KENWOOD

Technical Information Exchange

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TS-830 Receiver Level Diagram

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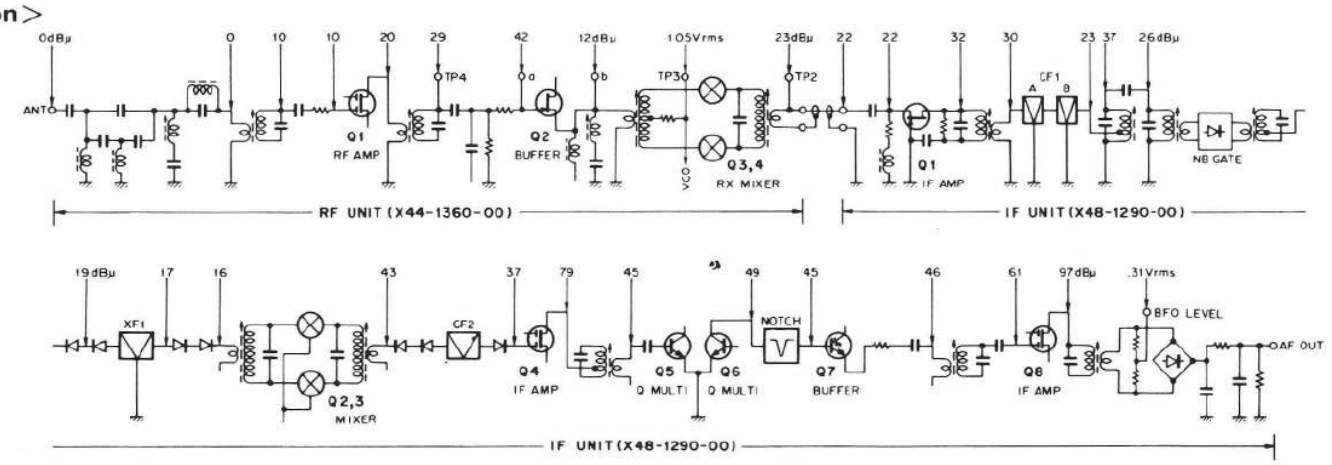
In response to email queries about how to use RX Level Diagrams in the TS-830 service manual to troubleshoot a dead or very weak receive condition here is an explanation of how to use them. Unfortunately this diagram is not very useful if you have a dead receiver or one with very low sensitivity. I will explain later. Here is how I believe that Kenwood intended that you use the RX Level Diagram and this explanation serves for all the Kenwood hybrid models.

＜RX Section＞



NOTES:

1. The figures shown are signal generator output required for a constant audio output with a constant AF gain control setting and AGC SW OFF. Set the AF gain control for 0.63/8Ω (50 mW) audio output 0 dB signal generator input at 14.2 MHz.
2. To inject signal generator output connect a 0.01μF 500V capacitor between the signal generator and the check point.
3. To check the level at point a, the secondary ANT coil is grounded.

1. RX Level Diagram does not show signal levels that you would expect to find and measure with your VTVM and RF Probe or O-scope. This is a common misunderstanding.
2. RX Level Diagram shows test points and typical signal levels that you need to inject with a Signal Generator and an "injection probe". When you do this you obtain a specified audio output signal level (0.63volts) across an 8 ohm dummy load connected to the remote speaker jack on the rear of the rig. The voltage level of 0.63volts = 50mW audio output.
3. To use the RX Level Diagram you need:
   A. Stable, accurate, shielded RF signal generator
   B. Calibrated output attenuator
   C. An "injection probe" (coax lead with .01 uf 500v cap in center conductor)
   D. 8 ohm non-inductive dummy load (6-47 ohm ½ watt carbon resistors in parallel will work)
   E. AF VTVM (most VTVMs will work at audio frequency ranges)
   F. 50 ohm dummy load for antenna input
   G. The ability to convert the KW Japanese signal levels listed on the Level Diagram to American uv or dBm levels. For example if the RX Level diagram shows that you need to inject 29dBu at TP-4 at the output of the RF amp then you need to set your RF sig gen for 14.0uv or -84dBm. (If you do not know how to make these conversions then contact me)

