

socket for the detachable ac line cord has a built-in fuse holder, and there's a GROUND lug with wing nut. An internal switch accessible from the side panel toggles between 90-132 and 180-264 V ac input. Ten-Tec let us know that the power module vendor was changed in early 2011. The test results shown are for the current production model.

As shown in Figure 13, this unit has significant spurious output with a 20 A load such that it is audible, especially at 5 MHz. ARRL Lab Engineer Bob Allison, WB1GCM, tried wrapping 10 turns of the dc power leads around a mix 31 ferrite toroid with the result that the spurious was reduced by 24 dB, making it, and other spurious outputs, inaudible. Ten-Tec noted that they didn't hear any noise during their testing of this supply at normal receive power levels. Based on the input from our testing, Ten-Tec has informed us that all power supplies in current stock, and those in future production, will include similar filtering within the unit cabinet. In addition, they will supply a simple to install (no soldering required) retrofit kit that fits into the cabinet at no charge to owners of earlier units who request one.

Instructions are on a single 8.5 x 11 inch sheet and include a general description, installation and use instructions and specifications. No warranty information or schematic is included, but the Ten-Tec website describes a 1 year warranty on Ten-Tec products.

Manufacturer: Ten-Tec Inc, 1185 Dolly Parton Parkway, Sevierville, TN 37862, 800-833-7373; www.tentec.com.

Lab Testing

Tables 2 through 5 show the results of operational testing in the ARRL Lab. All of the supplies measured very close to 13.8 V output with no load. To simulate typical use during SSB or CW operation, the Lab tested dynamic regulation by switching rapidly between 1 A and 20 A loads. The test result appears as *DC variation during dynamic testing* in the tables. The supplies reviewed here all tested between 110 mV and 140 mV, in line with the best of the supplies reviewed previously.

Typical of switch mode power supplies, all of the supplies reviewed are tolerant of swings in ac line voltage. Any of these supplies would be a good choice for emergency or portable operation with variable ac sources. The *Low line drop out voltage* is the point at which a power supply's output drops to 11.4 V dc, the minimum specified operating voltage of most transceivers. This test was done with a 20 A load. With the supply loaded down and operating at the dropout threshold, a substantial ac ripple at the output was observed — between 1 and 1.5 V peak to peak. The ripple disappears when each supply gets to about 90 V ac input. The ripple is not as severe with a

Table 6
Conducted Emission Levels of Switching Power Supplies†

FCC Part 15 conducted emission limits (dBµV) are:
0.15 - 0.5 MHz, 66 to 56 (decreases with the logarithm of the frequency);
0.5 - 5.0 MHz, 56; 5.0-30.0 MHz, 60;
>30.0 MHz, none.

†Lower numbers indicate better Part 15 compliance.

Conducted Emissions in dBµV Measured in the ARRL Lab

Jetstream JTSP30M

MHz	1 A	7 A	20 A
0.522	44.2	45.0	49.7
0.770	46.5	47.9	51.1
1.635	41.3	45.9	51.3
9.336	39.7	42.0	47.0
9.783	40.4	45.0	52.0
1.834	31.0	44.4	51.7
1.898	31.0	45.6	51.7
3.582	28.9	40.0	47.6
3.782	28.6	38.7	46.6
7.171	22.7	39.6	38.6

Powerwerx SS-30DV

MHz	1 A	7 A	20 A
0.472	42.6	50.0	52.4
0.801	42.6	49.0	50.4
1.606	40.0	48.6	52.8
9.396	41.2	51.0	53.0
9.678	47.3	53.7	58.1
1.801	36.6	44.8	49.7
1.872	36.6	44.0	50.6
3.524	33.6	40.5	49.6
3.812	32.0	42.0	44.1
10.103	44.9	49.7	56.1

QJE DX PS30SWII

MHz	1 A	7 A	20 A
0.462	36.1	42.9	42.9
0.970	33.6	42.9	47.0
1.595	30.8	42.0	47.9
6.011	20.0	36.2	43.7
10.860	23.7	35.6	38.0
1.848	24.6	42.1	48.2
1.975	27.0	41.8	48.0
3.892	21.2	34.9	42.2
3.986	18.8	36.1	42.2
7.042	18.0	35.1	38.8

Ten-Tec 941

MHz	1 A	7 A	20 A
0.340	44.9	48.0	48.1
1.130	35.9	39.2	40.5
2.644	27.8	37.3	42.0
4.311	23.7	30.7	39.8
9.071	24.3	30.3	38.2
1.809	30.6	34.7	41.0
1.861	24.3	39.2	42.0
3.629	23.8	33.2	42.0
5.341	21.0	33.8	38.4
14.313	17.0	29.2	35.0

†Frequency for 20 A measurement if different from 1 A and 7 A measurements.

light load; no audible hum was observed on reception. However, the Lab does not recommend transmitting at full power with a line voltage below 90 V.

Figures 6 through 13 show the output of each supply under a 20 A load. In the first plot in each set an oscilloscope was used to observe ripple on the dc output, as well as the presence of high frequency switching spikes while under load. All of the supplies exhibit low ripple. High frequency switching spikes were evident on the output of the Powerwerx and Ten-Tec supplies.

The second plot in each set shows broadband noise on the output of each supply. In this test, the supply is connected to a 20 A load. The supply output is ac-coupled to a spectrum analyzer and the analyzer set up to sweep the frequencies from 1.5 to 100 MHz. The resulting spectral plot shows the level of noise generated by the power supply at these frequencies. The spectral plot is actually made up of carriers approximately 30 kHz apart. Since the entire plot is 100 MHz wide, there is not enough resolution to see each carrier.

The level of broadband noise generated by the switching power supplies is generally higher with higher loads. These plots show performance under a typical 100 W transmitter load, and the noise levels are lower with the 1 A load typical during receive. All of the power supplies reviewed here produce higher levels of broadband noise throughout the HF and low VHF spectrum compared to the best supplies featured in previous reviews.

Finally, each supply was tested for conducted emissions (noise that the device conducts into the ac house wiring and power lines via the device power cord). The sidebar "Conducted Emissions Testing" that accompanied the August 2009 power supply review (Note 5) covers this test in detail.

Table 6 shows the FCC limits of conducted emissions and the five highest levels inside and outside the amateur bands as measured in the ARRL Lab. Tests were conducted with 1 A, 7 A and 20 A loads. All of power supplies tested here passed Part 15 requirements for conducted emissions levels except the Ten-Tec 941 with a 20 A load on 160 meters. Overall, the QJE DX PS30SWII was the quietest of the units tested, followed closely by the Jetstream JTSP30M. The Powerwerx SS-30DV was the only supply in this group with the required FCC Part 15 compliance notice on the cabinet. Remember that the Part 15 compliance levels are stringent enough to reduce — but not eliminate — interference.

Any of the supplies tested here will power a 100 W HF transceiver and accessories. As noted here and in previous reviews, there is a lot of choice in features and specifications. Take a close look at noise performance, particularly if you operate at 7 MHz or lower.