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Introduction

I started on doing modifications of CB- and HAM-radios since 1980 at the age of 12 years. I mostly wasn't satisfied with the sound of the modulation or reception of my rigs. This is normally founded by restrictions of the local law or by rationalize productions. Only expensive high-class amateur radios have a good sound on their basic state.

Therefore there must be some possibilities for improvements. So I learned the basics of RF electronics on myself and did a lot of modifications until today and I would like to spend my experiences to all other electronic interested people, CB- or HAM-radio stations.

You have to recognize your local laws. Mostly modifications aren't allowed by the local law or by the manufactures. So you do it on your own risk. Also the brand new HAM rigs are mostly build with a lot of teeny-weeny SMD parts. You have to use special equipment and you also must have a great expert knowledge. So some modifications aren't for only hobby electronic technicians.

So this and all of my Modification Sheet are for education purposes only !

Used pix are mostly done with my Fujifilm „FinePix 6800 Zoom" on resolution „3M/Fine", but they are reduced on their size due to minimize the total file size of this publication.

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Overview:

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Chattering relay fix

As I got my FT-847 (serial 8F043xxx) I recognized the chattering relays after a short time of usage. I'm not using a switching power supply cause of some interferences or noise levels of this. I'm using a MANSON EP-925 regulated power supply with 3-15 Volts / 25-30 amp.

So the "chattering relay fault" is definitely not cause of the usage of switching power supplies or cause of RF feedback like published in this forum before. I had the same bad effects on the dummy load too. Hmm, so the fault must be on another side....

I disconnected the vhf/uhf pa module. The effect gets better but still was there. I disconnected the hf pa module. And the effect has gone !!! So the fault must be in the hf pa module !
Now I did some tests of connecting/disconnecting the pluspole of the hf pa module cable while the FT-847 was running. And I saw a small flash everytime I connected the cable to the pa module !!

So overvoltage on switching on the FT-847 was the fault ! And a lot of DC power supplies have a build-in overvoltage protection too. So when the FT-847 has the short overvoltage, the DC power supply reduces its voltage output too, the FT-847 internal overvoltage relay RL1001 goes off cause of the reduced DC input, and then the DC of the power supply can go up again, a overvoltage peak in the FT-847 is the result, RL1001 goes off again,....

...and we just have the loop ! RL1001 on the AF-CNTL-Unit is chattering.

Here's the fix:

Maybe this mod could be risky if you would really have a overvoltage from your DC supply.
So do it on your own risk !!!

1. None, really none of the bandpass switching relays on the PA-UNIT have a antiparallel overvoltage protection diode (suppression diode !??) !
   So I soldered 1N4148 diodes parallel to each relay coil of the PA-UNIT. So that means parallel to RL5001 - RL5015. Only the HF output relay RL5016 has a overvoltage diode (D5005).
   The cathode is on the pluspole of the relay coil, the anode is on the ground side.
   So these diodes don't have any action on normal use, but when the relays go off their coil is producing a overvoltage peak. These suppression diodes eliminate these peaks.

   The chattering got a little better, and had sometimes gone, but this wasn't the real fault.
   So these diodes are useful, but don't solve the problem on most cases.

2. Now I gave the FT-847 internal overvoltage protection circuit (consisting of Q1118/Q1122/RL1001) a longer reaction delay. It's a real simple mod and works fine without any problems till yet ! You can solder very easily cause the neccessary parts have enough room for this mod and you don't need to remove the AF-CNTL-UNIT.

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AF-CNTL-UNIT:

- **1N4148** supression diode parallel to coil of RL1001.
  I soldered it from D1039 to D1041 like in the picture.

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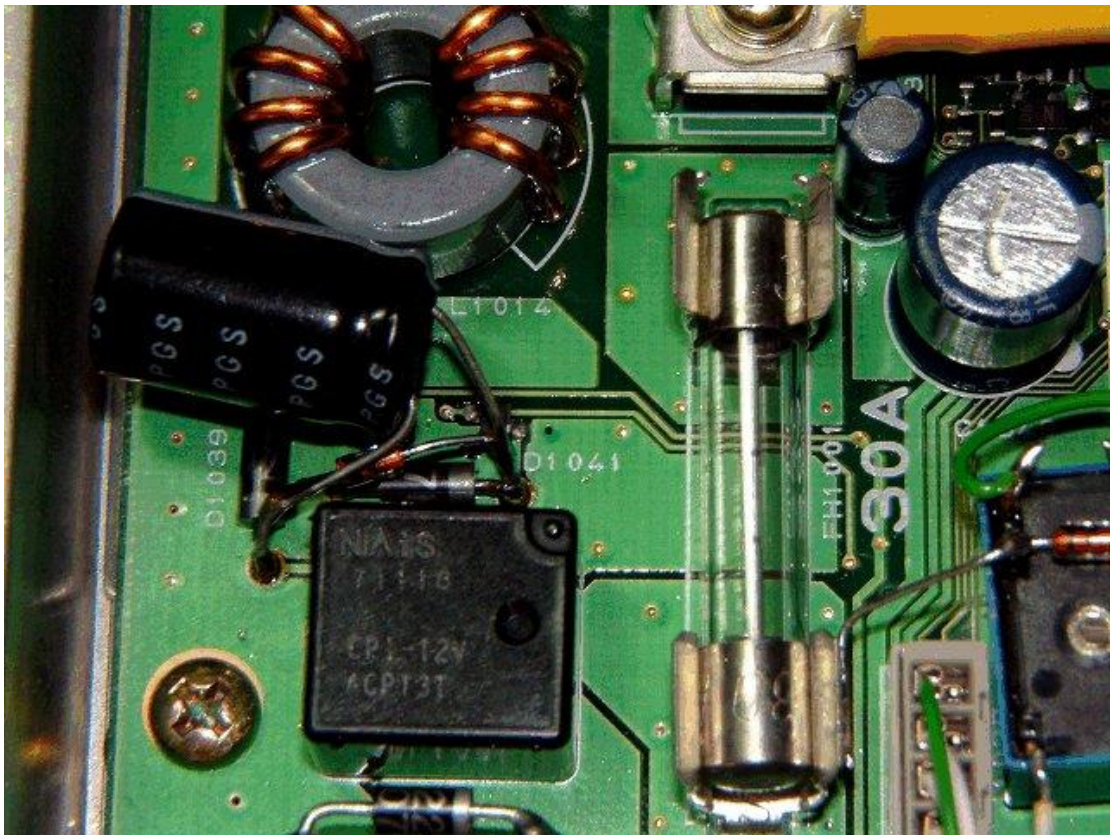
- Adding a **470µF (0.47mF)** electrolyt capacitor across this supression diode. This cap is parallel to the relay
RL1001 and gives it the needed fallback-delay. The pluspole of the cap is looking toward D1039,
the minuspole toward D1041.



Since this mod I really can enjoy my FT-847.

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Improving the stock mike MH-31

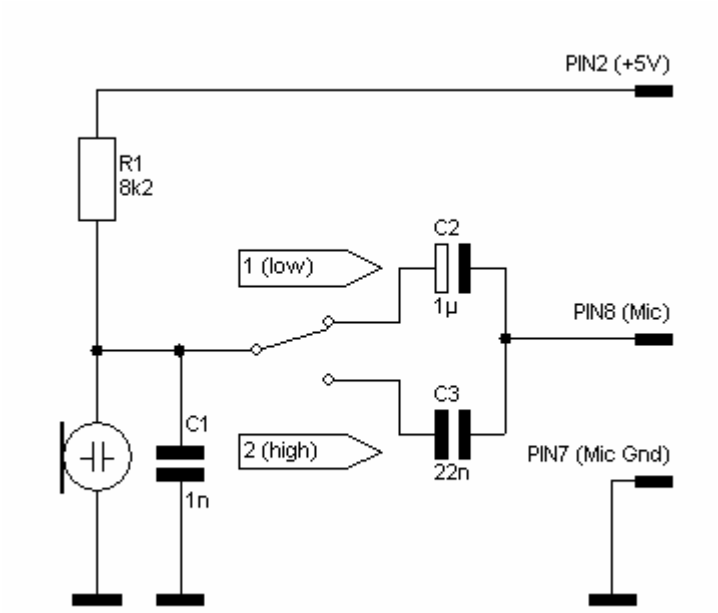
a) Modifying the stock microphone MH-31 internal circuit

A real simple mod to improve the dynamic stock microphone is to **remove the internal resistor (680 ohms) and the internal capacitor 0,33µF (0.33mF)** of the 1/2-tonecontrol switch. Removing the resistor gives a much higher output level of the dynamic capsule. Now it's more unrelevant how close or how far you're speaking into the microphone. You get a wider range of operation distance to the microphone front without loosing the audio level immediately.
But by removing the resistor the low/high tonecontrol effect has gone too cause of the higher mic input impedance of the FT-847 mic amplifier. To fix this replace the original 0.033mF with a smaller value, e.g. **22nF** (0.022mF). Maybe you can use other values depending on your own voice and the favoured degree of the highpass function.

b) ..or replacing the capsule with a better and louder electret one

I replaced the original dynamic mike capsule against a better and much louder electret capsule. This gives a much clearer and more natural sound, with additional heights. On the SSB side the PA gives a higher average output level cause of the higher input audio level. And the sound gets even better on AM/FM/SSB. I don't like dynamic capsule sounds but must say that the dynamic capsule used in the FT-847 stock microphone isn't bad at all ! There are much poorer capsules on the market.

