

The famous ICOM IC-7200 is a great transceiver and I like it very much.

As announced in several forums I realized that it has some (few) weaknesses on the early models.

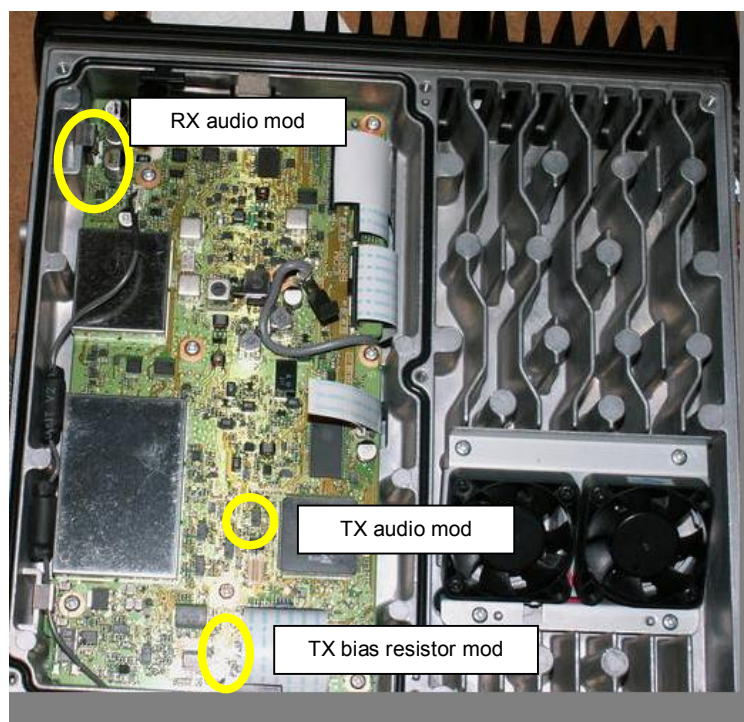
The USB chip does not give a proper audio level (30mV instead of 100-300mV like specified) and the transceiver has an EMC problem while using headphones in the front headphone socket. Here your SSB modulation is partially demodulated and audible.

Both faults can be fixed by the ICOM service (and as far as I read in the forums it IS fixed by factory in the newer models). Mine took only 1 ½ week at ICOM-Europe, a great and fast service !! This fast response was absolutely unexpected from me (I thought about 1 – 2 months instead), so I like to thank ICOM-Europe on this way too !!

Nevertheless I found some things in the schematic which I liked to change too. To turn this great transceiver into a superb transceiver with a great audio (TX + RX).

vy 73,

Jochen (DG2IAQ)



Overview

RX

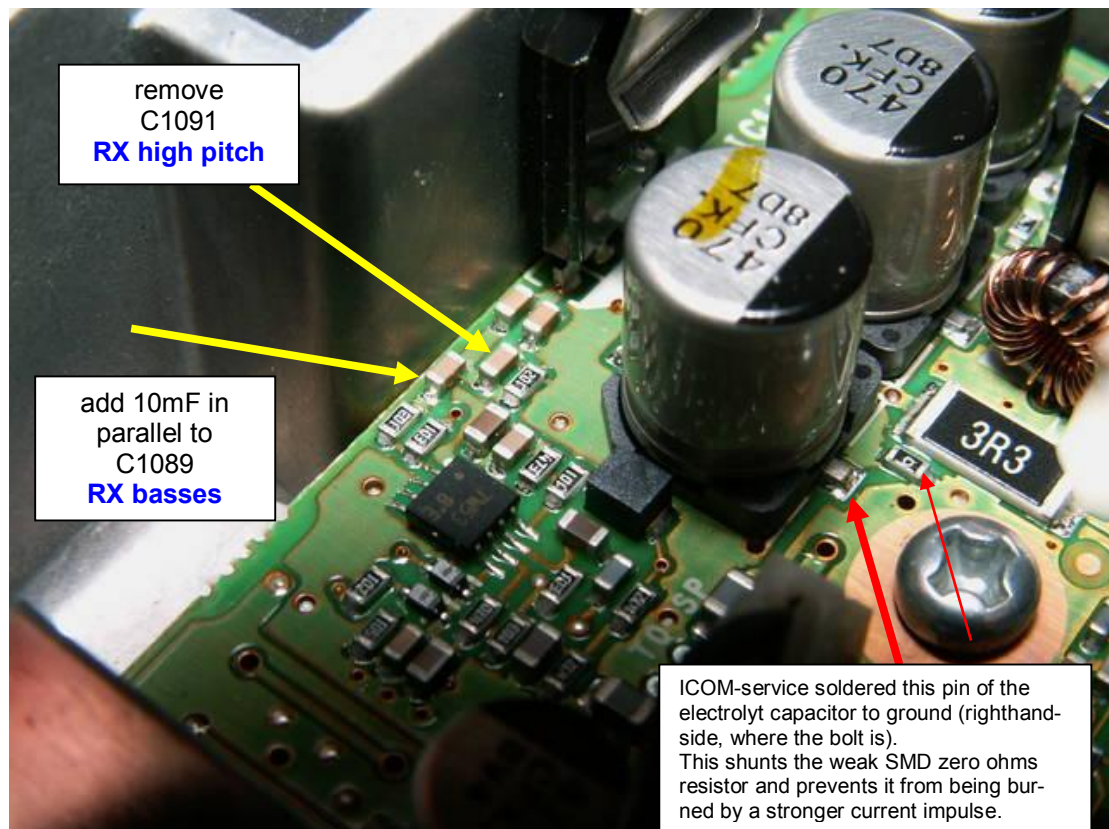
1. I found an **AF low-pass in front of the AF PA stage**. This is surely initially done to lower the AF white-noise, but the strength of this low-pass also reduces the speech intelligibility as syllables are attenuated too.

