



Yaesu **FRG-7700** Survival Guide



PAØPGA

SPECIFICATIONS

Frequency Range:

150 khz - 30 Mhz in 30 bands

Modes:

AM, SSB (USB, LSB), CW, FM

Sensitivity:

	AM	SSB/CW	FM
0.15 - 0.3Mhz	30 μ V	3 μ V/500 ohm	-
0.3 - 2Mhz	25 μ V	2 μ V/500 ohm	-
2 - 30 Mhz	5 μ V	0.5 μ V/50 ohm	1 μ V/50 ohm

Selectivity:**-6 db****-50 db**

AM wide	12 khz	25 khz
AM medium	6 khz	15 khz
AM narrow	2.7 khz	8 khz
SSB/CW	2.7 khz	8 khz
FM	15 khz	30 khz (-40db)

Stability:

Less than +/- 1 khz from 1-30 minutes after power-on

Less than +/- 300 hz after 30 minutes warm-up.

Antenna Impedance:

0.15 - 2 Mhz (BC) 500 ohms unbalanced

2 - 30 Mhz (SW/BC) 50 ohms unbalanced

Power Requirement:

100/110/220/240 Volts AC, 50/60 hz

Power Consumption: With Memory Unit:

Standby 10W 10W

ON: 33W 39W

12Vdc: 850mA

Size:

334(W) x 129(H) x 225(D) mm

Weight:

Approx 6 kg.

With memory unit:

6.5 kg

Audio Output:

1.5 Watts (8 ohms, 10% THD)

Speaker Impedance:

8 ohms

4 - 16 ohms for external speaker or headphone

FRG-7700 Survival guide



This is a survival guide for the FRG-7700, one of the most versatile receivers from Yaesu.

With the help of this guide your Frog can survive the next 20 years and more.

This guide is in the true boatanchor tradition, a collection of known faults and their solution, and a story of resurrection of a receiver at my workbench.

My command of the english language could be better, so I apologise for linguistic mistakes here and there. I just hope that I could help anybody to maintain his FRG-7700 in good condition.

73' Wim Penders PA0PGA

Description:

The FRG-7700 is a compact communication receiver, for the reception of AM/SSB/CW and FM signals between 150kHz and 30 MHz. The receiver is very sensitive and stable, and has a pleasant audio.

It has no special bells and whistles, but is designed with the shortwave listener in mind.

That is maybe the reason that the receiver after 20+ years, is still very popular, and in demand by hams.

Tuning is simple and exact, choose band and mode and you are in business, No trills and frills, listening with this receiver is very basic, and you learn to listen, instead to play with menu's.

You can obtain a used one in good condition for a affordable price on hamfests or on Internet.

Be careful if you buy from Internet, there are many guys who advertise with a receiver in good condition, but when it arrives it is a box full of junk. I have a credo here: If it is not possible to collect equipment myself, and pay cash, I am not interested, and can better save my money. I have to see what I buy.

Serial:

The FRG-7700 was getting to the amateur market in 1981 and is replaced in 1986 by the FRG-8800.

There is not much difference between the first and the last receivers, the only thing I saw was a different coupling of the frequency scala to the dial mechanism. In the early versions it was a felt ring, in the later version a spring.

You can check the age of your FRG-7700 if you look at the serial number:

I have here sn# 4E 290421, this receiver is made in May 1984, the first digit gives the production year, the second letter the month, (A= Jan, B= Feb a.s.o.), then 3 digits of the production run and 3 for the serial number. Another is 1F 070507, this receiver is made in June 1981.

Other numbers are M1C 050492 (march 1981, with memory module) and 1E060340 (May 1981).

Manuals:

Copies of the User Manual and the Service Manual can be obtained from the **Fox-Tango** website, by far the best website for all classic Yaesu equipment. If you want to work on your FRG-7700, it is a must to have the manuals and schematics. See: <http://www.foxtango.org>

The manuals are very informative and deal with the use and alignment of the receiver, and have a complete partlist.

Another very good source for free manuals is <http://www.mods.dk> who has manuals of almost all modern Ham equipment. The only drawback is that you are limited to 2 manuals a day. On this site are also modifications, pictures, descriptions and more. Recommended!

Parts:

Unfortunately after 20+ years there is no dealer around who still carries spare parts, but fortunately there are not much special parts used in this receiver and most parts are easy substituted by standard parts.

The receiver is very rugged and, normal used, there are not much problems.

The only parts that can give trouble after longer use are the mechanical parts as switches and potmeters. It is not easy to find replacements for them, keep an eye open for special parts at hamfests, or have a good junkbox with old radio parts. I can recommend the Graveyard section on the Fox-Tango site, they are a excellent source for special parts. See for yourself at www.Foxtango.org

Alignment:

Most FRG-7700 receivers have no problems, but after 20+ years of use, a re-alignment can be necessary.

To align the receiver, you have to be very familiar with the used circuits or you end up with a worthless piece of junk, if you don't understand what you doing. That is true for all kinds of communication equipment. I have seen all kinds of junky stuff on e-bay, that was tampered with and sold for high prices, to the chagrin of the new owner.

Most of the time the problem is a loss of the frequency coverage, usually at the end of the tuning scala.

The receiver has normally a overlap at each range from between 30 to 50 khz at each side from the range, for example at 7 Mhz the receiver tunes from 6950 to 8050 khz, and other bands have the same overlap at each end.

The PLL circuit in the FRG-7700 needs some attention if you have the following symphoms:

If the end point of each Mhz range is getting lower at the high side of each band, a re-alignment of the first PLL is necessary, (receiver receives not higher than 950 or so on the analog scala)

If only the end points at the 5, 12, 20 and 29 Mhz bands are too low, a re-alignment of the second PLL is necessary.

This alignments are not difficult to do, you need a good counter, a VTVM, RF millivolt meter or oscilloscope and fitting plastic or ceramic tuning tools. Under no circumstances use metal screwdrivers for alignment of the coil cores, they will ruin the cores. Use only fitting plastic or ceramic alignment sets.

For the trimmers use a small screwdriver or a ceramic one,

The procedure to align the PLL is described in the Yaesu Operator and also in the Service Manual,

There are some changes to make in the manual:

PLL Reference oscillator Adjustment:

Set the MR switch off, and connect a frequency counter to TP04, (instead of pin 9 of the MB-84040B ic, as the manual says) and adjust TC 2002 for a frequency of exact 6.400 Mhz on the counter.

The result is the same as in the manual, but you don't have to work at the ic, with the risk of shorting pins.

The PLL Local alignment can be done as in the book, if you don't have a HF VTVM to measure the voltage, you can use a HF oscilloscope for this alignment, together with a counter.