Nevertheless I wanted to use a better one to improve my stock microphone.



The new internal circuit.

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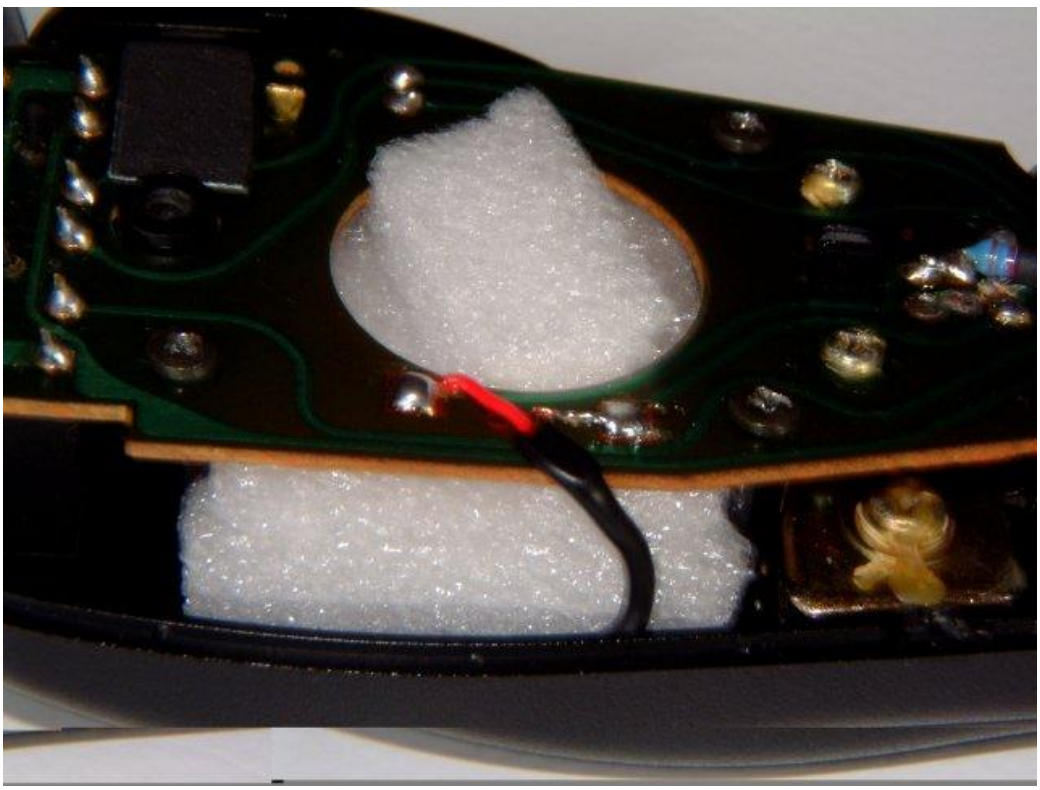
Turning some small holes in the middle of the new capsule position to give a better audio input.



Fixing the electret capsules backward room by **foam**. This reduces audio effects (hollow sound), provoked by the plastic chassis of the MH-31.

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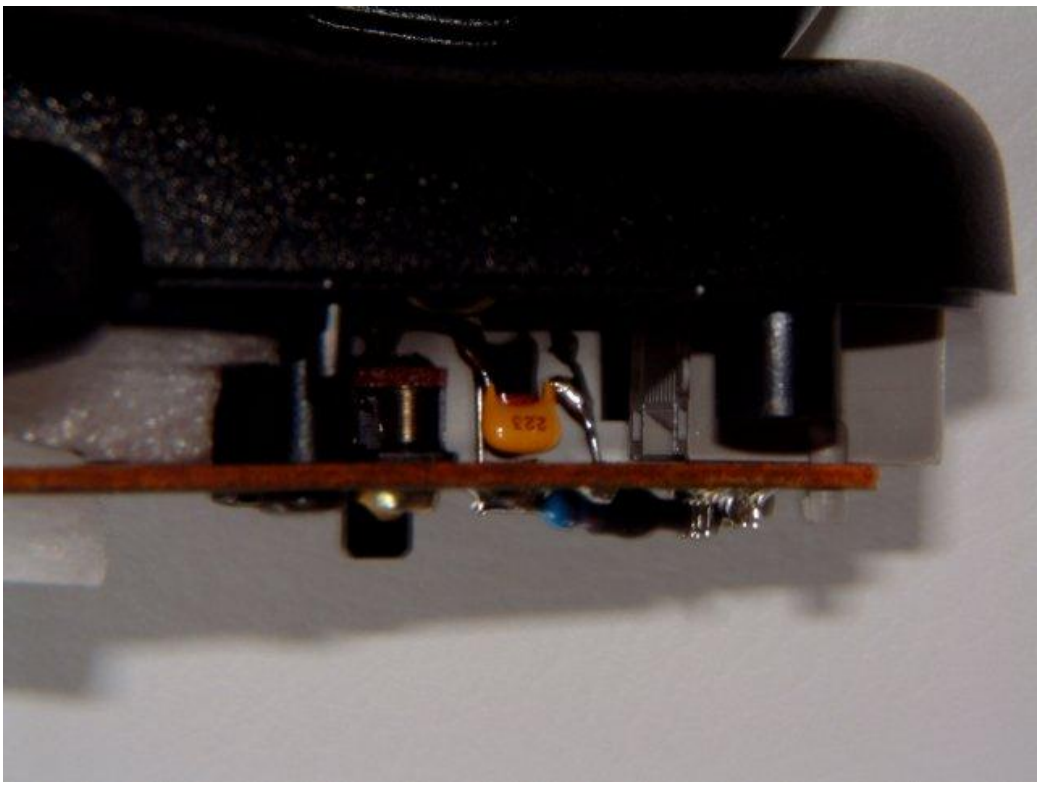
Resistor for the DC power supply of the capsule on the upper side of the PCB.



Capacitors on the down side of the PCB.

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Improving FM modulation (adding more basses)

The FT-847 has the same behaviour as many new amateur radios. On the FM modulation side the sound is clipped and the basses are reduced drastically to reduce distortions. The resulting sound is real tiny and shrill when you're using another mike than the original dark dynamic capsule. The sound behaviour is depending on the used microphone. I recognized this behaviour only on the FM side of the FT-847 by using the better electret capsule. On the AM/SSB side the basses are still present on the modulation.

So I did the same trick as successfully done in my FT-7100M before.

As seen in the schematic (AF-CNTL-UNIT) the pre-amplified microphone input signal is separated to AM/FM/SSB through Q1081. On the FM side the mic signal is amplified again on Q1038(4), limited on Q1071(2) and low-passed on Q1071(3+4).
But the input capacitor C1184 on PIN 13 of the pre-amplifier IC Q1038 has only a value of 4,7nF (0.0047mf). So depending on the input impedance of Q1038 this gives a high-pass behaviour. But I wasn't able to calculate the high-pass-frequency cause I haven't the necessary information about its input impedance. So I found out a better choice for C1184 by doing some tests (trial-and-error method).

By **adding a capacitor of 22nF (0.022mF) parallel to C1184** you get the needed, more natural sound with additional basses present. On the other hand I had to **reduce the FM modulation level in the FT-847 menu #25**, depending on the used microphone.

range:	0 - 63
factory preset:	32
used before with electret capsule:	13
used after my FM mod:	**8**