So I **removed C1091** ($0.047\text{mF} = 47\text{nF}$) for a much better clarity by a raised pitch and I soldered a **10mF** ($= 10\mu\text{F}$) tantalum capacitor **in parallel to C1089** ($0.1\text{mF} = 100\text{nF}$) to raise the basses.

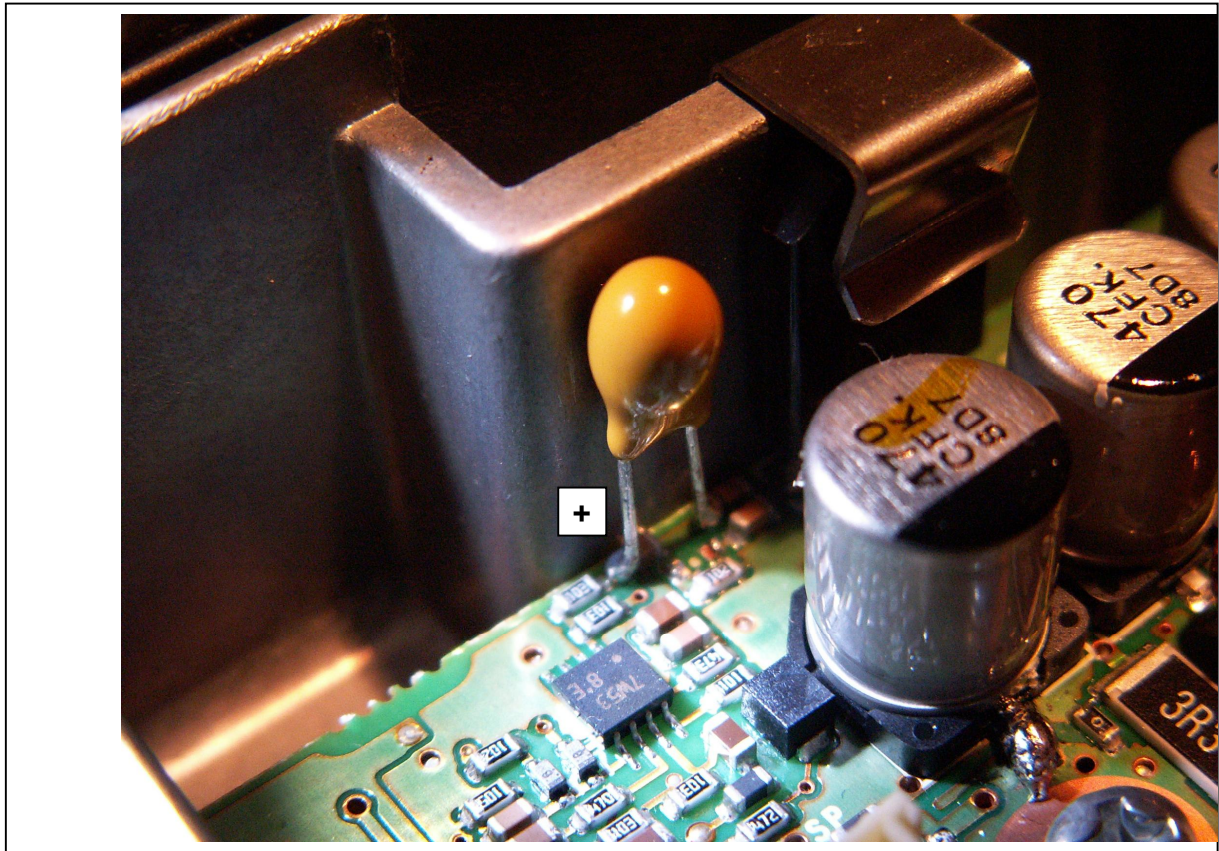
Now I have a high-fidelity audio on a good external speaker which goes in concern with an improved speech intelligibility, especially on weak signals. As the internal front speaker is more designed on higher frequencies and is not so broadbanded you won't hear as much difference here. So it's mainly for good external speakers.