However, if you do'nt have either, skip this alignment, If you receive signals, this section is working. Just check for a 47.6 Mhz signal.

For alignment of the first PLL, connect your dc VTVM to TP05 in front of the first PLL box, and rotate the main dial to the "1000" position of the analog dial. Adjust T2007 for a reading of 7 volts on the meter. Try to make 7 volts as close as possible.

Rotate the dial to the "0" position and check the voltage, it will be around 2.4 Volts. The manual says between 1.5 and 2.0 Volts, but none of the four receivers I tested were in that range. All of them had higher values from 2.25 – 3.1 volt and are working fine, so I let it at that.

For alignment of the second PLL connect your dc VTVM to TP03 just in front of the MB8718 ic and rotate the dial again in the "1000" position.

Set the bandswitch at the 5 Mhz band and adjust T2004 for a reading of 7.4 volts dc.

Change the bandswitch to the 12 Mhz band and adjust T2003 for a reading of 7.4 volts dc.

Change the bandswitch to the 20 Mhz band and adjust T2002 for a reading of 7.4 volts dc.

Change the bandswitch to the 29 Mhz band and adjust T2001 for a reading of 7.0 volts dc.

Try to make this adjustments very careful, often these voltages are too high, resulting in a loss of range or a failure to lock properly, with a high noise level as result.

Now rotate the dial to the "0" position and change the bandswitch to 0, 6, 13 and 21 Mhz position and check the voltage at TP03, they should be between 1.5 and 2.0 volts.

I measured voltages between 1.45 and 1.70 volts in my sets.

Be carefully with the coil cores of the PLL, they have been stabilized by a lot of wax, which can give some trouble.

Be gentle, you can "feel" trough the wax for the correct position of the core, and normally there is not much movement necessary in any direction to obtain the correct voltage.

Don't force things, if the core breaks, you are in trouble. In case of a broken core slot, remove the core altogether, and put it in upside down, you have a second try this way. The cores are not interchangeable, so do one at a time.

The general alignment can be done as described in the manual, with the proper tools and equipment, it is a straightforward job.

For a fully alignment you need a signal generator with attenuator and a range from 0.1-65 Mhz, a frequency counter, VTVM, and if you want to align the noise blanker too, you need a noise generator.

Follow closely the procedure in the manual, if the receiver is in a normal condition, the changes should be minor.

Is the set very unsensitive, check first the semiconductors in the circuit, or there can be resistor or condensor failure, that is much more likely than misalignment...

Closely check for abnormalities (burnt or cracked components, bad soldering joints, bad connectors and other trouble spots). If you check carefully, use the schematics and the very good circuit description in the handbook to make yourself familiar with the circuits used.

My experience with 4 of this receivers is that most of the failures I encountered, where man-made by amateurs who never read a handbook, but first plug in a soldering iron, and sell the set when the smoke has settled, and then often try it again with the next set coming their way.....

Troubles I have encountered so far:

Power Supply:

There is a source for trouble here: the transformer, rectifier bridge and condensor 6800u/40V are always on, because they deliver 13.5V to parts of the receiver, used for the clock and automatic switching at the selected time.

This should not put too much strain on the powersupply, because the current is minimal. The source for trouble is the rectifier, who becomes very hot, so hot in fact that in one case the wires to the transformer caught fire, and the condensor exploded. Check the soldering joints from the bridge, in the board, they can have some cratering, soldering them trough with a soldering iron, is then the solution. A change for 4x 1N5405 or another bridge rectifier is also possible. If you don't use the receiver for automatic recording of transmissions, or for a long time, disconnect the set from the mains, or mount a powerswitch at the backside of the set, that way there is no risk of fire. If you have the memory option, it is best to use the backup battery adapter.

Dial Lamps:

Dial lamps are long lasting, but they have to be changed now and then. They are 12 Volt /100mA types, with long wires, and can be obtained in every parts store. Eventually you can use bulbs with short wires and solder them to the existing long wires after cutting away the old bulb, using isolation tube or crimping tube to isolate the wires and joints. That way you don't have to remove the metal frontplate for access to the soldering joints.



Be Careful: Remove the powercord first!! The lamp of the VFO is mounted in a small reflector that is very close to the soldering side of the receiving board and this lamp is always "glued" to the grommet from the heat of the lamp, so changing is very difficult. To get access, you have to disassemble the front panel and the analog dial. During the change it is easy to bend the reflector somewhat, and make a short to the board, **destroying the counter/clock ic in the process, because the IC (and part of the powersupply) is On all the time. It is really necessary to remove the power cord,** otherwise you do not remove all the power, with disastrous results.

Displaydriver IC MSM-5524RS:

If the display is not working, there can be several problems, but the most common is the failure of the big driver IC the OKI MSM-5524RS or the surrounding switching circuit.

The MSM-5524RS is a 40-pin LSI chip, with a clock, dual timer (on/off time), a countdown timer for 60 minutes, and a 5-digit frequency counter, which is used in this receiver for the display of the received frequency.

The MSM-5524RS drives a 5 digit fluoricent (green tube!!!) multiplexed digital display for clock and frequency. A mode switch changes the display for frequency, clock, on-time, off-time and sleep function.

If the receiver is switched off, the display is off, however power to the IC is always on. The display stays on when the mode switch is in one of the clock modes and then displays the time even when the powerswitch is off.

The MSM-5524RS IC is the same as used in the Kenwood R-1000 receiver, and you can find some info of the chip and circuit diagrams in the R-1000 manual, which I reproduce at the next pages.

There are some things to know about the frequency display:

The displayed frequency is the PLL frequency (0.455 – 30.455Mhz) offset by the IF frequency (455khz), resulting in a frequency display of 0.000 to 30.000Mhz. There is just one offset possible, so in SSB mode there is always a frequency difference between the carrier frequency and the displayed frequency of about 1.5 khz because the carrier of a SSB signal is at the lower or upper side of the signal. The highest resolution of the display is 1 khz, so there is always a frequency difference of 1-2 khz between the true and the displayed frequency.

This explains the difference in frequency as you are listening to a ham net on a given frequency.

For AM however, the displayed frequency is correct, if the received station is tuned in the center of the filter.

The MSM-5524RS IC is very dependable, and, when normally used, there is seldom a failure.

You see seldom a R-1000 with a display failure, because they use a different board layout.

Problems with this IC are almost always man-made, like a short during the change of the light bulb in the VFO, (see above) or poking around in the set with the powercord attached.

If this IC fails, you are in big trouble, because the manufacturer stopped the production some 15 years ago, and supply is very scarce if found at all.

I saw one (used!!!) on e-bay, for a ridiculous price (around \$ 60.-), so be prepared for a long search.

