Pascal Villeneuve, VA2PV, va2pv@arrl.org

Product Review

Xiegu XPA125B 1.8 – 50 MHz 100 W Amplifier

Reviewed by Phil Salas, AD5X
ad5x@arrl.net

Besides my main station Elecraft K-Line (K3/KPA500/KAT500), I also own some QRP rigs — namely Elecraft KX3, Xiegu X5105, and Xiegu G90 transceivers — which I use primarily for portable operations. The Xiegu XPA125B 100 W amplifier is an interesting addition for those who want to use their QRP radios as part of their higher-power fixed station. While the XPA125B is clearly designed to seamlessly interface with the Xiegu X108G, X5105, X6100, and G90 transceivers, it will also work with any QRP rig. And an internal wide-range automatic antenna tuner provides antenna system flexibility when necessary.

XPA125B Amplifier Technical Details

The XPA125B is powered directly from a standard 13.8 V dc power supply capable of 20 – 25 A. There is no fan (i.e., the heavy metal case provides the necessary thermal protection), and a handle on the left side provides ease of transport. The amplifier is specified to output 100 W on 160 – 10 meters, and 80 W on 6 meters, typically with less than 5 W of drive. Transmit and receive switching is provided by an internal relay. There is an amplifier bypass switch, and the XPA125B is also bypassed when it is powered off. The XPA125B provides manual band changing for non-Xiegu transceivers, and auto band switching when used with Xiegu transceivers.

The XPA125B Display and Fault System

There is significant control, monitoring, and display information available on the XPA125B's LCD front panel display. Displayed functions include input and output SWR, input and output RF power, voltage and current, PA stage temperature, and band and ATU status. Four buttons provide manual control of the amplifier: the one on the left is an **ON/OFF** power button, the **PA** is used to switch between standby and operating, the **BAND** button is for band selection, and **ATU/TUNE** enables the automatic antenna tuner. The XPA125B also monitors multiple parameters to protect it from damage. These include high SWR (>3:1), high current (≥25 A), high voltage (≥15 V dc), and high temperature (≥100 °C). A fault condition suspends normal operations, normally by bypassing the amplifier. Faults clear automatically when the amplifier is unkeyed. The full XPA125B specifications are shown in Table 1.

Setting Up the Amplifier

Begin by installing the 30 A fuse in the fuse holder if it is not pre-installed. Connect the following: a ground wire, the antenna coax into the SO-239 **ANT** con-

Figure 1 — The Xiegu XPA125B rear panel.

Bottom Line

The XPA125B is a compact 100 W amplifier that is designed to work with any QRP transceiver. The built-in automatic antenna tuner adds to its operating flexibility. However, there are technical issues that one needs to be aware of.

nector, the coax from the transceiver to the SO-239 **TRX**, and the power amplifier (PA) key cables from the **COMM** 3.5-millimeter port to your transceiver. The PA key interface is not necessarily compatible with all transceivers. A ground enables the amplifier. However, if 3.2 V dc or more is applied to the XPA125B PTT port, the internal processor will be permanently damaged. The optional CE-19 interface provides ALC, PTT, and band-changing information for the Xiegu X5105 and G90 transceivers, and the correct PTT interface for non-Xiegu transceivers. The Xiegu X108 and X6100 transceivers interface directly with the XPA125B without requiring the CE-19. If you are using Xiegu transceivers, set the input power to 5 W, as the ALC interface will adjust the driving power as required. For non-Xiegu transceivers, the input power should be initially set to 1 W. Finally, connect the 13.8 V dc into the **DC IN** port, and turn on the amplifier by pressing the power button for 2 seconds (see Figure 1 for the rear panel connection ports).

Performance Measurements

Because the XPA125B will typically be used with 5 W QRP transceivers, I tested it up to a maximum of 5 W drive, as the specifications note that this is the typical drive level needed for full power. Table 2 details the measured amplifier input versus output. The XPA125B display power readings are compared to a NIST-traceable Array Solutions PowerMaster (input), and Mini-Circuits PWR-6GHS+ sensor and calibrated attenuators (output).

