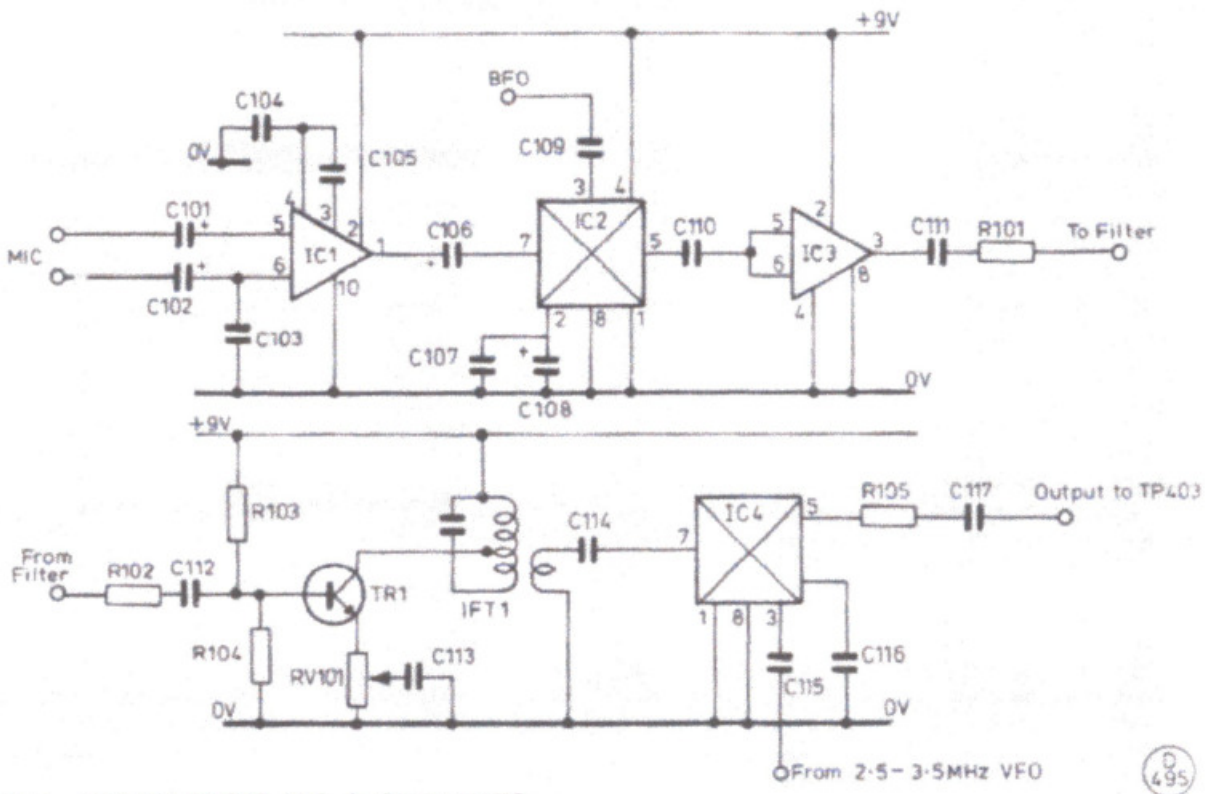


Fig 1 SSB GENERATOR AND 2–3MHz MIXER

being taken from the gate of Q102 *via* a relay — where an output of about 1 volt p/p is available at 50 ohms.

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The first thing to be done is to arrange the method of disabling the stages not required on transmit. The IF stages are muted by cutting the track between R424 and R427, joining a wire to R424 and connecting this to the receiver's 9v. supply. Also it is necessary to disable the two HF mixers and the HF IF amplifier; again this is easily accomplished by cutting the track.

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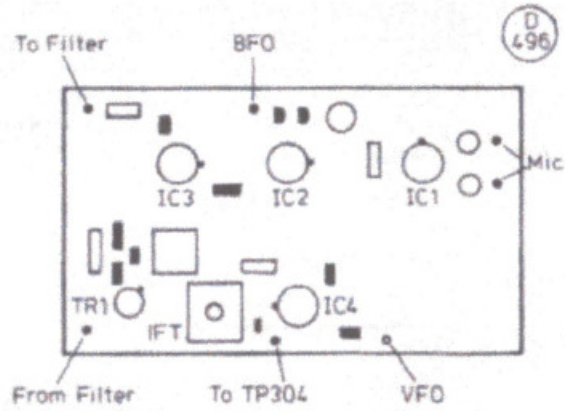


Fig. 2 SSB GENERATOR AND 2-3MHz MIXER (BOARD 1)

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C200, C202, C203, C210, C212, C213, C214 = 0.001 μF disc
C201, C206, C207, C208, C211, C215, C216 = 0.01 μF disc
C204, C209 = 2.5 pF
C205 = 100 pF
VR201, VR202 = 2K2
R201, R202, R208, R209 = 22K
R203 = 47K
R204, R205 = 33K
R206 = 220 ohm
R207, R210, R211 = 100 ohm
IC201 = SL641
IC202 = SL640
TR201 = BC108
TR202 = BC109
TR203 = 40822 (*Ambit*)

Coils: 5 turns tapped 2½ turns on Toko 10K coil formers from *Ambit*; resonating capacitor 13 pF.
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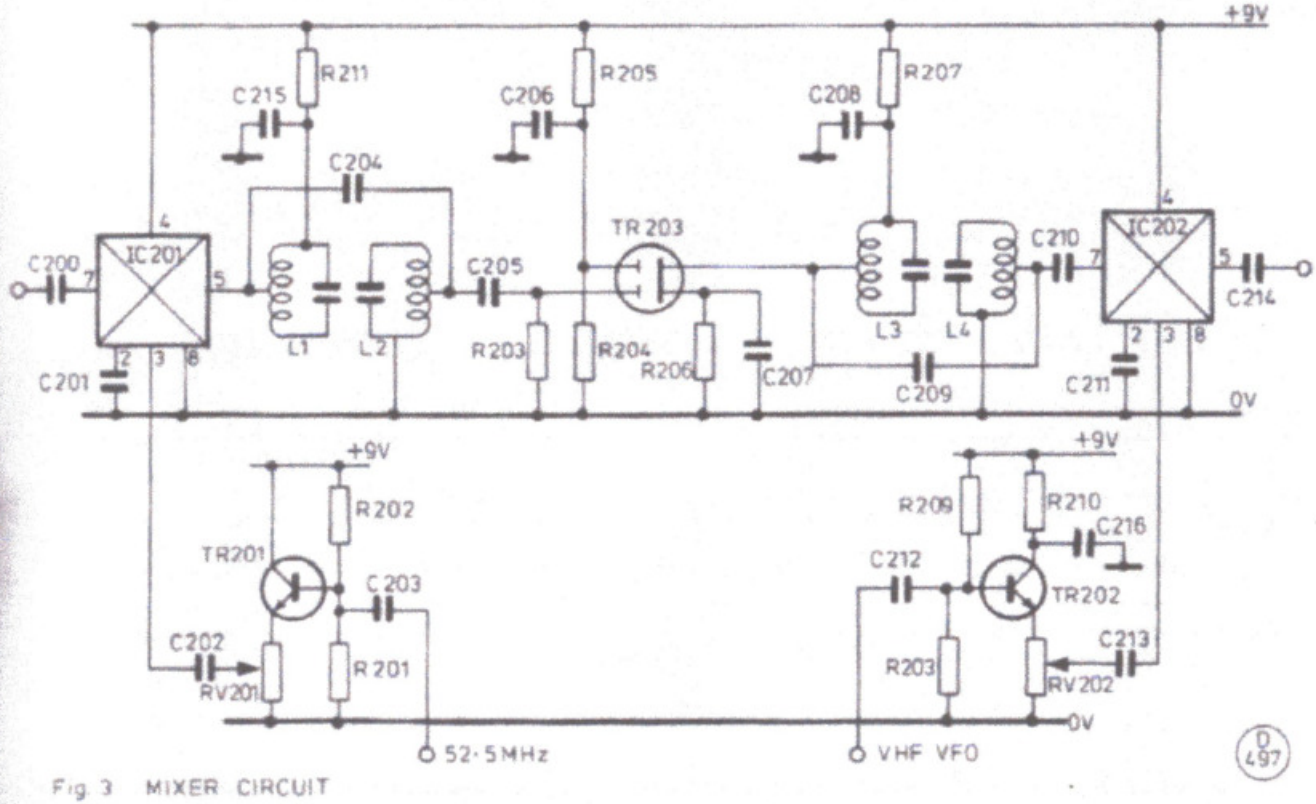


Fig. 3 MIXER CIRCUIT

the entire range at each MHz mark. The output for the 2.5 to 3.5 MHz VFO is taken from TP404: these outputs are taken from the boards by mounting miniature 2K2 ohm presets on the board in the case of the BFO and 2.5-3.5 MHz VFO, and in the case of the two high-frequency oscillators direct through miniature co-ax.

