

Audio Restoration Repair Bose Wave Music System AWRCC1 AWRCC2 AWRCC7

This applies to the Wave Music System, Wave Music System II, Wave Music System III, in all AC voltage variations.

These particular versions, manufactured in the 2000's, are designed in the USA, but include a majority of low-quality parts sourced in China, which are the primary source of all the problems. Their parts quality is far below that of the original 1990's Bose units, which were completely sourced and manufactured in the USA. These WMS units have the front-loading CD player.

Bose refuses to release Schematics or Service Manuals, however, that is not a problem for experienced ethical technicians to reverse-engineer the circuits, and repair them to a higher standard than Bose's own technicians (based on the questionable quality of the originally-installed Chinese parts).

After reading and understanding this document, any competent hobbyist or technician with good soldering skills may make his own repairs, with a high probability of success, without needing to feel captive to Bose's facilities.



The normal symptom of this series is weak sound or no sound. Generally, they are able to be switched on, and the display responds to the commands of the Remote Control.

The cause of the problem is massive and widespread failure of all the Chinese SMD capacitors - around 40 of them. For example, 1uF capacitors showing ESR of 20-30 Ω , 10uF capacitors showing ESR of 10-17 Ω . The consequence is that the associated IC's current becomes unstable, and causes the TDA7376 output amplifier and / or associated copper traces around the IC's, to burn.

There is NO quick and cheap fix, and simply replacing ONLY the burnt TDA7376 (which many technicians of dubious ethics do) is another timebomb waiting to explode, because it is still subject to damaging unstable current and will overheat and fail again in a short time, IF all the capacitors are NOT replaced simultaneously.

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

These modifications apply to the Wave Music System units with the Front-Loading CD. The applicable PCB numbers (all very similar with minor differences only) are as follows:

