

12kHz LIF Converter V3

Please Note: This document supersedes all previously released documents and drawings on the LIF subject. This is the latest and most up-to-date document at this time. While all previous documents can be used as reference, please refer to this document only for the most current technical information.

Apr. 15. 2016

Intro

The LIF2016 is the continued development of the LIF, which is now available as a SMD assembly that fits in the YF-122 filter slot. It can still be used with all the other radios the same way the LIF2014 was set up. The LIF is the down-converter hardware that works in conjunction with the MDSR software.

The "new" MDSR SA has been developed as a stand-alone application. It includes a spectrum analyzer and a propagation monitor that has been programmed to work in conjunction with the MDSR engine. The transceiver interface software OmniRig has been implemented to control over 100 different makes and models of radios. The MDSR software package is available from our Website and Yahoo user group free for non-profit amateur radio purposes. This provides a complete transceiver application package for PC desktops and laptop computers.

The up-converter hardware is now available as a kit from our website as well.

Note: the LIF2016 is not compatible with the BiLIF. Units LIF2014 and BiLIF2011 are required for RX/TX operations.

The converter is now internal for the FT-817, FT-857 and the FT-897 and other models using the YF-122 footprint optional filter.

Any receiver or transceiver with a 455kHz or 450kHz IF will work with the LIF2016 interface; the FT-817, FT-857, FT-897, FT-950 (450kHz IF), IC-703, IC-7000 and IC-756 have been tested and confirmed. Instructions are available on our website. More models are and pictures are available on our Yahoo user group.

We also have documentation about installing the LIF into a Bearcat BCD996P2 scanner.

What is new for V3?

- The LIF2016 is now a SMD assembly and installation is simpler
- The small size allows the unit now to be installed into the transceivers for RX operations
- The LIF2016 has the same schematic as the LIF2014 providing excellent performance
- Includes everything to get the mod done fast and right

1. Technical Specifications

Hardware:

Local Oscillator Frequency	462 – 474kHz
Input Frequency	455kHz +/- 5kHz (450kHz option available)
Input Level (max)	1mV – 20mVpp
Conversion Gain (max)	55dB
Output Level for S-9	0.2Vpp
LIF Bandwidth:	+/- 5kHz
LIF Center Frequency:	9 – 18kHz
Supply Voltage Range	11 – 15V

Software:

USB, LSB Demodulation Bandwidth:	300 – 1800, 2400, 3200Hz
CW Demodulation Bandwidth:	300 – 800Hz

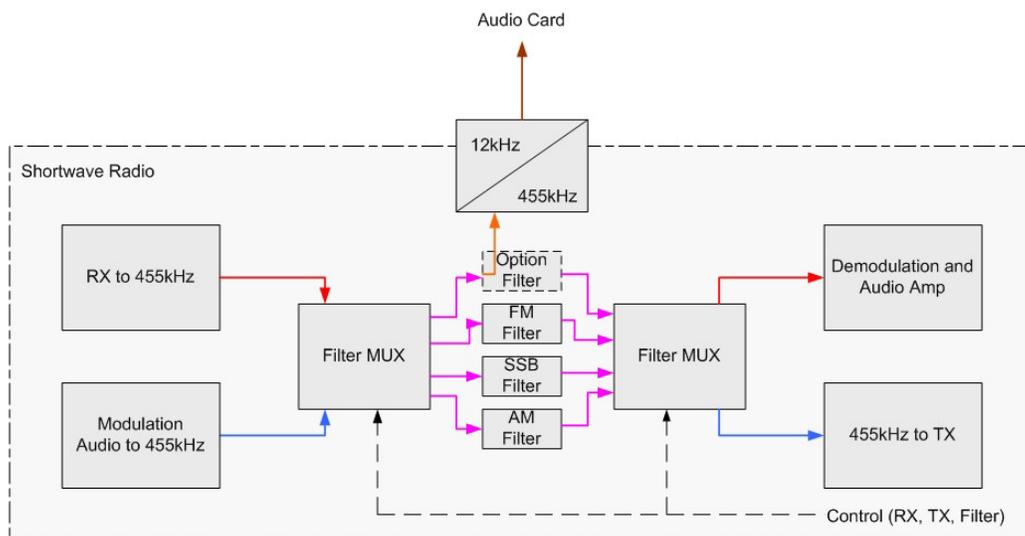
2. Creation of 12kHz LIF (Low Intermediate Frequency)

2.1 How to extract the 455kHz IF from a radio

The LIF2011 hardware takes the 455kHz IF, which is generated inside the radio before the signal (while in RX) is filtered and demodulated, and converts it down to a 12kHz LIF (Low Intermediate Frequency). All HF transceivers use one crystal, ceramic or mechanical filter (or IF-level DSP) to separate the USB spectrum from LSB spectrum and, at the same time, do this for RX as well as TX. This creates one point in the transceivers where a 455kHz unidirectional IF is present. How this IF is routed depends on the state of the transceiver.

Each transceiver is different. The models that have already been tested are posted on the website <http://users.skynet.be/myspace/mdsr/>. There is also a lot of information in the files and photo section on the MDSRadio Yahoo user group.

The signal flow below shows how the LIF board is connected and how it affects the performance of the radio. Everything after the filter section is disabled. This also includes the AGC portion if the 455kHz ceramic filter which bridges the option filter port is not installed.