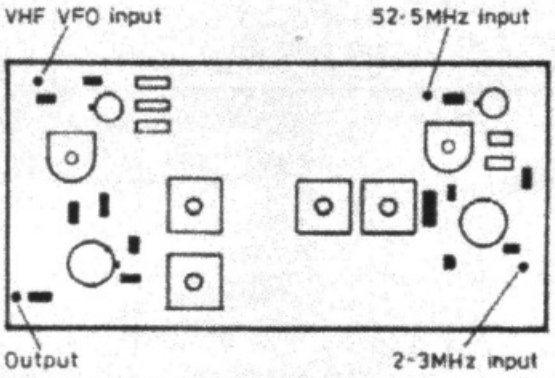


Fig. 4 HF MIXER (BOARD 2)

The MFL-455 filter supplied by *Amhit International Ltd.* was used in this design: unfortunately, however, this is no longer available in the UK. Therefore, whichever filter is decided upon care must be taken, especially on the receive side, that the matching of the filter is correct: this will ensure that the passband of the filter is as flat as possible.

The filter board is mounted on the underside of the IF strip using wire feet, just to the rear of the original filter position. Two miniature co-ax's are taken from the input and output of the filter assembly towards the rear of the set and going to the sideband generator.

The next problem is to match the output of the final to the input of the RF stage. Emitter followers were tried, but the most successful arrangement was a wideband transformer of five turns quadfilar-wound onto an FX2049 balun transformer core and wired as 3:1. This worked as well as anything tried and, being passive, was much easier to install.

The output of the RF stage is taken from the gate of Q102 where R12 joins the board; it is impossible to use the same relay as for the input switching for this position, because of the feedback produced in the RF stage. However, the spare relay contact on the input relay can be used to switch the 9v. supply on transmit and receive.

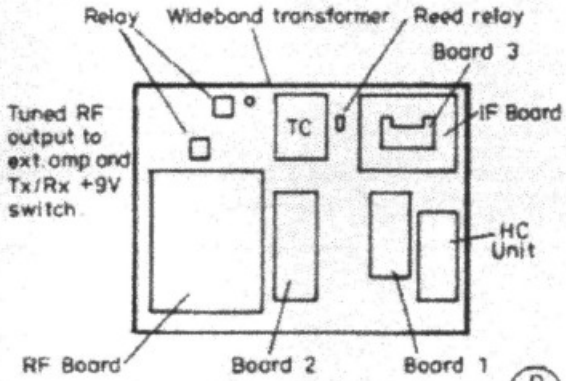


Fig. 6 TRANSCEIVER UNDERSIDE

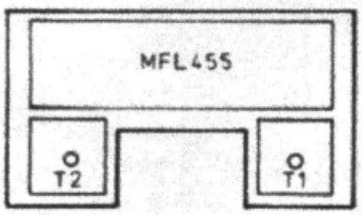


Fig. 5 FILTER (BOARD 3)

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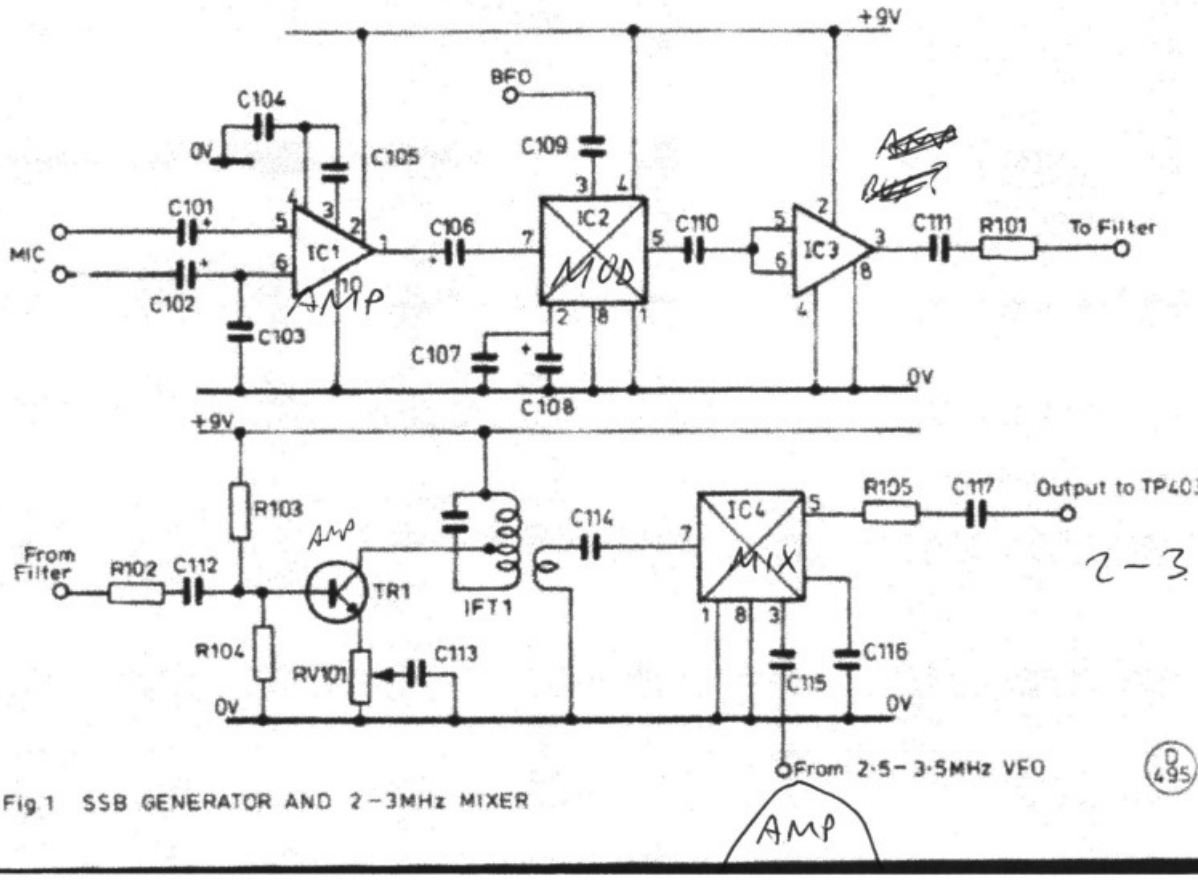


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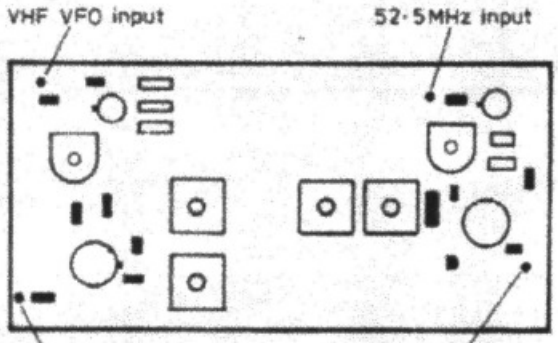


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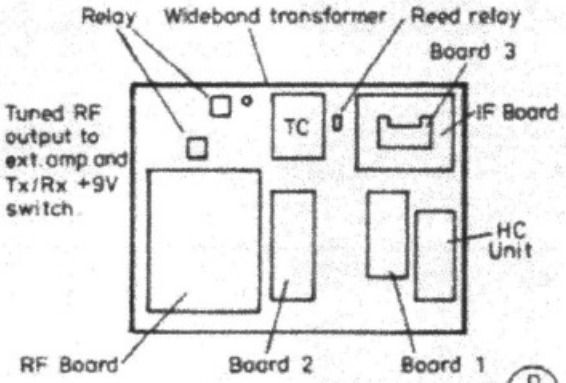


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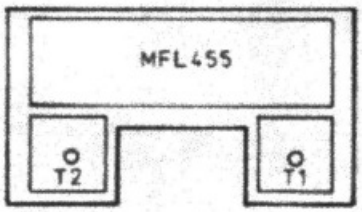