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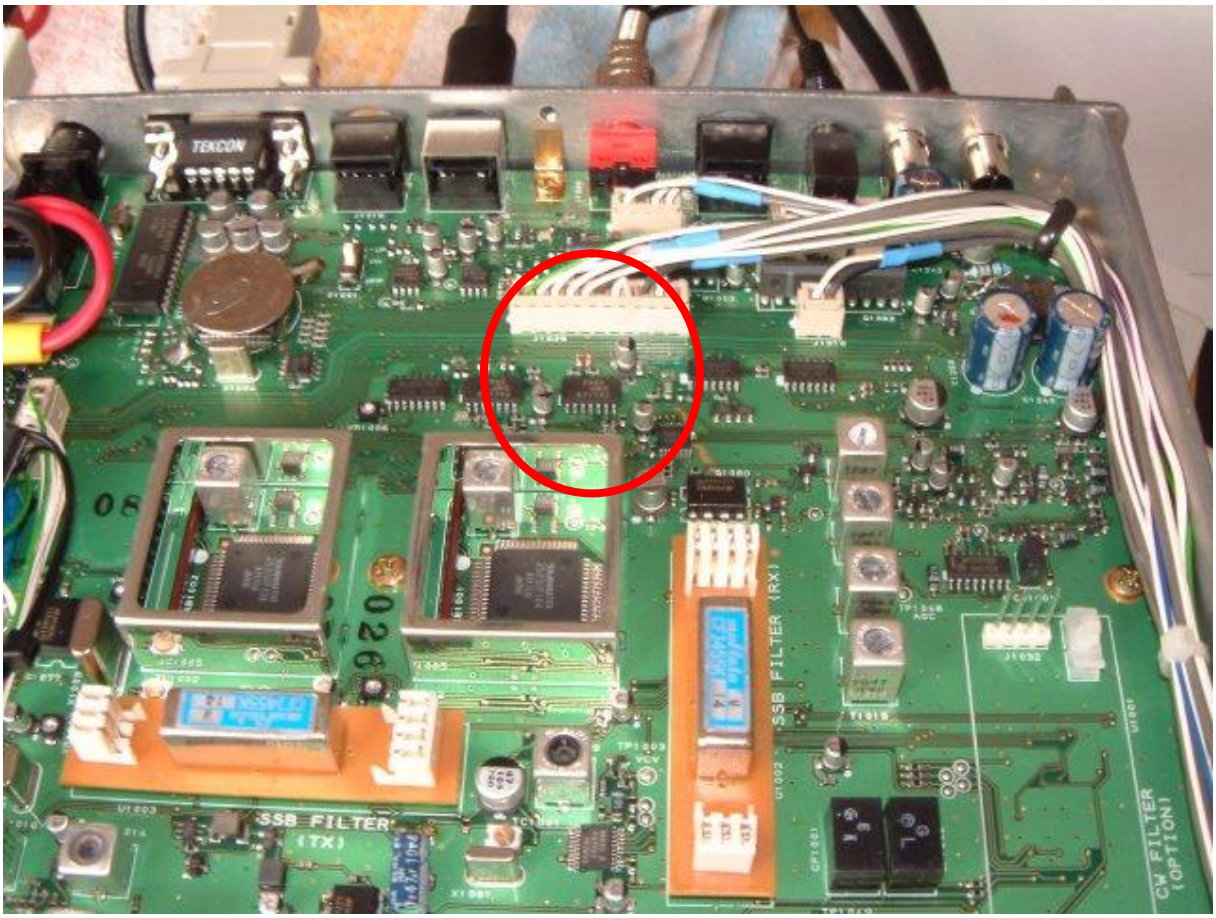

on the AF-CNTL-UNIT please go to the marked area

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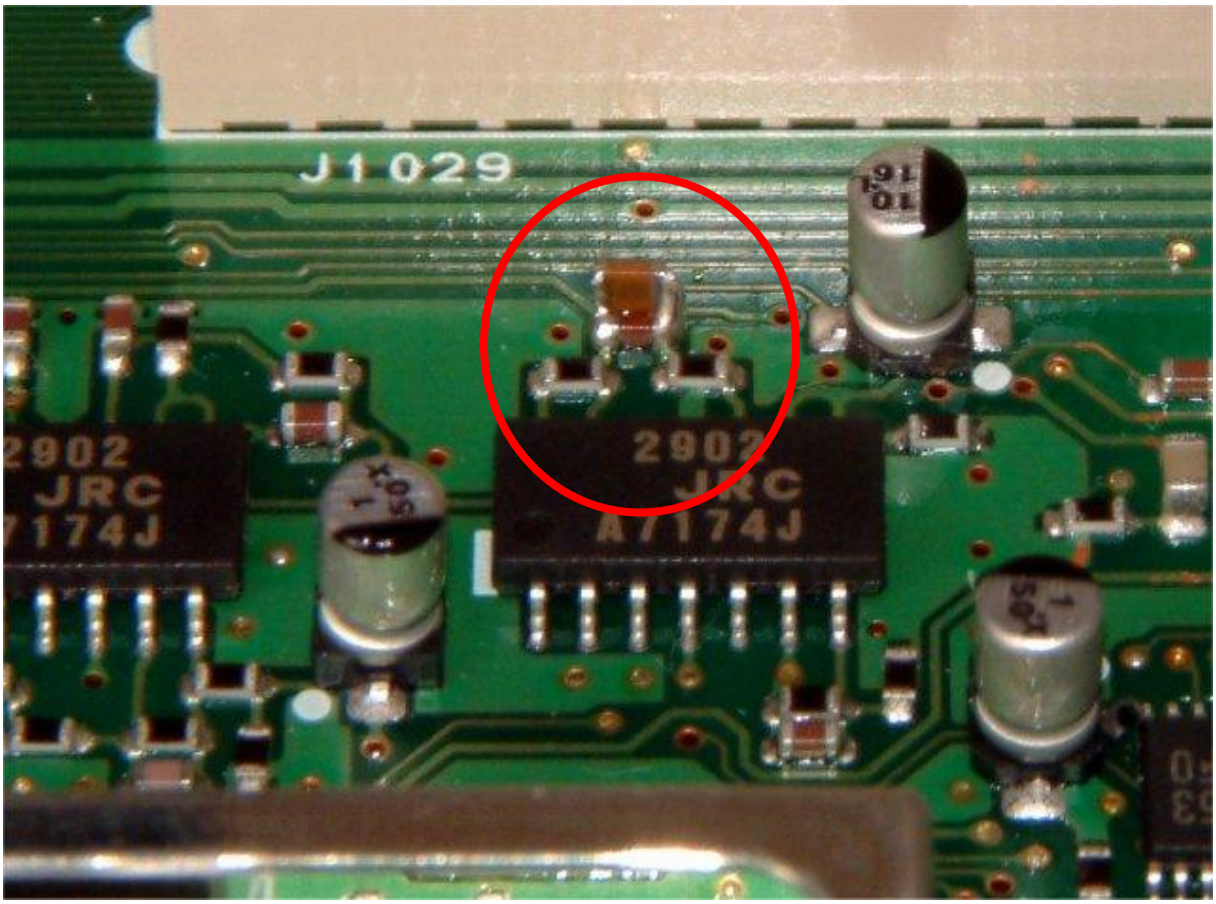

I soldered a 22nF (0.022mF) SMD capacitor parallel to C1184.

Don't forget to reduce the FM modulation in menu #25 and find out which value is best for you !!

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HIFI Audio Mods

TX		
	C1115 (0.1mF) → 2.2mF parallel	More basses on mic amp input
	Replacing the stock Murata SSB TX filter with an INRAD Crystal filter 2.8 kHz	
RX		
	C1253 (2.2mF) → 4.7mF parallel	Slower response of "AGC slow"
	C1371 (0.01mF) → 0.47mF parallel	More basses on SSB detector
	C1255 (0.01mF) → 0.1mF parallel	More basses on FM detector
	C1254 (0.1mF) → 0.033mF	More heights and more audio gain on FM detector. Now the switch between SSB and FM is nearly equal and you don't have to re-adjust the volume knob. Better and more clear understanding of weak FM signals.
	C1207 (1mF) → 47mF	More basses on AF amp input
	R 1281 (4,7k) → 4,7k in series	Reducing AF gain and lower AF lowpass to reduce white noise on AF amp stage
	C1225 (1mF) → 47mF	More basses on AF amp input
	C1233 (47mF) → 470mF	More basses on AF amp gain network
	C1242 (470mF) → 1.000mF parallel	More basses on AF amp gain network
	Cut the PCB between C1233 and PIN 1 of the AF amp Q1086 and put 68kOhms between	Reducing the audio step fault
	Replacing the stock Murata SSB RX filter with an INRAD Crystal filter 2.8 kHz	Contester can also use the narrow 2.1 kHz filter of course, but then you won't hear the audio improvements on SSB as strong as like on the 2.8 kHz filter.

