Audio Restoration Repair Project: Bose FM / AM Wave Radio receiver, and conversion from 110-120VAC to 220-240VAC

This particular version, manufactured in 1997, is a very well-made unit, capable of long-life, with satisfying sound.

The internal components are of high quality from reputable manufacturers, which is a pleasure to see. There was only one capacitor which was out-of-spec – very rare to see in a 15-year-old unit.



These modifications apply to only this 1997 Series 2 model (originally marketed in the USA), and not the other versions of this radio. To be certain, open your own radio, and compare your circuit board to the one shown below. If it is identical, you can modify your radio with confidence. You should work with the schematic diagrams, downloadable from the web.

Disclaimer – you modify your radio at your own risk. I take no responsibility whatsoever, for any changes / damage you may make.

The modifications fall into 4 categories. You may choose to make any or all of these modifications to suit your own needs.

- 1. Conversion of input voltage to receive 220-240VAC, instead of 110-120VAC
- 2. Conversion of Tuner FM 50kHz spacing; AM 9kHz spacing
- 3. Conversion of de-emphasis from 75uS (USA) to 50uS (EU)
- 4. Upgrade of the signal path capacitors

Bose specified parts:

Bose does not sell their custom parts directly to the public, so this project was accomplished with easily available parts, purchased from outside the Bose dealer network.

The only part which was impossible to source externally, is T102 - a 114 kHz (6th harmonic of the 19 kHz pilot ¹) filter, which likely helps to minimize IBOC/Hybrid Digital radio noise. Practically, this filter is unnecessary in this country, as we have no IBOC transmissions. If you hear strange interference noises on FM in your country, you may well have to buy this filter from a Bose parts center.

This is the main PCB before starting work

Here you can see the main PCB. The input voltage at the top left, the power section is at the centreright, the tuner section at the left, the signal processing at the bottom center, and the audio section at the right side.



1. Conversion of input voltage to receive 220-240VAC, instead of 110-120V AC

At the top left of the circuit board, do the following modifications, as shown in the picture below:

- 1. Disconnect from the circuit board, one leg each of C2 and R1. I did not remove them entirely, so as to allow the easy option of reinstallation, if required later.
- 2. At C5 (not populated), install a 4.7nF 275V-310V AC suppression capacitor of only the X2 type. I used a Vishay 339MKP unit. Many neighborhood electronics suppliers do not know about X- or Y-class AC capacitors, rather preferring to convince you to buy a regular film capacitor from their existing stock. Do not believe them for a moment. Installing a regular film capacitor will compromise the safety of your radio, and may destroy it.
- 3. Disconnect jumpers Y1 and Y2, and install a new jumper at Y3.
- 4. Remove F1 (the 120V 0.5A fuse), and replace it with a 250V 0.25A fuse.

At this point, the radio will operate perfectly, connected directly to a 220/240VAC wall outlet.



2. Conversion of Tuner - FM 50 kHz spacing; AM 9 kHz spacing

According to the North American specification, FM stations are spaced 200 kHz apart – on the display you see 91.10, 91.30, 91.50 MHz. AM stations are spaced 10 kHz apart – on the display you see 1310, 1320, 1330 kHz.

According to the European specification, FM stations are spaced 50 kHz apart – on the display you see 91.10, 91.15, 91.20 MHz. AM stations are spaced 9 kHz apart – on the display you see 1314, 1323, 1332 kHz.

This is controlled by U301 MC68HS705C8 port PD2. PD2 is pulled low (weakly) by R346 100KOhm. To make the change, PD2 must be pulled high ², by installing R360 1KOhm (currently unpopulated).

In addition to the change of spacing, a Euro-spec circuit must be much more selective to be able to listen clearly to the stations, which are located 4 times closer together than in North America.

This next change is very important, to enable clear reception of the closely spaced stations. Remove the original wide 10.7 MHz filters at CF101 and CF104, and replace with narrow Murata 150 kHz units SFELF10M7JAA0-B0.

No additional alignment was required on this particular radio - but your radio may differ.



3. Conversion of de-emphasis from 75uS (USA) to 50uS (EU)

In order to match the transmission specifications, the de-emphasis must be changed. If the deemphasis is left at 75uS, the high-frequency sounds will be muted, so that you hear a "darker" sound.

Replace C103 and C121 (currently 15nF), each with a 10nF 100VDC film capacitor ³. You can see them in the picture below – 2 orange capacitors at the bottom left.

4. Upgrade of the signal path capacitors

On the picture below, you can see some blue Nichicon KT 10uF Audio-grade electrolytic capacitors, and also 4 red Wima MKS2 0.47uF and 1uF film capacitors. Some of them had to be mounted horizontally, because of limited vertical clearance.

These are in the signal path, and replacement with these types will give you a radio which sounds fully alive, and pleased to play all day long.

Once you've removed the circuit board from the radio, make a component map, with the specified capacitor values, and choose the necessary replacement parts from Mouser or Digikey.

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Under the metal can at the right (requires desoldering and removal), adjacent to U301, was the only defective capacitor which required replacement - a 47uF unit. Check the ESR on your unit.

This is the main PCB after completing the modifications



Credits

^{1, 2, 3} Thanks to Jov Pamarang for his assistance in these areas of the RF conversion.

Parts for this restoration

Parts and advice are available for owners who wish to tackle this project by themselves.

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