HEROS technology Ltd
general electronics

VLF LF 10KHz - 500KHz Up Converter

Brochure

Since many countries are allocating the old 500KHz (600m) maritime radio distress band for experimental use by Radio Amateurs, a growing number of them as well as listeners have become interested on VLF and LF bands.

The fact that few radios are available on the market covering frequencies from below 10KHz to 500KHz, convinced us to provide radio amateurs with the high-performance receiving VLF-LF Converter that we introduce here.

The VLF-LF Converter extents the range of any shortwave receiver to below 10 KHz to 500 KHz.
It connects between the antenna and the HF radio. When turned ON the <10KHz to 500 KHz band translates to HF receive tuning, 3.500MHz - 4.000MHz, Model-350 or 4.000MHz - 4.500MHz, Model 400, allowing enjoy the world of VLF and LF bands, including the 500KHZ band.

For example, if a conversion frequency of 4.000MHz - 4.500MHz, Model 400, is used, and the receiver tuned on 4.135.500MHz, you are receiving on 135.500KHz, just ignoring the digit “4” on the dial.

The VLF LF Converter permits the reception of navigational beacons (NDB), standard frequency broadcasts, NAVTEX, weather broadcasts, LORAN, the 137KHz and 500KHz Amateur bands, European LW broadcast stations, monitoring the sounds of nature created by planet Earth (Natural Radio) such as sferics, hiss , tweeks, whistlers, Dawn Chorus, other not well know VLF radio atmospherics sounds, and many more.

Technical Specifications:

- Type: Superheterodyne converter. Double balanced mixer; Quartz crystal oscillator.

- Frequency range: <10KHz to 500KHz. including 600m band.

- IF output: 3.5MHz-4MHz, model 350; 4MHz-4.5MHz; model 400.

- Input/Output impedance: 50 Ω

- Gain: 5 dB

- IF rejection: 110dB typical.