Maybe they have been used in some clock radio's from the eighties, but I did not find any yet. Your best bet is to obtain a spare set with a defect display or otherwise, and use the good IC.

Kenwood used the same IC in their R-1000 receiver, so that can be a source as well.

Causes of trouble for this IC are the switch and the switching diodes which choose the mode of operation.

One of my sets had a bad mode switch. Using the clock was no problem, but the switch could not change to the frequency mode, it still displayed the time. The reasons were bad switching contacts in the mode switch.

I took the switch out and removed the back plate. If this is carefully done, you can put the switch back together again without problem. After a squirt of contactspray and working the switch a couple of times, everything worked nice again.

In another case I found diode D43 that was no diode anymore but a resistor of 5k-ohm, the on and off time of the display was the same, and there was a curious frequency display. The frequency displayed was the receiving frequency /10, plus 455, so 7455 displayed as 791, so apparently the 455 khz offset was not switched on.

I changed all three diodes for 1N4448 types, because they had a bad oxydation of their leads. Later I found out that this particular receiver has been used in a yacht, and salt water spray left its corroding mark...

If you have some weird display problems, check those diodes first, or the attached switches and transistors.

Display:

The display type is FIP 5A8B, a 5-digit green fluoricent tube, of the kind that is much used in home audio equipment and in practically every receiver and transceiver of the eighties. Yeasu uses a amber filter, to change the color in the style of all their equipment of the time (FT101ZD, FT901)

This tube has a filament, and has in the long run the same problem as all tubes: the filament is coated with emitting material, but after long use, this material is exhausted and the display is getting dim.

If your display goes weak, you can solve the problem temporarily by removing the orange filter in the display window. Your Frog has then a very bright green display, that will again last for years. I tried it, but was not happy with the look of it, It was no Frog anymore, so I put the filter back.

AM band:

Under 2 Mhz the FRG-7700 is in my opinion very unsensitive, and if I want to do some Dx-ing in this band, I use my R390A receiver, I will try to make my FRG-7700 at least as sensitive, it will be the next mod project, and I will update this page, when I have everything figured out.

Paint:

You can find now and then a mint receiver on the market. Generally speaking the appearance is a sign of how careful the previous OM was with it, but most receivers have seen some use, and look like it.

The paint on the frontplate of the FRG-7700 is easily scratched, in particular the sides.

Yaesu did it the cheap way here, a spray of metallic paint over the plastic faceplate and that is a pity, because it is very difficult to repair. I tested with different car repair sticks, but was not able to find the right shade paint.

Most sides of the frontplate are heavily scratched, so I will try to paint the sides alone, if there is then a small difference in shade, it will not be so obvious. Removing the paint altogether from the sides is also a possibility, it can be done with thinner and rubbing with an old cloth, you have just to be careful with the front itself, the paint there is quick damaged. Thereafter you have black sides, which don't look bad, and scratches are for the most part invisible. I did a test, the plastic was not affected by the thinner.

Painting the front as a whole is almost impossible, the lettering is printed on the front and is easily damaged.

So I clean everything, including knobs and dials with water and soap and a old toothbrush.

Rub it dry with an old cloth. Don't let parts long in the water, the aluminium inserts are glued to the knobs and come off if you leave them to long in the water and there is a possibility that the white paint on the knobs comes off too.

I repair them with a toothpick and white Hammerite paint. Direct after filling the lines, I sweep the excess paint off with a cloth saturated with white spirit. You have then a excellent line.

The Hammerite paint dries quickly, and is very strong, I have never had to repaint a knob again.

I use it also for repainting and refill markings on boatanchor receivers, like the R390A and Racal.

The covers are sprayed twice by Yaesu: first a spray of normal paint, and then the sides and coverplate were sprayed with a kind of cracle paint. In some occasions parts of the second layer flaked off. This is very impossible to repair, so I clean the plates rigorously and after that use a good automobile wax to make the best of them.

I like everything clean, but some wear and tear is visible after 20+ years. I have no problem with that, if the receiver is electrically sound. Don't we have all wear and tear problems hi..?



CIRCUIT DESCRIPTION

COUNTER AND CLOCK CIRCUITS

The PLL circuit output is amplified by Q29 ~ Q32 (2SC1815(Y)) in the RX unit then is fed to Q33 (SN74LS196N) where it is divided by ten. The divider output is fed to Clock and Counter IC MSM5524, which provides a display output that is reduced in frequency by 455 kHz with respect to its input.

The master oscillator for the Clock and Counter oscillates at 3.2768 MHz. The display circuit operates on +11 V DC, which is created by a DC-DC converter.

The FUNCTION switch has four positions: FREQUENCY display, CLOCK display, TIMER ON, and TIMER OFF. Each time the HOUR switch is depressed increments the clock display by one minute; continuously depressing the MIN. switch continuously increments the minutes digit of the clock, while the hours digit is left unchanged. Depressing the HOUR and MIN. switches at the same time resets clock display to "1 hour 0 minute 0 second", and releasing both switches restarts clock operation.

When the FUNCTION switch is placed in the ON or OFF position, pressing the HOUR and MIN. switches at the same time resets the clock to "0.00".

To preset the timer, first preset the desired ON time (or OFF time), then set the TIMER switch to ON. This will turn off (or on) the power to the unit. (When the preset ON time (or OFF time) is reached, the power to the unit is again turned ON (or OFF). At this time, the POWER switch may be placed either ON or OFF position. A relay contact output interlocked with this timer operation is available at the REMOTE terminal.

[MSM5524]

• Maximum Ratings

Rating	Symbol	Condition	Value	Unit
DC Supply Voltage	V _{DD}	T _a = 25°C	-0.3 ~ 7	V
Input Voltage	V _i	T _a = 25°C	-0.3 ~ V _{DD}	V
Storage Temperature Range	T _{stg}	—	-55 ~ +125	°C

• Electrical Characteristics

Rating	Symbol	Condition	Value	Unit	
DC Supply Voltage	V _{DD}	Counter	—	4.75 ~ 7	V
		Clock	—	4 ~ 7	V
Crystal Frequency	f	—	3.2768	MHz	
Operating Temperature Range	T _{op}	—	-35 ~ +85	°C	

• Maximum operating frequency

Rating	Symbol	Condition	Min.	Typ.	Max.	Unit
Count frequency (FIN)	f	V _{DD} = 4.75 V _i = 1V _{p-p}	3	—	—	MHz