The first thing I noticed was that there was about a 0.5 to 0.6 V dc voltage drop through the dc connector on the XPA125B at the higher current levels. There was another 0.3 V drop along the 3-foot dc power cable supplied with the unit. The XPA125B power connector is a six-pin Molex, but only two tin-plated pins are used for power. Also, the power cable appears to be about 16 gauge, but 14- or 12-gauge wire would be more appropriate. To keep the voltage at 13.8 V dc on the XPA125B display, I had to set my power supply to 14.6 V dc. This resulted in 100 W output on 20 meters. Setting my power supply to 13.8 V dc resulted in the maximum output on 20 meters dropping to 94 W. Also, the XPA125B internal wattmeter appears centered in accuracy on 20 meters. It reads low below 20 meters, and high above 20 meters. So, while the internal wattmeter appears to show that you are close to the typical 80 W specification on 6 meters, the actual power is 62 W with 5 W drive. Also, the input power monitor reading is significantly in error. Finally, I found that the input and output SWR and power readings do not work unless the amplifier is on-line and being keyed. Of course, when this is the case, the input SWR

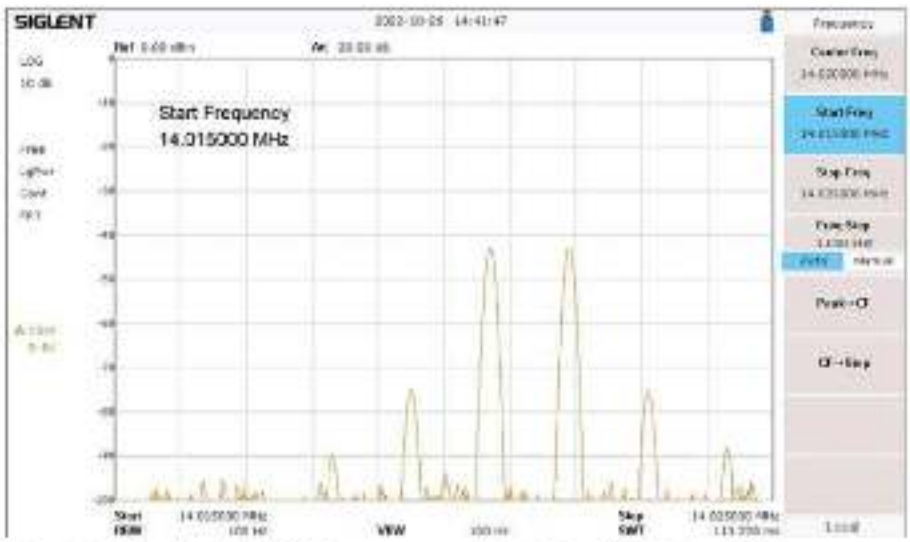

Figure 2 — The Xiegu XPA125B two-tone test with the Elecraft KX3 set at 5 W output.