283027-001 Main PCB

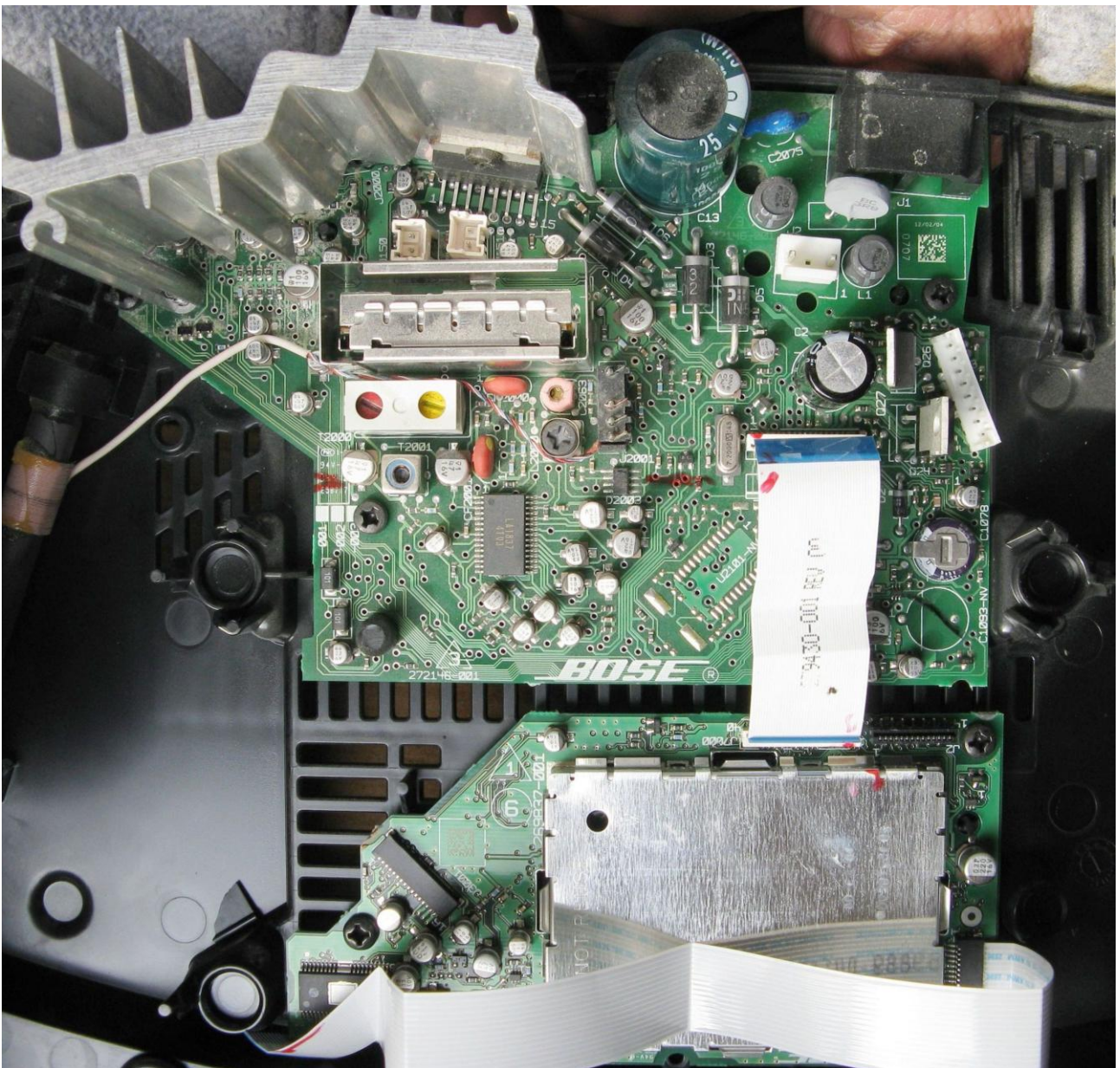
291619-001 Main PCB

342507-006 Main PCB

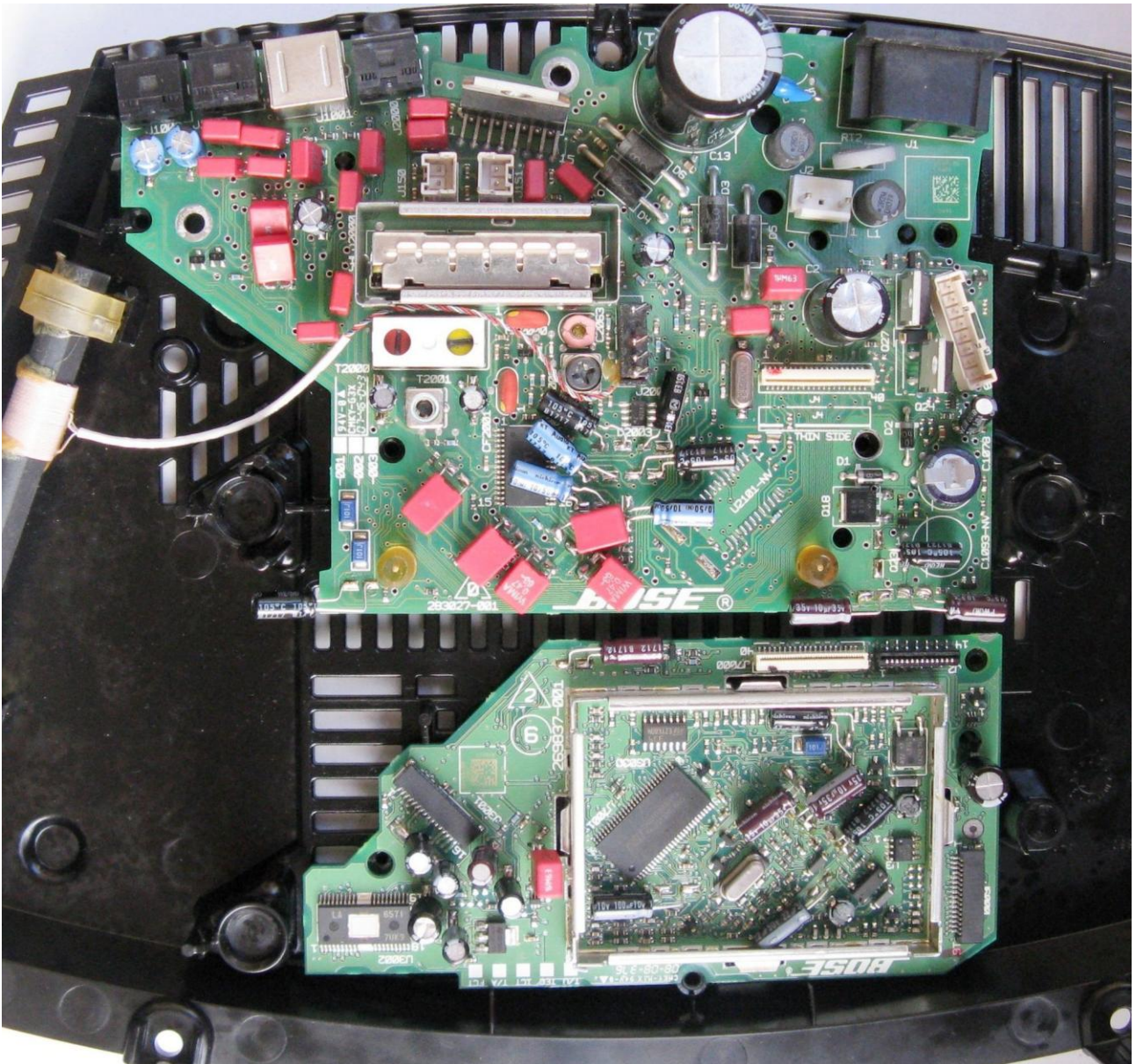
269837-001 CD Processor PCB

345156-005 CD Processor PCB

To be certain, open your own radio, and compare your