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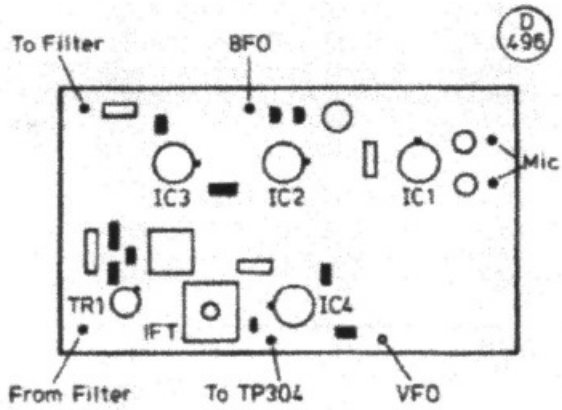


Fig. 2 SSB GENERATOR AND 2-3MHz MIXER (BOARD 1)

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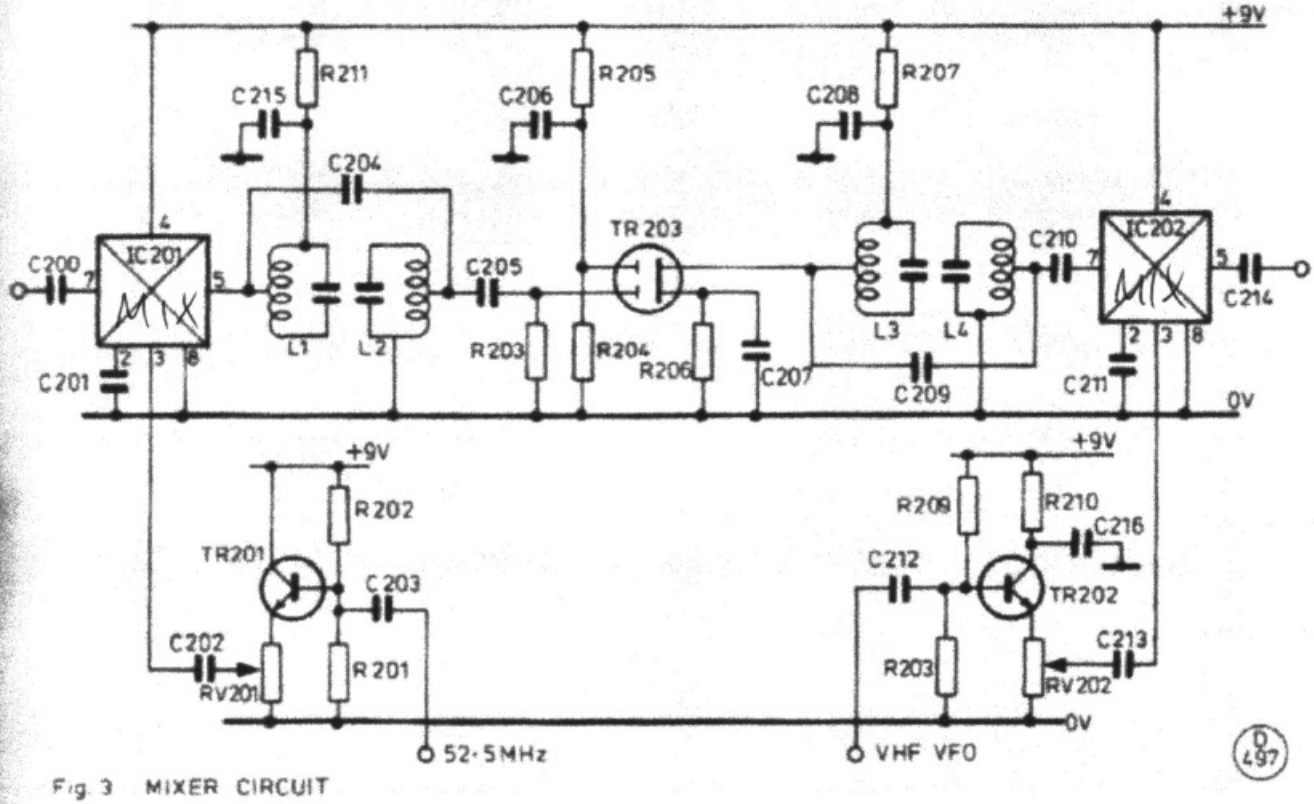
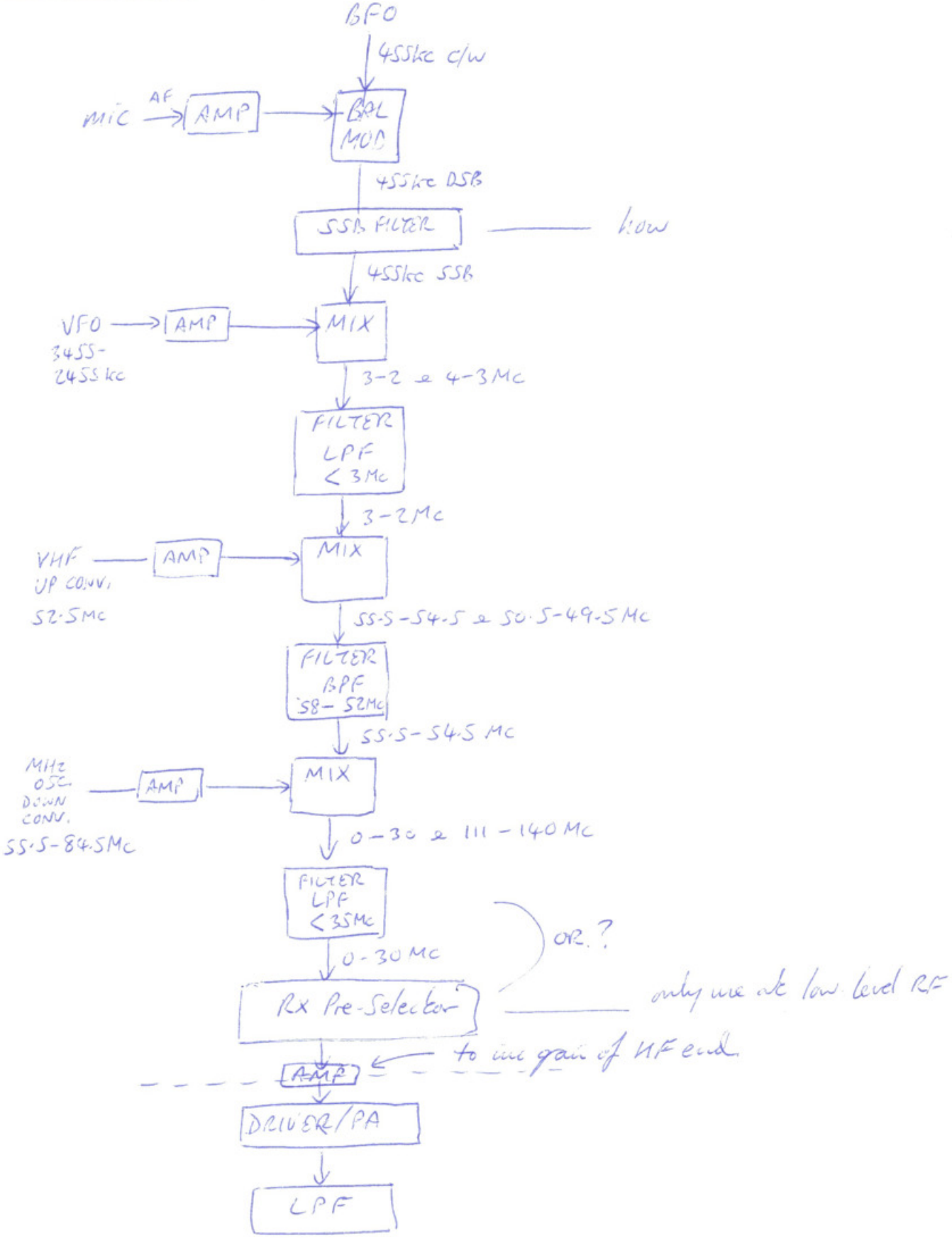


Fig. 3 MIXER CIRCUIT

FRG-7 TRANSCEIVER



GLOBAL BUSINESS EXCELLENCE
GLOBE
UNLOCKING OUR POTENTIAL
Nestlé

Radio Modifications



Yaesu Musen FRG-7

Fine Tuning Control mod

The main kHz tuning control is too sensitive for precise tuning of SSB and CW stations. Early production units were soon improved by the addition of a fine tuning control.