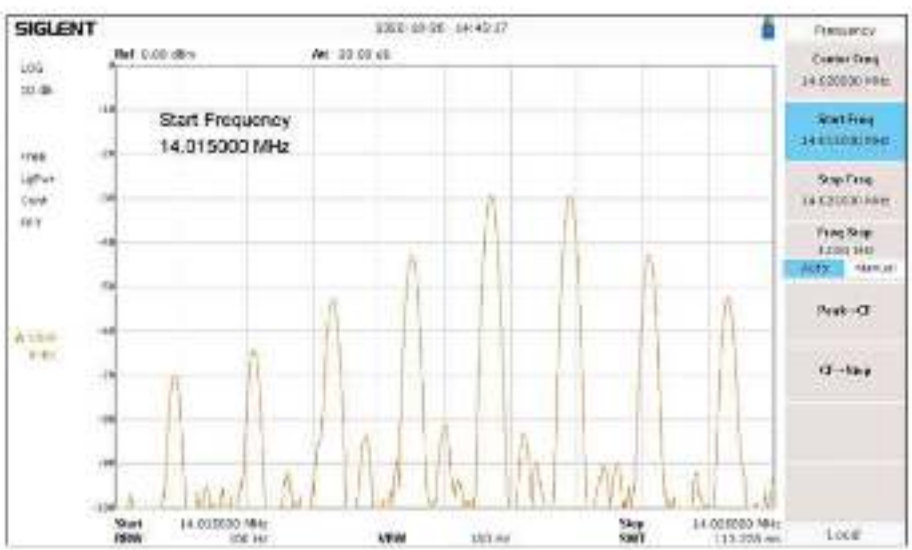

Figure 3 — The Xiegu XPA125B resultant two-tone output.

always shows 1:1, as it is looking into the input of the on-line amplifier.

Finally, the gain drops as you increase drive. This indicates that the amplifier is going into compression at the higher power levels. This implies that you are degrading IMD as you near the amplifier's rated output. My KX3 has a built-in two-tone generator, so I looked at the barefoot KX3, and then the KX3 driving the XPA125B to 94 W on 20 meters (external power supply set to 13.8 V). As you can see in Figures 2 and 3, there is significant degradation of IMD performance when the amplifier is used.

The XPA125B Automatic Antenna Tuner

The XPA125B internal ATU provides manual (user-initiated) tuning. Tuning is initiated when the **ATU/TUNE** button is pressed for several seconds, and 5 W of RF carrier is applied. The ATU can be used whether the amplifier is on-line or not. If your QRP transceiver doesn't include an ATU, the XPA125B will take care of this for you. However, as mentioned earlier, the XPA125B SWR meters do not work unless the amplifier is on-line and keyed. The automatic tuner will tune, but you have no indication of the final SWR unless your QRP transceiver has an SWR meter.

Tuner Matching and Loss Measurements

Resistive matching range and loss testing was performed with the precision setup described in the "Product Review" column in the August 2012 issue of *QST* (see **www.arrl.org/qst-in-depth** for details). Tuning power was set at 5 W, per Xiegu recommendations. All measured losses are subject to the ±3% accuracy of my NIST-traceable test equipment. The XPA125B tuning range is specified at 14 – 500 Ω resistive, though

Table 1
Xiegu XPA125B, serial number X02DG22210070

FCC ID number 2ANLH-XPA125B.

Manufacturer's Specifications	Measured in the ARRL Lab
Frequency range: 1.8 – 30 and 50 – 54 MHz.	160-, 80-, 60-, 40-, 30-, 20-, 17-, 15-, 12-, 10-, 6-meter bands, as specified.*
Power output: 100 W PEP with 12 V – 15 V dc on 160 – 10 meters; 80 W on 6 meters.	100 W, as specified on 160 – 12 meters. 79 W on 10 meters, 62 W on 6 meters with 13.8 V dc.
Driving power required: Max 5 W.	1.8 – 54 MHz, 0.2 – 5.0 W (see Figure A).
Spurious and harmonic suppression: >50 dB.	HF, >61 dB; 6 meters, 50 – 76 dB. All bands except 6 meters meet FCC requirements.
Third-order intermodulation distortion (IMD): Not specified.	3rd/5th/7th/9th-order products (dB below PEP at full output): 14 MHz, –20/–29/–41/–46 dB. See Figure B (dB below PEP at 80 W output): 14 MHz, –28/–39/–38/–46 dB. See Figure C.
Transmit-receive switching time: Not specified.	Key to RF output: 31 ms. Unkey to receive: 30 ms.

Power requirements: 12 – 15 V dc, 30 A max.

Size (height, width, depth, excluding knobs, handles, and connectors): 2.8 × 6.3 × 10.3 inches. Weight: 5.86 pounds.

*In the US, the legal power limit on 30 meters is 200 W PEP output, and on 60 meters it is an ERP of 100 W PEP relative to a half-wave dipole.