circuit board to those shown below. If it is identical, you can repair/modify your radio with confidence.

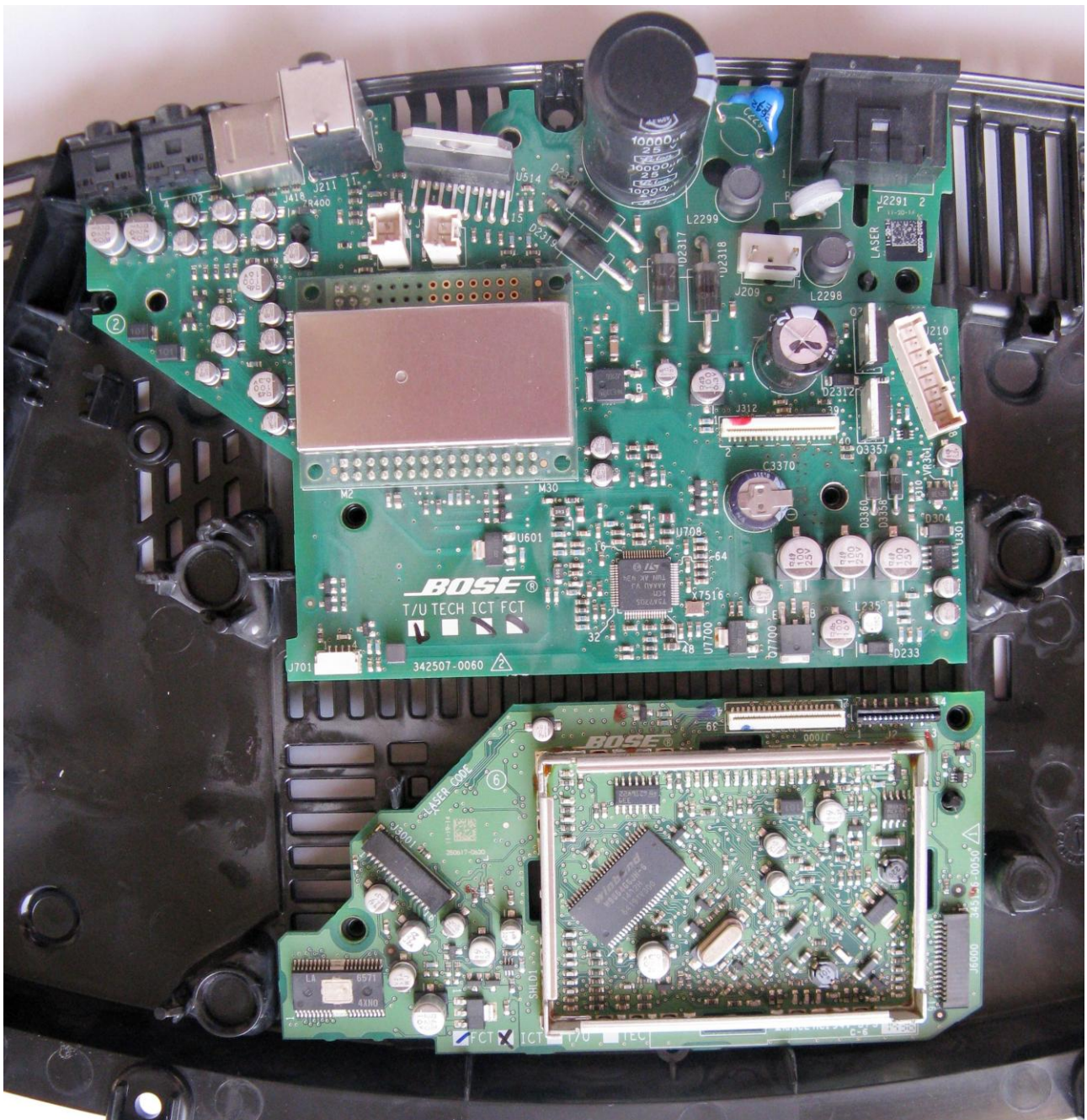


This is the early version BEFORE starting work - the CD mechanism and speaker cabinet have been removed.