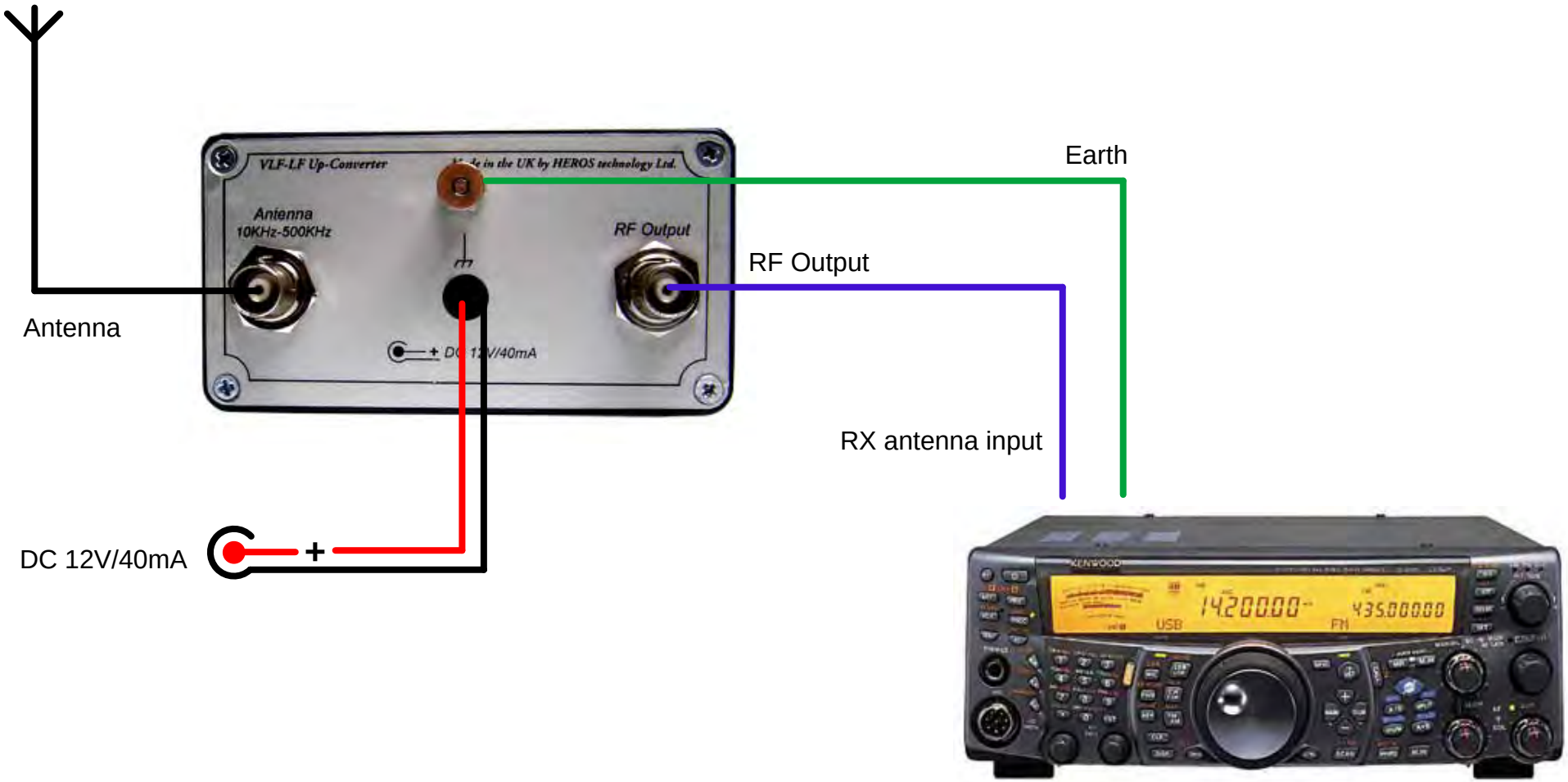
- MW band rejection: 80dB

- Crystal oscillator: Low phase noise; quartz crystal ±10ppm;
  3.5MHz or 4MHz, fundamental.

- Power: 12volts/40mA

- Enclosure: Aluminium

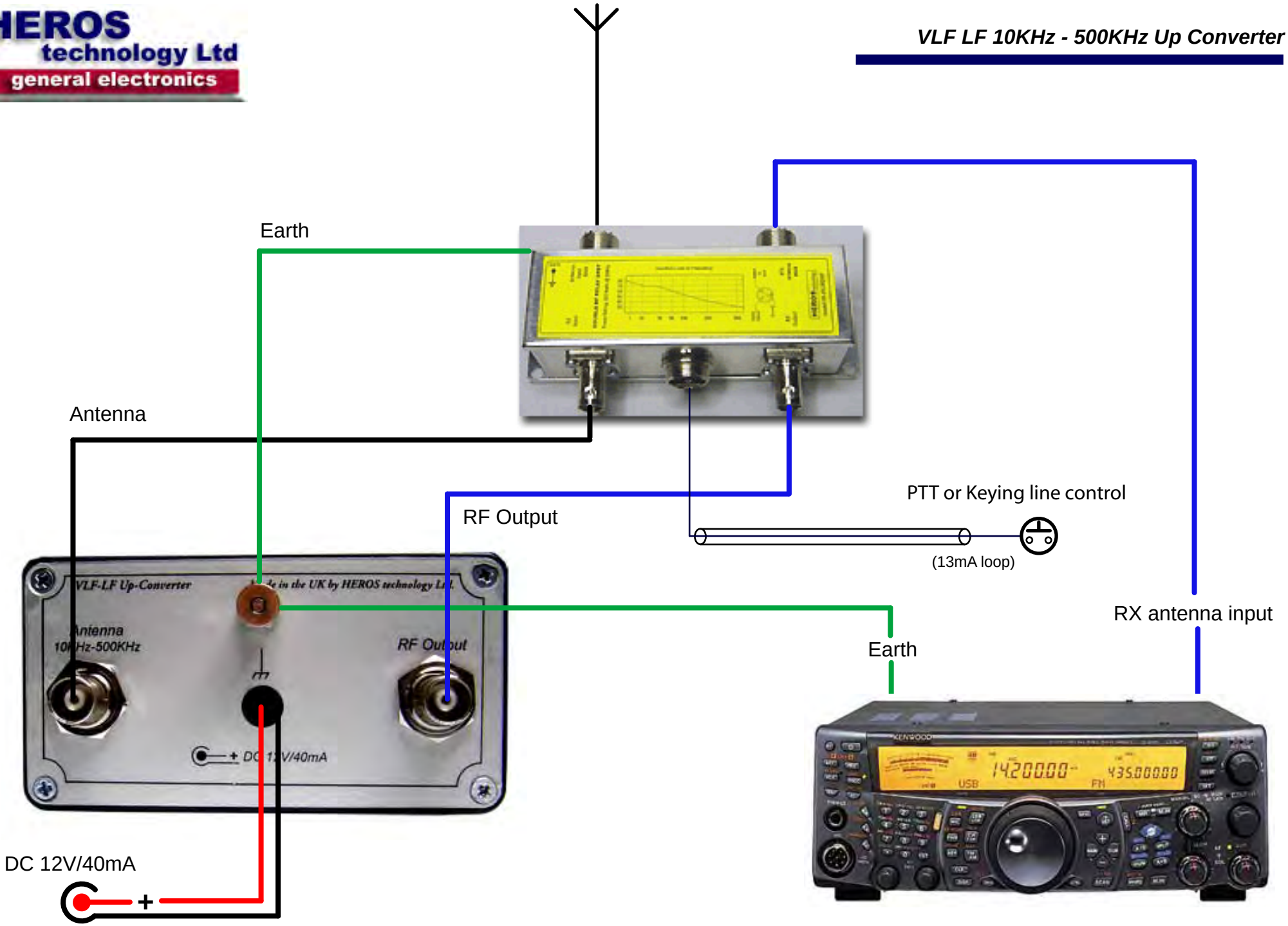
- Size: 125mmx105mx55mm (4.921x4.133x2.165in)