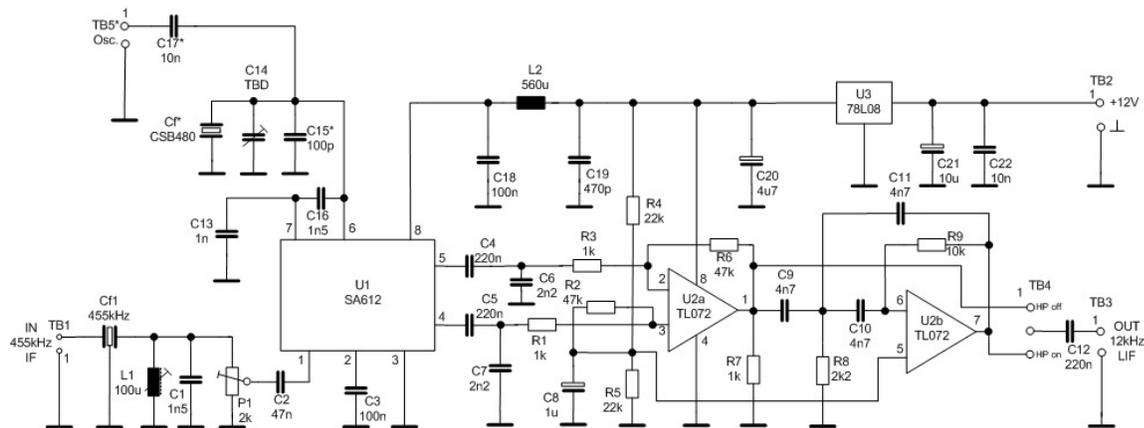
2.2 About the Local Oscillator Frequency

The LO frequency and the placement of the DSP filters is very important for the proper functionality of the MDSR software. In order to make it easier to match the filters and the BFO frequency with the available resonators, a wide BFO adjustment has been implemented. This adjustment can now be individualized for each mode. In the "Lock to TXVR" mode, the transceiver and the MDSR mode are synchronized to allow for the optimization of the filter passband with the DSP filters of the MDSR.

2.3 Schematics of LIF converter

As a converter, the SA612 Gilbert cell is used. The ceramic crystal filter oscillator provides the LO injection signal between 462kHz to 474kHz (depending on the filter available) and the output is amplified and filtered with a TL072. This provides an overall gain of about 35dB. A three pole 455kHz filter and a variable tank circuit in front of the mixer protect the Gilbert cell from cross-modulation. A switchable 8kHz high pass filter linearizes the spectral response for the soundcard and removes the low part of the frequency band at the mixer output. This improves the dynamic performance for the demodulation. A switchable 8kHz high pass filter linearizes the spectral response for the soundcard and removes the low part of the frequency band at the mixer output. This improves the dynamic performance for the demodulation. A 8V regulator stabilizes the voltage and therefore allows for a wider supply voltage range.

This converter works with any radio using a 455kHz IF system that provides a 1 – 20mV signal for a S-9 meter reading at the optional filter port. (450kHz option is available.)

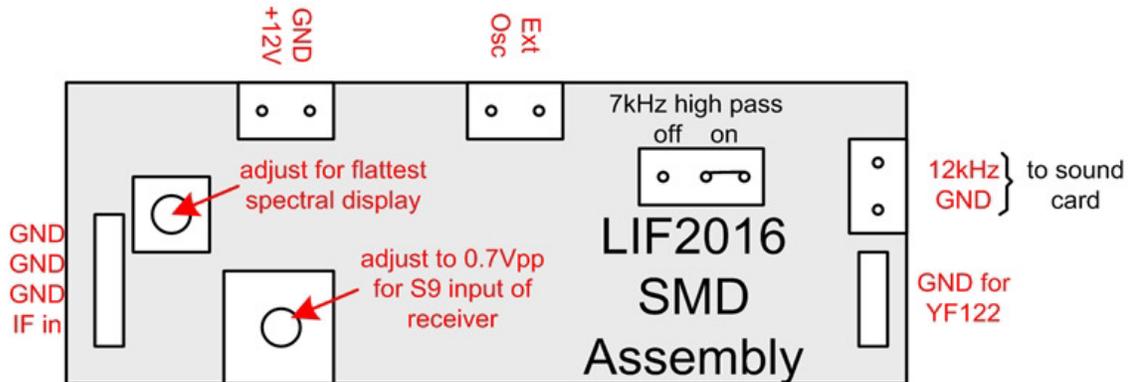


Note

There is some debate about the SA612 as being very sensitive to over-modulation. This is true when it is used as a 1st mixer in a radio design. For the LIF converter, it is the 3rd mixer, so the Gilbert cell's performance and simplicity are ideal.

2.4 Adjusting the LIF2016

There are only two adjustments that the LIF unit requires: the conversion gain and the flatness of the filter response.



Setting the gain of the LIF converter

The 0dB point of the audio card is 0.7Vpp. To adjust the gain, connect an oscilloscope or an AF audio meter to the output of the converter.

Setting Filter response flatness

Turn the variable coil L1 to achieve the flattest response curve on the MDSR-SA. This will not give a totally flat curve and is dependent on the receiver's characteristics.

Note: Use a non-metallic tuning tool, and be careful not to break the ferrite core of the coil.

Final Calibration will be done in the MDSR Software

For this adjustment procedure, the MDSR and the MDSR-SA software need to be installed on the computer. Use the MDSR help file for further details.

3. Conclusion

This completes the assembly and the test of the LIF2016. We hope this unit will provide a new enjoyable experience while listening to your radio through the LIF – MDSR computer interface. It is advisable to build the PCB into an aluminum box as shown in the Yahoo user group. This is an “off the shelf” box made by Hammond. It is not necessary, but will provide better isolation from TX radiation created by the radio.

Any issues and/or questions should be directed to the MDSRadio Yahoo group.

Thank you,

The MDSR and LIF development team.