This is the early version AFTER completing work – the CD mechanism and speaker cabinet have not yet been reinstalled.

On the Main PCB, moving in a clockwise direction, the Preamplifier is at the top left; the TDA7376 Output amplifier IC is at the top center; center right is the 10,000uF filter capacitor and the 4 bridge rectifier diodes for the power amplifier 15VDC rail; AC input at the top right; below is the 2SC1173 NPN, 2SA473 PNP and KSH210 PNP power transistors which produce the Preamplifier 9VDC rail; bottom and center left is the tuner section.



This is the later version BEFORE starting work - the CD mechanism and speaker cabinet have been removed.

On the bottom CD/Microprocessor PCB, the CD section is at the left, and the Microprocessor section is in the shielded enclosure. The early and later versions are almost identical.

When remounting this PCB into the Black casing, it is necessary to mount this PCB 2.5mm lower than originally installed, to allow clearance for the vertical height of the new capacitors, below the CD mechanism.

To achieve this, simply remove the top 2.5mm of the 3 mounting studs on the Black casing, by either grinding off with a Dremel, or melting off with a flat soldering iron.



This is the later version AFTER completing work – the CD mechanism and speaker cabinet have not yet been reinstalled.

The repair/modifications comprise 4 stages.

1. Removal of all Chinese SMD capacitors – absolutely essential, no matter what symptoms you are experiencing
2. Replacement of all capacitors with Nichicon and Panasonic 105°C Low-ESR electrolytic, and Wima high-precision Film TTH (not SMD) capacitors
3. Diagnosis and repair of sound problem – requires DMM voltmeter and oscilloscope
4. Replacement of the TDA7376 Output amplifier (if still no sound, after making all repairs)

1. Removal of all SMD capacitors

It is a given that ALL these low-quality Chinese capacitors are defective. There is no quick or cheap way to solve this. ALL of them must be removed. The DC electrical current in the machine is completely unstable, and all the semiconductors are highly stressed. One or more semiconductors have already failed. No wishful thinking will make the problem go away.

The large heatsink at the rear of the machine must be removed, to provide access to all the capacitors.

Every technician has his own favorite method of removing SMD capacitors.

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My favorite method is to grip the capacitor from above with a pair of pliers, push DOWN, and simultaneously firmly twist the capacitor in the horizontal plane, about 120-180°.

NEVER pull the capacitor in an upwards direction. The correct horizontal twisting action will break the capacitor leads at their weak point, and the capacitor will separate from the PCB.

If this method is done correctly, it will never cause damage to the solder pads on the PCB.

After the capacitor has been removed, you should apply the soldering iron (about 290°C) onto the pads, in order to remove the residual part of the SMD capacitor leads, which are still attached to each pad.

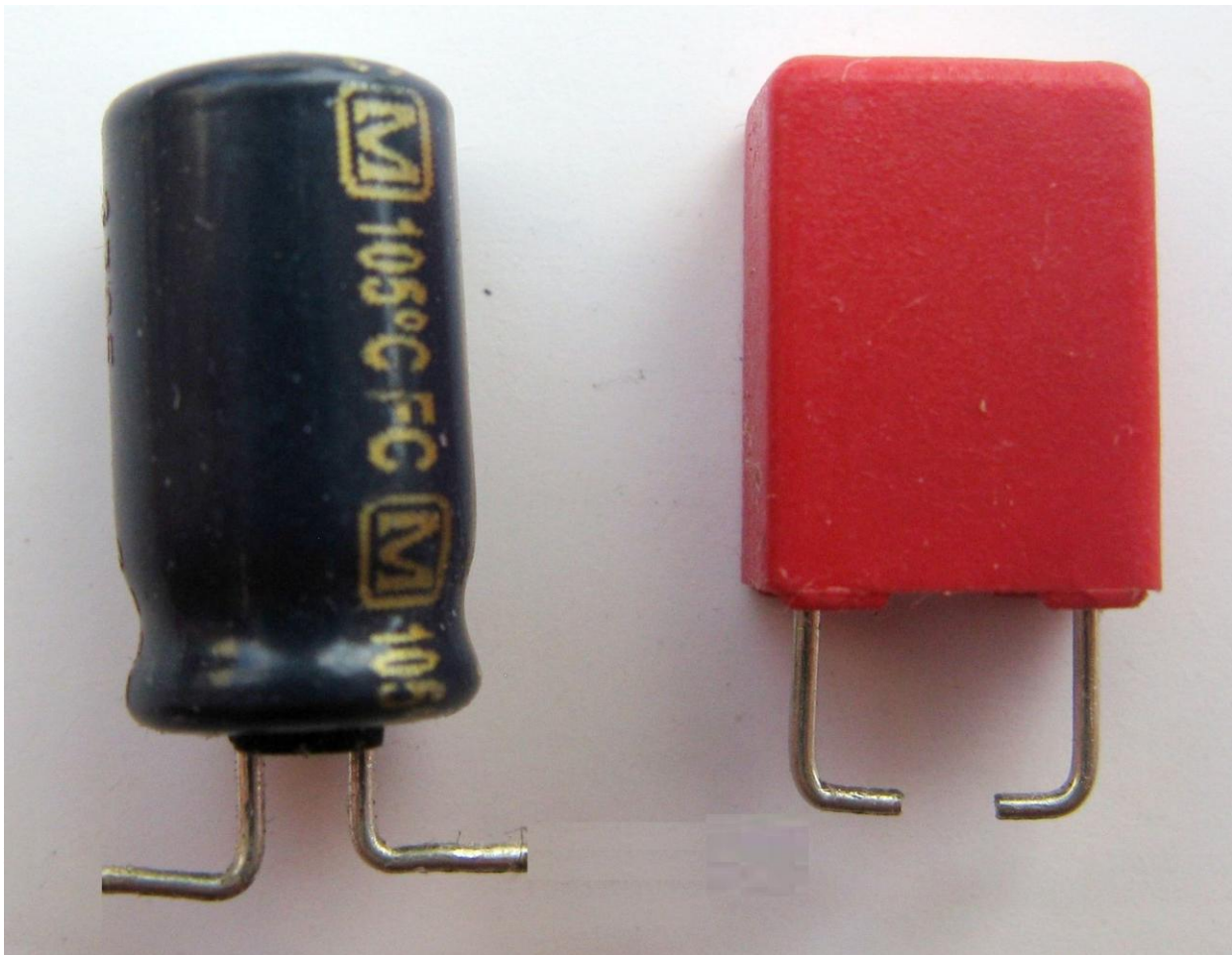
2. Installation of new capacitors

The first priority is to restore the normal stability of the DC current in all circuits. Therefore the use of far-higher quality capacitors is essential.

Capacitor replacement is done BEFORE attempting to troubleshoot. In many cases (but not this one), replacing the capacitors will solve ALL the problems, and no further troubleshooting is necessary.

I refuse to use new SMD capacitors for replacement. Current technology SMD capacitors are far less reliable and far more failure-prone than conventional TTH (Through-The-Hole) capacitors.

Each new TTH capacitor must be prepared for installation on the original SMD solder pads. These solder pads suit capacitors with a 3-5mm lead pitch. For capacitors which must be mounted horizontally (due to limited vertical clearance), creativity is needed. Pay attention to mounting positions shown in the previous large photos. For capacitors which will be mounted vertically, bend and cut the new leads as shown in this photo.

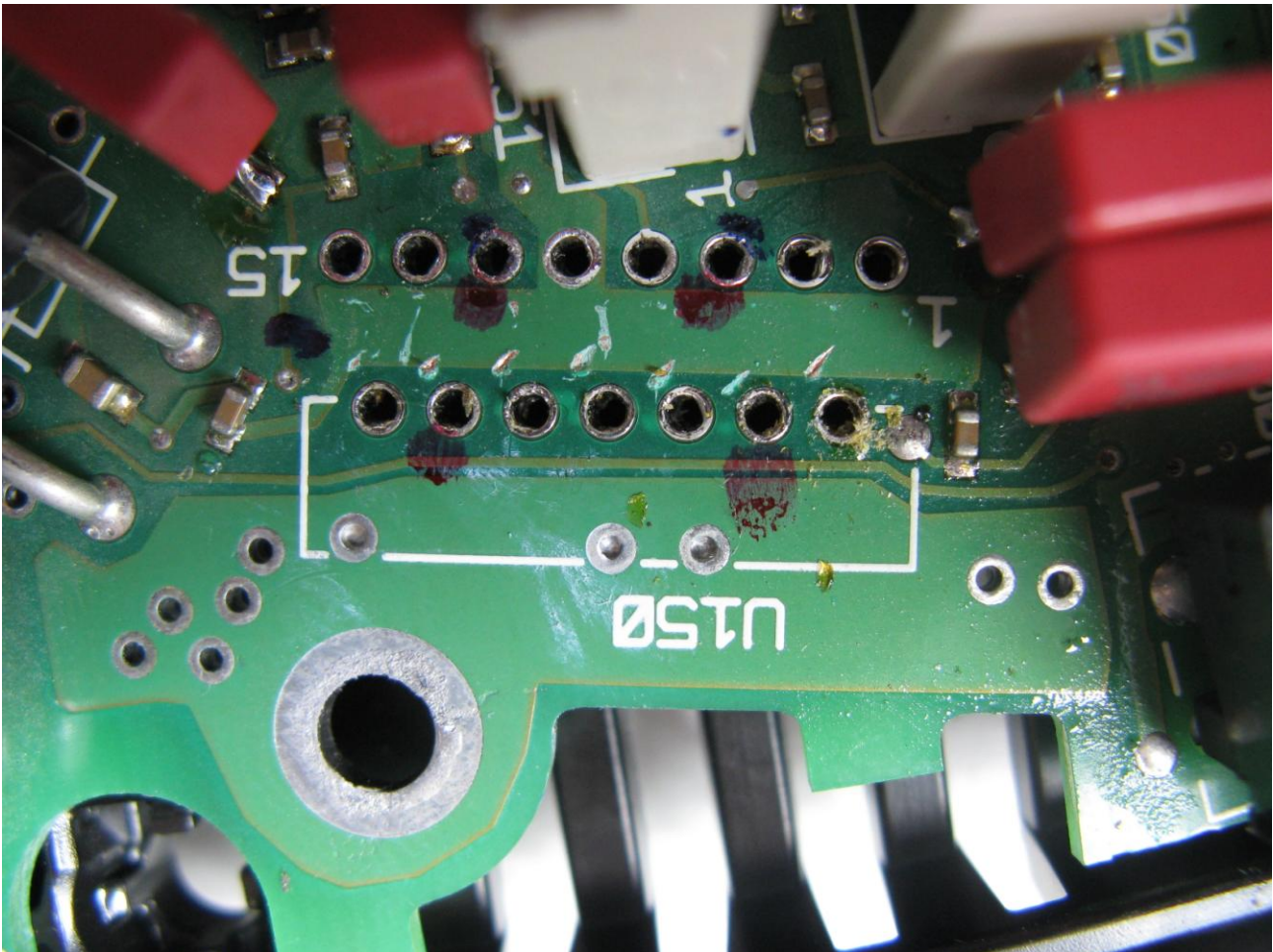


3. Diagnosis and Repair of sound problem

At this stage, assuming that you have worked patiently and diligently, you should be able to reassemble the machine and test it. You may very well have a working machine again, and with even more fulfilling sound than the original situation, having used far higher quality components.

If the machine is still not producing correct sound, the first place to look is at the TDA7376 power amplifier. There are 15 pins arranged in 2 rows, and the pins of interest to us at this stage are Pin 4 Left input, Pin 1 Left Output, Pin 12 Right input, Pin 15 Right output.

Here, the relevant pins are shown marked in red (with the destroyed TDA7376 removed).



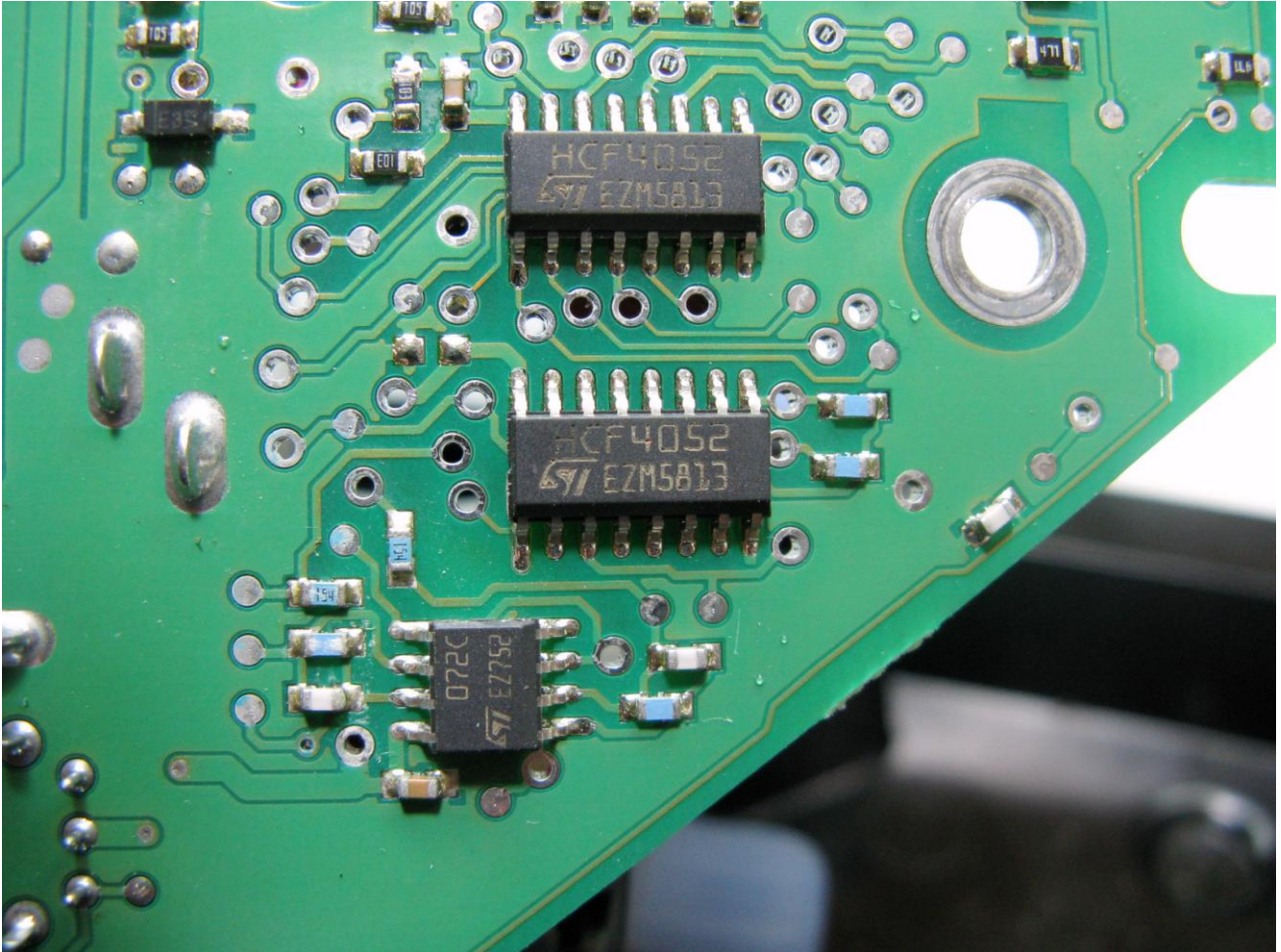
With an appropriate audio signal source connected to the rear AUX-IN connector, these pins are checked on the oscilloscope for correct waveform.

For example - if Pin 4 has a good waveform, but Pin 1 waveform is defective, obviously the TDA7376 is defective, and must be replaced.

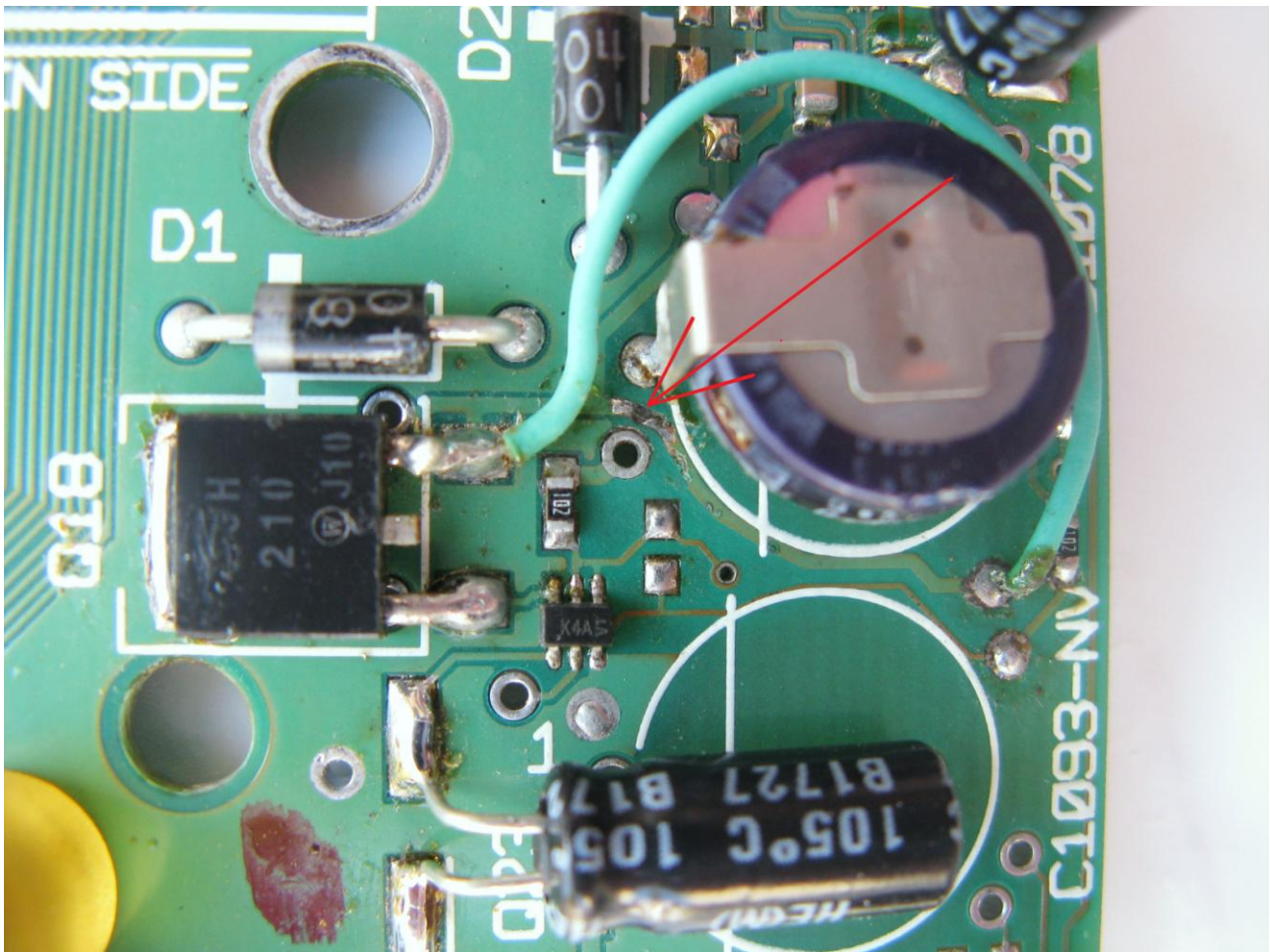
If Pin 4 has a defective waveform, then the audio signal is not arriving from the preamplifier section, and the cause must be traced. This was the problem in this case.

The troubleshooting continued as follows in the preamplifier section:

1. Scoping the waveforms on the input and output pins of the HCF4052 MPX and TL072 OpAmp IC's on the bottom of the PCB. A completely defective waveform showed an amplitude of less than 1mV P-P on all these components. That told me that these IC's were not performing correctly.
2. I decided to check the VCC and VSS pins for correct voltage. The VCC showed less than 1mV DC. That told me clearly that the DC Voltage rail is defective.



3. I disconnected AC power, and traced back through all the Via's, to the source of this Rail, which is the Collector of the KSH210, and checked the components in this area. All checked just fine, with no shorts, or abnormal readings across the pins.
4. I then reassembled the PCB and connected power, and checked the KSH210 Collector again - Zero Voltage. I checked the KSH210 Emitter - Zero voltage. Not good. I checked the Emitter of 2SA473 - good voltage. Aha!
5. There is the EXACT problem - Cable break between 2SA473 Emitter to KSH210 Emitter. I connected my spotlight and magnifying glass and found a bit of black soot at the position shown with the red arrow. I scraped away the black soot, and discovered the break in the copper tracing.
6. That is a direct consequence of the original Bose low-quality capacitors failing and causing the KSH210 to become stressed, and burn its surrounding traces.
7. I bypassed the damaged trace with a new wire, from the Via direct to the KSH210 Emitter.



8. I then reassembled, applied AC power, and checked the KSH210 Collector - 9.1VDC showed. Good progress, but not the end of the story.
9. I then reapplied an audio signal source to the AUX-IN, and scoped the TDA7376 input Pins 4 and 12 - clear and proper waveforms, which means that all the preamplifier IC's are fully operational.
10. Problem solved. This was clearly a case of the original Bose Chinese capacitors causing collateral damage, well beyond the actual failure of the capacitors themselves.

4. Installation of the new TDA7376 Output amplifier

I installed a new TDA7376 output amplifier, and reassembled the machine. Excellent sound.

Parts for this restoration

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

<http://www.condoraudio.com>

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