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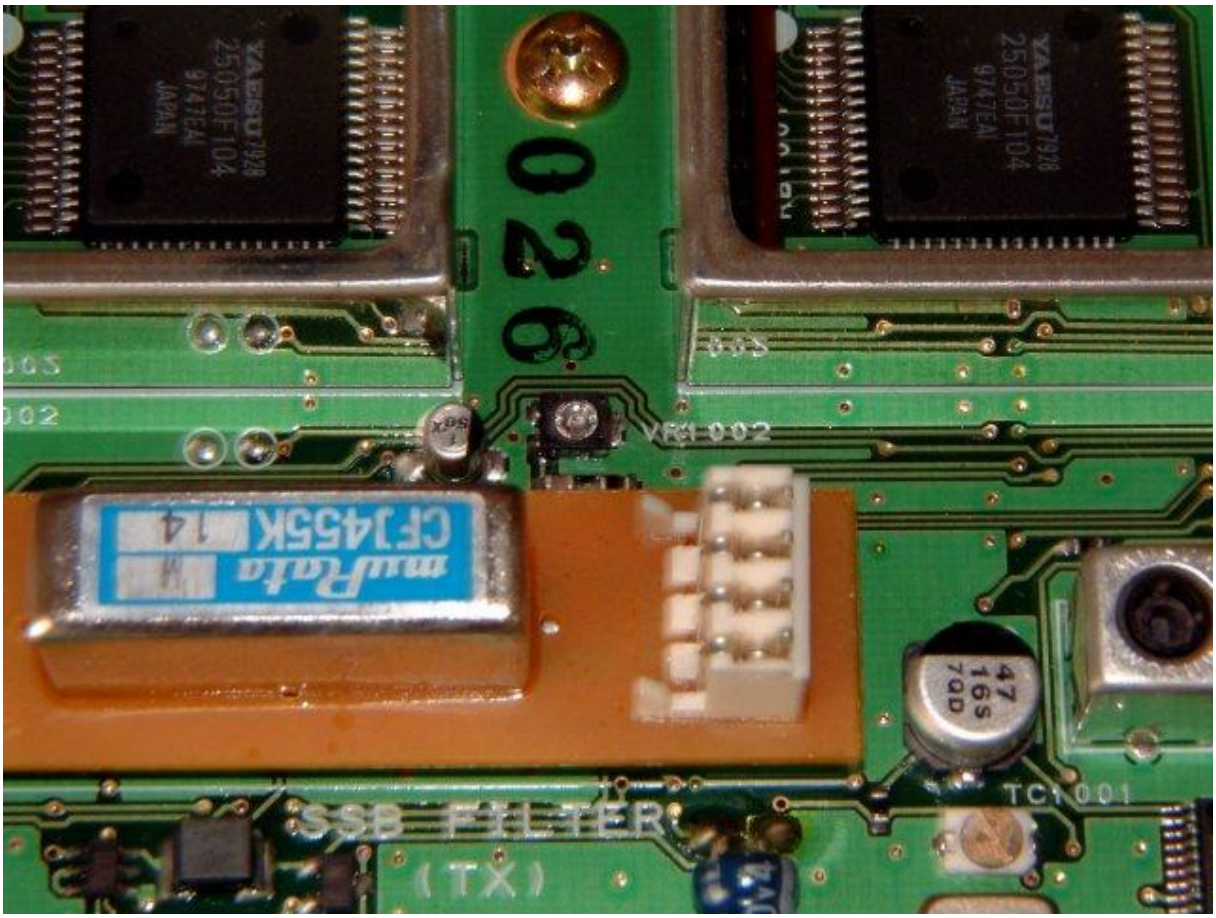
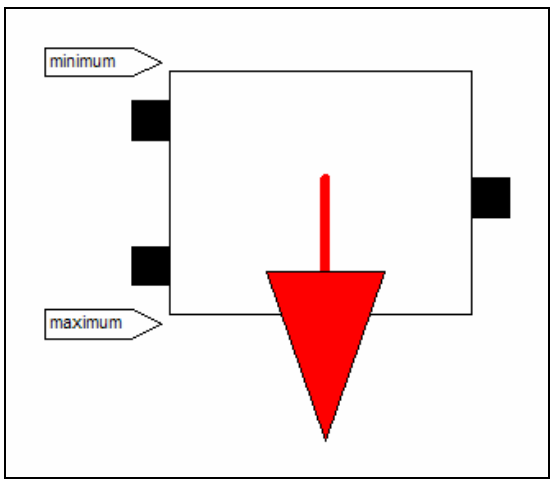
Alignment of the RF Speech Processor

The internal RF speech processor is only switchable and useable on SSB mode. On my FT-847 its factory alignment was real "conservative". You only heard a little improvement by switching the processor on/off.



So locate VR1002 on the AF-CNTL-UNIT.



Here you can see my new alignment. You can hear an improvement when turning the pot clockwise and go over 50%. I'm using the level of about 80% as you can see above. Turning it up to 100% has caused distortions on my transmissions but this vary on your used microphone. But 80% should be a safe and real punchy value. On a studio capsule about 40% were the limit. Try on your mike !!

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Improving shortwave reception (less noise floor). A must have !!

Many receivers in the middle price range are using cheap switching diodes with a unwanted high noise floor. The receivers are sounding restive on shortwave, even when no signals are present. You can hear a relatively high noise floor.

The mainly problem is using this cheap diodes in the build-in switchable bandpass filters. Modern receivers are using switchable bandpass filters to improve the S/N ratio. But the usage of cheap noisy switching diodes produce interferences in the bands. And you have a noise floor, even when no signal is present. No problem on broadcast reception, but you can hear this effect on SSB !

On the FT-847 the switchable bandpass filters on the RF-UNIT are used for this areas:

BPF1:	0.500	–	1.800 MHz	diodes D3050 / D3064
BPF2:	1.800	-	2.500 MHz	diodes D3051 / D3065
BPF3:	2.500	-	5.000 MHz	diodes D3052 /D3066
BPF4:	5.000	-	7.500 MHz	diodes D3053 / D3067
BPF5:	7.500	-	10.500 MHz	diodes D3054 / D3068
BPF6:	10.500	-	14.500 MHz	diodes D3055 / D3069
BPF7:	14.500	-	22.000 MHz	diodes D3056 / D3070
BPF8:	22.000	-	30.000 MHz	diodes D3057 / D3073
BPF9:	37.000	-	54.000 MHz	diodes D3058 / D3090
BPFA:	54.000	-	75.000 MHz	diodes D3059 / D3071

So I cut each of those diode pairs and **replaced it by Schottky diodes BAT85**. You can use ultra-lownoise PIN-diodes too, e.g. like BAR43 or HP5082-2800.
The HP5082-2800 have an even lower noisefloor and you can additionally raise up the internal RX amplification via the "Alignment Menu" too. But the HP5082-2800 are quiet a bit more expensive than the BAT85. As I started with the BAT85 I'm now using the expensive HP5082-2800 in my FT-847.

Wow !!!

I read several articles about the FT-847 on www.eham.net and most people really love the FT-847 receiver part, mainly on vhf/uhf, but on shortwave too. They never had any problems.
But what a improvement of the shortwave receiver now ! I'm using a ¼ wave CB antenna whip for shortwave reception so my signal levels aren't so high, especially on the lower bands. So mainly I'm hearing signals between S0 and S7.

The noise floor has totally gone !
The receiver is real quiet. When no signal is present the S-meter is real down. But when SSB signals are present I'm able to copy weak ones (without any value on the S-meter) with minimum R3 or more. Everytime, on any cases. And the audio sound quality is much better too. Without looking onto the S-meter you really can't decide, if the heard signal has a value of S1 or S9 ! Weak signals have now nearly the same "power sound" like the big ones.

I'm really satisfied.

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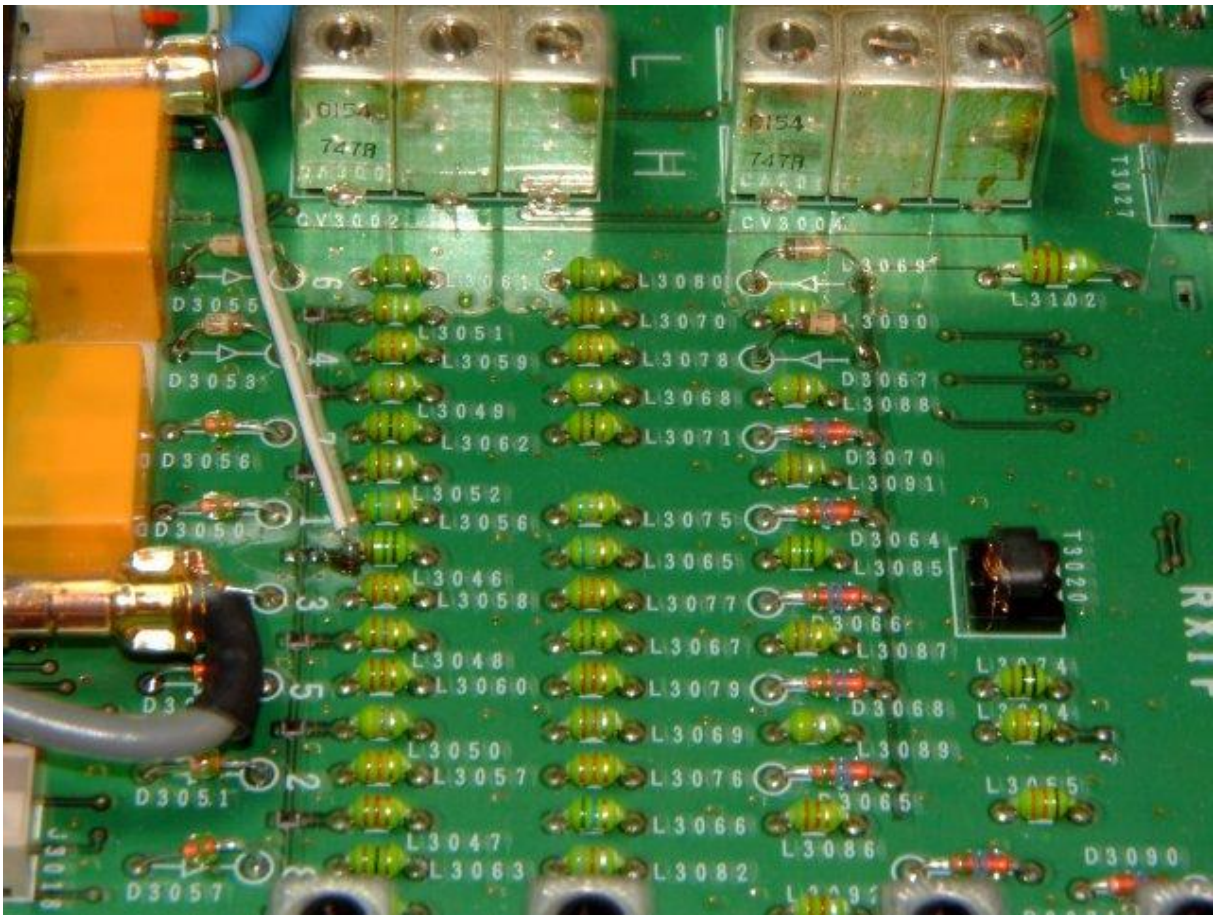

The mod is real simple. If you have located the diodes on the RF-UNIT, just snip them. The correct assignment is printed on the PCB, so you can't do faults by their direction. Afterwards just solder in the better Schottky diodes on the same places.