Table 2
Xiegu XPA125B Amplifier Measurements, 13.8 V dc amplifier display. Standby: 0.16 A, key down, no drive, 2.1 A.

Band	True Input	XPA125B Mon In	XPA125B Mon Out	True Output	Gain	DC Amps Act/Mea
160 M	1.0 W	0.1 W	61 W	62 W	17.9 dB	10/11
	2.0 W	0.3 W	86 W	89 W	16.5 dB	11.8/14
	3.0 W	0.5 W	94 W	98 W	15.1 dB	12.4/14
	4.0 W	0.7 W	98 W	103 W	14.1 dB	12.6/14
	5.0 W	0.9 W	100 W	108 W	13.3 dB	12.7/14
20 M	1.0 W	0 W	73 W	72 W	18.6 dB	7.9/8
	2.0 W	0 W	85 W	85 W	16.3 dB	8.7/9
	3.0 W	0.1 W	92 W	91 W	14.8 dB	9.3/9
	4.0 W	0.2 W	95 W	96 W	13.8 dB	9.7/10
	5.0 W	0.3 W	100 W	100 W	13.0 dB	10/10
10 M	1.0 W	0.1 W	68 W	63 W	18.0 dB	6.9/7
	2.0 W	0.1 W	86 W	82 W	16.1 dB	8/8
	3.0 W	0.2 W	91 W	87 W	14.6 dB	8.5/9
	4.0 W	0.3 W	93 W	89 W	13.5 dB	8.8/9
	5.0 W	0.4 W	97 W	94 W	12.7 dB	9.1/9
6 M	1.0 W	0.1 W	37 W	30 W	14.8 dB	7.5/8
	2.0 W	0.3 W	52 W	44 W	13.4 dB	9.3/10
	3.0 W	0.7 W	63 W	51 W	12.3 dB	10.2/11
	4.0 W	1.0 W	72 W	57 W	11.5 dB	11.1/12
	5.0 W	1.4 W	76 W	62 W	10.9 dB	11.8/13

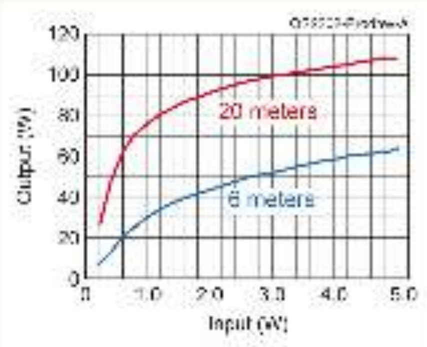

Figure A — Xiegu XPA125B amplifier input versus output power.

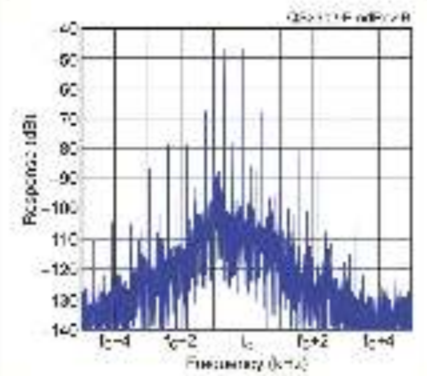

Figure B — Xiegu XPA125B amplifier transmit IMD at 100 W on 20 meters.

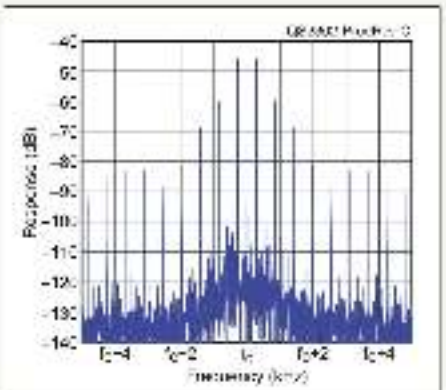

Figure C — Xiegu XPA125B 20-meter band IMD performance at 80 W. Third-order products are –26 dBc, and fifth-order products are –39 dBc. Overall, throttling back to 80 W will transmit a cleaner signal on the bands.