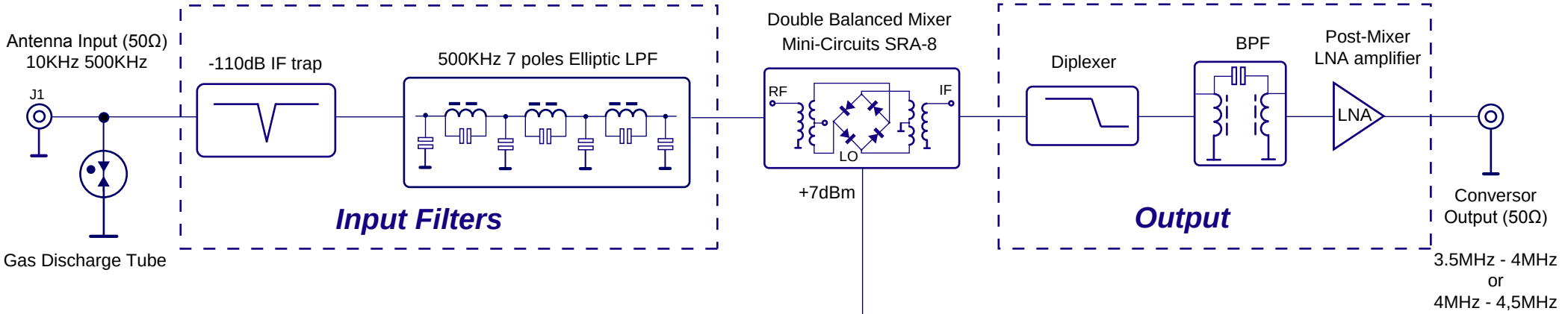
VLF LF Up Converter Inter connection diagram

