

Review: The Tokyo Hy-Power HL-1.5KFX HF/50 MHz Power Amplifier
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Introduction

When considering a power amplifier, there are quite a few trade-offs to be considered. Amplifiers are available with output power levels from about 600 watts to 1.5 kilowatts, they can be manually tuned, auto-tuned or fix-tuned, and they can have vacuum tube or solid state finals. I prefer a solid-state fix-tuned amplifier since I need an amplifier only occasionally, but then I want it on-line and operational immediately. So I was pleased to have an opportunity to evaluate the new Tokyo Hy-Power HL-1.5KFX amplifier, available through Ham Radio Outlet (www.hamradio.com). And to complement this amplifier, HRO will soon be selling the THP HC-1.5KAT full legal limit auto antenna tune which provides plug-and-play operation when connected directly to the HL-1.5KFX.

The Package Arrives

If you have been around HF amplifiers, you'll be pleasantly surprised at the size of the HL-1.5KFX. It is quite compact at just 10.7 inches wide, 5.6 inches high, and 14.3 inches deep including the power supply. So it is perfect for even compact operating locations – as well as portable and DX operation. It is hefty, though, weighing in at about 45 pounds. But this is a manageable weight for most of us. The HL-1.5KFX is also physically attractive. Photos A and B are close-up photos of the front and inside of the amplifier. As you can see, the appearance and construction is very functional and clean.



Photo A: Front view of the HL-1.5KFX

Photo B: Inside view of the amplifier

Amplifier Details

Before getting into performance details, let's first look at some of the specifications and features of this amplifier. First of all (and probably of most interest) is power output. The HL-1.5KFX uses four power MOSFET final devices to generate 1000 watts PEP SSB and 900 watts CW typical output power from 1.8-30 MHz, which is only about 2-dB down from full legal limit. On 6-meters, the output power is spec'd at 600 watts typical. AC power requirements are 20 amps maximum at 120VAC or 10 amps maximum at 240VAC. For continuous operation modes RTTY, THP recommends that you reduce power 20-30% and use the optional fan kit (HXT-1.5KF). The amplifier comes set-up for 240VAC as most U.S. homes limit 120VAC current to 15 amps. However, no AC plug is provided which is common for most 240VAC amplifiers.

In order to protect the final amplifier MOSFETs, THP provides five major protection circuits, all of which have front-panel indicators: Overdrive when drive power exceeds 100 watts, Over Heat if heat sink or power transformer temperatures exceed safe levels, Over Voltage if the final MOSFET drain voltage exceeds a safe level, FUSE if either of the two fuses blows, and PR which indicates reflected power has exceeded 80 watts. These protection circuits all cause the amplifier to go off-line in order to protect the amplifier.

For CW, the HL-1.5KFX operates full QSK using fast miniature power relays for T/R switching. These relays have a typical enable time of 5ms which is slightly faster than many vacuum relays. I was really pleased to see this, as I am primarily a CW operator and I find QSK almost a necessity when working DX pile-ups. The 5ms relay switching time is faster than the amplifier keying -to-RF-output delay of most transceivers. As an example, I measured this delay at 8-10ms on an IC-7000, and 12-15ms for the IC-706MKIIG. So any CW character shortening will be due to your transceiver, not the HL-1.5KFX. If your transceiver has an adjustable output delay, you should set this to something greater than 5ms to ensure you never hot-switch your transceiver or amplifier.

Finally, the HL-1.5KFX will automatically change bands when connected to most relatively recent transceivers. Cables are even included to interface band data information with many higher-end ICOM, Kenwood and Yaesu transceivers. You must provide your own ALC and amplifier keying cables. The user manual also provides information for interfacing with the Ten Tec Orion, and states that you can request interfacing information on your specific radio directly from THP. You can manually change bands from a front panel switch, but automatic band-changing is very convenient. THP also recommends automatic band changing, and the manual states that amplifier damage can occur if you accidentally transmit full power with the band set incorrectly.