This mod does only affect the speaker audio stage, not the headphone audio stage (which is on the front unit and not on the main unit).

So with this mod you have a slight improve on the internal speaker (for field usage), but a significant improve on a good external speaker (I call it the "Living room mode"... J...), and no difference on the headphones.



Then it looks finally like this:



RX audio before (green) and after mod (black)



TX

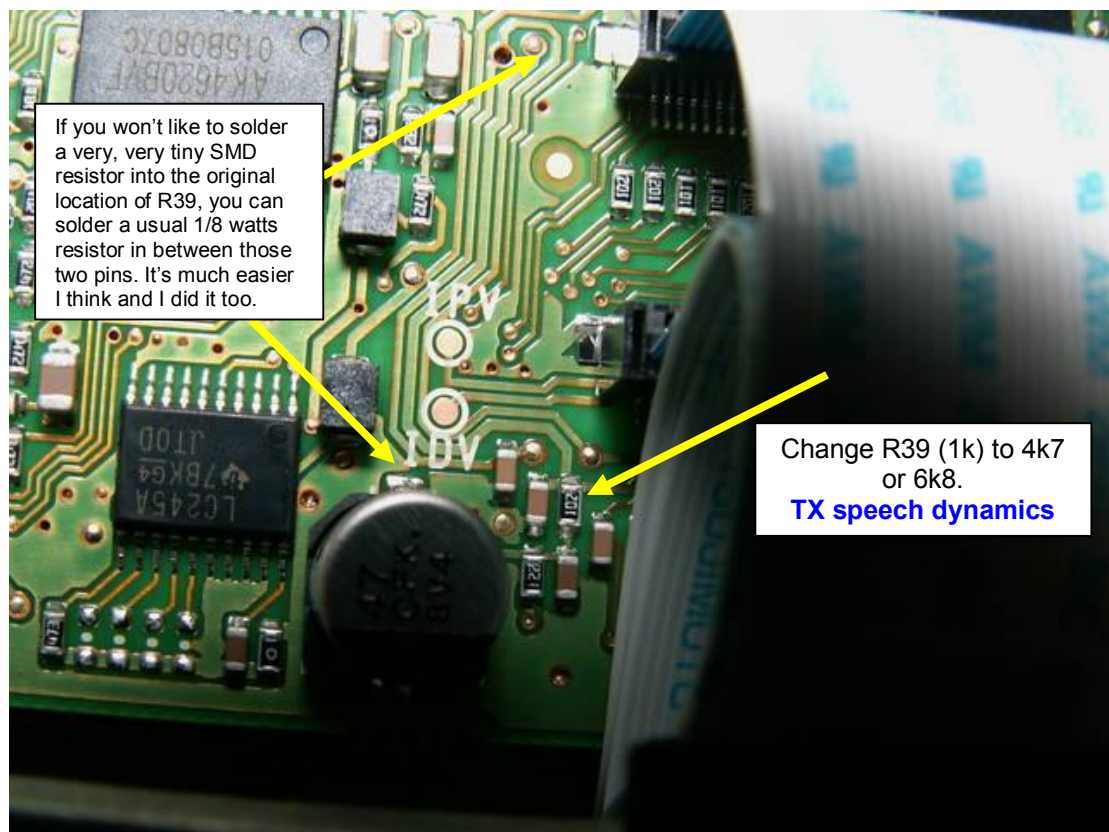
1. The **DC-bias resistor** on most ICOM transceivers I know yet, prevents the modulation from being "strong and dynamic". ICOM microphones usually also have to be spoken quite close from mouth to mic front. And dynamic capsules with their lower audio level can usually not be used without an external microphone preamplifier.