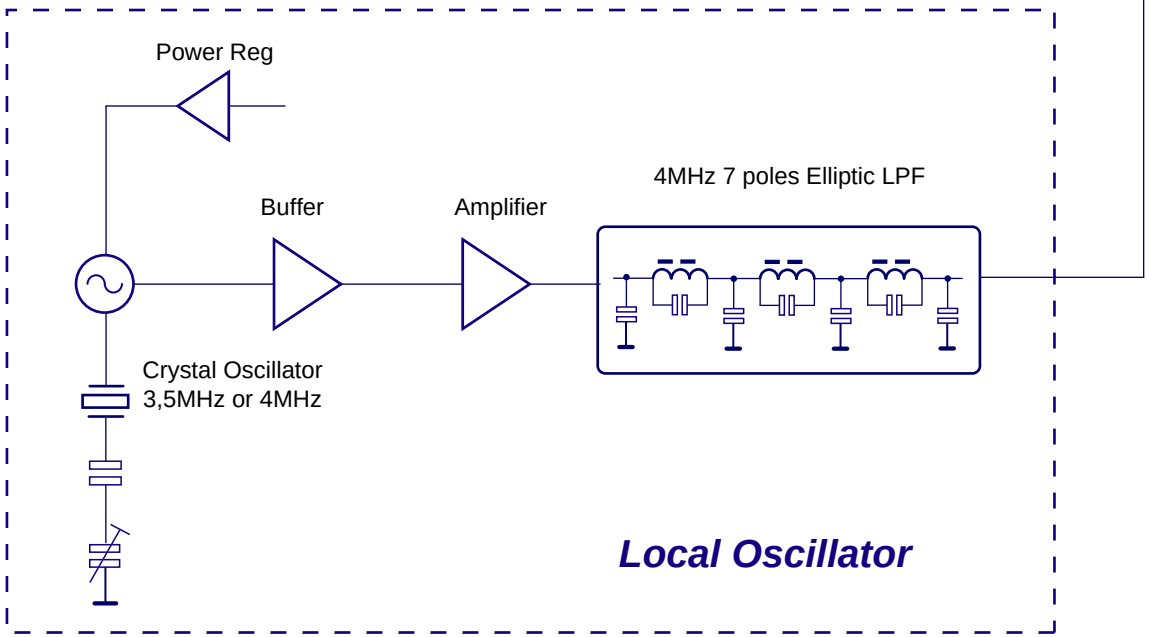
HEROS technology Ltd
general electronics

VLF LF 10KHz - 500KHz Up Converter



VLF LF Up Converter interconnection with Dual By-Pass relay. Diagram



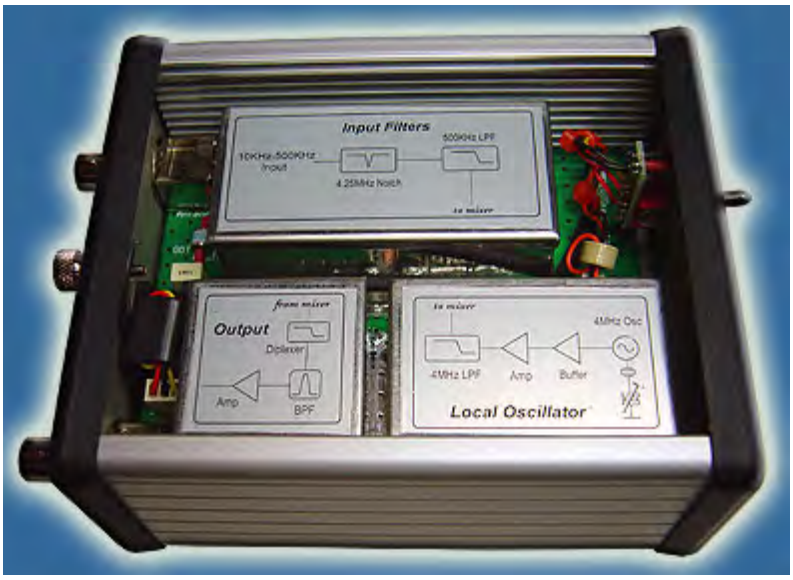


HEROS technology Ltd
general electronics

Drawing	VLF LF Converter Diagram		
Approvals	Size	DWG No	
Issued	A4	REV	Sheet 1/1
Checked	Scale	FCSM No	
Drawn JJ de Oñate		Date XV II MMX	

Input Filters

Referring to the above functional blocks diagram, the 50 Ω antenna is connected to J1 ,BNC type connector;
a Gas Discharge Tube protects the converter from transients that may come from the antenna.



Next the input filters section is a combination of a 110dB IF trap and a 7th order, 0.3dB insertion loss, Elliptic
Low Pass Filter with a cut-off frequency of 500 kHz.

