

FL-2100B and FL-2100Z WORKING WITH SOLID-STATE TRANSCEIVERS

Ron Mills VK5XW

13 Taylor Terrace, Rosslyn Park, SA. 5072

Following are one persons experiences with a problem that has always existed with the FL-2100 series linear amplifiers interfacing with solid-state transceivers.

These linear amplifiers present a mismatch to the transceiver, resulting in a high SWR reading, in particular on the 21 to 28 MHz bands. This is very noticeable when the transceiver is working with the linear in the standby or off position. Typical SWR readings are 1.7:1 on 21 MHz and 2.5:1 on 28 MHz. (Lower bands are only marginally affected). This unwanted SWR causes the solid-state transceiver to reduce output power by as much as 20 percent on 28 MHz. The FL-2100 series was not designed for solid-state operation but for transceivers with valve outputs such as the FT-101, etc, where any mismatch caused by the insertion of the linear into the circuit is better tolerated.

With the FL-2100B in the OFF position, the RF from the transceiver goes from the "RF IN" SO-239 socket via a change-over relay, to an old style SWR bridge then to the "RF OUT" SO-239 socket. All of this wiring is done with heavy silver-plated wire. Numerous ways were tried to reduce the mismatch and the only success achieved was to remove the wire from the relay to the SWR bridge and route it directly to the "RF OUT" socket. This brought the SWR on both 21 and 28 MHz to around 1.3:1, but made the SWR bridge inoperative. The SWR problem could be overcome somewhat with the linear operative by retuning the input circuits for each band. (This is only possible on the FL-2100B and the FL-2100Z (pre-WARC band model)). The FL-2000 does not have tuned input circuits.

In December 1986, an article appeared in a local radio magazine regarding this problem in the FL-2100 (models not specified). The author claimed that by replacing the silver-plated wire with coaxial cable the problem had been solved. Thinking something must have been overlooked in my original attempts I retraced my steps gradually replacing the SWR bridge and the wiring with coaxial cable only to find it made no difference to the FL-2100B. The coaxial cable was then taken out and the original wiring replaced, again bypassing the built-in SWR bridge. Things were left like this until a FL-2100Z, with WARC bands fitted, was purchased.

I am now using an IC-751 which has its own built-in SWR bridge. As the same high SWR was being encountered with the FL-2100Z, a search began again in an attempt to get rid of the mismatch as much as possible, as the majority of operating at this QTH is barefoot and the linear is sitting inoperative in-series with the IC-751.

The IC-751 was connected, via a short length of RG-213U coaxial cable, to the FL-2100Z, then via the same type of cable to a Welz CT-300 dummy load. The SWR read on the IC-751 was again around 1.7:1 on 21 MHz and 2.6:1 on 28 MHz.

Imagine my surprise when I removed the bottom from the FL-2100Z. There were now two relays in the input/output circuit. The first relay from the input SO-239 socket was a small one and the one that takes the full output power with the linear operating was the same large type used in the FL-2100B and the non-WARC FL-2100Z (the non-WARC Z model still only uses the one relay). The SWR bridge in both models were now using a compact toroid type SWR bridge mounted right at the output SO-239 socket. What made things even more interesting was the fact that all of the RF wiring was done in coaxial cable (so much for the theory of replacing the wiring with coaxial cable!).

The large output relay has two change-over sets of contacts. By using the second smaller input relay, one set of contacts became vacant on the output relay. These contacts were then paralleled with heavy gauge tinned copper wire to those in use and immediately the SWR dropped to around half the original readings. The coaxial cable used for the input circuits, ie from the "RF IN" SO-239 to the small relay and from the small relay to the large output relay change-over contact was quite small in diameter. This small cable also went from the non-operated change-over contact of the small relay to the input circuits of the linear proper — incidentally, the input circuits for each band on the Z model are non-tunable — the non-WARC Zs are tunable.

An attempt to replace this thin coax with the same length of RG-58 C/U gave exactly the same SWR. On impulse, the original thin coax was paralleled with the length of RG-58 C/U. The SWR went down. The coax was then paralleled from the small relay to the output relay with RG-58 C/U of the same length. The SWR had now dropped to 1:1 on both 21 and 28 MHz. I have no explanation why this paralleling of the two coaxial cables of nominal 50 ohms each finally removed the mis-match in combination with the paralleling of the relay contacts, however, it works! This has been verified by two other amateurs who replicated the above with similar results.

An interesting side effect of these modifications relate to the FL-2100Z built-in SWR meter. As delivered, the SWR meter would not move off zero unless there was a very large mis-match in the antenna system. After the alterations, it operated as it should! This was also verified in the other two FL-2100Zs modified.

Hopefully the above may prove useful to other amateurs who do not like losing power with their solid-state transceivers due to the impedance mis-match of the FL-2100Z.

Do not forget that there are **very lethal** voltages inside the linear when on (standby and operating) so ensure that the linear is unplugged from the mains power when doing any work on it.

I have shifted the voltage tap on the power transformer from 850 volts to 620 volts. This reduces the output voltage from 2400 volts to 1800 volts. PEP of 400 watts is still easily available with reduced stress on the 572B valves and there is less likelihood of any flash-over due to antenna mis-match during tuning.

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Figure 1: Test Set-up using the IC-751 SWR Meter.