Table 1 MSM5524

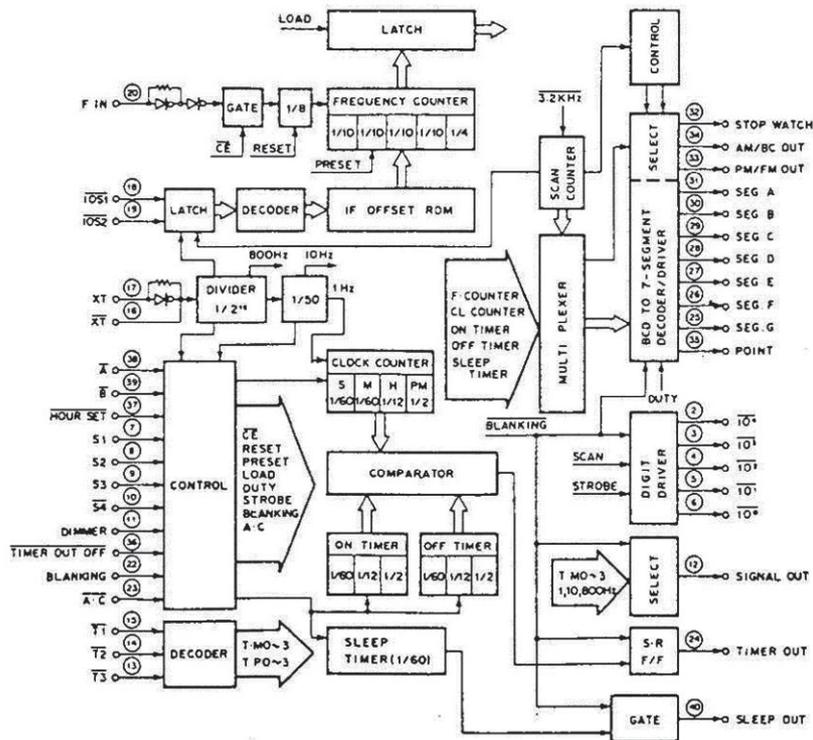


Fig. 2 MSM5524

CIRCUIT DESCRIPTION

MSM5524

The equivalent circuit and electrical characteristics of the MSM5524 are shown in Table 1 and Figure 2 respectively.

1. Display Drive Output

The display drive output dynamically drives a five-digit common-anode display element. Segment outputs are present at pins 25 ~ 31, while digit outputs are present at pins 2 ~ 6. The active state of each segment (H) and digit (L) requires an output current of 1 mA and 2 mA respectively, which are supplied by drive transistors Q35 ~ Q39 (2SA1015(Y)). Function display outputs are assigned to each pin as follows:

- Pin 35: Point
- Pin 34: AM and BC
- Pin 33: PM and FM
- Pin 32: Stop watch

These operation-mode display elements are driven by transistors Q42 and 43 (2SC1815).

Input			DISPLAY SELECT	MODE
S ₁	S ₂	S ₃		
H	H	H	Clock	Clock Timer
L	H	H	Sleep • Timer	
H	L	H	ON • Timer	
L	L	H	OFF • Timer	
H	H	L	AM	Radio Frequency Counter Frequency Counter
L	H	L	FM	
H	L	L	SW	
L	L	L	Frequency Counter	

H: V_{DD} level or open; L: ground level.

Table 2 Function of indicator selection terminal

Code	\bar{A}	\bar{B}	Function
CLOCK	L	L	Resets to AM 1 : 00 (00 ^S).
	H	L	Advances the "minute", maintains the "minutes" and counts the "seconds"
	L	H	Advances the "hours", maintains the "minutes" and counts the "seconds"
	H	H	Normal operation
ON TIMER	L	L	Resets to AM 0 : 00.
	H	L	Advances the "minutes" and maintains the "hours"
	L	H	Advances the "hours" and maintains the "minutes"
	H	H	Maintains the timer-ON time. When the timer-ON time is reached, pin 24 turns ON
OFF TIMER	L	L	Reset to AM 0 : 00.
	H	L	Advances the "minutes" and maintains the "hours"
	L	H	Advances the "hours" and maintains the "minutes"
	H	H	Maintains the timer-OFF time. When the timer-OFF time is reached, pin 24 turns OFF

Dropping \bar{A} or \bar{B} to "L" advances one digit. When the \bar{A} or \bar{B} is kept at "L" for more than 1.6 seconds, the digit advances continuously at a speed of 10 Hz.

Table 3 Function chart of input \bar{A} , \bar{B}

2. Time Correction

Pins 38 (\bar{A}) and 39 (\bar{B}) accept time setting inputs which are active at "L" level. Placing these terminals to "L" level permits the functions shown in Table 3 in accordance with the mode selected from Table 2.

Each time the time correction button is depressed increments the clock display by one hour or minute.

When the button is depressed for more than 1.6 second, the clock display is continuously incremented at a rate of 10 Hz.

3. Other Pin Functions

a. Pin 23 \bar{AC}

All clear input. Initial clear is accomplished by grounding this terminal through capacitor C198 (0.047 μ F) when the power to the unit is turned ON.

b. Pin 22 BLANKING

Input logic of this pin is active at level "H".