Lab Notes: Xiegu XPA125B 1.8 – 50 MHz 100 W Amplifier

The Xiegu XPA125B amplifier presented quite the challenge for the ARRL Lab to test. We had originally obtained a slightly older version of this amplifier. It worked well enough, except for the problem that the RF power output was low on the upper bands. This might not have been a problem in and of itself, but when we pushed it hard to get closer to the rated power, the transmit IMD performance was not good at all. We then found that Xiegu had a new and improved version of the amplifier, so the editors decided to review the new unit.

When we received the new version, we saw the same problem with power output on the 10- and 6-meter bands. Worse, this unit did not meet the FCC limits for spurious emissions on 6 meters. We had purchased the amplifier through HRO, so we contacted them. HRO immediately agreed to exchange the amplifier for us. The replacement arrived promptly. It was a bit low on power on the upper bands, but not as bad as the older version had been. But the unit would not go into transmit on 80 meters and displayed a **LOW EFFICIENCY** error message. Again, HRO immediately agreed to help, and we soon had a third unit. (Kudos to HRO for its excellent customer service!)

Like the previous two amplifiers, this amplifier, again, did not meet its power output specification on both the 10- and 6-meter bands (see Table 1). The harmonics on 6 meters did not meet the FCC limits for spurious emissions. If this amp is to be used on 6 meters, an external filter must be used.

The transmit IMD, measured at full available power on all applicable bands, was marginal, but a noticeable improvement was observed when the output power was reduced to around 80 W (see Figures B and C). If users of this amplifier want to be good neighbors on the bands, on SSB it is best to throttle the output back from full power to achieve the cleanest signal from the amplifier on any band.

The amplifier showed another unexpected anomaly. The input power was reading significantly low on the amplifier's input power meter compared to the input power measured on the Lab's wattmeter. For example, on 20 meters, the input power read 0.5 W, with an input power of 5 W measured using an external wattmeter. The amplifier is specified for an input power of 5 W, so to prevent damaging the amplifier with overdrive, note the setting of your transceiver, which produces a 5 W RF output, and be sure not to exceed that while operating with this amplifier. We did not see this problem on the other amplifiers we tested, so the unit that customers receive may or may not have this problem, but it is something that customers should look out for.

It might just be the bad luck of the draw, but the Lab found problems with each of the amplifiers it tested. It makes a good HF CW amplifier for your QRP rig. It can be used on FM, although it did get quite warm during testing, so it would be best to throttle it back a bit. It works on SSB, but it will be quite a bit cleaner if it is operated at about 80% of the power it will achieve on all bands. And on 6 meters, a low-pass or band-pass filter will be a must to avoid exceeding the FCC limits on harmonics. — *George Spatta, W1GKS, ARRL Assistant Laboratory Manager*

I went outside the low range for these tests (see the results in Table 3).

The XPA125B couldn't match extreme resistive impedances on 160 meters. However, it was able to provide matches on all other bands, though the losses could be high in some cases. Also, I often had to force a re-tune several times to achieve an SWR less than 2:1, as measured by my external SWR meter (the XPA125B internal SWR meter is inoperative). The XPA125B antenna tuner does not have any memories, so you must re-tune each time you change frequencies, depending on the mismatch. When the tuned match is greater than 2:1, there is no indication of tuning failure, though the PA will fault if the SWR is greater than 3:1.

Operating

I was able to test the XPA125B with my Xiegu G90, Xiegu X5105, and Elecraft KX3, and a QRP Labs QCX-mini 20-meter transceiver. I used the optional CE-19 interface with the Xiegu radios, and it worked well by providing keying and automatic band changing for the XPA125B. The XPA125B control interface is a miniDIN6 connector, so I built interface cables for the KX3 and the QCX-mini using a miniDIN6P cable. The KX3 keys the XPA125B directly. As the QCX-mini PTT output is 5 V dc on transmit, and 0 V dc on receive, I originally built a special interface for this. However, as the QCX-mini only operates full break-in, this was a problem due to the slow transmit/receive relay in the XPA125B. So, I just made a manually switched amplifier keying cable for when I used this radio.

