

The Best Active Whip Antenna

formerly

J310 – J271 High Z Preamp IIP2 Optimization

Dallas Lankford, 4/6/2011, rev. 4/25/2011

The J310 – J271 high Z input preamps for MW applications were optimized for the MW band. This short note shows how to optimize the preamp for other frequencies. For the MW band, the J271 gate resistor to ground was fixed at 820K ohms. This was not the optimum resistor value for highest MW IIP2, but merely the closest standard resistor value. In general, a variable 1M 25 turn pot (trimmer) allows maximum IIP2 to be achieved for any frequency by alternately adjusting the J271 1M 25 turn pot and the J310 10K 25 turn pot. In this way the IIP2 of the J310 – J271 preamp can be made considerably higher than the IIP2 of any currently available receiver from MW up to at least 15 MHz (in the latter case for 2 tones below 15 MHz). IIP2 tends to be lower at higher frequencies, varying from about +100 dBm in the MW band to about +83 dBm at 15 MHz. Perhaps using 2 each parallel FET's can improve this, but I can't think of any reason why the IIP2 needs to be higher than +83 dBm at 15 MHz. Even if you got IMD2 from the original version, the IMD2 was probably around 15 MHz due to 6 and 9 MHz signals, and originating in your receiver, not in the J310 – J271 preamp. And it was probably because the antenna you connected the preamp to was too large, like a 15' high by 40' long flag (600 ft²) which one SWL used. Flag antennas are loop antennas, and their signal outputs increase as frequency increases. The largest MW delta flag I would use would be 15' x 60' (450 ft²). For SW I would down size it to one half or one third the area of the MW flag or delta flag. That would still give you an excellent antenna with more than enough sensitivity for 0.5 to 30 MHz (probably OK for NDB / LF as well). Larger delta flag or flag arrays are only useful at a few remote DX locations with very low levels of man made noise, like Kongsfjord, Norway.

The J310 – J271 high Z preamp makes an excellent high performance active whip antenna. It is inexpensive, easy to build, and beats all the others for IIP2 in the MW band (typically +110 dBm). If you don't have an intercept measurement system, replace the 1M pot at the gate of the J271 with a 820K ohm fixed resistor, and adjust the 10K ohm pot for about 5 volts at the source of the J271.

The common mode chokes are 24 bifilar turns of #24 enameled copper wire on a high permeability FT-50 ferrite toroid.

The output impedance of the preamp is about 150 ohms. Speaker wire impedance is about 100 ohms nominal. There is no need to impedance match the preamp to the twin lead. The balun at the receiver can be a 1:1 balun, 8 bifilar turns #24 enameled copper wire on a high permeability T-50 toroid.

FB ferrite beads are Amidon FB-101-61 (or 64).