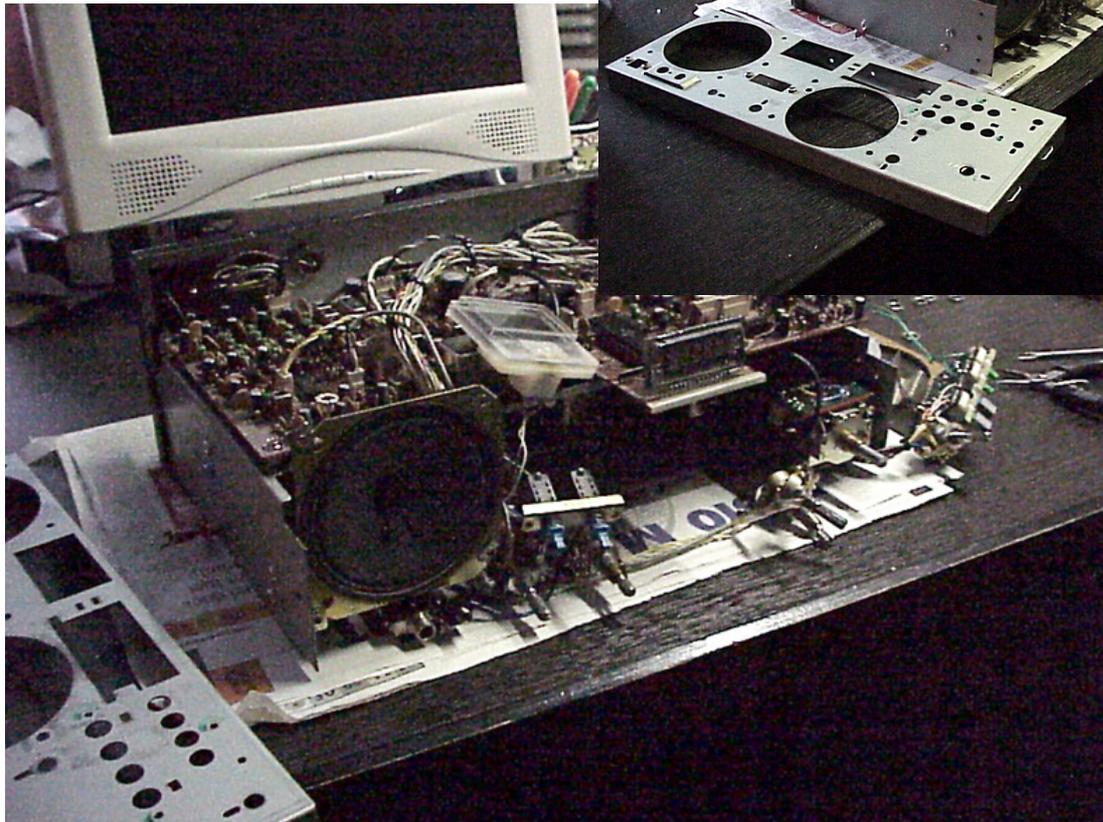
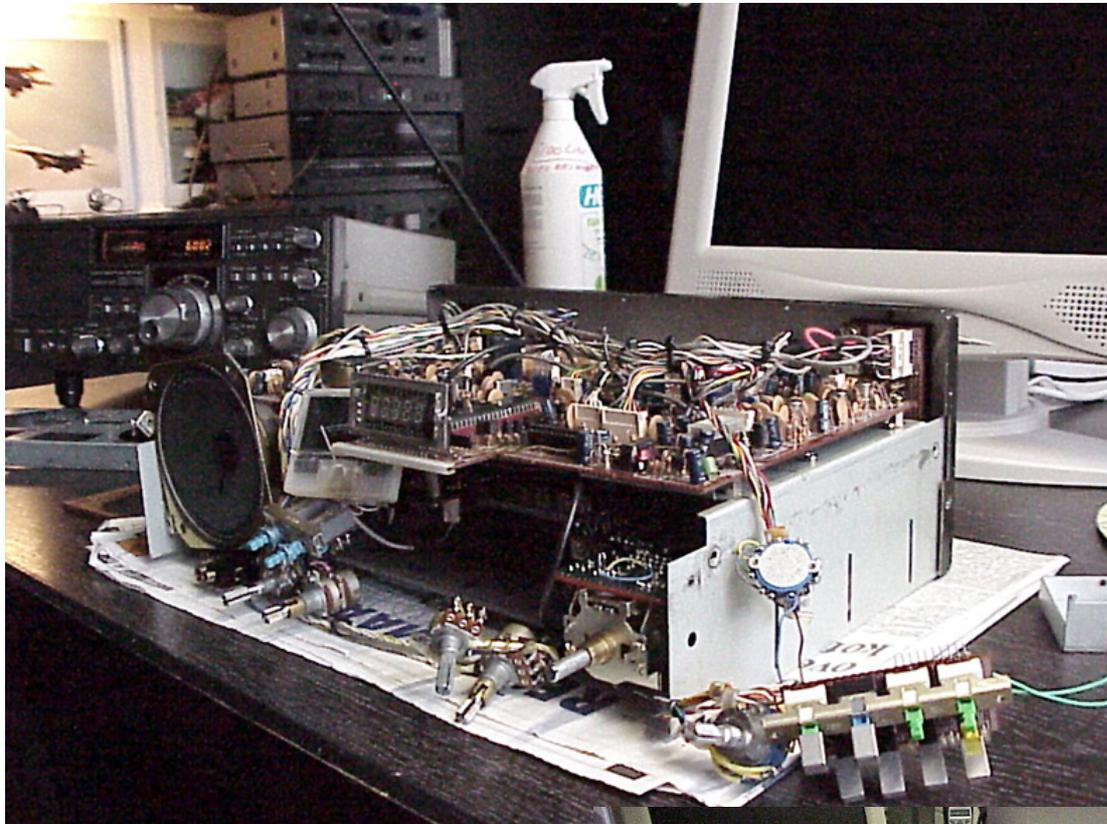
When this pin is set to "H", all the outputs except the timer and sleep outputs are inhibited. It is usually set to "L".

c. Pin 11 DIMMER

This pin accepts the command signal that causes to reduce display brightness. When this pin is set to "H" (active), the display output pulse width is reduced to one fourth.

d. Pin 20 F_{IN}

This pin accepts the frequency counter input signal.



A FRG-7700 adventure (a resurrection story of a FRG-7700)

I had a recently a receiver with a bad displaydriver, and obtained another from Internet as spare, with a defect. Well, as things go, this rx had also a display problem, the previous owner told me that he had used the receiving and PLL board himself for a swap, because the powersupply of his had blown up, so I expected that I had just got a bunch of spareparts for my other receivers.

After much searching, I found a source for the MSM-5524RS and repaired the original receiver, and after desoldering the old IC, I put the new IC in a IC socket, because several times desoldering a 40-pin IC is not good for the quality of the board and the IC...

In fact I use always a IC socket if I change IC's. If they fail once there can be a reason they fail again in the future, and putting in a socket is cheap and makes life easier when the need arise.

The spare receiver didn't look too bad, so I decided to try how far I could get with the resurrection of this receiver, just for the fun of it. (After 46 working years I am retired now, so time is no issue).

First I had to construct a new powersupply, because the owner had trown away the burned board, but fortunately had still the original transformer, complete with burn marks and burned wires.

First of all I tested the transformer, after cutting off the burned wires and repairing them with the use of crimping tube and suitable wires. The transformer was ok, after a day under full load there was no trouble, so I decided to use him.

The transformer is a common type with a switched primary 110/117 and 220/240V, the secondary is 12V @ 2 Amps.