This section provides good performance right up to the start of the AM broadcast band with a sharp roll-off, giving
a good rejection to MW broadcast signals avoiding introducing overload or intermodulation products in the receiver.

Local Oscillator

Low phase noise, crystal controlled oscillator
provides +7dBm signal level to the mixer.
A good quality quartz crystal of 3.5MHz or 4MHz, according to the model of converter, is used.
A trimmer capacitor is accessible by the user if fine adjust of frequency is required in times.
A linear fixed voltage IC regulates the voltage applied to the oscillator to enhance stability and avoid drift.

The oscillator is followed by a buffer stage to improve its stability. Next, an amplifier accommodates the signal to the required level. It connects to a 4 MHz, 7th order, Elliptic Low Pass Filter which cleans up any harmonics and assures that a pure signal applies to the mixer to minimize spurious responses.

Mixer

The mixer stage is designed around a Mini-Circuits SRA-8+ double balanced mixer. It is rated to operate from 500Hz,
giving and excellent frequency coverage. Designed for +7 dBm of LO power, it have a conversion loss of less than
5 dB at VLF LF bands, which is compensate by the post-mixer amplifier. A double balanced mixer has the advantage
of high port-to-port isolation, which keeps the strong LO signal from degrading the dynamic range of the IF receiver.
Every effort has been made to terminate the ports of the mixer in a proper 50 Ω impedance to maximize its performance.

The mixer IF port is most critical in terms of proper termination, for so, a diplexer circuit provides a 50 Ω resistive load to the mixer while passing the desired signal to the IF amplifier, with minimum loss.

Next, a Band Pass filter at IF frequency connects to a Low Noise Amplifier to compensate losses, delivering around 5dB of gain to the output, necessary to overcome losses from external cable tails, relays and connectors.

Design

A carefully PCB and shielding design keep feed through signals of the HF receiving frequency down to a very low l evel; therefore, weak LF signals will not be interfered by strong HF signals on the same frequency.

The HF receiver used should have strong rejection of HF signals through paths other than the antenna connector. Most HF transceivers and receivers have good performance in this respect, but some SWL receivers do not and may be used with the addition of filters and shielding.

Operating

The VLF LF Converter is suitable for use with active antennas, loops and preamplifiers that provide a 50 Ω output. Beverage antennas may need a matching network device or Magnetic loop for best performance.
Using an active antenna, be sure the power coupler does not introduces a DC voltage across the antenna input that may destroy the converter mixer.

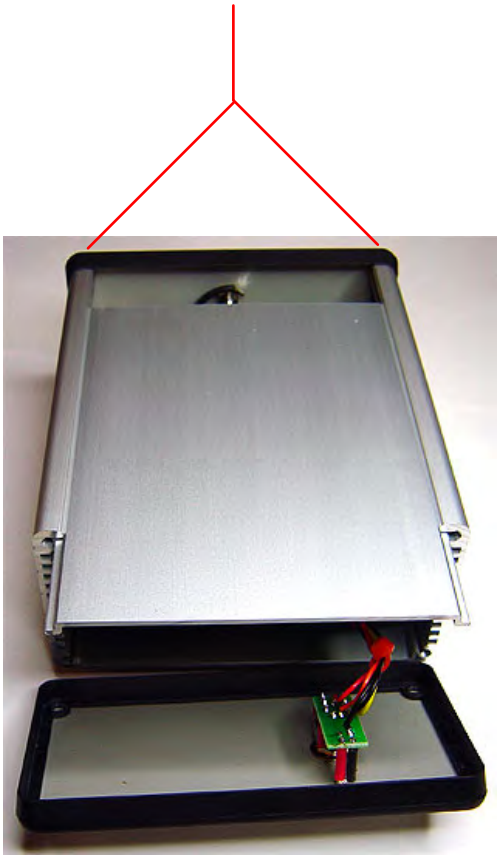
IMPORTANT:

When using a HF transceiver as IF receiver, take precautions to prevent transmitting any signal into the converter.