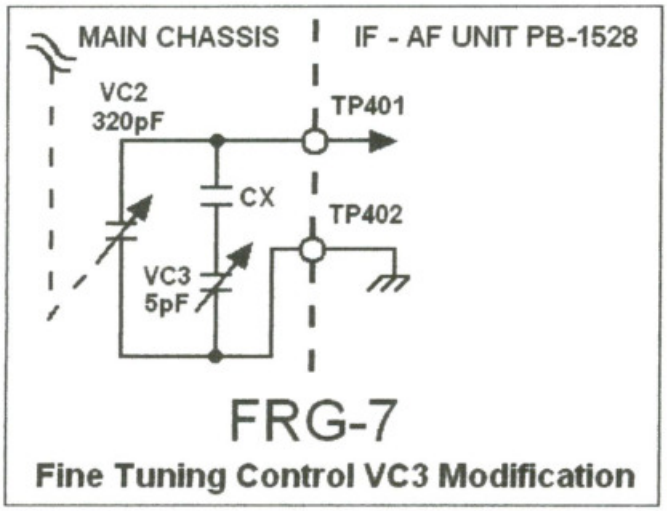
Early production model

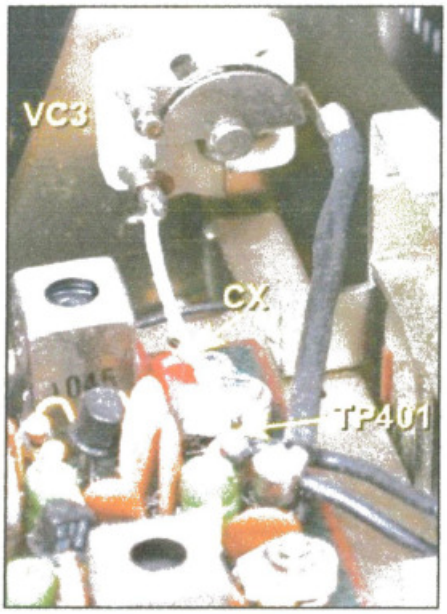


Main production run

The original fine tuning range was ± 6.2kHz. This is adequate but still a bit sensitive for precise tuning. This modification will reduce the fine tuning range to a more manageable amount.

Circuit Diagram





The fine tuning capacitor VC3 is in parallel with the main kHz tuning capacitor VC2. By adding a capacitor CX in series with VC3 it reduces the range of the fine tune control, see Table.

	kHz Tuning Dial		CX Capacitor
	100kHz	900kHz	
VC3	± 6.2kHz	± 2.9kHz	Wire Link

Fine Tuning Control	± 5.3kHz	± 2.3kHz	33pF
	± 4.9kHz	± 2.1kHz	22pF
	± 3.5kHz	± 1.6kHz	10pF



As can be seen from the table the effective fine tuning range changes from the low to high end of the main kHz dial. If you fit a 10pF capacitor the fine tuning range is approximately halved. If you use a capacitor value less than 10pF - e.g. 3.3pF - you may experience too little range at the top end of the main kHz dial.

The type of capacitor is also important as its stability will influence the overall performance of the receiver. Two types of capacitor offer good stability, Silver Mica and NPO (Negative-Positive-Zero) Ceramic. Silver Mica capacitors offer excellent temperature and long term ageing stability. However, they are expensive and becoming difficult to obtain. NPO ceramic capacitors are very stable over wide variations in temperature and time. They are relatively inexpensive and are available from the majority of electronic component suppliers.

Back

Radio Modifications

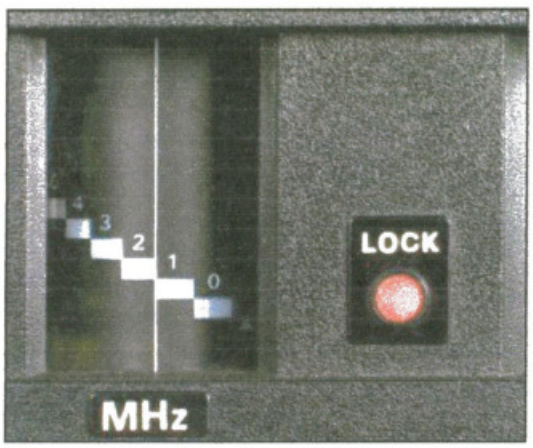


Yaesu Musen FRG-7

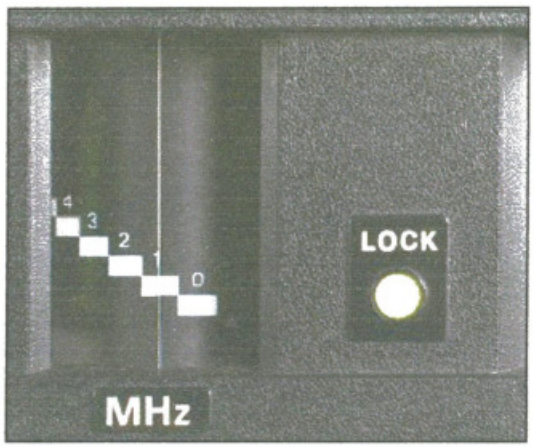
MHz Lock Red/Green LED Mod

The function of the MHz lock lamp is to show when the synthesized heterodyne oscillator is locked. Adjusting the MHz dial to the desired frequency band will lock the system turning off the lamp. So the indicator is on when the synthesizer is unlocked and off when the synthesizer is locked.

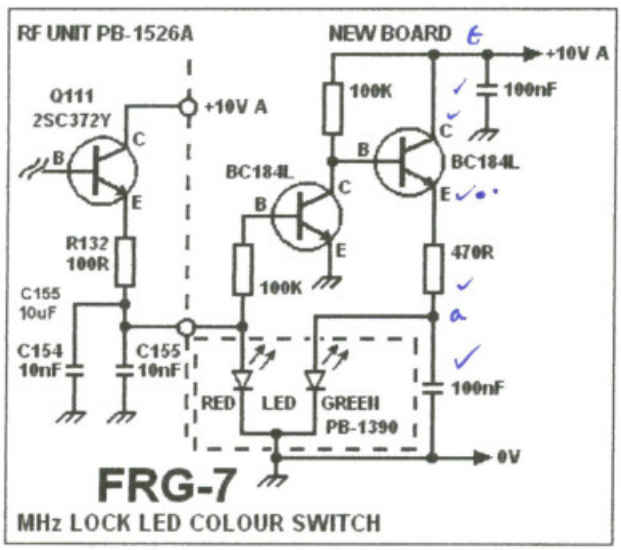
The modification is basically cosmetic, giving a clearer indication of synthesizer lock.



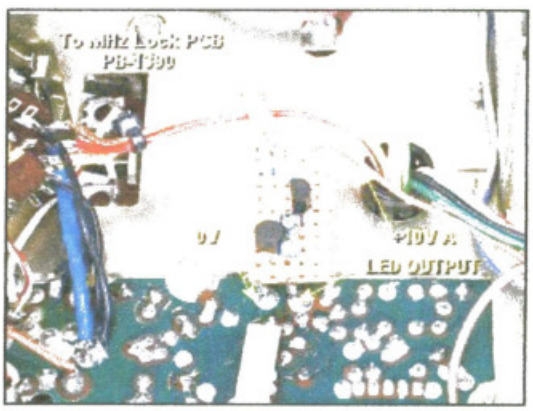
MHz out of lock



MHz locked



Circuit Diagram

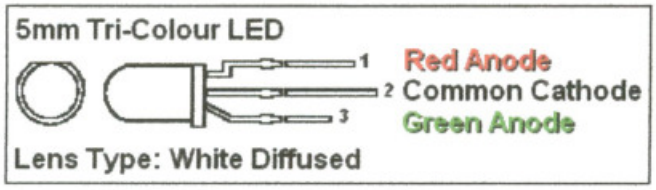


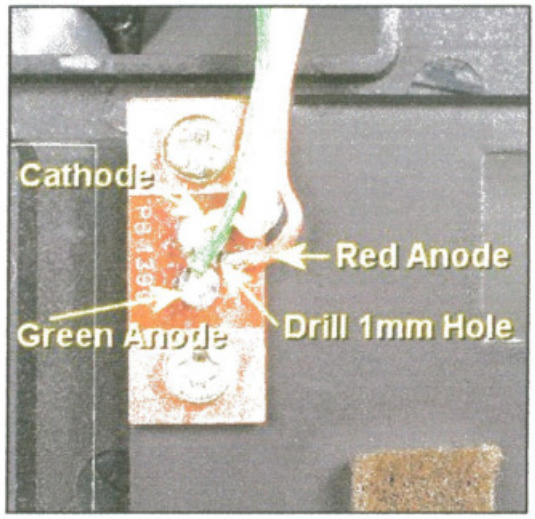
MHz lock LED colour switch board

The new circuit uses a 5mm tri-colour LED driven by a transistor switch. When Q111 on the RF unit PB-1526A is turned on (unlocked) the red LED is on. This turns on the first BC184L transistor, holding off the second BC184L and the green LED. When Q111 is turned off (locked), the red LED is off. This turns off the first transistor switching on the second BC184L and the green LED. The new circuit is built up on a small piece of plain matrix board and soldered into position using two terminal pins. Before the 5mm tri-colour LED can be fitted, an extra 1mm

hole must be drilled in the PB-1390 PCB at the position shown in the photo.