On this picture you can see the first replacement diodes above. (D3055/D3053/D3069/D3067). The red ones are the original, cheap ones.

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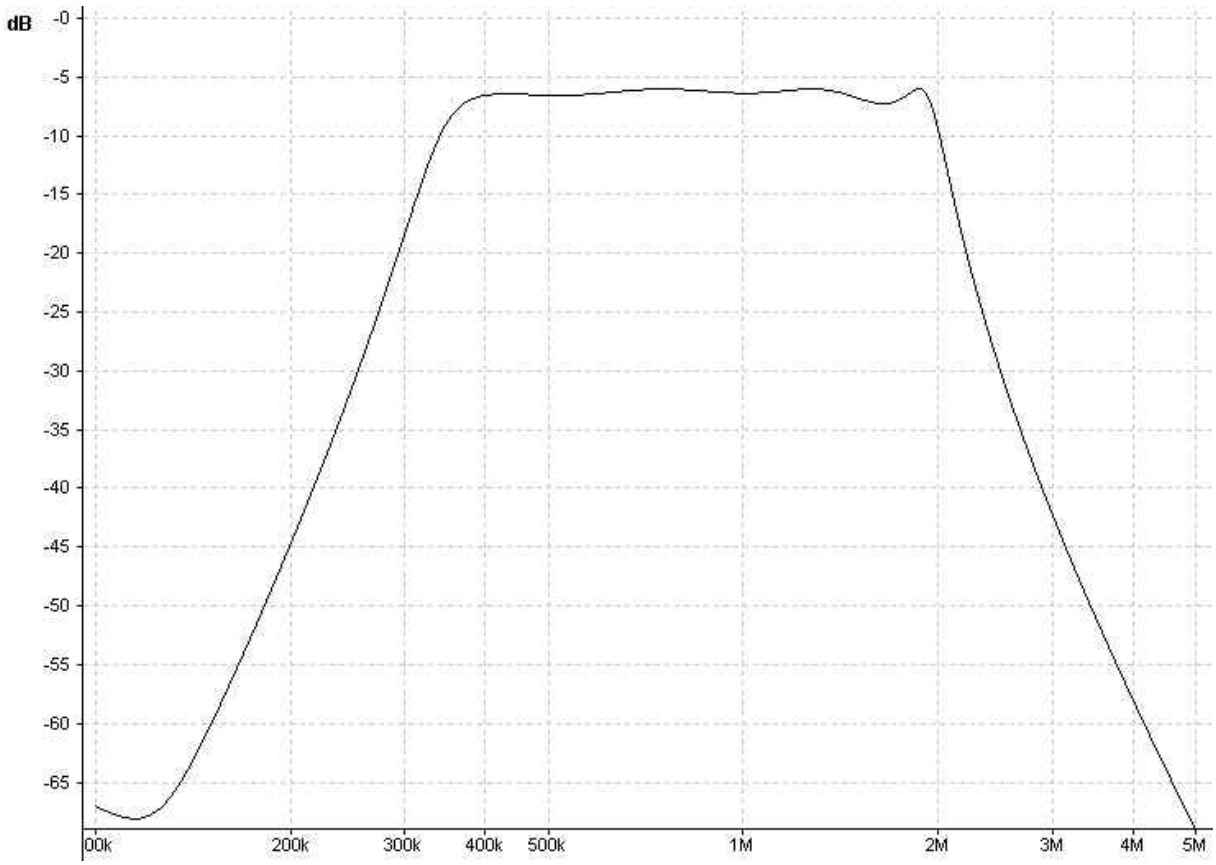
RX Bandpass Filters

Then I checked the several RX bandpass filters with my electronic program and recognized, that the filter curves work well for the necessary band areas they're designed for. No need to modify them.
I have read an earlier article that you do have to modify some bandpass filters on an old Yaesu FT-747GX to get them correctly back on the several HAM radio bands. The bandpass filters in the FT-847 are well designed and really flat in their passband range..



BPF1 0.5 – 1.8 MHz

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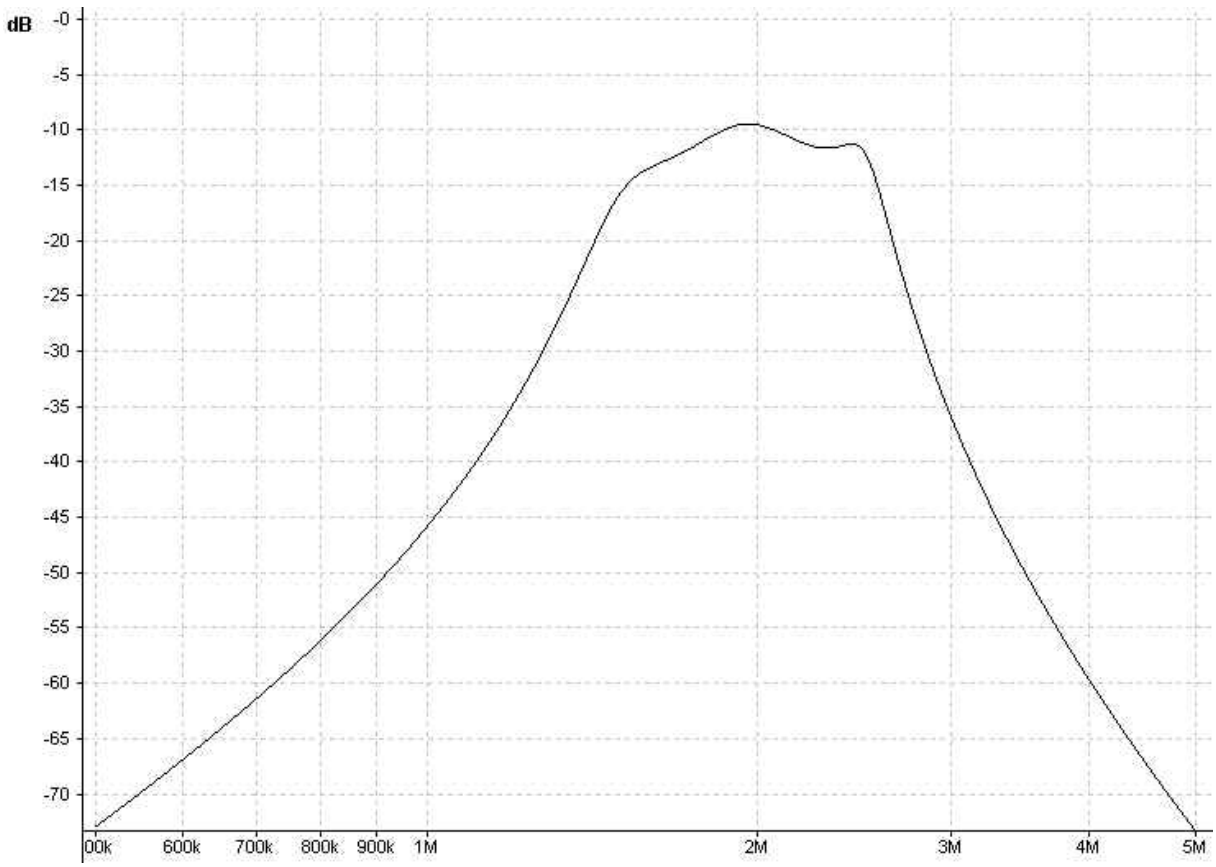