My HF antenna is a 43-foot vertical, and the XPA125B autotuner easily

Table 3
Xiegu XPA125B Resistive Load and Loss Testing

VS WR/Impedance		160 M	80 M	40 M	20 M	10 M	6M
10:1/5 Ω	Loss (%)	66%	28%	.20%	20%	.20%	.28%
	VSWR	2.2:1	1.6:1	1.6:1	1.4:1	1.2:1	1.5:1
8:1/6.25 Ω	Loss (%)	48%	17%	9%	9%	16%	22%
	VSWR	3.9:1	1.8:1	1.6:1	1.5:1	1.4:1	1.5:1
4:1/12.5 Ω	Loss (%)	20%	12%	9%	9%	12%	12%
	VSWR	2.2:1	1.7:1	1.4:1	1.7:1	1.8:1	1.2:1
3:1/16.7 Ω	Loss (%)	16%	12%	10%	10%	10%	10%
	VSWR	1.7:1	1.8:1	1.4:1	1.5:1	1.8:1	1.2:1
2:1/25 Ω	Loss (%)	12%	12%	12%	8%	8%	10%
	VSWR	1.7:1	1.8:1	1.8:1	1.6:1	1.5:1	1.8:1
1:1/50 Ω	Bypass Loss	0%	0%	0%	0%	0%	0%
	Bypass VSWR	<1.1:1	<1.1:1	<1.1:1	<1.1:1	<1.1:1	<1.1:1
2:1/100 Ω	Loss (%)	<5%	8%	7%	7%	6%	8%
	VSWR	1.6:1	1.6:1	1.6:1	1.7:1	1.6:1	1.6:1
3:1/150 Ω	Loss (%)	<5%	10%	10%	6%	8%	10%
	VSWR	1.2:1	1.5:1	1.7:1	1.4:1	1.6:1	1.6:1
4:1/200 Ω	Loss (%)	<5%	<5%	<5%	<5%	<5%	8%
	VSWR	1.1:1	1.4:1	1.6:1	1.5:1	1.6:1	1.2:1
8:1/400 Ω	Loss (%)	15%	6%	6%.	10%	11%	12%
	VSWR	2:1	1.5:1	1.6:1	1.6:1	1.5:1	1.1:1
10:1/500 Ω	Loss (%)	20%	<5%	<5%	12%	26%	26%
	VSWR	2.5:1	1.4:1	1.4:1	1.3:1	1.4:1	1.3:1

handles the SWR on 60 – 10 meters. I made one SSB contact on 20 meters and received a good audio report. However, I refrained from making additional SSB contacts due to the high IMD when running full power. I felt much better using CW and made several contacts with each of my four QRP rigs on 40, 30, and 20 meters.

Conclusion

The XPA125B is a compact 100 W amplifier that integrates perfectly with Xiegu transceivers and, to a slightly lesser extent, with virtually all other QRP transceivers. The internal antenna tuner provides all the antenna system flexibility most hams will ever need. However, there are several items to consider:

The Good — The XPA125B is compact and rugged, requires no fan, monitors many parameters, and is well protected.

The Bad — The XPA125B doesn't meet its typical output power level specification on 10 and 6 meters. Also, the input voltage must be set almost 1 V dc higher in order to meet the typical power output specification on the other bands. And the input power and input SWR readings are useless.

Additionally, the XPA125B seriously degrades the IMD performance of the driving transceiver. Lastly, the XPA125B does not meet FCC spectral output requirements on 6 meters (an external low-pass filter would be needed).

Manufacturer: Xiegu. Distributed and supported in the US by select US distributors. Price: $619.95; CE-19 Expansion Port, $34.95.