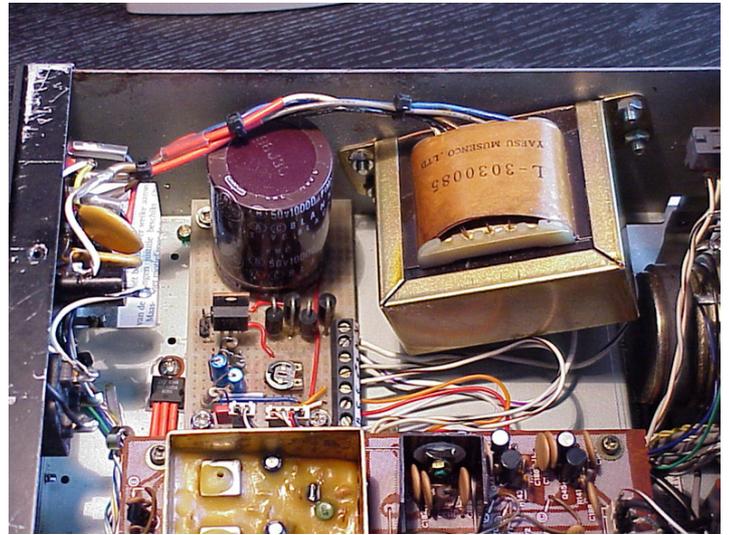
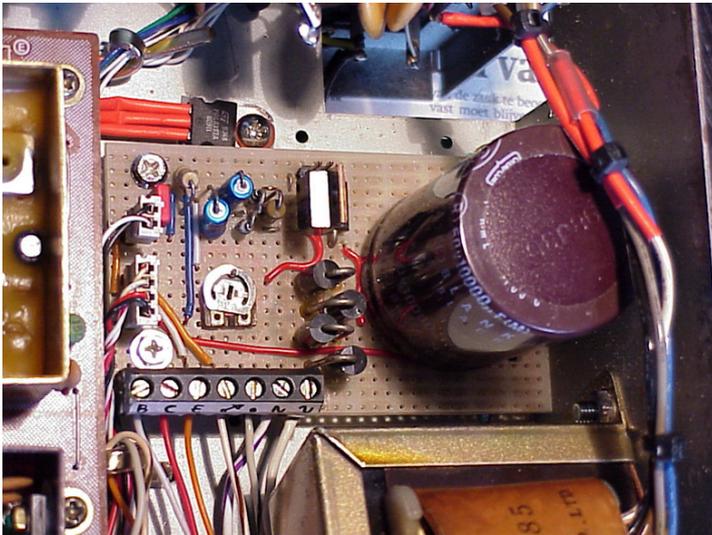
For the power supply board I had 2 options: copy the existing board from another receiver or construct one myself.

I wanted to use the original features, and designed a board, centered around a trustful LM-317 regulator IC and a NPN power transistor. For the bridge I used 4x 1N5005 5A silicium diodes and the condenser is a 10000uF/50V type. I mounted all on a piece of epoxy experiment board, see the pictures and schematic below.

The LM-317 makes the construction very easy, and the output to the rx is adjustable to exact 11 Volts.

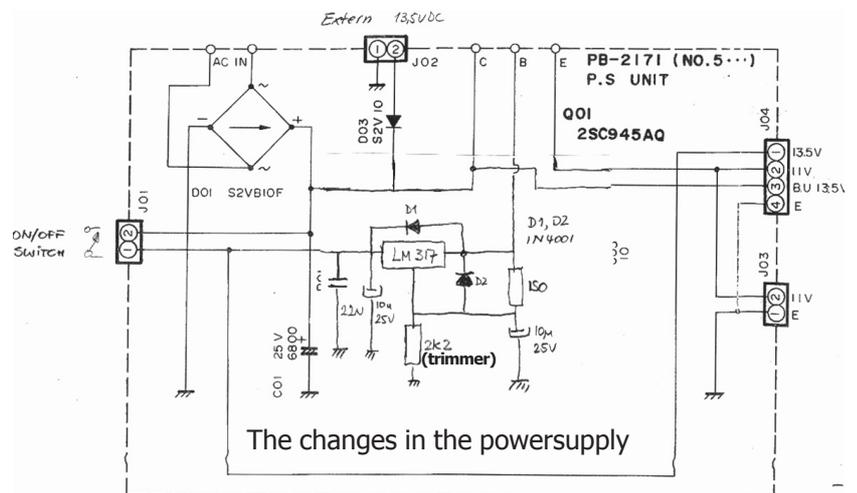
I put in a couple of protection diodes over the LM-317, for safety reasons. (The 2k2 resistor is a trimmer!)

The powersupply works fine, and stays much cooler than the original one. After a day on there is no warming-up, and stability of this receiver is now the best of the lot.



After connection of the power supply, the receiver seemed to work: it had a hissing sound, and after much searching (the display didn't work, the bandswitch was not in the right position and the analog dial was off-scale, I found a station in the 13 Mhz commercial band, that I recognized, and after confirming with another receiver, I was able to "calibrate" the analog dial and put the bandswitch knob at the right position. Well, that was the only band with signals, but at least there was hope for the better.

After a careful inspection of the PLL board, I saw that the bandswitch had been tampered with, the switch had been removed and resoldered, but several print traces were pulled off, and repaired



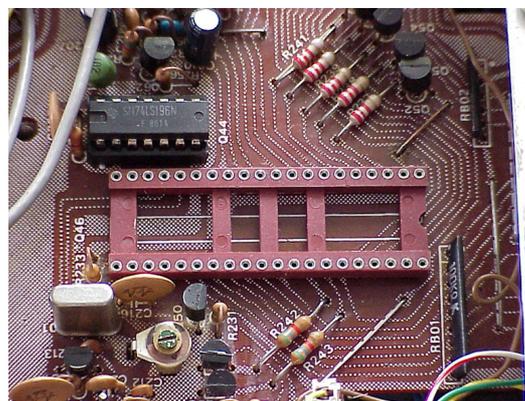
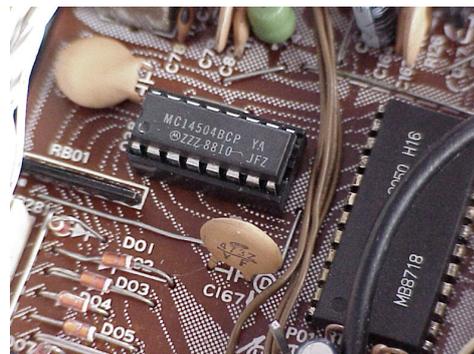
with some wires, so I measured the connections and found a broken trace. To repair the board, it was necessary to take the PLL board out of the receiver. While I was at it I measured all diodes and inspected the rest of the board very carefully. All seemed ok.

After studying the schematic, I suspected a partially defect MC14504. It is a level translator between the BCD bandswitch, memory unit and the MB-8718 programmable divider, so I soldered the IC out and put in a IC socket. If I got a spare, changing the IC was done in no time.

After inserting the board, I checked the bands, and now I had several more bands with signals.

Several bands were there, but on the wrong position of the switch, 7.000 – 8.000Mhz was now 12-13Mhz, and other bands had also weird switch positions. Because the display didn't work either, I put a counter to the counter output of the PLL, to have at least a indication of the frequency. (the counter frequency –455khz is the receiving frequency).

I made a truth table of the 6 input pins of the MB-8718, and soon discovered that pin 15 had no true 0 or 1, but had always a voltage of 3.15V on it. When touched with the multimeter probe, the divider switched to the right frequency, so my suspicion of a bad MC14504 proved correct and I ordered a new MC14504. After putting it in the socket, all bands were now in the correct order. I checked and adjusted the two PLL circuits, because they were way off the right tuning voltage.