BPF2 1.8 – 2.5 MHz

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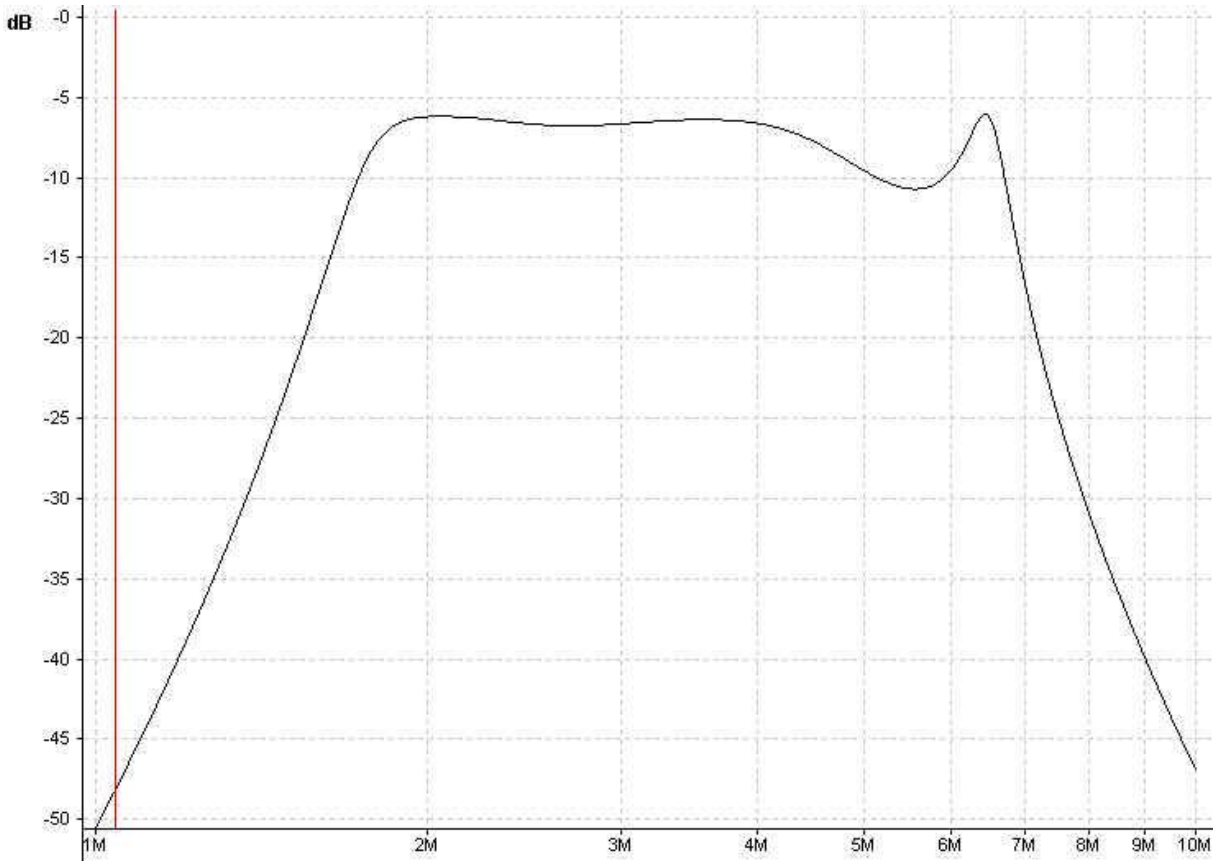

BPF3 2.5 – 5.0 MHz

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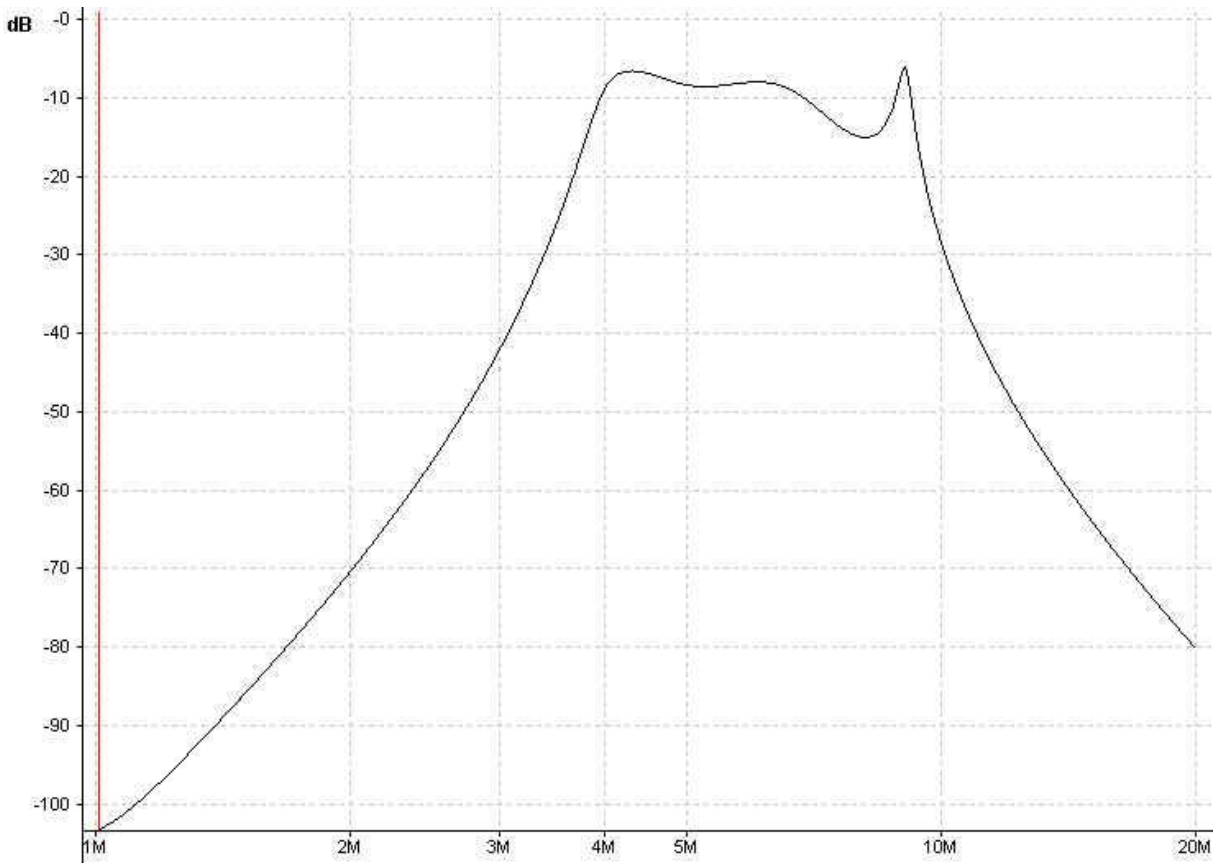

BPF4 5.0 – 7.5 MHz

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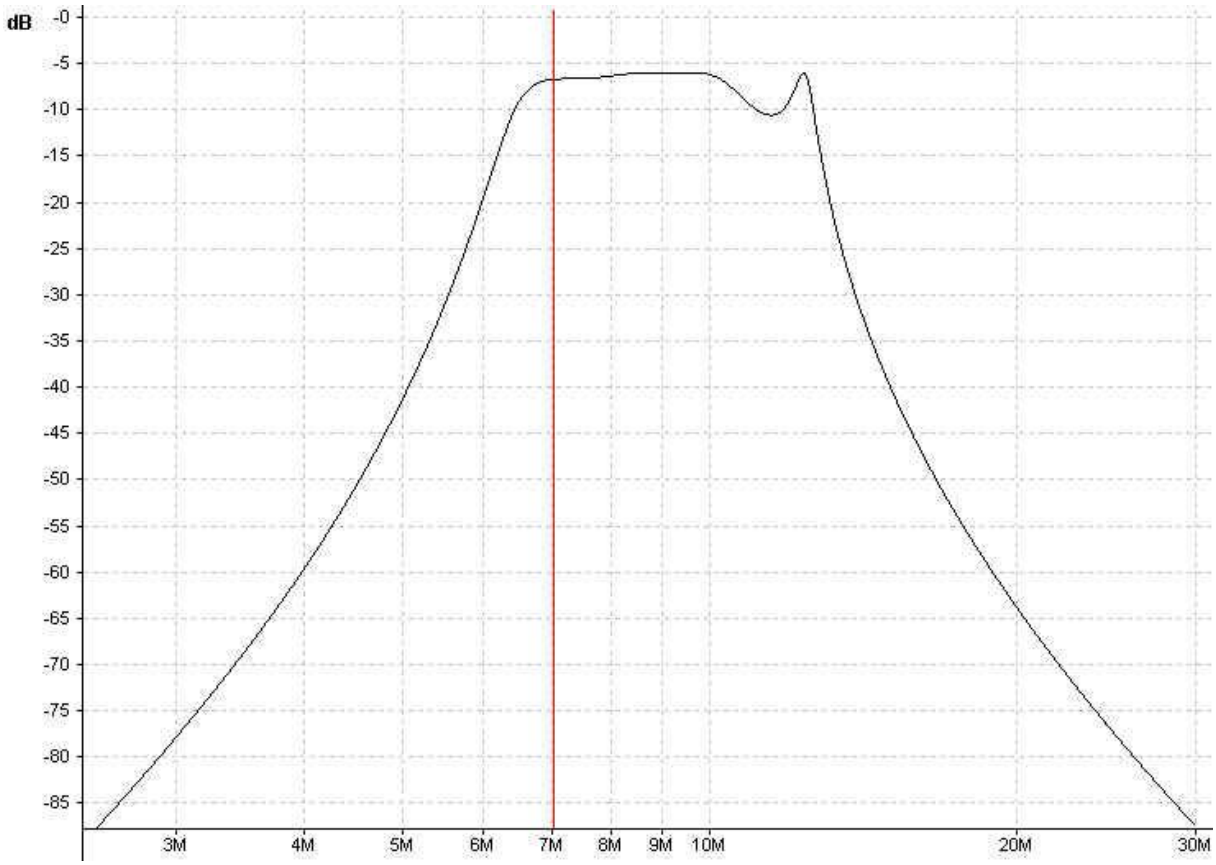