Parts List		
Component Type	**Value**	**Quantity**
Resistor	470R 0.25W	1
Resistor	100k 0.25W	2
Ceramic Capacitor	0.1uF (104) 50V	2
LED Red/Green	5mm tri-colour LED Data pdf	1
Transistor	BC184L	2
Circuit Board	Plain Matrix Board	1





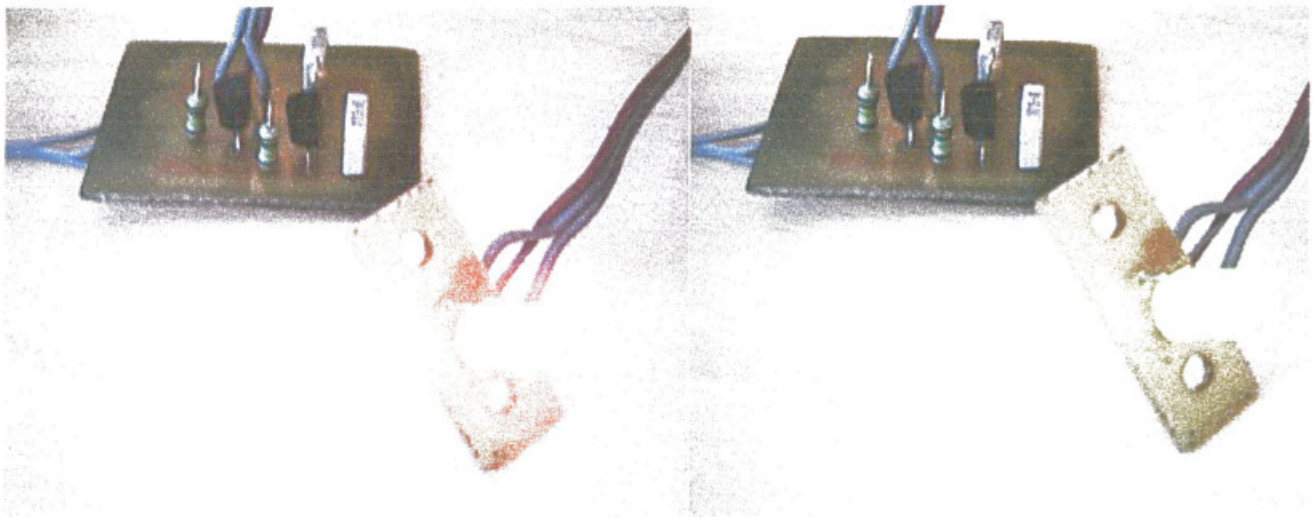
MHz lock LED board PB-1390

Back

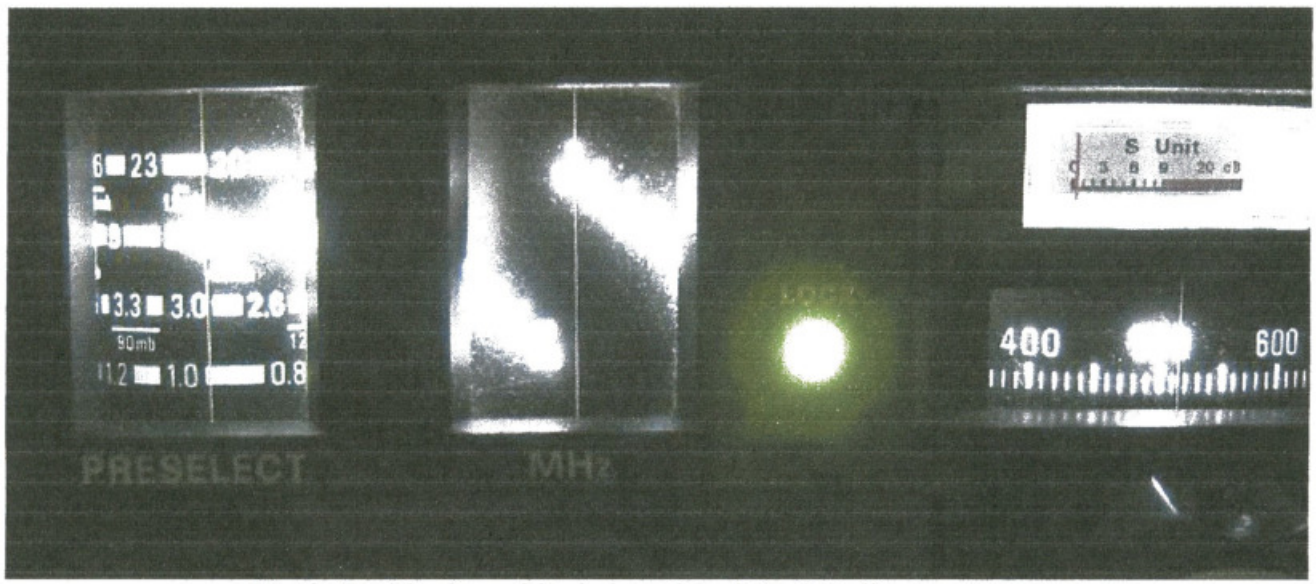


Continue on to see the construction details.

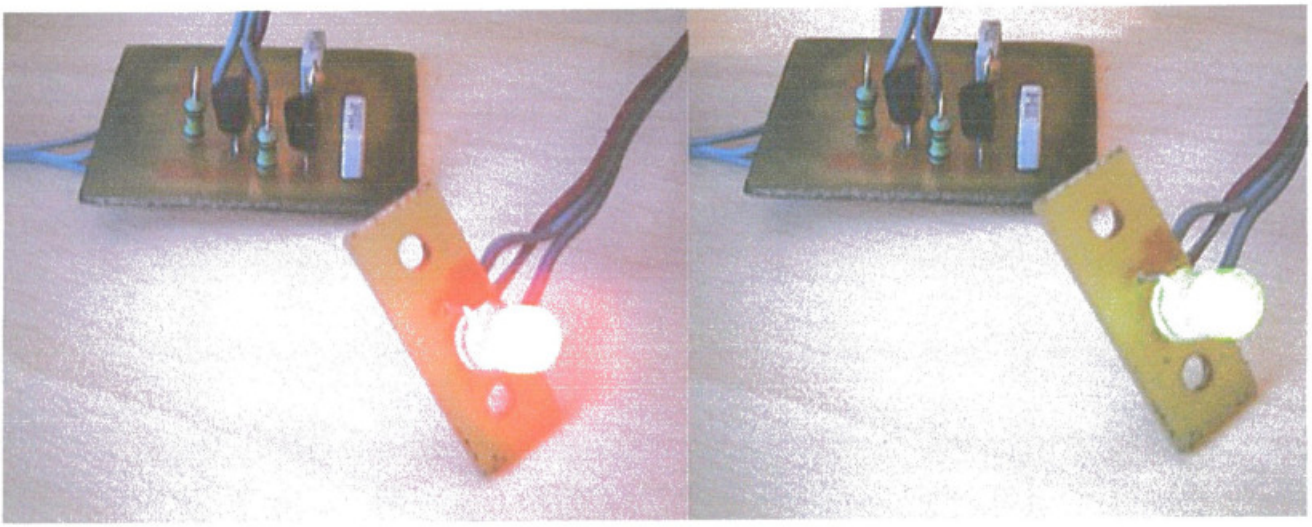
Bi-Color LED-LOCK Indicator for FRG-7

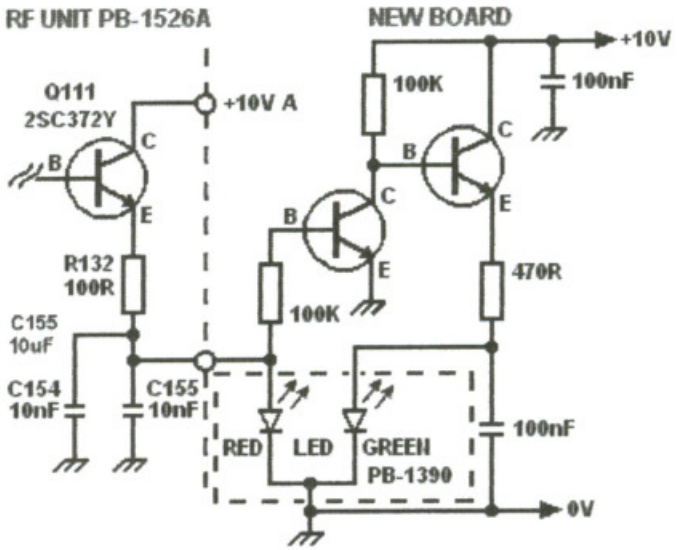


The easiest and best upgrade addition you can make to a Yaesu FRG-7 is adding the Bi-Color Led-Lock Indicator.
When the radio is out of a lock condition the indicator will show red , when locked it turns green. This is much more intuitive in operation than the way Yaesu did it in the 70's and add's a little high tech to the otherwise fine old Yaesu.