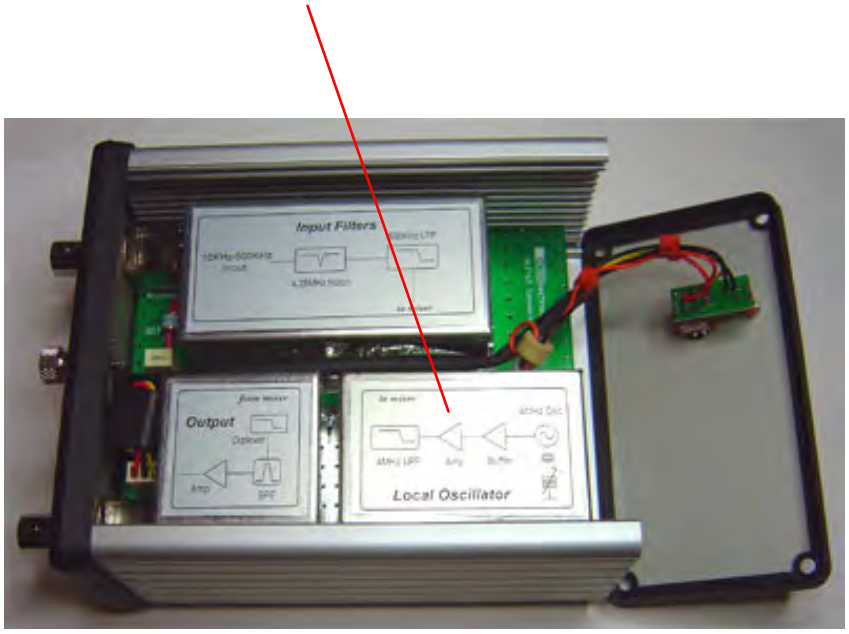
Oscillator calibration

The VLF-LF Up-converter comes calibrated from factory after a burn test of 24 hours. If for any reason you need to recalibrate the local oscillator proceed as follows:

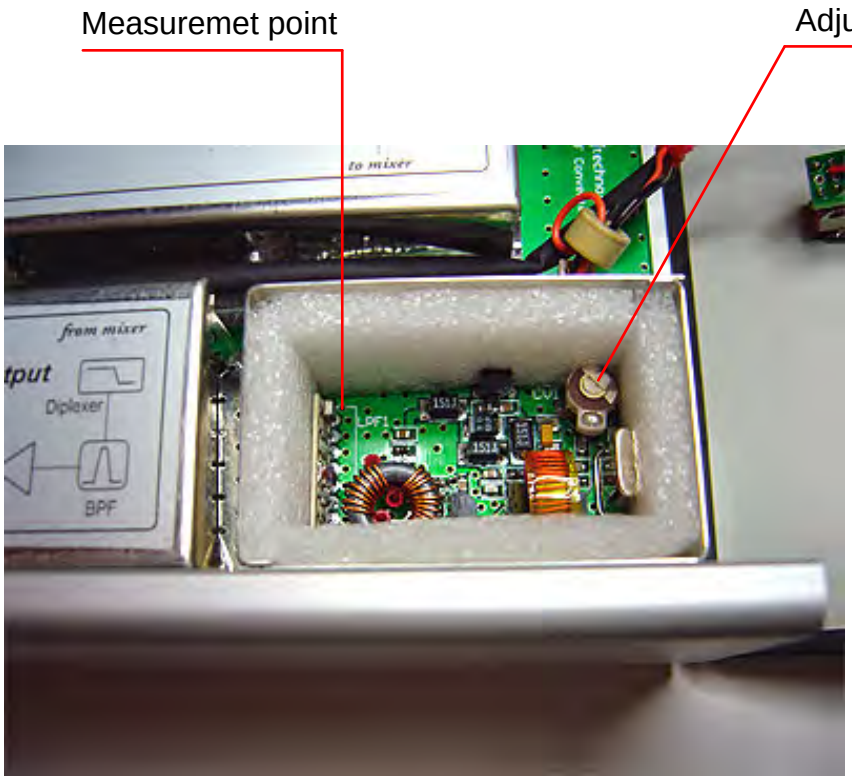
Remove the four front panel screws and slide gently the lid. You may untie the two upper screws on rear panel.



Remove the lid from the local oscillator section.



Switch ON the converter. Allow at least 30 minutes of warming time before adjusting at room temperature.



NOTES: