

Kenwood TS-520X  
100 Watt Conversion  
How To

I need to preface my remarks by explaining that I have only seen 2 TS-520X rigs in my Kenwood service experience and both of those were quite a few years in the past. Unfortunately I did not take any photos and my notes are not as complete as I would like. Lastly, I do not have any KW documentation for this radio or the TS-520V. I did see a Japanese TS-520 schematic some time ago that had the single S2001A PA drawn in the lower right hand corner of the main schematic along with notes in the Japanese language. No I could not read it! I also posted on the Yahoo Kenwood Hybrid forum for help from TS-520X owners and got no responses.

With that background in mind what I offer here is a combination of what I know and what I believe. Where I am not 100% certain I will indicate that. Lastly, if in the course of converting your TS-520X or V model for 100 watts output if you find I have provided some mis-information I would appreciate hearing from you so it can be corrected.

I will start by telling you that what you will be doing is essentially configuring the radio to match the TS-520 schematic. If you do not have a copy of that schematic you will need to obtain one. N6WK.com is a good source among others.

What are the as-built differences? How do they reduce the TS-520 100 watts rf output to approx 10 watts rf output?

The way that they reduce the output power to approx 10 watts is to use a single S2001A tube, reduce the 900vdc anode supply to 400vdc, reduce the 210vdc screen grid voltage to approx 160vdc, and to reduce the RF drive at the S2001A final tube control grid from approx 45rms rf volts to approx 36rms rf volts.

More detail is as follows:

1. There is one S2001A final tube in the PA cage. There is a hole punched in the chassis for the 2<sup>nd</sup> octal socket. You will need to purchase a socket either phenolic or ceramic and mounting hardware.
2. There may or may not be a cooling fan as I believe it was an option depending on the radio serial number. Suggest you buy one from Bob Mansker KE5FTF.

3. Below the PA cage you will find a 6.2 ohm rectangular sand power resistor R18 that takes the place of the 2<sup>nd</sup> final tube filament. It will need to be removed and will not be used. You will have to add a jumper for the 2<sup>nd</sup> filament and a .04 rf bypass capacitor to chassis ground same as on the 1<sup>st</sup> tube.
4. At the control grid pin of the tube socket you will find a 15pf 500wvdc Type 1 rf ceramic capacitor C41 from Pin 5 to chassis ground. This capacitor needs to be removed. It is used to shunt a portion of the RF drive voltage from the 12BY7A plate circuit to chassis ground. This reduces the RF voltage swing (RF drive level) to the S2001A.
5. Instead of using the 800 tap on the transformer secondary the 400 tap is used and a full wave bridge rectifier is used in place of the voltage doubler. This means that at the top of the RF choke there is only 400vdc available which drops to approx 375vdc at full load. This bridge rectifier will have to be removed and the S2001A anode supply rebuilt as a voltage doubler per the schematic.
6. There is only one HV electrolytic filter capacitor. You need to roll the AVR board up out of the way and will see that there is a 2<sup>nd</sup> hole punched in the chassis to mount the other filter cap. Suggest you remove the existing cap and buy and install a HV filter cap kit from K4EAA.
7. There is a 12k ohm resistor R22 that drops the screen grid voltage to the finals. It needs to be removed and discarded. I do not remember if there is an R6 470 ohm resistor or not on the HV Rect board. I believe that there is as it is needed to complete the C-R-C Pi filter, but you need to verify.
8. You will need another brown phenolic plate cap and parasitic suppressor for the 2<sup>nd</sup> final tube. You will mount and solder that on top of the main RF Plate Choke in the PA cage. I suggest you remove the S2001A and install two NOS 6146B or 6146W tubes unless you have a source for another S2001A tube. One thing that I am not certain of is if the plate choke is the larger weave or pi-wound choke or a solenoid wound choke. If it is pi-wound it is possible that the glass envelopes of the tubes might make contact with it. If that is the case then I would buy a TS530/830 solenoid wound choke from Bob Mansker KE5FTF and install it as it will be smaller in diameter. Contacting the choke winding with the hot tube glass envelope could damage the choke winding insulation.
9. You will need to install a 2<sup>nd</sup> parasitic suppressor at the control grid of the 2<sup>nd</sup> tube to couple the RF drive to the control grid Pin 5.
10. You will need to install a 100 ohm stopper resistor at Screen Grid Pin 3 of the 2<sup>nd</sup> tube and a .01 rf bypass capacitor.

11. I believe that the cathode of the S2001A has two 10 ohm cathode resistors and 3 RF bypass caps. I suggest you remove them as they will be carbon composition and replace them with four metal film 20 ohm ½ watt resistors. Place two resistors in parallel at each tube cathode pin to ground. You will also need to add 3 more .04 uf disc ceramic rf bypass capacitors. Again you are simply making the wiring for the two final tubes exactly as depicted in the TS520 schematic.
12. You will need to check the fuse holder and remove any lower amperage fuse (typically a 4 amp) and replace it with a 6 amp.

If you are uncertain about the ratings of any of the capacitors and resistors check the TS520 Service Manual parts list and use the exact same wattage and WVDC ratings.

Where I have listed a capacitor or resistor identifier above such as C41 or R18 you will need to verify that for yourself. If you decide to buy a TS-520 cooling fan from Bob Mansker you of course will have to provide wiring for the 100vac supply for it. You will obtain that off the 100 vac tap on the primary side of the power transformer just as shown on the TS-520 schematic.

Make sure that you do a very good QC of all the wiring before you power it up.

You will also have to set the zero signal resting plate current to 60ma before attempting to load the radio. I would also carefully measure the anode voltage at top of the RF plate choke, the screen grid voltage, the cutoff bias and operating bias voltage at the control grids and the heater voltage at both tubes. With the exception of the 900 vdc anode all the other voltages will be read at the tube socket solder lugs.

I do not think that there is any change needed on the RF board for the 12BY7A Driver tube screen grid divider resistors. I would measure the Driver tube Anode and Screen Grid voltages to make sure to spec. I believe the only change in the RF drive to the final tubes was the addition of the 15pf shunt capacitor at the control grid of the S2001A tube. With that capacitor removed you should have around 45 rms rf volts drive available and good ALC indication in Tune mode when loading. You of course will load normally as you would for any TS-520 radio and not to exceed approx 200ma for 100 watts output.

Lastly, since you have added a 2<sup>nd</sup> tube and associated wiring you will have changed the fixed parasitic capacitance that the Driver LC tuned circuits see. Therefore you will have to re-peak at minimum the 28 mhz Drive coil for maximum ALC indication. You may want to take the opportunity to do the entire coil pack alignment.

I may have overlooked something here. Again, very carefully check your new wiring against the schematic before energizing the radio.

Regarding the TS-520V it is my belief that the only difference is that it has a Final board with only one socket mounted on it instead of octal sockets with point to point wiring. The above steps will apply to it as well.

I would appreciate hearing from anyone who takes on this conversion.

73s

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