My frg7 with ultra white leds and Led-Lock Indicator upgrade.

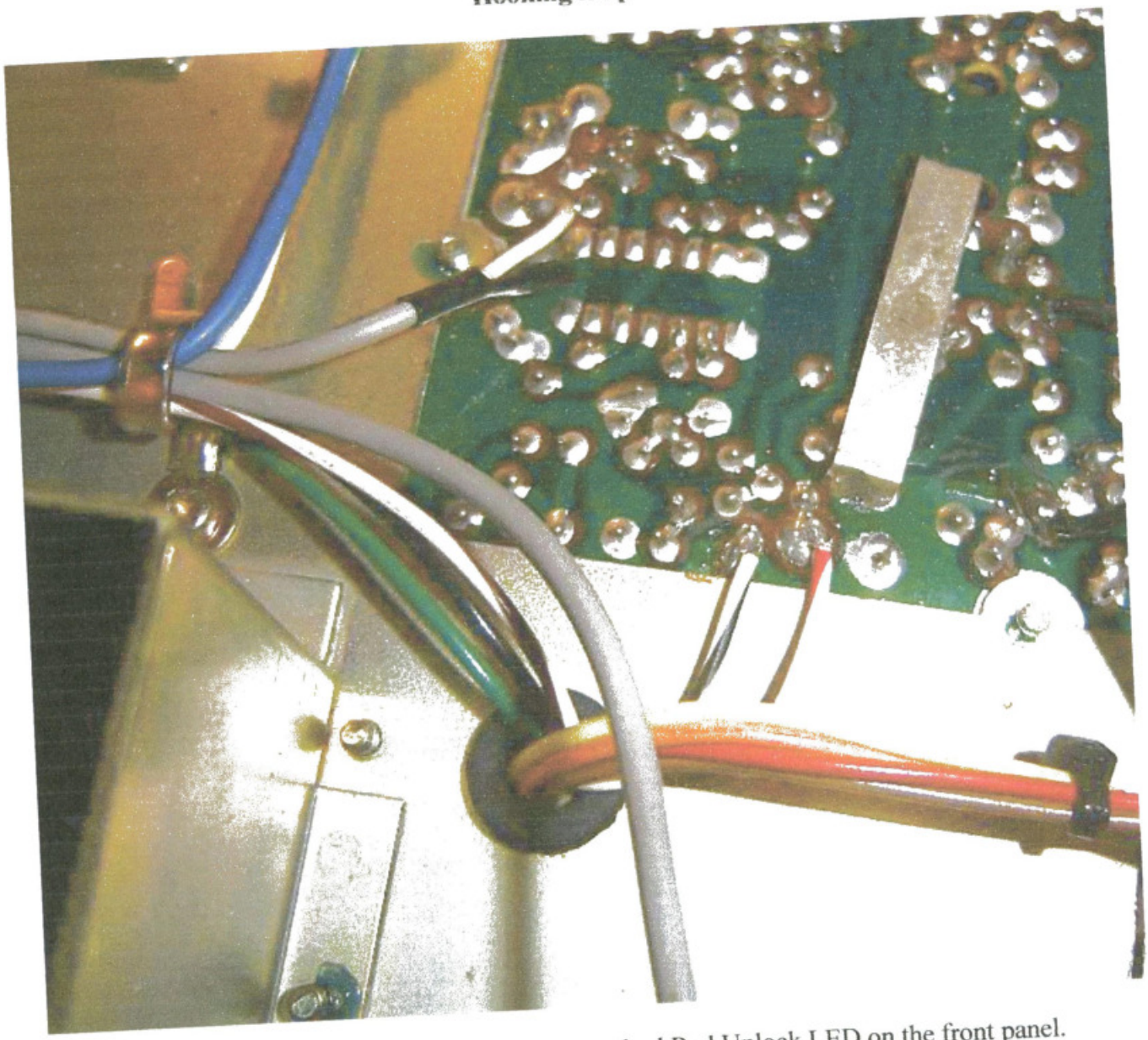




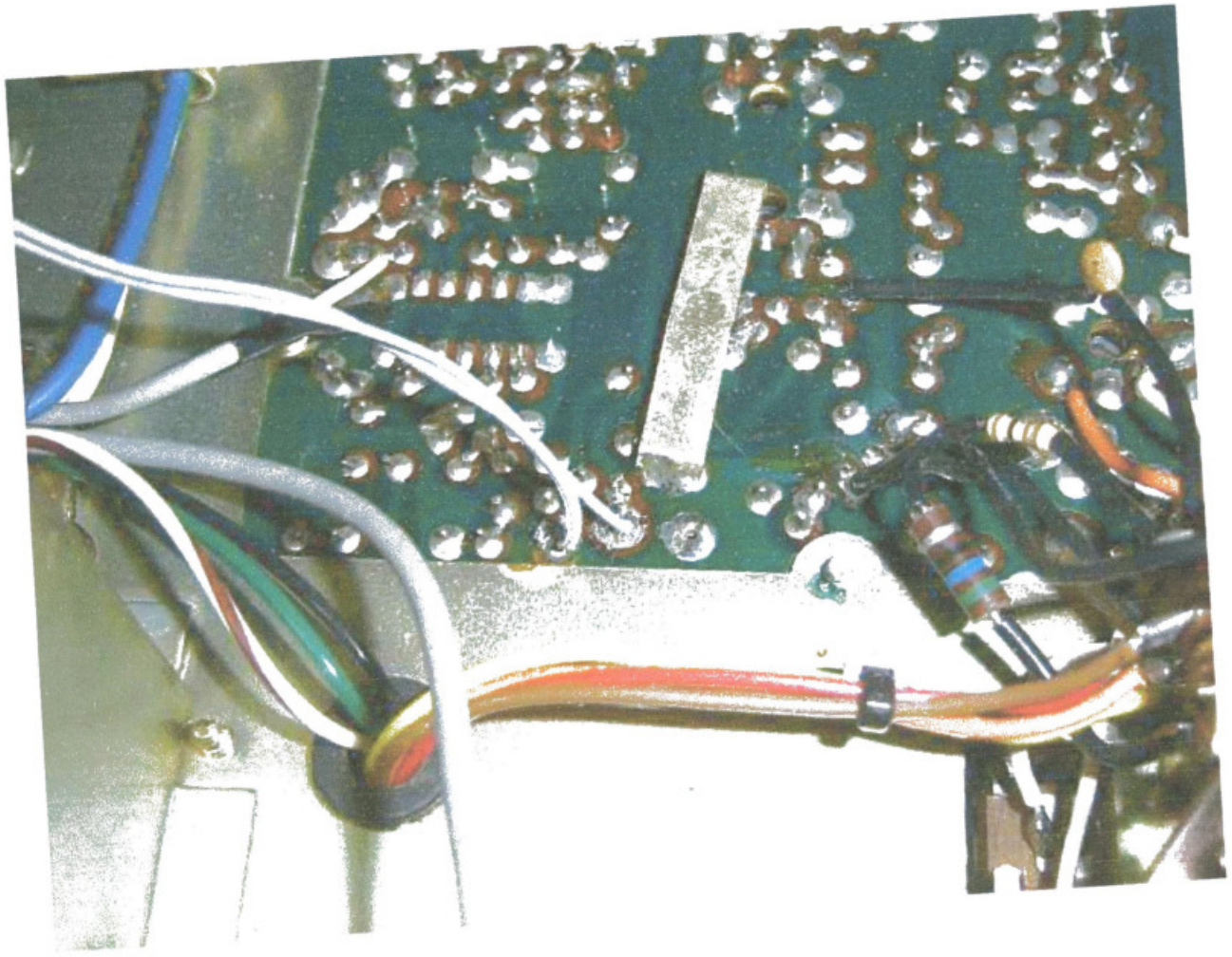
Basic Parts Layout
Main Board Art
LED Board Art
BC547 Data
BC184L Data
BC546 Data

I used BC547 transistors , checked the current and they fit very well, but many other similar transistors will work here.