From the simple DC view the electret capsule is provided by the bias resistor, which is in most cases a 1k resistor. But from the AF view things change totally. Here the DC buffer capacitor works like a "jumper to ground" for the AF. This means the 1k bias resistor now is in parallel from mic to ground. You surely can imagine how much speech dynamics and speech level a "1k to ground" would destroy on a mic amplifier input ! So the DC bias resistor needs to be raised to prevent this effect.

Electret capsules usually have a wide range of DC bias, so they are satisfied with a DC supply of typically 1,5V – 10V. This means we do not have to take too much care on the final resistance value of the bias resistor, we only need to make sure that its value is high enough not to destroy too much audio level to ground.

From my experience 4k7, 5k6 or 6k8 is perfect and you never need to go over 10k as the audio level would not be attenuated significantly while being larger than 4k7.

I **use a 6k8 for R39** (1k) in my IC-7200.



So on my IC-7200 it looks now like this:



If you like to make this mod more "field or travelling conform", you can put a drop of hot-glue from the case of the resistors to the black part below. Then all mechanical stress is smoothly balanced and you won't have to fear for any breaks of the solderings.

But I don't think it's necessary.

2. I also realised that there's a **3 kHz audio low-pass on the internal mic amplifier**.

I often hear statements like *"the human speech goes from typically 300-3.000Hz, so why to change this AF lowpass here ? It's in the range"*.

As lot of people have modern transceivers nowadays, just make a simple test on your own:

Turn your transceiver to a broadband audio signal (like AM broadcast stations or ham operators with broadband microphones). Then use your audio DSP settings. In the case of my Yaesu FT-897D it's quite easy as I can change the lower and the upper corner of the audio band-pass in digital steps (e.g. 6.000Hz, 3.420Hz, etc).

If the statement above would be true, there should be no difference in readability or speech intelligibility while going from the maximum audio range of 6.000Hz down to 3.000Hz. Right !?

Wrong !

There's a significant difference in speech intelligibility if you come close to 4.000Hz and of course below !

To make the story short:

I **replaced C1034** (470pF) from the mic amplifier stage by a **330pF** and the original "muffled in the high tones" audio of my IC-7200 went (AF lowpass 3,4 kHz à 4,8 kHz). You also could remove it completely if you like or if it's easier for you. This results in a slight more hiss on the S, SCH or Z syllables, but has no negative effect.

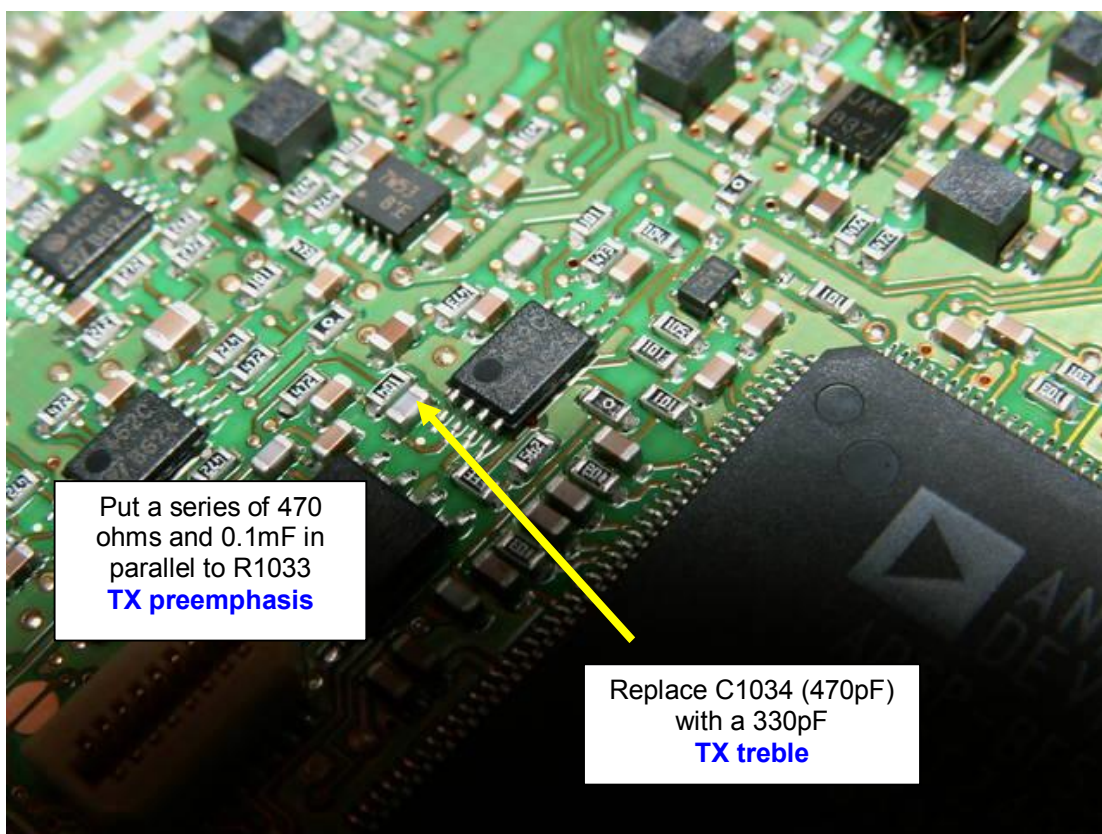
In addition I added a pre-emphasis to raise the high tones even more and to improve speech intelligibility. This was done by **a series of 470 ohms + 0.1mF** (100nF) **in parallel to R1033**. As a side-effect this pushed the mic-gain too, so using dynamic or military capsules is not a problem anymore.