I could see that here had been a very frustrated amateur at work, who had turned on every coil and trimmer, in the process making more trouble than he started with.

After re-alignment, the PLL board was working again, but now the VFO was not working well.

When I tested the output with the counter, I found that the output wire in the connector was broken, so I had to repair the connector. Now I had signals on every band, but had another curious problem: On USB or LSB I had signals, but also a steady tone of around 3khz, independent of the incoming signal. It seemed to me that both sideband oscillators were running at the same time, but I could not see how, because the sideband switch was working correctly. After pulling the board out, I discovered that there was a solder connection between the power

pins of the two oscillators, so they worked at the same time. Maybe a previous owner didn't like to switch between USB and LSB.

While the board was out, I desoldered the MSM-5424 and the 74LS196 IC and put them in a socket. Close inspection discovered some more shorts between solder joints. The OM who worked on this receiver was clearly not qualified to work at this kind of equipment, and has a BIG soldering iron...

After reinserting the board, I had now signals at all bands. The remaining problem was now the counter and the clock. The counter displayed only a righthand zero, the clock was partially working, the AM Led was on all the time, the ON and OFF timer had the same time, only the countdown timer was working. My first impression was that the clock/counter IC was defective.

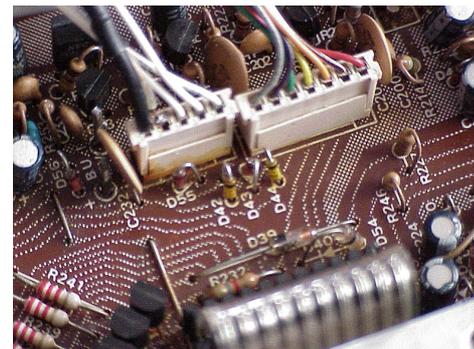
I tested the counter amplifier and discovered that the 74LS196 did not get a proper signal. The first 2 transistors of the amplifier were working, but then things went wrong, so I took the board out again to change the transistors, but after close inspection I found that the BIG soldering iron has been there also, and made a short between collector and base of the third amplifier transistor. After correction of this I had a signal at the 74LS196 IC and surprise!, had now also a 3 digit frequency display. The displayed frequency was the counter input, without the IF offset of 455khz, and divided by a factor 10. (I had the counter still connected).

So, it seemed that the counter IC did at least something. The Xtal oscillator was working and at the good frequency. Mode switching is done at pins 7, 8 and 9, so I checked the in and outputs of the IC and found that pin 8 was no true zero. I checked again the mode switch, which was ok, and the diodes D42/D43/D44, who are used for switching.

Bingo.. D43 was defect and displayed a resistance of 5 K-ohm in both directions.

The diode wires were very corroded, so I changed all three diodes. I found out afterwards that this receiver was used on a sea-going yacht, and some spots were corroded from the salt water.

After changing the diode the frequency display was working correctly, and the problem with the clock was solved also. The AM Led was checked, and was changed because it seemed at the end of his lifespan. It was the first time I saw a burned – out Led, they seem to have a eternal life!



The S-Meter was also not functioning properly, and after taking it out, I saw that the movement was just a block of rust. I cleaned it as far as possible, but the needle stuck every now and then, so I suspected a broken movement, or the coil out of his bearings.

While I had the meter out, I searched my junkbox, and found a VU meter from an old cassettedeck, which was a near-perfect fit. I checked the resistance of the movement and even that was almost the same. I swapped the meter scale, and put the meter back. The only change was the connection, it was reversed on the new meter.

The FRG-7700 was now working again, so I did a tune-up according the manual, surprisingly, it needed not much re-alignment.

Compared with my other FRG-7700, the signals were almost the same strenght, so I spended some time to clean the chassis, knobs and frontpanel, and rebuild the set.

After rebuilding, I will try some modifications, to improve selectivity and test some ideas of my own, like a clarifier, improve sensitivity for the AM bands and others.

Modifications:

Fine tuning:

One of the things I missed on this receivers is a small RIT control or fine tuning, a very handy device when I am listening in on a net or ragchewing Hams.

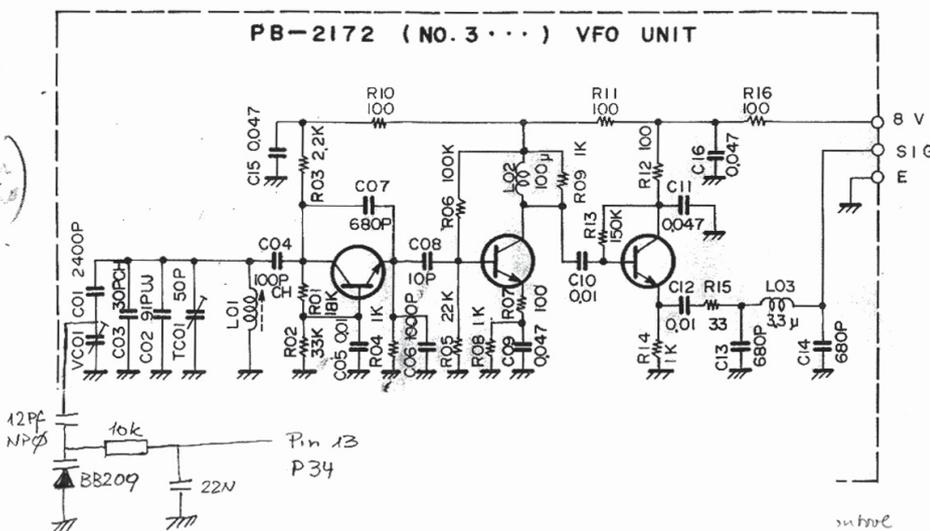
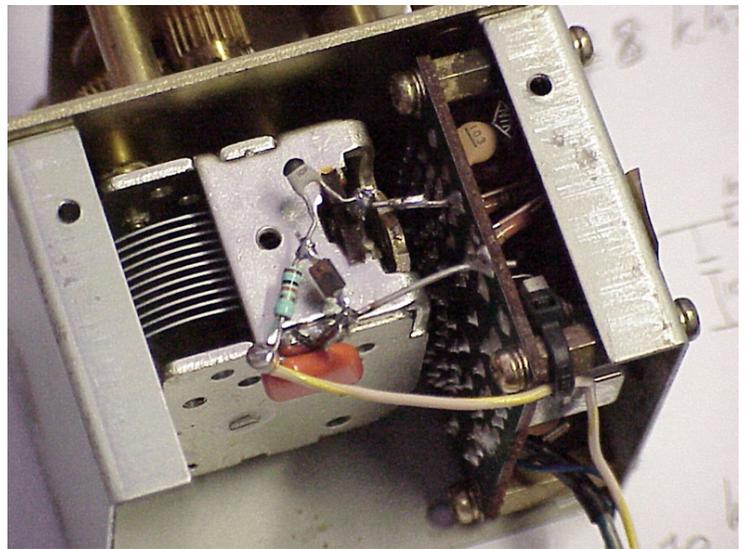
The ragchewers are not always at exactly the same frequency, and constantly tuning with the main dial is no fun, because you easly overcompensate, losing all information. The main dial can be set exact enough, but not quick enough to follow quickly changing talk.