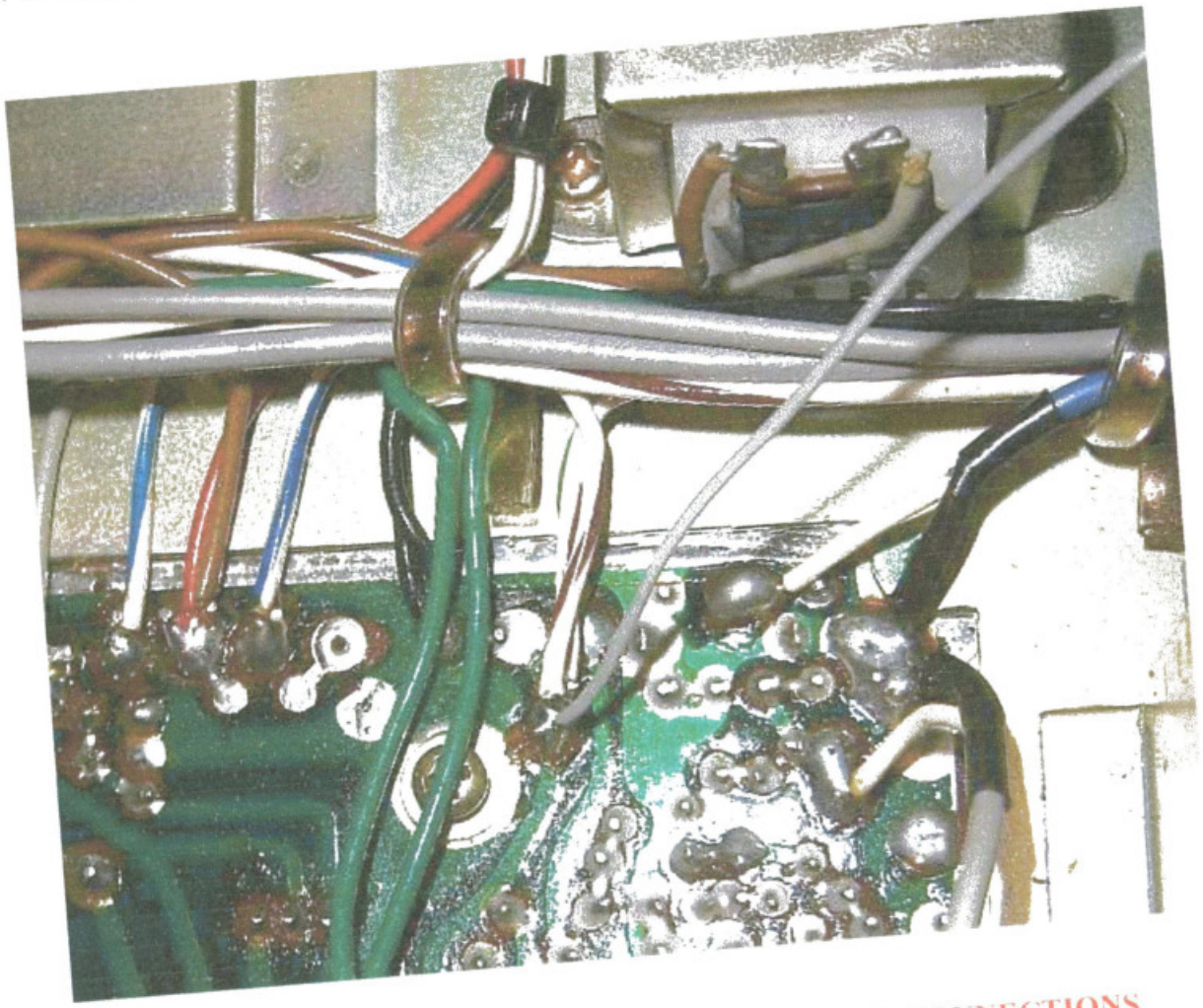
Hooking it up



This white/black and white/red wire goes to the standard Red Unlock LED on the front panel. The white/black is ground and the white/red will now go to the point on the new board between the red Led and the 100k resistor.



The 10V supply rail is here on the white/brown wire.



ALWAYS DOUBLE CHECK ALL VOLTAGES AND CONNECTIONS



The Preselector Tip

Sometimes it might be found that the ¨Preselector¨ operation is quite wide - that is - when listening to a station there is no well defined peak in signal strength over a wide range of movement of the ¨Preselector¨ knob.
There is a peak , but it can be hard to find ,and is made worse by this radios slow AGC.

The tip is....

1.Tune the stations frequency as good as you can.
2.Flip the ATT lever to DX (this will reduce signal stregth)
3.Adjust ¨Preselector¨ for the signal level peak.(the correct position is now obvious)
4.Return ATT to the normal position.

Try it , you will see it works.



With ATT set in the normal listening position it can be hard to find the best preselector setting.

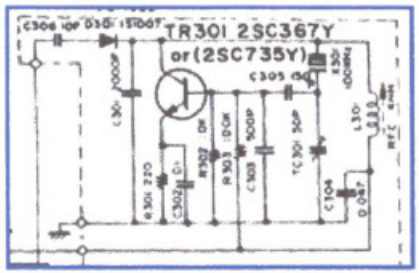


Set it to DX. The signal strength will drop allowing a more defined peak to be found.....

"Thanks Greg, it does work. Great idea. Thanks" - Alan.

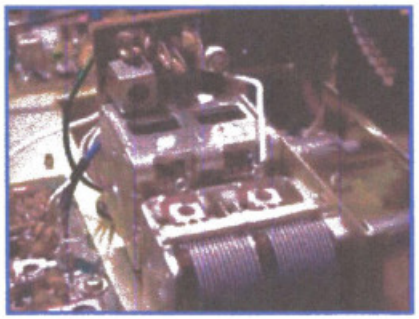
Adding a 100 KHz Marker Generator to your FRG-7 Receiver

While many early amateur receivers work just fine they usually lack a digital readout and must rely on analog dials for tuning. The problem of dial calibration is complicated by the non-linear effects of tuning capacitors. A nice addition to the FRG-7 analog receiver is the addition of a 100 KHz marker generator (Oscillator). Unfortunately the FRG-7 did not come with this feature but it's an easy add on if you have the oscillator to do the job. The oscillator I used came from an older tube type Yaesu amateur transceiver. Having an old FT-200 / Tempo One in the junk pile I decided to put the old crystal calibrator board (PB-1068) to use. The board made for a perfect addition to the FRG-7 and did a nice job, (PB-1068) uses the old style 100 KHz HC/13Uw crystal and for the oscillator transistor. If you're looking for one of these oscillators, check with us as we do get them from time to time.





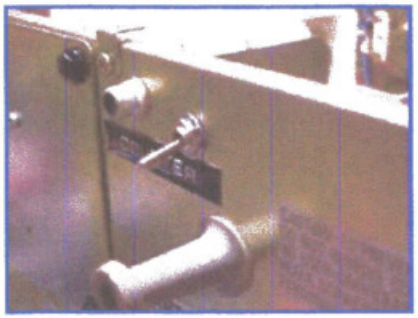
Installation of PB-1068 in the FRG-7 Communications receiver requires only two wires, one for 9 Vdc and a signal output. It is recommended that you run the output of the crystal oscillator directly into the SO-239 antenna connector on the rear of your transceiver. After experimenting a bit trying to find the best place to inject the oscillator signal, we have found this to be the best bet overall.

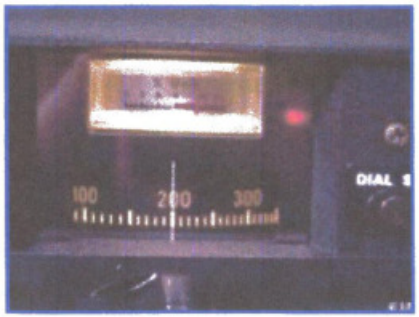




White wire, 100 KHz signal injected into RF Amp at VC1, but better if you just run this wire to the SO-239 antenna input.