Now my IC-7200 TX has a brilliant audio with a great speech intelligibility and much talk power. It has the touch of an aggressive DX modulation and is not the stock flat wide-range audio curve anymore.

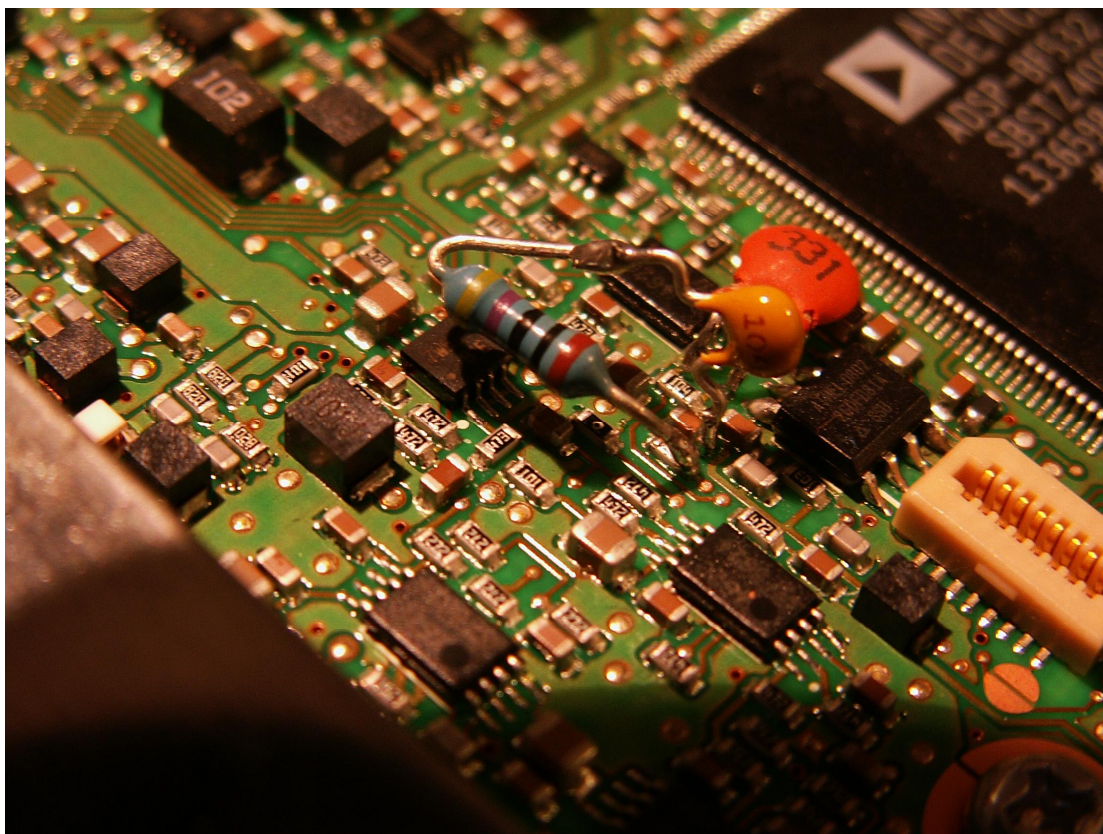
Together with the audio mods of the China version of the HM-36 of AB5N (Bob Nagy) or SE5X (Lennart Deimert) the audio is absolutely brilliant on the IC-7200 now !

I even was able to remove the SE5X mods completely, just jumpered the serial resistor + cap so that finally I only have the electret capsule in the mic line – and nothing more.

Just hear my MP3 recordings before/after my mods and you'll hear the huge difference.

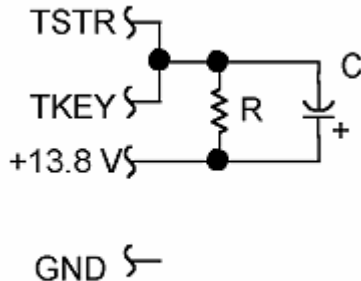


Then it looks like this:



3. RF Tuning module (10 watts RF)

I built an inexpensive RF tuning module which sets my IC-7200 into 10 watts CW mode for around 15 sec. by simply pressing the TUNE button at the front.



You can see my 1st version. The final version was done by

100k + 1000mF (25V)

which gives around 15 sec. tuning time.

I will build an improved version with the big electrolyt capacitor 180° turned down (= close to the plug). Cause the one above is too long and you can't put the IC-7200 in vertical position for transporting. Meaning you can't use the stands of the rear if you do not remove the tuning-module before. The tuning-module would break easily or would stress the socket.

For normal operations or if you would always remove the tuning-module before transport, it would of course not be a problem. And most of the commercial tuning-modules look like the "long version" above. J

4. External microphone-preamp for dynamic capsules

I liked to use a military capsule which not only looks like a HEIL HC4/5-clone but sound as high pitched and crystal clear too.



So I moved the electret capsule into it's original position at the top of the HM-36.

Now there's room enough for the HEIL clone capsule.



Then put a small switch into my HM-36 handmike to be able to switch in between the stock electret capsule and the dynamic military capsule



And don't forget that we talk about a dynamic capsule and that the ICOMs' mic line is still feed with the DC bias for the electret capsule ! So for any dynamic capsule we need a serial DC de-coupling capacitor. I chose a non-polarised 1mF type.

The ground pins of both capsules are soldered together, only the "hot wire" is switched.



But finally I realised that the audio levels of the dynamic capsule and the electret capsule were far away from each other.

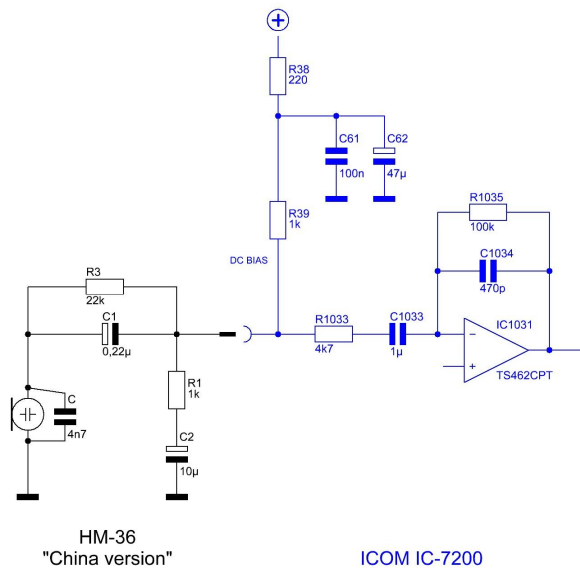
While the electret capsule drove my IC-7200 on easy 50W AVG and 70W AVG with speechprocessor ON – while speaking more than 3 inch from the mic front, the

dynamic capsule needed a very close speaking range but drove the IC-7200 only to 20W AVG or 50W AVG with speechprocessor ON.

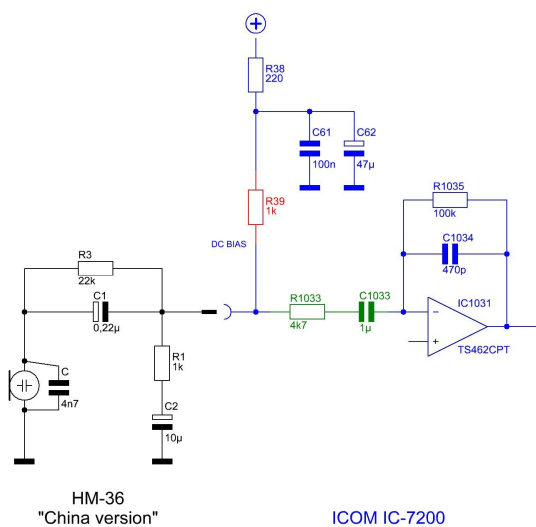
A typical mic-preamp is not possible in the HM-36 as the 6 wires are not connected to the +8V pin of the mic socket ! So there's 1 wire missed for such a project.

And I didn't want to use an external mic-preamp.

The original schematic of the HM-36 and the IC-7200 mic-input looks like this:

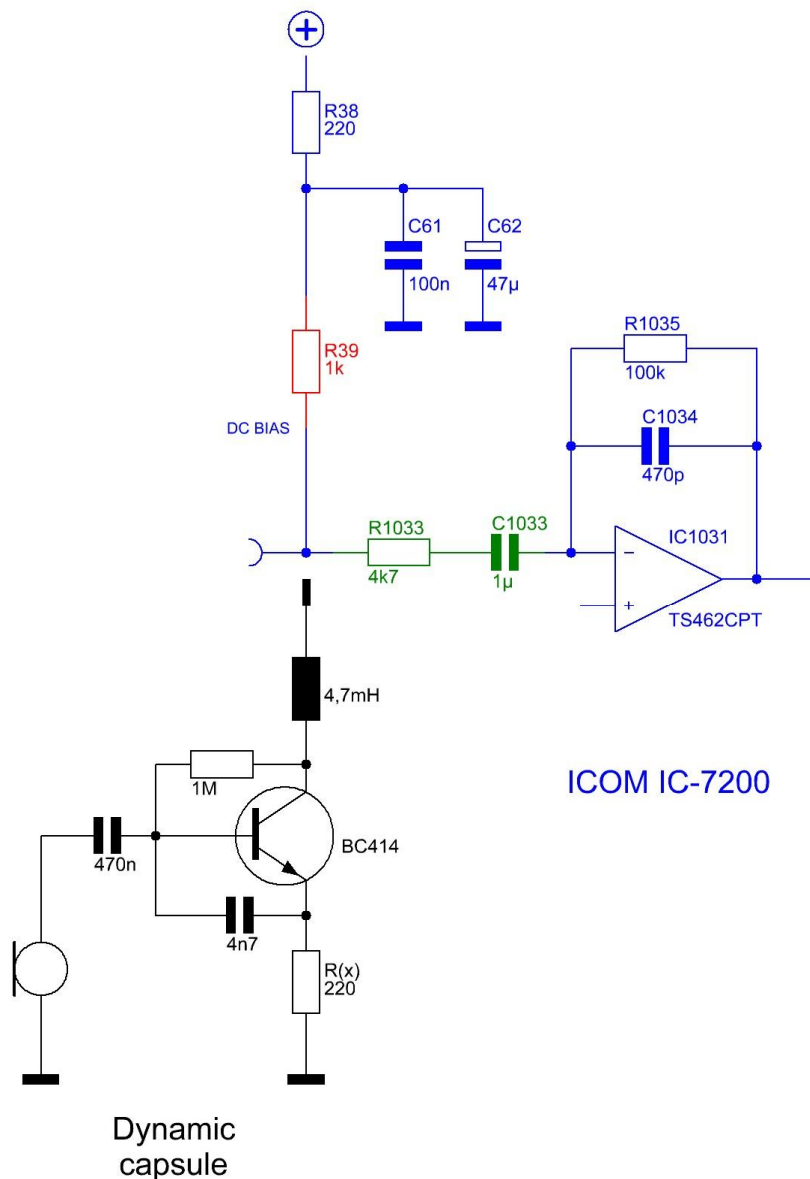


So after looking into the schematic (and lately after 3 bottles of red wine **J**) you will suddenly realise that nearly 1/3 of a simple 1-stage transistor preamp is just there in the IC-7200 !



You can see the collector resistor (RED) and the preamp output (GREEN).

So around 30% of my project was there – just unused, and the rest of the mic-preamp were easy to design. Please look at this:



Do you now see the complete 1-stage transistor preamp, consisting of the lower group and the collector resistor R39 and the AF output consisting of R1033 + C1033 ?

