How to get on 500 kHz with your K3

After some weeks of experimenting i found this design to work very stable to use the K3 for transmitting and receiving on 501 - 504 kHz. In this document you can read how to set up your K3 to transmit and receive on this beautiful band full of maritime history.

The design of the amplifier is straight forward, easy to reproduce and general available components. On 12 V the DC input is about 25W. On 24 V it should be about 100W (not tested yet). The amplifier operates in class D with a high efficiency. I mounted the IRF 540 on a heatsink but it stays cool at 12 V. The coils are wound on 22mm pvc tube. Please note the angle of the three coils to prevent coupling.

This design is a compilation of some other designs. Please check the Google group UK500kHz for more idea's, diagrams and discussions. Before i used the 'totem pole' driver to the fet i used a TC4427 gate driver. This also gives satisfactory results.

Optional i built a x-tal oscillator to also be able to use the transmitter stand alone.

To tune the ant. i make use of a variometer (which i took out of an old Skanti TRP1 emergency transmitter). A variometer can be made easily and several designs can be found on the net. To build a nice variometer is a nice experiment in itself. Tune on max. antenna current.
Due to the antenna limitations we stay within the legal limit of 5W EIRP. With this design i can work on a daily basis over a distance of 1000 kms. In two weeks time i worked about 25 stations in 4 countries.

If you live in Europe please note that in The Netherlands you can reach two web SDR's that include the 500 kHz band. You can use these if you want to monitor your own signal. The SDR's are located at the Technical Universities of Twente and Eindhoven.

Links are:

http://websdr.ewi.utwente.nl:8901/

http://lindsey.esrac.ele.tue.nl/

Have fun reproducing and improving this design!

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K3QTX-V2 Get on 500 kHz with your K3

3/3/2010 Design compiled and tested from different diagrams from G3XBM and GW3UEP by P

L1: 33,5 T 22mm dia 20 SWG
L2: 21 T 22mm dia 20 SWG
L3: 42 T 22mm dia 20 SWG

When S2 is off you can toggle between to antennas for receive by S3

Operating at 500 kHz

A few countries allow experimental amateur radio operation in the 500 kHz band (600 meters). This is a fascinating and historic band that is used for beacons and ground-wave communications. For hams, there are very specific mode and power restrictions, and an experimental license may be required. In the U.S., see http://www.500kc.com/ and http://www.arrl.org/ for the latest news. The K3 can be used for both receive and transmit on this band as explained below.

 500 kHz Receive-Only Operation

The K3 can receive signals in the 500-kHz band if both the KXV3 and KBPF3 modules are installed. The KXV3 (RF I/O module) is needed because it provides an RX ANT IN jack. This jack bypasses the high-pass filter in the normal receive antenna path. At 500 kHz, the high-pass filter-- which protects the T/R PIN diodes--will attenuate signals by about 20 dB. There is no such attenuation at 500 kHz when using the RX ANT IN jack, and sensitivity is excellent. We measured an MDS of -133 dBm with preamp OFF and a DSP filter bandwidth of 50 Hz. The KBPF3 (general-coverage module) is needed because the normal 160-meter band-pass filter covers only about 1.7 to 2.1 MHz. The KBPF3 includes a low-pass filter that passes signals down to 500 kHz with very little attenuation. A low-noise receiving antenna is recommended for use at 500 kHz.

 Diversity receive should be very useful at 500 kHz. To do this, you'll need a sub receiver (KRX3) that is equipped with its own KBPF3 module. You'll also need a separate receive antenna for the sub, oriented differently from the receive antenna used with the main receiver.

500-kHz Transmit/Receive Operation

The K3 cannot be used to directly transmit on 500 kHz at high power.   The low-pass filter cutoff frequency is well above that needed for attenuation of harmonics on this band, and other components in the transmit path are optimized for 1.8 MHz and higher. However, the K3 can put out a clean 500 kHz signal of about 0.5 milliwatts at the XVTR OUT jack (on the KXV3). This can be fed to an external amplifier (this is left as an exercise for the reader). Transmit power is restricted on this band, and is usually expressed as ERP (Effective Radiated Power). This means you can use high power to make up for the use of an electrically short antenna. Since 1/4 wavelength at 500 kHz is about 468 feet, not many hams will be using a full-length vertical or dipole.

As with receive, transmit at 500 kHz requires the KXV3 and KBPF3 modules. In this case, though, you'll need to use the XVTR IN and XVTR OUT jacks, with XVTR IN going to the receive antenna, and XVTR OUT going to your 500 kHz amplifier and a transmit antenna. If the same antenna is used for both transmit and receive, an external T/R switch will also be needed, controlled by the K3's KEY OUT signal. If separate transmit/receive antennas are used, it may be necessary to provide a PIN-diode switch to open or short the receive antenna during transmit. The XVTR IN jack is normally used with a transverter, so it doesn't have such protection built in.

IMPORTANT: In order to transmit at 500 kHz via the XVTR OUT jack, you must set CONFIG:KXV3 to TEST. This routes all signals through XVTR IN and XVTR OUT, which is why the receive antenna must be connected to XVTR IN in this case. (You can't use XVTR OUT for transmit and RX ANT IN for receive due to switching limitations.) Be sure to set KXV3 back to NOR when using normal ham bands.

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If interest in the 500-kHz band is sufficient, we'll change add 160 meters as an IF band for use with transverters. This would allow you to set up a 500 kHz transverter band, so it would not be necessary to set KXV3 to TEST.

Synthesizer Considerations

Before using 500 kHz, you'll need to make sure your synthesizer is adjusted to cover this band. Tap DISP and use VFO B to locate the "PLL1" display. If the voltage is less than 0.9 V when VFO A is set, contact customer support for suggestions on how to adjust it. If you plan to transmit on this band, connect an short (3') antenna to the XVTR OUT jack and listen to your signal with another 500 kHz receiver. Make sure the signal sounds clean.