A FRG-7700 with a memory unit has no problem with that, you tune in, push the Memory button and then Memory read. You can then tune around the frequency with the Memory fine knob.

After studying the circuit diagram I found that the Memory Fine potmeter is nothing more than a voltage divider, the output is used to tune a varicap in the memory unit.

Well, why not tune a varicap in the VFO with the existing circuit ? I did it this way in a home brew transceiver some 25 years ago, and that worked fine.

So I took the VFO out the receiver, a very easy job, although it means the removal of all knobs, scales and front panel. Be careful with the lampholder on the VFO, (see above!!), disconnect everything, including the power cord.



The changes in the VFO

I then build in the VFO a small circuit with a VHF varicap that was on hand (BB 209), and a small ceramic condenser (12pf) over the existing variable condenser. The tune voltage is HF decoupled by a 10k resistor and a 22n condenser. I soldered everything spider-style to the tuning condenser. See picture.

The only critical part in this mod is the ceramic condenser, it must be a type with a neutral temperature coefficient (NP 0, black dot). After testing, the VFO was retuned (with the trimmer only)! to 2500 khz with the variable condenser fully meshed. With the condenser fully open I had a frequency of around 3600Khz. The variable tuning range changes somewhat over the band: on the low side the frequency span of the fine tuning is around 12 khz, at the high side it is around 3-4 khz, but because the fine tuning was meant for the hambands which are all on the low end, the variation is more than enough for normal use. The stability of the VFO is just the same as before, and also the calibration of the analog scale is not affected.

In normal use I have the fine tuning in the midposition, so I can tune either way of the station.

Should you need a smaller or greater variation, just change the ceramic condenser, I found that the variation at the low side is around 1 khz/pf. The reason of the frequency span variation is that the new condenser at the low side has a smaller effect, because it is in parallel with the whole main tuning condenser, and if the condenser is fully out, the added capacitor+varicap is doing the job.

A wire is soldered to the connection of the 10k resistor and the 22nf condenser and is brought out of the VFO, together with the 3 existing wires. This wire has to be some 10 cm longer than the others. The variable voltage from the fine tune potmeter is on pin 13 of Plug 34, this plug is not connected if you don't have a memory module, so we can solder a pin to the end of the VFO wire, isolate everything with crimping tube, and plug this pin in position 13 of P34. For the pin I used a old wirewrap connectorpin, it has the right size. The wire of pin 13 has a white/violet color. See pictures from this mod. If you should obtain a memory module, the only thing you have to change, is pulling the wire off the plug, and connect the plug to the memory module.

This modification is very elegant, because there is no drilling or extra knobs necessary, simply undone if necessary, easy to use and has no side effects in stability of the receiver.

I can recommend this mod and have now done it to all my FRG-7700's, except one, who had the memory module installed.

Another set of modifications are described on a very interesting Swiss internet site:

The adress is:

<http://www.dr-boesch.ch/radio/yaesu-frg7700-mod1.htm>

You find very much interesting stuff there about ham equipment and a lot of very good descriptions of ham equipment. The pages are in German, so I will give a translation of the mods, for the benefit of all of you who are not fluent in that language.

I did only the listed mods on the receiver board, there are some more on the powersupply, but i did not use them, so look at the site eventually.

I used parts what I had on hand, special the minichokes, I listed the used ones.

After modification the receiver is to re-align according the service manual, for the best results.

The adjustments are very minor in a well-aligned set.

The original mods were described by Georg Lechner in magazine Weltweit Horen nr 11/1986

Description of the mod:

The FRG7700 is a half synthesiser, half conventional design, and is nearly identical to the Kenwood R1000. The circuit design is ok, but can be improved. The set and memory module is very stable, but some changes improve the receiver considerably:

- 1) Put parallel to the SW socket a minichoke of 100-200 microhenry, and parallel with the BC socket a choke of 1 MilliHenry, to form a DC path to unload antenna charges.
- 2) Change R3 (47 ohm) near the antenna plug in 470 ohm, to make the attenuator more usable.

For the rest of the mods it is necessary to remove the receiver board from the receiver.

- 3) Remove R01 (4k7) and R03 (470 ohm) to lessen the coupling between the BC and SW inputs.
- 4) Change C07 (47nf) to 4n7, and C69 (10nf) to 2n2, for lower audio interference.
- 5) Change R46 (470 ohm) to 330 ohm, and put a 500microHenry - 1 MilliHenry minichoke in series, for a higher collector current of Q1 to Q6.
- 6) Change R60, R61, R76 and R78 from 470 ohm to 330 ohm, for a better 1nd and 2nd mixer current.
- 7) Change R79 (100 ohm) in a 100-300microhenry minichoke for a better decoupling of the mixer.

- 8) Change C94 and C95 (all 10nf) in 1nf, for a lower load of T09 and T10.
- 9) Remove R85 (4k7) for a better Q of T09.

If step 8 and 9 is done, you have to re-align T09 and T10 for maximum signal.

- 10) Change C89, C101, C111 and C117 (all 10nf) to 560pf, to lessen the load on T08,T10, T11 and T12.
- 11) Remove R65 (12k) to raise the Q of T05
- 12) Remove R124 (10k) to raise the Q of T13.

It is possible to remove also R115 (10k), but the gain and noise of the 2nd IF will raise to high level, and can cause oscillations. So it is not recommended.

You can change the IF filters for better ones, a recommendation (I did not change any):

- CF01: CFW 455HT or CFG 455H, bandwidth 6khz
- CF02: CFJ 455k6 or, much more expensive: Icom FL44A, 2.3 khz
- CF03: CFS 455J, 3khz
- CF04: CFS 455H6, 6 khz

- 13) Change C164 (470 uF) to 47 uF, for a higher pitched audio.
Personally, i did not like the result, and changed this elco back to 150 uF.
- 14) Solder a 330nf condenser parallel to C158 (100nf), for a better tone correction. Again, I did not like the result, and changed C158 to 270nf.
This last part is a pure audio modification, and makes the audio somewhat higher, and gives a better SSB signal, but for SW broadcast, the audio quality is good as is and need no changes.