Connecting the Amplifier

Connecting up the HL-1.5KFX is easy, though it may not always be a trivial effort depending on your transceiver. First you must purchase an appropriate AC plug from your local home improvement store (240VAC: "hot" leads are black and white, and "ground" is green. 120VAC: "hot" is black, "neutral" is white, and "ground" is green). THP recommends that you actually measure your line voltage and then verify that the amplifier is strapped for the correct AC voltage, as incorrect strapping could result in damage to the amplifier. **BE CAREFUL** when measuring the AC line voltage. And while the HL-1.5KFX has an internal AC interlock that operates when the cover is removed, you should *never* remove the cover unless the amplifier is unplugged. Finally, verify that the 115/220VAC switch on the bottom of the amplifier is correctly set.

As mentioned earlier, the HL-1.5KFX comes with the necessary cables for interfacing with the band data output of popular higher-end transceivers. You can see the RF in/out and well-marked ICOM, Kenwood and Yaesu connectors in Photos C and D.



Photo C: HL-1.5KFX backside view



Photo D: Close-up of XCVR interfaces

However, my IC-706MKIIG is not directly supported by the supplied cables. But it is easy to construct an interface cable utilizing the accessory cable assembly that ICOM supplies with this transceiver. For IC-706 series radios you can use either the DC analog band data output or the CI-V remote control output. For the IC-7000, you should use the CI-V interface as analog band data is not available unless the radio is modified (modification information is in the IC-7000 user's manual). For the IC-706/IC-7000 Send, ALC and Band Data interface, the necessary connector wiring is as follows:

<u>ICOM ACC Pin/Desc.</u>	<u>HL-1.5KFX connector</u>
Pin 2/GND (RED)	Common ground to all connectors
Pin 3/HSEND (ORG)	SEND/RCA Jack
Pin 5/BAND (GRN)	ICOM/RCA Jack (not necessary if CI-V cable is used)
Pin 6/ALC (BLU)	ALC/RCA Jack
CI-V/3.5mm mono jack	CI-V/3.5mm mono jack (cable supplied with HL-1.5KFX)

The HL-1.5KFX requires less than 1-ma of keying current, so you can interface directly with the HSEND keying output of the IC-706/7000. When using CI-V you must set interface parameters as described in both the HL-1.5KFX and transceiver user manuals.

Rather than solder RCA plug-terminated cables to the tiny wires on the ICOM accessory plug, I terminated the wires on a small piece of All Electronics PC-1 perf-board mounted in a 1551HBK 2.4 x 1.4 x 0.8" plastic box, along with three RCMJ RCA jacks on the plastic box (only two required if the CI-V interface is used). This let me use a component video cable set (All Electronics CB -271) to interface this plastic box to the HL-1.5KFX. Photos E & F show the internal wiring and external view of the interface box.



Photo E: IC-706 interface internal wiring



Photo F: External view of the interface

Now just set the amplifier's front panel Band Select switch to "ICOM", and the rear Band Decode switch to "DC Voltage Band Data" or "CI-V". For those who don't want to build an interface cable, an Ameritron ARB-704 Amplifier Interface Buffer with the PNP-13D interface cable gives you the ALC and amplifier keying outputs from the accessory connector on the IC-706/7000. For the band data, you would use the CI-V cable supplied with the HL-1.5KFX amplifier. The ARB-704 may also provide a solution for many other transceivers as numerous interface cables are available.

Performance

For my first series of tests I measured the amplifier power output into a legal limit dummy load, and I also checked the amplifier's internal power metering against an external peak-hold wattmeter which I observed being calibrated with NIST-traceable test equipment (National Institute of Standards and Technology). You'll note that I ignored 60- and 30-meters as output power in these bands is limited to 50 watts ERP and 200 watts, respectively. The ALC control on the amplifier was set fully clockwise so that the output of the amplifier was related solely to the transceiver drive applied. I measured key-down power on both the HL-1.5KFX internal power meter and the external wattmeter, as well as CW and SSB power with the external wattmeter. For the CW power measurement, I sent a string of "dits" while using a medium peak-hold setting on the external wattmeter. I used a long peak-hold setting for measuring peak SSB power while I called CQ (into the dummy load of course). As you can see in Table 1, the HL-1.5KFX does a nice job of meeting its typical power output specifications.