Pick up the 9 Volt DC for you oscillator at TP-406 on the AF unit. See RED wire in photo to the left.





Installing a small switch at the rear panel to turn the oscillator on and off, this way you do not deface the front panel.
The oscillator yields a +20db signal every 100 KHz as expected.

IMPROVEMENTS TO THE YAESU-MUSEN FRG-7 RECEIVER

ADDING A 2.6 kHz BANDWIDTH SSB FILTER

R. K. SEATON, BRS51218

ALL designs have compromises and shortcomings. In general we live with them; however when a little thought and a few pounds are applied to these shortcomings, improvements are possible.

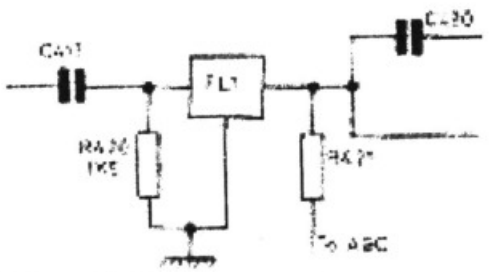


Fig 1. PART OF FRG-7 ORIGINAL CIRCUIT

The FRG-7 is an excellent design in most respects. Indeed it is still holding its own despite the availability of the broadband, digital breeds. However since purchasing and using the FRG-7 I found the selectivity at 6 kHz simply too broad for SSB/CW reception on the very crowded amateur bands, particularly now the diminishing sunspot cycle tends to drive everybody down to the lower frequencies.

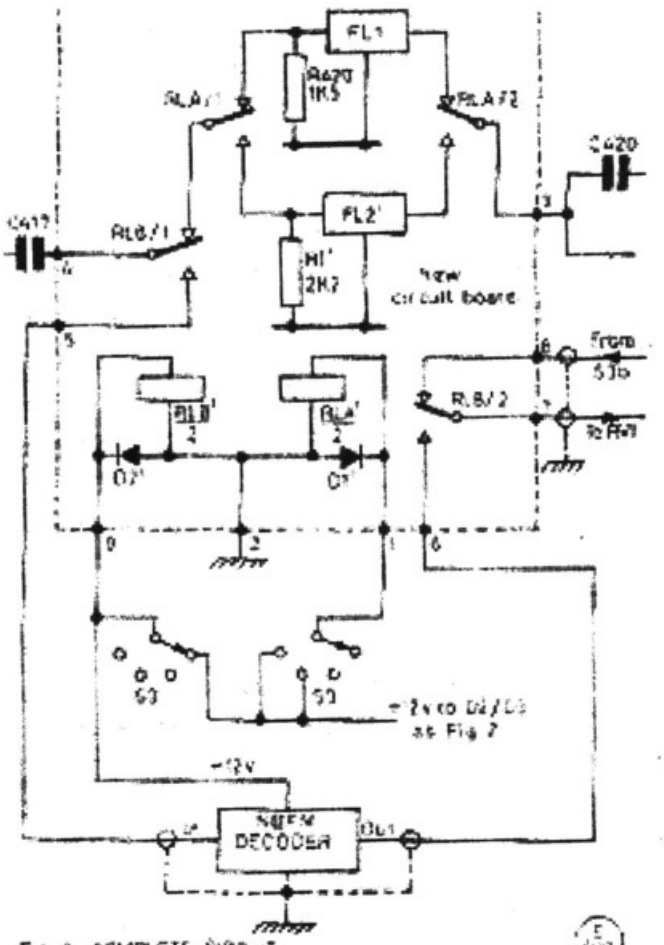


Fig 3. COMPLETE CIRCUIT

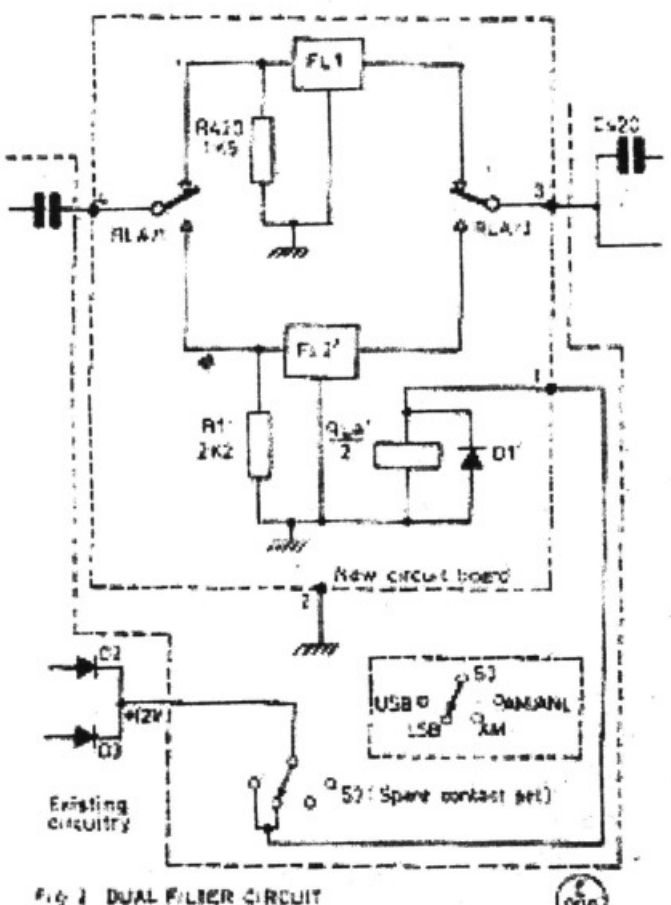


Fig 2. DUAL FILTER CIRCUIT

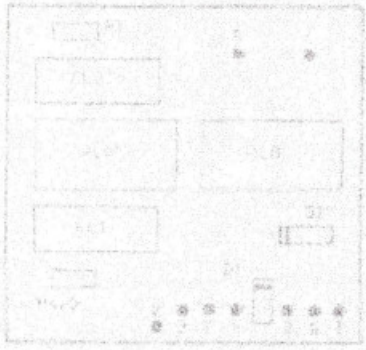
Table of Values
Fig. 3

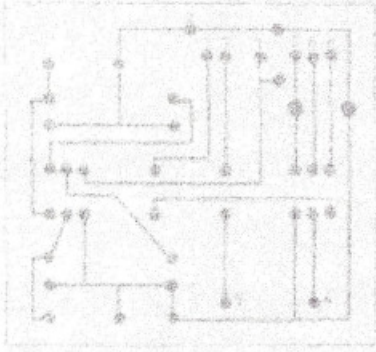
FL2' = CFM455J1 (Murata)
RLA', RLB' = DPDT sub-min DIL Hi type with 12v coil
R1' = 2K2, ¼ watt
D2', D3' = IN4004
NBFM decoder = e.g. FM80

Also: screened PVC covered copper wire and PCB or Veroboard: all components available from *Ambit International*, 200 North Service Road, Brentwood, Essex CM14 4SG.

A suitable SSB filter is readily available, having a bandwidth of 2.6 kHz and of the same physical size as the one fitted at the factory. It is electrically similar, with a slightly higher input impedance at 2K, as opposed to 1.5K of the one fitted. If the receiver is only required for amateur use it is a simple matter to remove the existing and replace it with the new. Ideally the input resistor, R420, should be changed from 1.5K to 2K, but in reality it makes little difference to the performance of the receiver, see Fig. 1. I considered doing this, but decided the receiver would be rather limited and consequently I came up with the following modifications.

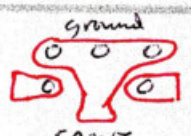
Investigation of the construction of the receiver showed two spare switch wafers on the mode switch. Whilst this is adequate for switching the two filters, I considered the wiring would be too long and preferred instead to use a relay, as can be seen from the circuit in Fig. 2. A small printed circuit was made, although I see no reason why *Veroboard* should not be used, as long as the leads are kept short. Details of the layout are shown in the associated diagram, Fig. 4.







		6dB width	60dB width	Insertion Loss	Impedance
EXISTING FILTER	LF-C6	3kc	8kc	7	1.5kΩ
NEW	CFJ455K14	1.2kc	4.5kc	7	2kΩ





FRG-7 narrow filter conversion.
By Frans Sessink - 1982

AM is now AM wide
AM/ANL is now AM narrow
ANL function is given up
IN USB.LSB and AM narrow the two filters work in series.