BPF5 7.5 – 10.5 MHz

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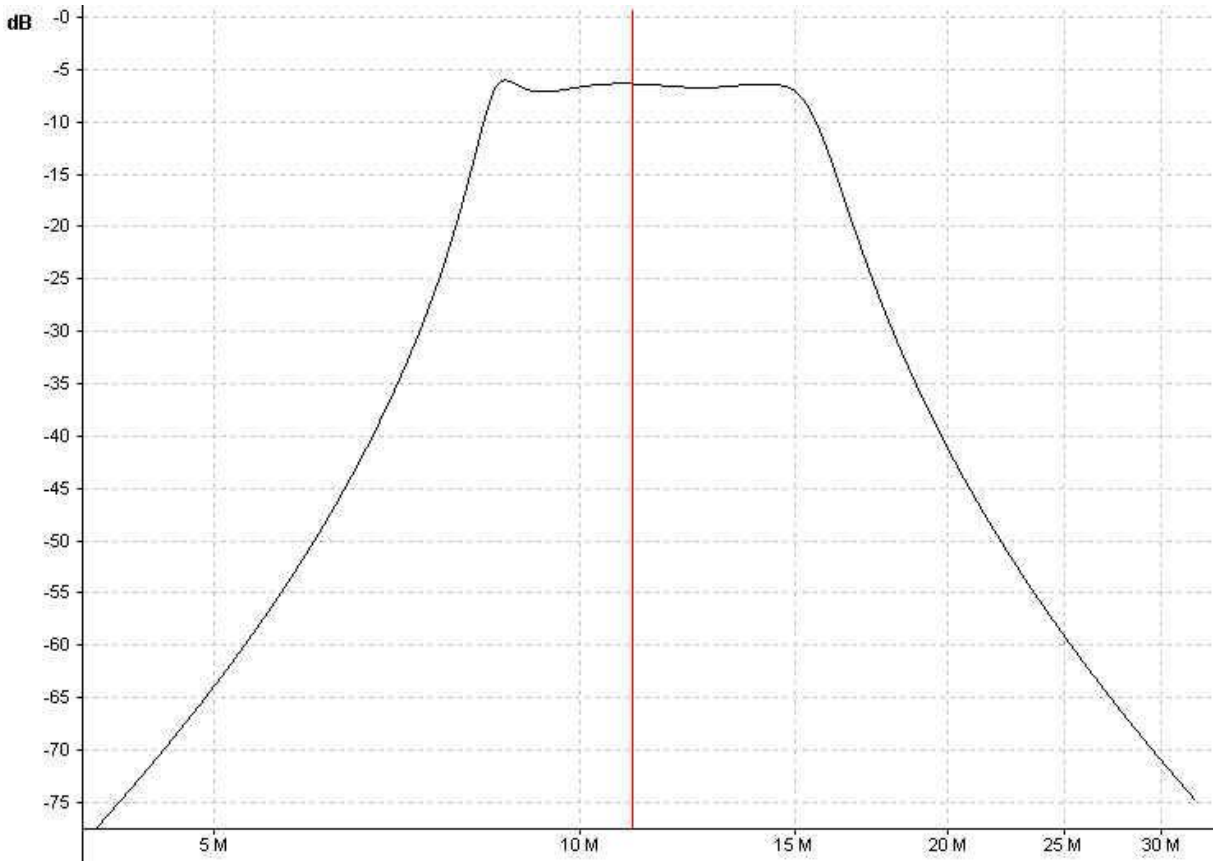

BPF6 10.5 – 14.5 MHz

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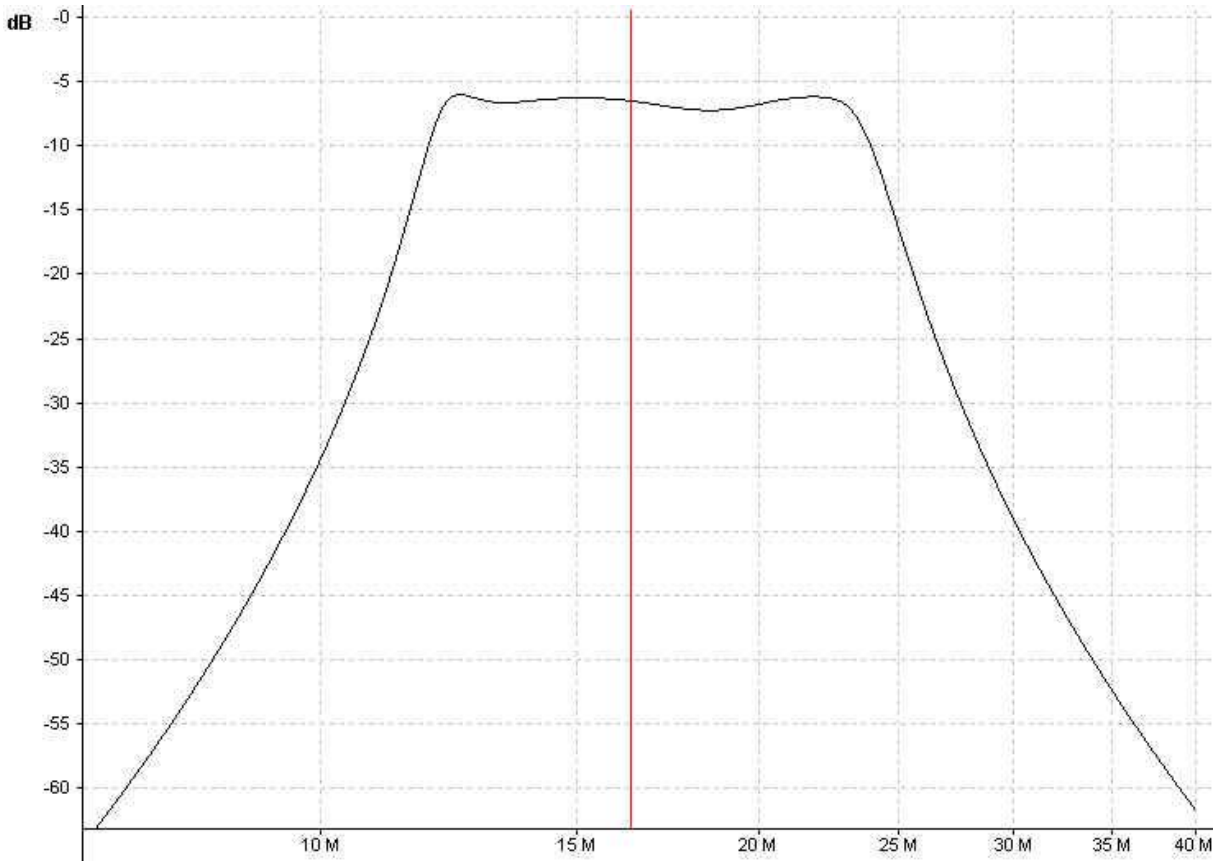

BPF7 14.5 – 22.0 MHz

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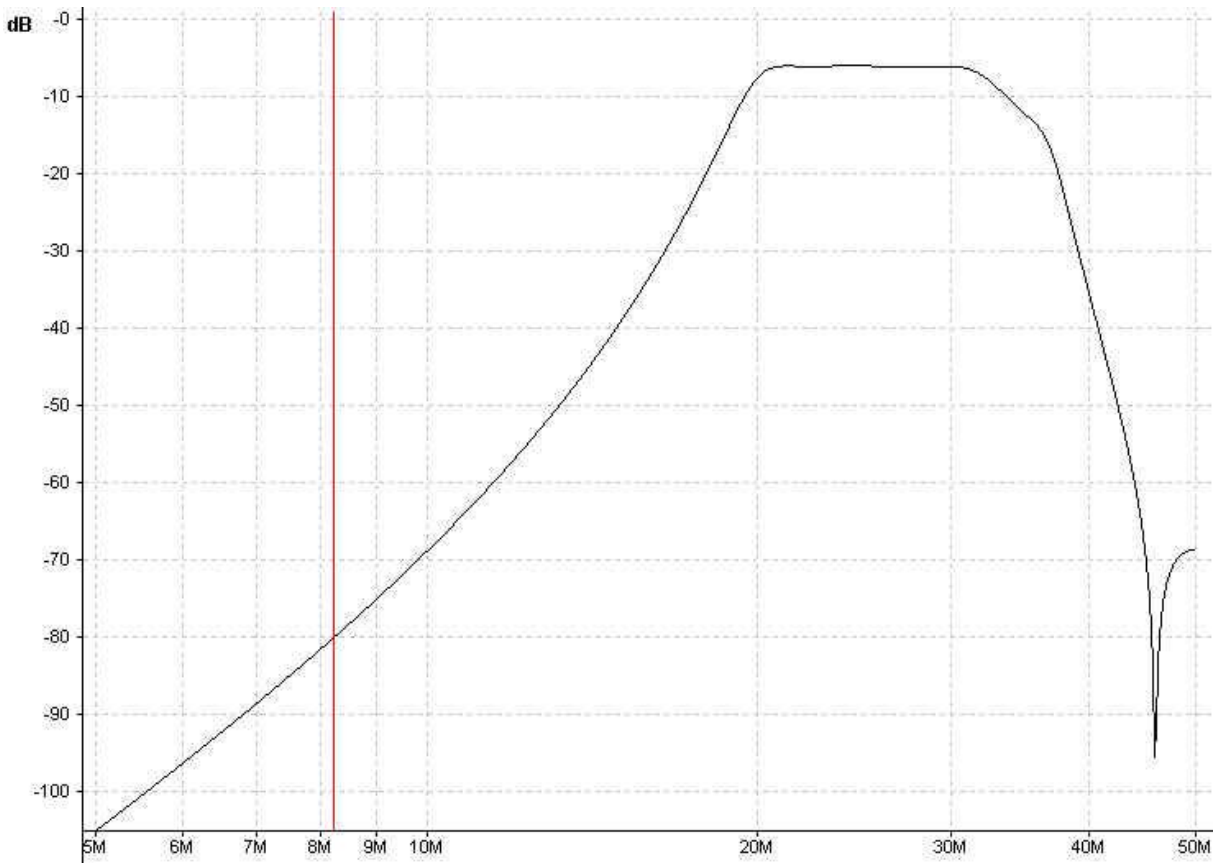