4. Connect the RF Signal Generator to the Antenna SO-239 connector on the rear panel of the rig. Set the frequency to 14.200 Mhz and adjust the output level for 0dbu which is 0.50uv or -113dBm. Note: This is where hams with older Heath/Eico LC style generators that lack a calibrated step attenuator may have a problem.
5. Make sure there is no S-meter indication. Cannot have any AGC action. You may need to turn the AGC off.
6. Connect an 8 ohm dummy load at the Remote Speaker Jack.
7. Connect AF VTVM across the 8 ohm dummy load.
8. With 0.50uv RF signal applied at Antenna Connector adjust the AF Gain control until you read 0.63 volts across the 8 ohm dummy load.
9. Remove the RF Sig Generator (leave set to 14.200 mhz) and install 50 ohm dummy load at Antenna Connector. Note: DO NOT adjust AF Gain for any of the next steps.
10. Connect "injection probe" to the RF Signal Generator. Connect ground lead to chassis. Touch probe (free end of .01uf blocking/coupling capacitor) to first test point on the RX Level Diagram. Adjust RF Sig Generator output attenuator until you read exactly 0.63 volts on the AF VTVM across the dummy load. Write the RF Sig Generator dBm or microvolt output level down. Repeat this for each of the RX Level Diagram test points. Now you can compare your results with the levels on the diagram and can see where you had to inject a higher level to obtain the 0.63v output.

Where you see higher levels of required signal injection than what is listed on the RX Level Diagram in the service manual is where you would begin your troubleshooting. Depending on where you see this it could be as simple as cleaning a connector.

You can see why it is critical that you can inject a known calibrated signal level from your RF Signal Generator or be able to accurately measure what that level is.

Note: Once you leave the RF board and move on to the IF Board you have to set the RF Signal Generator for the 1st IF of 8.830 Mhz, adjust level and re-inject, do this again for the 455 Khz 2nd IF and then AF levels on the Audio Board (1 khz is acceptable). On very weak receivers you may chose to work backwards toward the RF board and antenna connector.

Now as I mentioned above this process does not lend itself well to inject signal levels on a receiver that has very low sensitivity. If you have a low sensitivity receive the problem you could have is the need to inject such a high level of RF to get the required 0.63v audio output across the dummy load that it could attack the AGC and result in injection signal levels significantly higher than the typical values listed on the RX Level Diagram. This is another reason you may have to turn the AGC off.

For this reason on dead or very weak receivers I don't usually reach for the RX Level Diagram as a starting point for troubleshooting.

Here is very briefly how I would troubleshoot a dead receiver:

1. Make sure all controls are properly set for receive.
2. Exercise the RF gain pot and see if the S-meter deflects upscale. If so it tells you that the AGC bus is hot and the gain controlled IF and RF mosfets should see the DC control voltage to turn them on. It also tells you that the S-meter circuit is working.

3. Exercise the RF attenuator, the FIX switch, the JJY Switch. Maybe even flip to Send a couple of times to exercise the Aux TR and Ant relays.
4. Turn on the Marker. Should see approx S9.
5. Try injecting 50uv from RF signal generator into the SO-239 connector. Should see approx S9. We do this in case the Marker signal is bad.
6. Try head phones if you are seeing S-meter indication and hearing no audio from the speaker.
7. Try all bands.

If the above fails then I typically chose to do a split search or half approach. I inject 8.830 Mhz signal (approx 500uv or -53dBm) at the RIF terminal on the RF board. If you get good audio output tone level and approx S9 meter indication you know that the IF chain, AGC detector, Product Detector, and the Audio chain are good and the cause of the low receiver sensitivity is then from the RIF connector on the RF Board back to the Antenna connector. It doesn't mean you don't need to align anything in the IF chain for peak receiver performance. It means no gross failures in the IF and AF boards. It means there is most likely an RF board failure such as bad board connectors, bad RF amp Q1 and/or bad transformer L41 (all common causes of weak or dead receive.)

If you get no tone and no S-meter indication when you inject the RIF signal then go to the AF gain pot and connect a jumper lead to the wiper and touch it with your finger. You should get a hum in the speaker. If you do then you know that the Audio pre-amp and output stage is working. Can also key the rig in CW mode and see if you hear the side tone. It would take far too many keystrokes to try to describe all weak or dead receiver troubleshooting steps. Don't forget to make sure you have good regulated 9vdc and RF-1 levels from the AVR board.

Back to the RX Level Diagrams:

If you have a receiver that is performing pretty well and you have the required test equipment you may want to run the RX Level Diagram and record all your injection levels for future troubleshooting. If you find your injection levels closely match the Kenwood levels you know the performance of your rig is near spec and you have good baseline readings. If you find any injection level significantly higher you can troubleshoot that area.

I have SSG dBu to uv and dBm conversion tables if anyone needs them. I can also provide you with formula that you can use with scientific calculator to convert any dBu value.

I have marked up the RX Level Diagrams in the service manuals to reflect the dBm levels for each dBu injection level.

Be glad to talk to anyone off line about the RX Level Diagram.

Best 73s

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