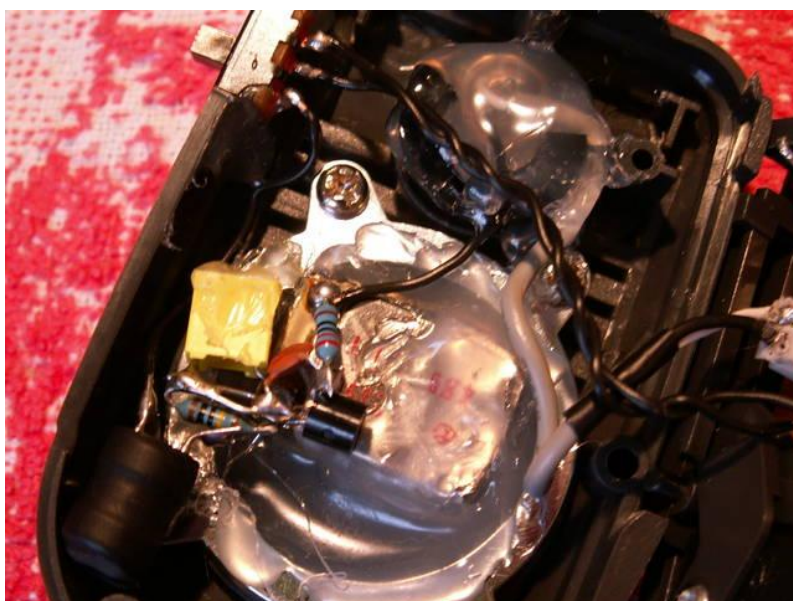
J

To prevent RFI I added a serial RF choke into the collector line.

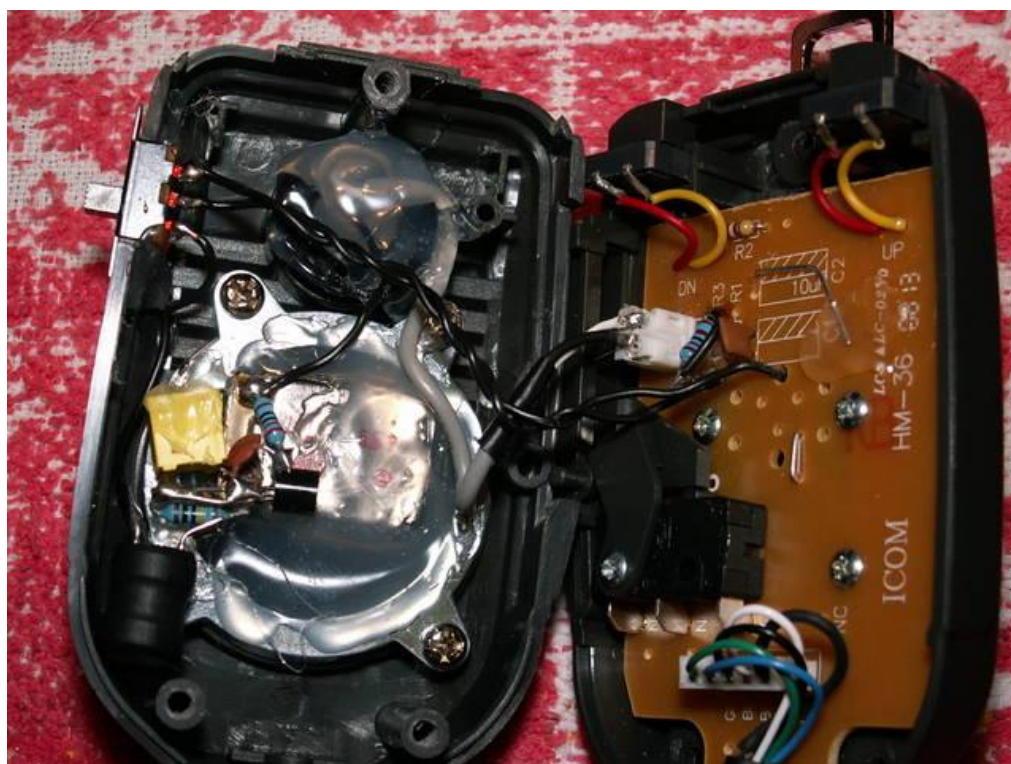
To adjust the amplification to your individual capsule needs you mainly can increase/decrease R(x). I used a 220 ohms type in my audio modified IC-7200 which gives now exactly the same AF level than with the electret capsule itself.

Finally it looks like this and was fixed with hot-glue.

This gives also a great acoustic shield into the microphone plastic case so that the sound only can reach the capsule from its front but not from the plastic rear. Otherwise you would get a muffled and plastic sound.



Some further photos at the end:



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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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