BPF8 22.0 – 30.0 MHz

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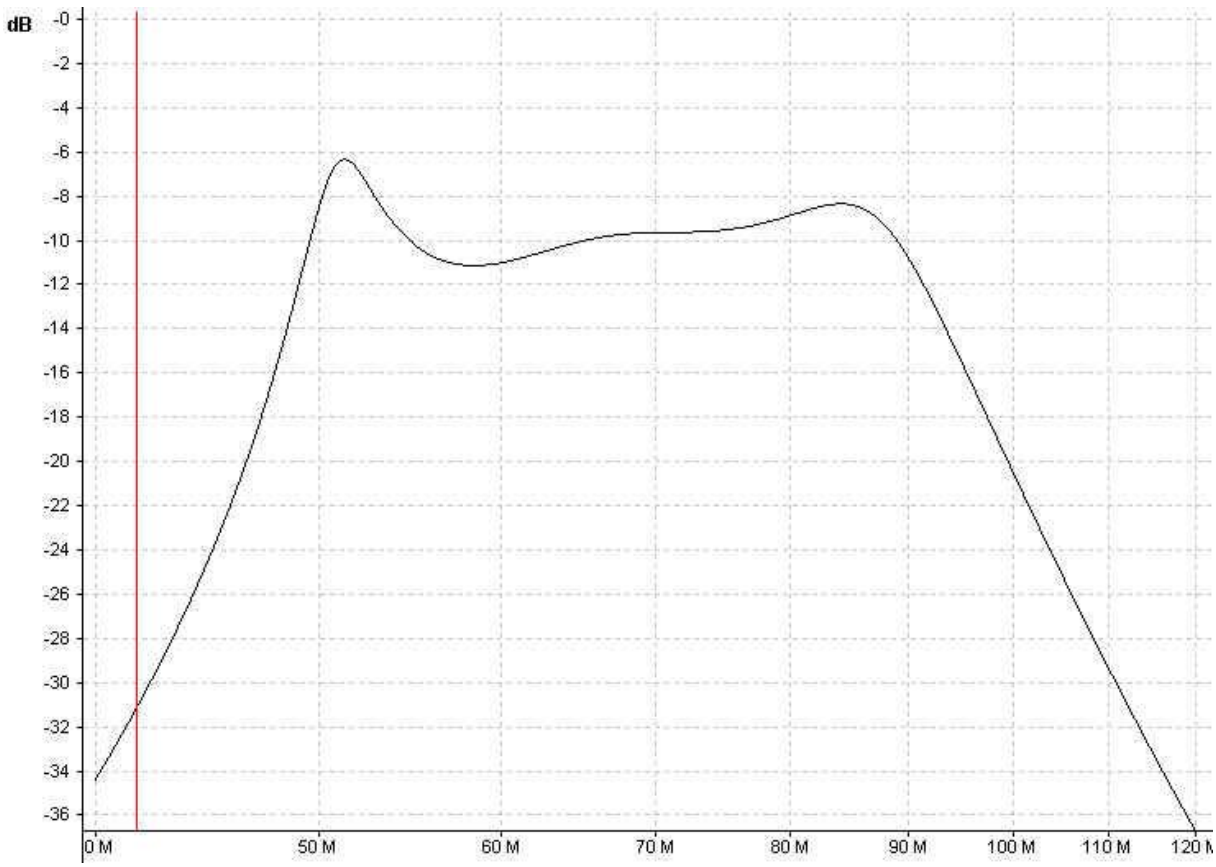

BPFA 54.0 – 75.0 MHz

This filter could be optimized

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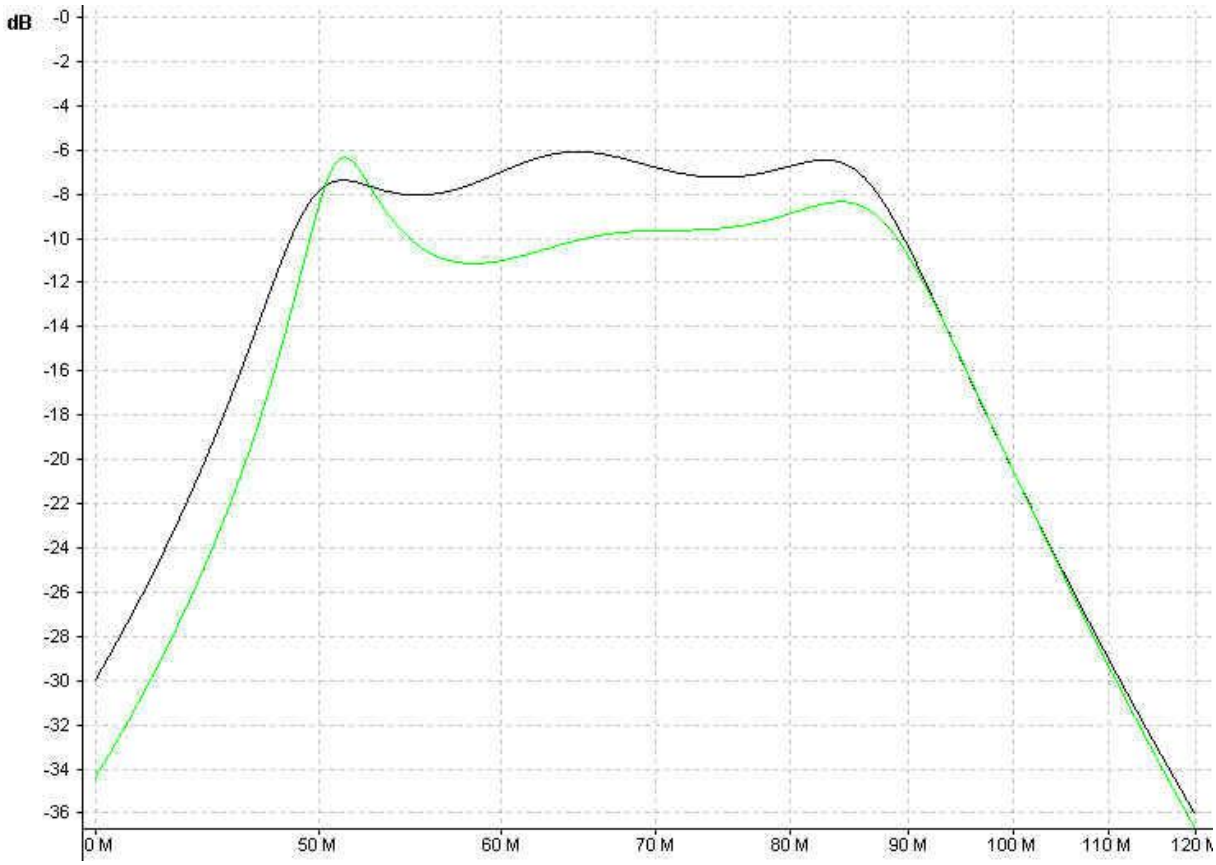

BPFA 54.0 – 75.0 MHz (optimized)

green curve → original bandpass
black curve → optimized bandpass

Modifications:

C3265 (18pF) → 22pF
C3297 (18pF) → 22pF
C3277 (220pF) → 180pF

I don't need this band so I didn't do that modification.

All plots are designed and printed by "WIN-Elektronik v3.1" (www.win-elektronik.de)

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DSP NR menu #11 alignment

I did several tests on SSB/FM modes. On conclusion I set the menu to 11 to get best results on all modes.

The factory presetting of 7 was only useable on FM but has no difference on SSB mode.

Values of 8 or more make improvements on both AM/FM and SSB and reduce white noise significant.

range: 0 - 15
factory setting: 7

my used setting: **11**

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Miscellaneous

You can find my own discovered mods here in this modification sheet.

But I did some other mods for my FT-847 too, e.g. the af pa step mod.

These still documented mods you can find on

www.mods.dk / Yaesu / FT-847

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Disclaimer • Disclaimer of liability

This modifications mostly need to be done by a electronic specialist who had enough practise and who has knowledge in SMD soldering. **You do the modifications on your own risk !**

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Although the greatest care has been taken while compiling these documents, we cannot guarantee that the instructions will work on every radio presented.

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Some circuit details are password-protected because of legal reasons. Please contact me via e-mail.

If your company would like to provide technical information to be featured on this pages please contact me at: dg2iaq@web.de

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