TABLE 1: Amplifier Power Output Measurements

<u>Band</u>	<u>Drive</u>	<u>Key Dwn Amp Meter</u>	<u>Key Dwn Ext. Meter</u>	<u>CW "Dits" Ext. Meter</u>	<u>Peak SSB Ext. Meter</u>
160M	100 watts	875 watts	800 watts	920 watts	1000 watts
80M	100 watts	900 watts	840 watts	920 watts	1010 watts
40M	100 watts	800 watts	780 watts	865 watts	950 watts
20M	100 watts	800 watts	800 watts	890 watts	975 watts
17M	100 watts	740 watts	760 watts	850 watts	940 watts
15M	100 watts	850 watts	880 watts	960 watts	1025 watts
12M	100 watts	700 watts	760 watts	880 watts	975 watts
10M	90 watts	800 watts	870 watts	960 watts	1020 watts
6M	90 watts	700 watts	690 watts	760 watts	820 watts

Next I checked the point where the SWR protection shutdown occurred – and found it to be right at 80 watts reflected power as specified. Since the HL-1.5KFX shuts-down with 80 watts reflected power (a 2:1 SWR at 900 watts output) you can operate into a higher SWR by simply reducing your output power if needed. But you really should address the high SWR issue (another reason to look at the HC-1.5KAT auto tuner).

On the Air

All the basic testing is great. But how about actual use and on-the-air performance? My first on-the-air experience with the HL-1.5KFX was on 6-meters using my IC-706MKIIG

as the driver and just an east/west oriented 6-meter dipole mounted on my chimney . There was a nice opening on e evening, and I was able to work a number of stations on both coasts, both on CW and SSB. When operating QSK on CW, I could hear the amplifier's T/R relays. However, the relay noise is not objectionable – and is really no louder than the relays in the IC-706MKIIG. When operating SSB, one of my Florida contacts told me I was readable but noisy. I flipped on the amplifier, and he said “It sounds like you just moved in ne xt door.”

Most of my operating was on 160-, 80-, 40-, 30- and 20-meters using my Yaesu MKV. One of the HL-1.5KFX supplied band data cables interface d directly with the MKV, so all I had to do was connect this supplied cable and two RCA cables (ALC and amplifier keying), and set the front panel Band Select control to Yaesu. In all cases, operation was smooth and easy. It is great to change bands on your transceiver and have the amplifier automatically follow. And it is extremely nice not to have to worry about tuning your amplifier when you change bands or frequencies. Just hit the key (or press the PTT on your mic) and transmit. I did tend to notice the QSK relay switching noise more, as the relays in the MKV are very quiet. Again, however, the amplifier relay noise was not objectionable . And the continuously running 2 -speed HL-1.5KFX fan was also very quiet – much quieter than the fan in my MKV.

One Last Comment on Band Data Interfacing

When ordering the amplifier from HRO, ask them if your transceiver is supported by the supplied band data cables. If not, ask HRO for their recommendation for cables and/or an interface if you don't want to build your own cables. And again, remember that cables for ALC and amplifier keying are not supplied with the amplifier .

Conclusion

The Tokyo Hy-Power HL-1.5KFX is a quality solid -state amplifier that is certainly worth considering. Its compact size easily lends itself to installation in even the most space-efficient stations, as well as portable and DXpedition applications . And the no-tune, instant-on, band-following features makes this an amplifier that is especially easy to use. So much so that flipping it on and operating the amplifier as conditions warrant becomes an almost thoughtless process. The only issue I have is that when someone asks me what amplifier I'm running, it takes a long time to say “HL-1.5KFX” in Morse code!